CHAPTER LXXXVI

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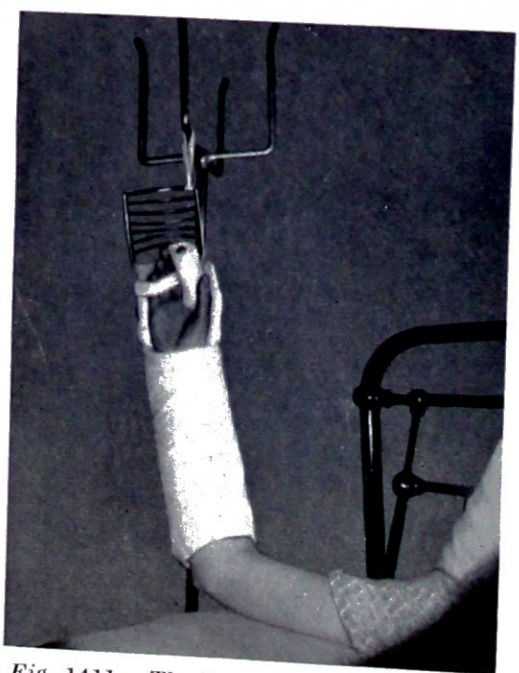

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a. In very early cases, the aim being to abort the infection. Should the inflammation, particularly the swelling, show signs of regression, daily injections are continued until resolution occurs.

b. In serious infections with considerable constitutional symptoms. Several hours, sometimes up to 24 hours or more, in-patient treatment, including antibiotic therapy, is given before the most opportune time for operation (if such be required) arrives. Whether operation is performed or not, antibiotic treatment is continued until at least 24 hours after the temperature and pulse-rate have become normal. It should be noted that conservative measures are employed during the stage of cellulitis which precedes abscess formation in many of the conditions to be described. It must also be realized that antibiotics can, by subduing local reaction, modify the signs of inflammation, but when pus is present acute local tenderness is always in evidence.

It is futile, damaging, and often disastrous to rely on antibiotics alone when suppuration has occurred. If there is pus in any part of the hand, it must be evacuated.

c. Pre-operatively.—In the majority of cases of infection of the hand, by the time the patient seeks advice, pus is present. Penicillin $\frac{1}{2}$–1 mega-unit (usually the larger dose) is then given intramuscularly three-quarters of an hour before operation. Further similar injections of $\frac{1}{2}$ mega-unit are given on the first five post-operative days in the case of out-patients, while in-patients receive the dose 6-hourly as long as is considered necessary.

Fig. 1412.—Sites for injecting local anæsthetic in the case of the fingers. The illustration also shows the site for the lateral injection of the thumb.

Cleansing the Area of Operation.—1·0 per cent aqueous solution of cetrimide applied with sterile gauze is satisfactory for this purpose.

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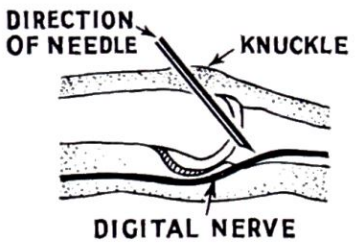

Fig. 1413.—Showing the *modus operandi* of injecting a digital nerve. (*After P. E. B. Holmes and D. J. J. Graff.*)

Step 1.—The dorsal skin between the knuckles is stretched, and after raising a weal, a fine hypodermic needle is introduced at a point shown in *Fig.* 1412. Steadily injecting the anæsthetic solution, the needle is advanced distally and forward, keeping fairly near to the proximal phalanx, until it is judged that the digital nerve (*Fig.* 1413) has been reached. Three-quarters of a ml. is deposited here.

Step 2.—The needle is then withdrawn as far as the subcutaneous tissue. While injecting more anæsthetic solution, its point is then advanced in the subcutaneous tissue across the knuckle as far as the contralateral interdigital cleft. In this way the dorsal nerves and the site of injection of the opposite side of the finger are anæsthetized. The needle is then withdrawn completely.

Step 3.—The deeper tissues and the nerve are infiltrated on the contralateral aspect of the affected finger.

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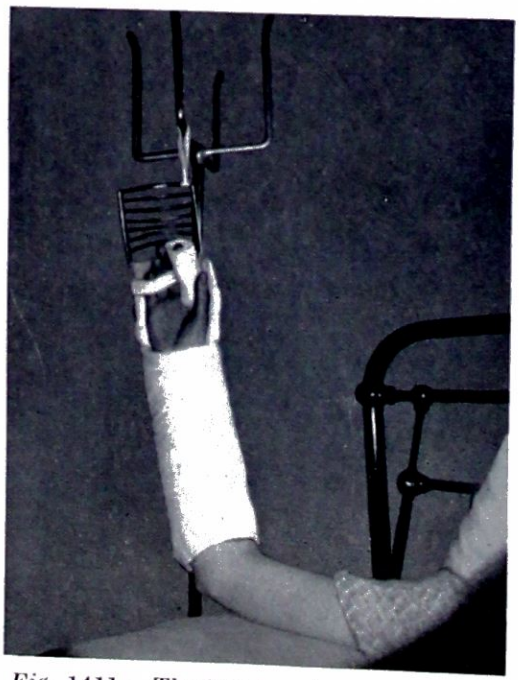

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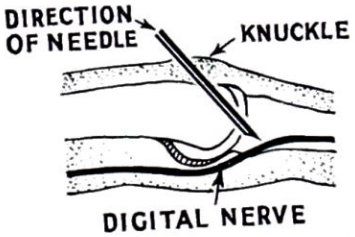

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In order to distribute the anæsthetic solution more rapidly 300 i.u. of hyaluronidase[1] can be added to 50 ml. of the anæsthetic solution[2] (usually supplied in a rubber-capped bottle). The hyaluronidase also promotes rapid absorption of the combined inflammatory and injection œdema (Catchpoll and Lunn).

In the case of an abscess of the hand proper, full general anæsthesia is required. On no account should a short anæsthetic, e.g., nitrous-oxide gas, be employed. Complete muscular relaxation and an unhurried operation are essential if the mistakes of the past are to be avoided.

A Bloodless Field must be insisted upon. Only under these conditions can the exact site and extent of the lesion be determined, and damage to tendon-sheaths and nerves be avoided. The cuff of a sphygmomanometer is applied to the upper arm. The limb is then elevated for two minutes, after which the bag is inflated to a pressure of 200 mm. Hg.

Instruments required for operating upon an infected hand are few, but should be delicate (*Fig.* 1414).

Operation is undertaken at a time when there is a high penicillin level in the blood. With the possible exception of tendon-sheath infection, it is insufficient merely to evacuate pus. The operation must be meticulous. Slough must be removed (if necessary it is cut away) and, what is extremely important, all granulation tissue lining the abscess cavity must be thoroughly abraded by gauze (usually the preferable method), or scraped away with a curette.

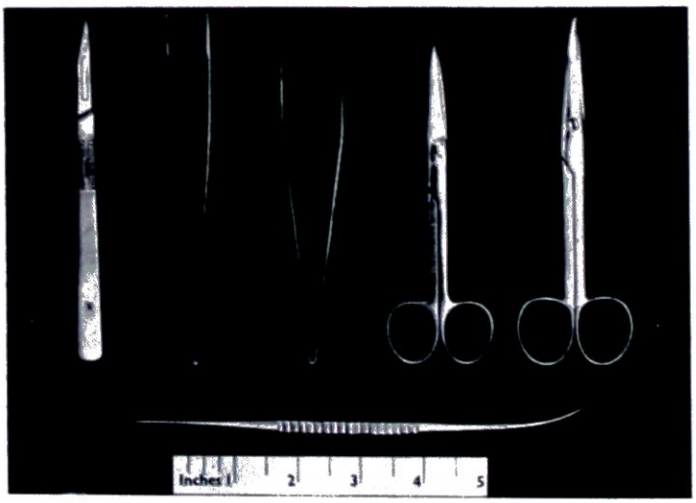


Fig. 1414.—A fine-pointed scalpel, toothed and non-toothed dissecting forceps, fine pointed scissors (straight and curved on the flat), a Watson-Cheyne dissector, and a small curette (not illustrated) are the only instruments required for operating upon infections of the hand.

The curette certainly should be avoided in the vicinity of vulnerable structures such as the periosteum or the sheath of a tendon. Only after granulation tissue has been removed, leaving the walls of the abscess cavity clean and oozing blood, will penicillin from the blood enter the cavity freely. Provided granulation tissue has been removed from every nook and cranny of the cavity it is unnecessary, and indeed harmful, to employ drainage material, for no further pus is expected to form; a little serum containing at first blood, and perhaps a few dead bacteria, is all that oozes from a cavity thus treated. The exudate lessens in amount about the third day, when quick healing is to be expected.

After-treatment.—Dry dressings are employed. The dressing is changed 24 hours after operation, when dry gauze, followed by a little wool, can be covered by a viscopaste bandage. Thereafter often an interval of two days can elapse between the redressings. Great care must be taken to prevent secondary infection during redressing. The patient is instructed not to get the dressing wet. This rule differs only in the case of paronychia; in this instance the patient is instructed to wash his hands frequently, dry them thoroughly with a towel kept for the purpose, and to reapply the dressing himself. Physiotherapy and exercises form an important part of late after-treatment of the more serious types of infection of the hand.

Continued Suppuration.—Provided the principles of treatment set out above have been followed, continued suppuration is uncommon. If it occurs, the first consideration in most situations is the possibility of extension of the infection to another fascial space or, in the case of a tendon-sheath, to the ulnar bursa (*see* p. 1018). Necrosis of bone is another cause of continued suppuration, clear radiographic evidence of which is not present until the fifth day, or later. In relevant cases the possibility of a retained foreign

[1] Hyalase—Benger Laboratories Ltd., Holmes Chapel, Cheshire.

[2] The mixture must be stored in an ordinary refrigerator to prevent deterioration of the hyaluronidase.

body should be borne in mind. Sloughing tendon is a potent source of prolonged suppuration.

LYMPHANGITIS

Superficial Lymphangitis is the more common variety, and the organisms (nearly always streptococci) gain entrance through an abrasion that may be microscopical. Within a few hours the adjacent portion of the hand becomes swollen and painful, and there is often considerable elevation of the temperature. Because superficial lymphatic vessels pursue the shortest course to the dorsum, œdema, which comes on early, is most in evidence in this situation (*Fig.* 1415). A little later red streaks, so characteristic of lymphangitis, can be seen coursing up the arm. Especially in lesions of the ulnar half of the hand, the first lymph-node to become enlarged and tender is the supratrochlear. In a few instances of infection entering the middle finger, the first lymph-node to become enlarged is *above* the clavicle, in which case infection is liable to enter the general circulation and give rise to severe constitutional symptoms. The lymphatics of the thumb and index finger pass straight to the axillary nodes. Lymphangitis can occur without demonstrable lesion, or as an accompaniment of one of the entities to be described, particularly terminal pulp-space infection and fulminating tenosynovitis.

Fig. 1415.—Œdema of the dorsum, which is often present in infections of the hand, gives rise to swelling that pits on pressure.

Deep Lymphangitis.—In deep, as opposed to superficial lymphangitis, there may or may not be red streaks passing up the arm. In their absence the diagnosis of deep lymphangitis can be assumed only by a series of negations—there is no pain or limitation of movement when the patient is asked to move the fingers; there is an absence of pain on hyperextension of the fingers and thumb, an absence of tenderness over the tendon-sheath, and absence of bulging of the palm, and an absence of tenderness over the middle palmar and thenar spaces. After all these points have been ascertained with negative results, there follow two affirmations—the constitutional symptoms are considerable and there is usually a rapid and striking increase in the swelling of not only the back of the hand, but the whole hand and forearm.

In all cases of lymphangitis the treatment is penicillin therapy and rest to the inflamed limb.

CELLULITIS

Cellulitis is the initial lesion of the fascial space infections about to be described. In a proportion of cases, which is higher in loose subcutaneous spaces than in those more confined, the inflammation resolves. In the remainder a localized abscess forms.

Incision during the stage of active cellulitis is highly mischievous. On the other hand, it is emphasized that fluctuation must not be awaited in infection of closed and deep spaces. Swelling, induration, and localized tenderness constitute a triad of signs that indicate that the time is ripe for operation.

SUPERFICIAL ABSCESS

A superficial abscess of the hand can be :—

a. Intradermal (purulent blister).

b. Subcutaneous.

c. The superficial loculus of a collar-stud abscess.

The volar surface of the hands of manual workers is often covered with greatly thickened epithelium. In these circumstances a subcutaneous abscess may burst through

the dermis and extend in the layers of the epidermis, in which event it is impossible to differentiate it from a purulent blister until the deeper loculus has been discovered at operation. This variety of collar-stud abscess is also encountered frequently in the pulps of the fingers and thumb.

CARBUNCLE OF THE HAND

A carbuncle is common on the dorsal aspect of the proximal segments of the digits, and on the dorsum of the hand. It is much more often encountered in males than females, because in the male these areas are often hairy. The carbuncle is liable to involve the extensor tendon, and is slow to heal. The treatment of carbuncle is discussed on p. 123.

PARONYCHIA

Paronychia is the most common infection of the hand (30 per cent). Organisms, usually staphylococci, gain entrance through a 'hang-nail' or an abrasion of the nail-fold during manicure. The inflammation commences as a subepithelial infection of either the nail-fold or the lateral sulcus (*Fig.* 1416). When seen within 24 hours of the onset, it is possible that the infection may be aborted by rest and antibiotic therapy. In most cases, however, by the time the patient presents, pus is present. Confined by the adherence of the eponychium to the base of the nail, the pus tracks around the cutaneous margin. In a high percentage of cases it undermines the proximal part of the nail and separates more and more of the nail from the subungual epithelium. In about one-third of untreated cases the more superficial part of the abscess ruptures, but suppuration continues, and not infrequently the abscess cavity becomes secondarily infected with *Esch. coli* and other organisms.

Fig. 1416.—The parts concerned in paronychia.

Operation.—Commencing with the handle of a scalpel, and continuing with a Watson-Cheyne dissector, the eponychium is pushed back from the base of the nail, as in manicure. Once adherent 'cuticle' is separated from the nail, the eye of a straight needle is used to break down the epithelium covering the pus. If gentle pressure is exerted over the nail, exit is also given to a subungual extension, if such be present. All remaining pus is removed by packing wisps of gauze into the crevice, and then discarding them. Redundant cuticle is cut away with fine-pointed scissors (*Fig.* 1417 A). Should there be a pocket under the corner of the nail-fold (and this point must be ascertained

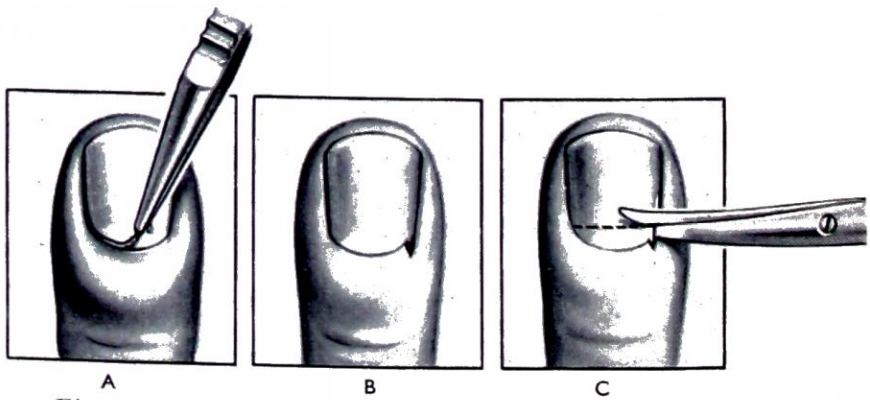


Fig. 1417.—A, Excising the eponychium; B, Pocket unroofed, when such is present; C Excising the proximal third of the nail (Kanavel's operation) (*see* text for indications).

by probing) a tiny wedge of overlying skin is removed (*Fig.* 1417 B). If the pocket extends beneath the nail, a corner of the base of the nail is clipped off. Only when pus has extended beneath a third or more of the width of the nail is excision of the proximal third of the nail required (*Fig.* 1417 C).

THE TERMINAL PULP SPACE

The pulps of the fingers and thumbs are subjected to more pricks than any other part of the body. Infection of the terminal pulp space is second only to paronychia as

the most frequent infection of the hand. The index finger and thumb are affected most often.

Surgical Anatomy.—The deep fascia fuses with the periosteum just distal to the insertion of the tendon of the flexor digitorum profundus (or, in the case of the thumb, the flexor pollicis longus). The deep fascia is also attached to the skin of the distal flexion crease, thereby closing the terminal pulp compartment at its proximal end (*Fig.* 1418).

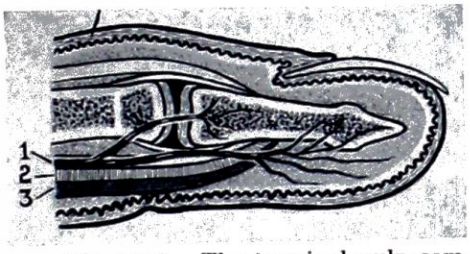


Fig. 1418.—The terminal pulp compartment is closed proximally by the deep fascia. 1, Digital artery ; 2, Flexor tendon ; 3, Deep fascia. (*After Handfield Jones.*)

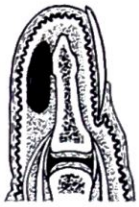


Fig. 1419.—The usual location of pus in the terminal pulp space.

The space is filled with compact fat, feebly partitioned by fibrous septa. These septa play but little part in the limitation of infection. Through this space run the terminal branches of the digital artery to supply the distal four-fifths of the terminal phalanx ; thrombo-arteritis of these vessels accounts for the frequency with which osteomyelitis complicates infection of this closed space.

Clinical Features.—Dull pain and swelling are the first symptoms. By the third day there are severe nocturnal exacerbations of throbbing pain, interfering with sleep. Light pressure over the affected pulp increases the pain. The corresponding supra-trochlear lymph-node is frequently enlarged and tender. If the pulp is indurated, and has lost its normal resilience, pus is present (*Fig.* 1419). Untreated, the abscess tends to point towards the centre of the pulp beneath a patch of devitalized skin. A collar-stud abscess then occurs ; still untreated, the abscess bursts.

Conservative Treatment.—If the case is an early one (under 48 hours) penicillin treatment for 24 hours is advised, for on no account should operation be undertaken during the stage of cellulitis ; only if local improvement is undeniable should non-operative treatment be continued.

Operation.—A transverse incision is made through the skin at the point of greatest tenderness (*Fig.* 1420). The beginner is warned not to be beguiled by entering the superficial loculus of a collar-stud abscess. Removal of the slough, which is frequently present, is essential ; great care must be taken not to traumatize the periosteum.

Fig. 1420.—Incision of an abscess of a terminal pulp space. (*H. Bolton.*) (*Journal of Bone and Joint Surgery.*)

Osteomyelitis of the Terminal Phalanx is all too commonly a sequel of terminal pulp-space infection. At operation, in a case of some standing, that part of the bone bereft of its blood-supply (*see Fig.* 1418) is sometimes found to be loose, and can be lifted out of the abscess cavity at the time of the operation. More often the sequestrum separates (*Fig.* 1421) some weeks after the abscess has been evacuated, in which case the wound continues to discharge. Repeated radiographs and probing will indicate when the sequestrum has separated. Only then must it be removed, after which healing will proceed apace. In the case of a child, provided the periosteum is relatively undamaged, regeneration of the diaphysis is possible. In the adult no regeneration occurs, and the patient is left with a shortened terminal phalanx covered by an ugly, curved nail.

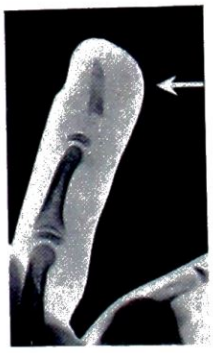
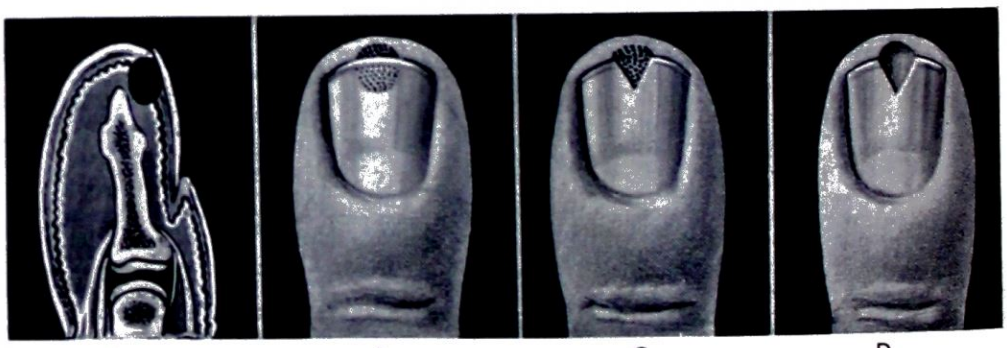


Fig. 1421.—Osteomyelitis complicating infection of the terminal fascial space.

THE APICAL SPACE

The apical space is situated between the distal quarter of the subungual epithelium and the periosteum (*Fig.* 1422 A). Usually it becomes infected by running a sharp object under the free edge of the nail into the 'quick'. The lesion, which is exquisitely painful, gives rise to comparatively little swelling. This rather common condition is often confused with terminal pulp-space infection, but unlike the latter, tenderness is greatest at or just beneath the free edge of the nail. Sometimes there is redness passing down one or both of the lateral nail-folds, and even extending around the skin edge at the base of the nail: paronychia is then likely to be diagnosed, unless the area of greatest tenderness is ascertained. Pus comes to the surface either just distal to, or just beneath, the free edge of the nail (*Fig.* 1422 B).



A B C D

Fig. 1422.—A, B, Location of an abscess of an apical space; C, D, Method of treatment.

Operation.—A small V (*Fig.* 1422 C) of the free edge of the nail overlying the site of greatest tenderness is removed, and a little wedge of the full thickness of the skin overlying the abscess is excised also (*Fig.* 1422 D). The amount of pus and debris evacuated is surprisingly small; commonly the abscess cavity extends down to the bone, but osteitis is most unusual. Following the operation, relief of symptoms is immediate, and the wound heals in under a week.

INFECTION OF THE VOLAR SPACE OF THE MIDDLE AND PROXIMAL SEGMENTS OF THE DIGITS

These spaces lie in front of the corresponding flexor tendon-sheath.

The middle volar space is separated above and below by fibrous partitions while, like its fellow, it is shut off from the dorsal cellular tissue by fibrous septa extending from the skin and the periosteum.

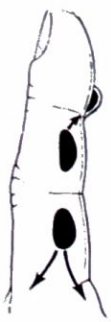


Fig. 1423.—An abscess of the terminal volar space usually points in the distal flexion crease, while pus in the proximal space passes to an adjacent web space. (*After M. Iselin.*)

The proximal pulp space is well separated from the middle pulp space, but below it communicates freely with the web space. The fatty tissue occupying these spaces is packed more loosely than that of the terminal pulp space.

Diagnosis.—Infection of these spaces is fairly common. It may be subcutaneous or deep to the deep fascia. In the latter case, especially when the middle segment is involved, the finger is held in semiflexion and an attempt to straighten it is painful. While the whole finger is swollen and tender, induration is confined to the affected segment. In comparatively early cases differential diagnosis between infection of either of these spaces and localized infected tenosynovitis is sometimes so difficult that an exploratory operation must be performed. In late cases of suppuration in the middle segment a purulent blister appears frequently near the terminal flexion crease (*Fig.* 1423), while in the proximal segment the swelling is asymmetrical because extension to the web space is frequent.

Operation.—After pus has become localized and the diagnosis is not in doubt, the best approach is through a transverse incision over the point of greatest tenderness. When the diagnosis is uncertain the space should be explored through a lateral longitudinal incision (*see* p. 1018).

WEB-SPACE INFECTION

The three interdigital web spaces are filled with loose fat that bulges between the three divisions of the palmar fascia (*Fig.* 1424). When the space is filled with pus most of it lies on the volar aspect, but there is often an extension passing over the transverse ligament to a smaller dorsal collection. If it is allowed to do so, it is here on the dorsal aspect, where there is less resistance, that the abscess points. Anatomically it is possible for pus in a web space to track along a lumbrical canal to the middle palmar space ; in practice it seldom does so. Infection of a web space often results from a purulent blister on the fore-part of the palm. It can also arise as an extension from an abscess of the proximal pulp space of a related digit.

Diagnosis.—Constitutional symptoms are usually severe ; consequently patients with this condition are often seen before localization of the infection has occurred. At this stage there is gross œdema of the back of the hand, and although web-space infection

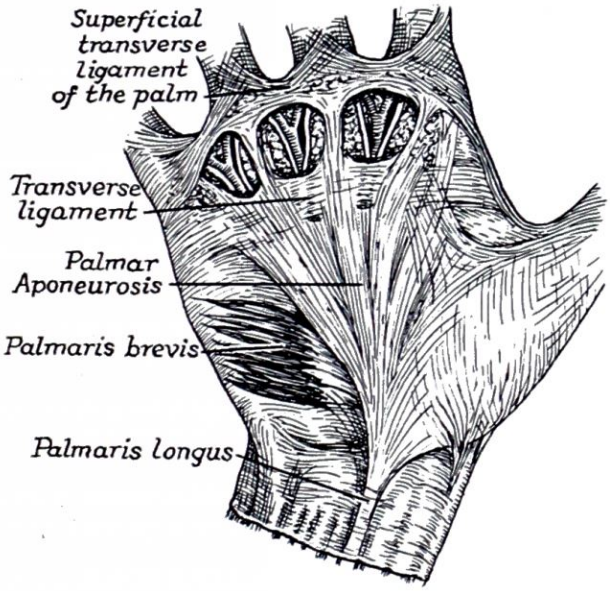


Fig. 1424.—The three interdigital web spaces situated between the transverse fibres of the palmar aponeurosis (transverse ligament) and the superficial transverse ligament, separated by the slips of palmar aponeurosis. (*After P. J. Poirier.*)

Fig. 1425.—Infection of a web space.

can be strongly suspected from the location of the tenderness, it is often difficult to rule out infected tenosynovitis. The patient should be put to bed with the arm splinted and elevated by suspension. Penicillin is administered. Once localization has occurred, the signs of infection of a web space become manifest. In severe infections the involved fingers are separated (*Fig.* 1425). In addition to the area of redness shown, there is often a fan-shaped blush on the dorsum extending from the web. The maximum tenderness is found on the volar surface of the web and at the base of one of the fingers extending a short way into the palm. There is often tenderness also on the dorsal aspect of the web. Untreated, pus can track across the volar surface of the base of a finger into an adjacent web space, and also up the sides of the proximal segments of the related digits.

Operation.—If there is an area of devitalized skin either anteriorly or posteriorly, the abscess is entered by snipping this away. In other circumstances a transverse incision is made on the palmar aspect, just below the web or just below the proximal flexion crease of the finger most affected, whichever is the more indurated. A few strands of palmar fascia have to be divided. The walls of the abscess cavity, which is often the size of a thimble, are cleansed of granulation tissue. If, by gentle probing, a communicating channel is found passing to the dorsum, it is advisable to make a counter-incision on the dorsal aspect. In either case the whole of the interior of the space must be denuded of granulation tissue.

INFECTIONS OF THE FASCIAL SPACES OF THE PALM

Superficial Infection has been described on p. 1009.

Subaponeurotic Infection.—Following pricks or splinter penetration, suppuration occurs occasionally in the space between the palmar fascia and the flexor tendon-sheath. In this situation, collar-stud abscess formation is not unusual, the pus tracking through the original puncture in the palmar fascia into the layers of the skin (there is no subcutaneous space in the centre of the palm (*Fig.* 1426)).

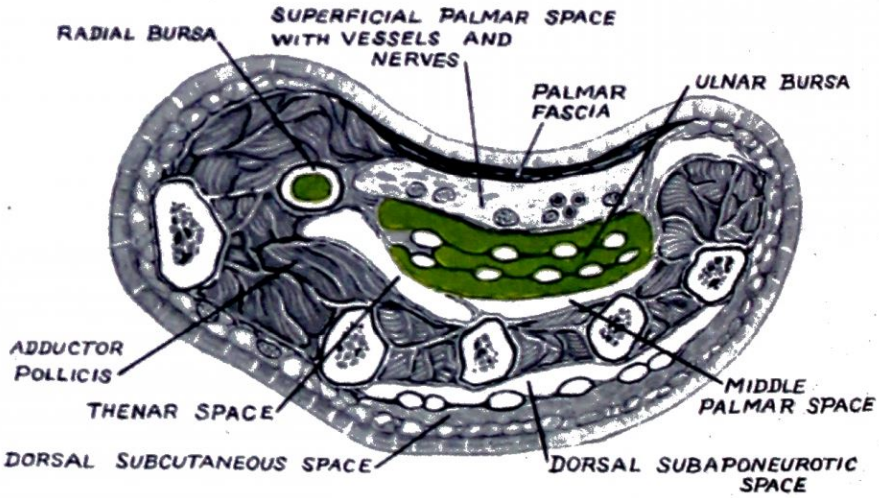


Fig. 1426.—Cross-section of the middle of the palm.

Operation.—In the case of both subcutaneous and subaponeurotic abscess of the palm, a small transverse incision is made in the line of the nearest skin crease over the most tender area or, when pus can be seen beneath the thickened epidermis, the abscess is entered by paring away the superficial layers of the skin. The interior of the abscess cavity must be inspected and probed with accustomed care; should an opening be found

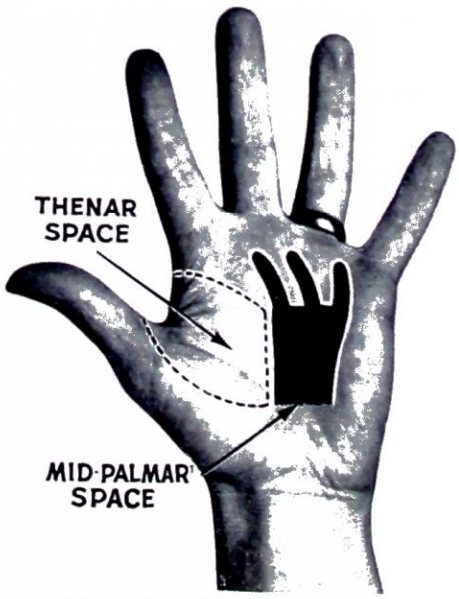


Fig. 1427.—The relative positions of the thenar and middle palmar fascial spaces. Note the three diverticula (lumbrical canals) from the middle palmar space.

Fig. 1428.—Incision for entering the middle palmar space.

leading to a deeper collection, it is essential to enlarge the opening sufficiently to be enabled to remove slough and infected granulations from its wall with strips of gauze.

Middle Palmar Space Infection lies very deeply. It is situated between the flexor tendon-sheaths and the fascia covering the interosseous muscles (*see Fig.* 1426), being separated from the thenar space by a fibrous septum, extending from the palmar fascia

Acute Fulminating Tenosynovitis involves the whole sheath rapidly, and is nearly always due to a streptococcal infection. The classical local signs are :—

1. Symmetrical swelling of the entire finger without redness.
2. Inability to flex the finger. (Slight movement occurs at the metacarpophalangeal joint due to contraction of the lumbrical.)
3. Flexion of the finger (*signe du crochet*) with exquisite pain on extension. (Unfortunately this sign is not always present, and it occurs also in infection of the middle pulp space (M. Iselin).)
4. Tenderness over the infected sheath, especially over its proximal cul-de-sac (*Fig.* 1434).

Conservative Treatment.—In cases of under 24 hours' duration, the forearm and hand (the latter being placed in the position of rest) are wrapped in cotton-wool, splinted and elevated. One mega-unit of penicillin is given intramuscularly and repeated

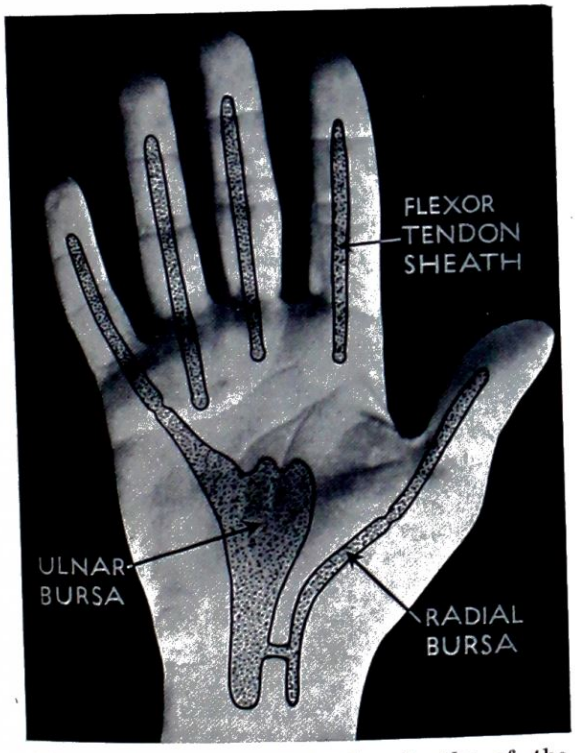


Fig. 1434.—The flexor tendon-sheaths of the hand. (Typical arrangement.)

Fig. 1435.—Showing the lumbrical muscles, which are the principal factors in conducting infection from the tendon-sheaths to the palm.

6-hourly when a clinical re-examination is made. Only if the local, as well as the general, response to conservative measures is unquestionable, is non-operative treatment continued.

Indications for Operation.—

1. Symptoms have been present for 24 hours or more without antibiotic therapy.
2. If swelling of the finger and acute tenderness over the sheath continue for 12 hours and when, in addition, throbbing pain is unrelieved by elevation and Tab. codein Co., it is inadvisable to delay operation longer than six hours.

It should be known that in some cases within 48 hours a portion of the tendon has turned yellow and has lost its lustre (J. E. Flynn) : this is more liable to occur in patients over 50 years of age than in younger individuals. It is a well-established fact that tendon necrosis occurs earlier and more often in cases of staphylococcal infection than in those where the infection is streptococcal—again emphasizing the baneful effects of the exotoxin of the staphylococcus.

Operation.—An incision is made along the lateral aspect of the middle segment (*Fig.* 1436) of the affected digit. The fibrous portion of the sheath is divided (*Fig.* 1436 inset), when the thin, bulging theca will be displayed. Some of the fluid within it is aspirated and sent for bacteriological examination : the theca is then incised. A short transverse

INFECTION OF THE DORSAL SPACE

The frequency with which pitting œdema accompanies pus in the palmar aspect of the hand has resulted in neglect of an appreciation of the dorsal fascial spaces as a site of infection, and a reluctance to incise the dorsum of the hand. The most frequent causes of dorsal space infection are a boil of the overlying skin, or a penetrating wound. Infection of the dorsal subcutaneous space of the hand is fairly common, as also is the corresponding space in the proximal segment of the digits (*Fig.* 1432): that of the dorsal subaponeurotic

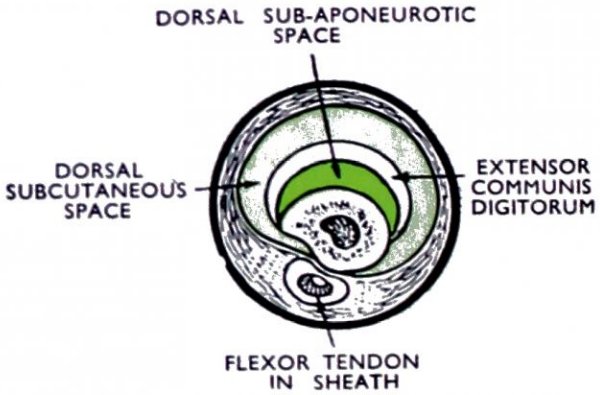


Fig. 1432.—Cross-section of a finger showing the relationship of the dorsal subcutaneous and dorsal subaponeurotic spaces. These spaces are continued downwards on to the back of the hand, bearing the same relationship to the extensor tendon.

space is rare. If swelling of the dorsum accompanied by tenderness, induration, and perhaps redness persists for more than 48 hours, fluctuation should not be awaited.

Operation.—An incision about ½ in. (1·25 cm.) long, which in this instance can be vertical is made over the point of greatest tenderness.

INFECTED TENOSYNOVITIS

The most frequent cause of infected tenosynovitis is puncture of a volar flexion crease of a digit. In these situations, not only does the tendon-sheath lie just beneath the very thin skin that covers the crease, but opposite the joints the sheath is devoid of a fibrous coat—the so-called 'pulleys' (*Fig.* 1433). Of these vulnerable creases, it is the distal one that is punctured most often. Exceptionally the sheath is infected by extension from the terminal pulp space. In the past this occurred with some frequency from the scalpel transgressing the hallowed ground of the septum that closes the proximal end of the space (*see Fig.* 1418). Because of their continuity with the ulnar and radial bursæ, the most dangerous sheaths to become infected are those of the little finger and the thumb. Nevertheless, it should be appreciated more widely that anatomical research has proved that the sheath of either the index, middle, or ring finger, or combinations of these, communicates with the ulnar bursa in 11 per cent of cases (E. W. Scheldrup). The typical arrangement of the sheaths is shown in *Fig.* 1434.

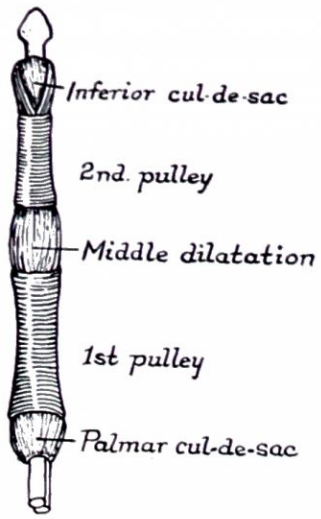


Fig. 1433.—The digital sheath, showing the particularly vulnerable areas where the fibrous layer is lacking. (*After M. Iselin.*)

The relationship of the flexor tendon-sheaths to the lumbrical muscles is of surgical importance.

The lumbrical muscles arise from the tendons of flexor digitorum profundus, the outer two by one head, the inner two by two heads. Their tendons pass around the *radial* side of the corresponding digits to reach the expansions of the tendons of the extensor digitorum, into which they are inserted.

The lumbrical canals act as conducting channels for pus to travel from an infected tendon-sheath to the middle palmar space. The weakest part of a tendon-sheath is its proximal end. When a sheath becomes over-distended it is here that it bursts. By referring to *Fig.* 1435 it will be appreciated that pus from a ruptured tendon-sheath enters the corresponding lumbrical canal.

Acute Fulminating Tenosynovitis involves the whole sheath rapidly, and is nearly always due to a streptococcal infection. The classical local signs are :—

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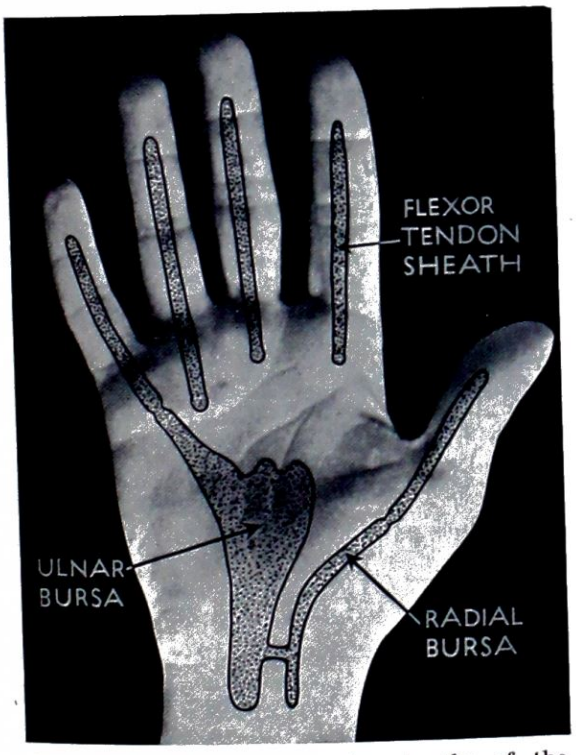


Fig. 1434.—The flexor tendon-sheaths of the hand. (Typical arrangement.)

Fig. 1435.—Showing the lumbrical muscles, which are the principal factors in conducting infection from the tendon-sheaths to the palm.

6-hourly when a clinical re-examination is made. Only if the local, as well as the general, response to conservative measures is unquestionable, is non-operative treatment continued.

Indications for Operation.—

1. Symptoms have been present for 24 hours or more without antibiotic therapy.

2. If swelling of the finger and acute tenderness over the sheath continue for 12 hours and when, in addition, throbbing pain is unrelieved by elevation and Tab. codein Co., it is inadvisable to delay operation longer than six hours.

It should be known that in some cases within 48 hours a portion of the tendon has turned yellow and has lost its lustre (J. E. Flynn) : this is more liable to occur in patients over 50 years of age than in younger individuals. It is a well-established fact that tendon necrosis occurs earlier and more often in cases of staphylococcal infection than in those where the infection is streptococcal—again emphasizing the baneful effects of the exotoxin of the staphylococcus.

Operation.—An incision is made along the lateral aspect of the middle segment (*Fig.* 1436) of the affected digit. The fibrous portion of the sheath is divided (*Fig.* 1436 inset), when the thin, bulging theca will be displayed. Some of the fluid within it is aspirated and sent for bacteriological examination : the theca is then incised. A short transverse

incision (*Fig.* 1436) is made over the proximal cul-de-sac, which is opened. Through this incision a ureteric catheter is introduced into the sheath, which is irrigated with normal saline solution; 100,000 units of penicillin in 5 per cent saline solution is then injected.

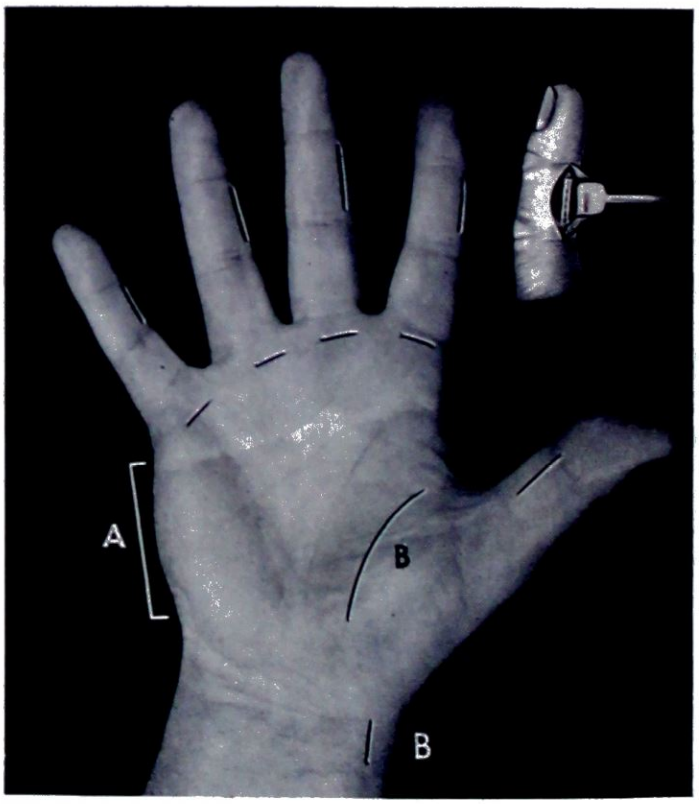


Fig. 1436.—Incisions for opening infected tendon-sheaths. A, Additional incision when the ulnar bursa is implicated; B, B, Additional incision when the radial bursa is implicated.

Results.—Seventy per cent excellent, 15 per cent fair, and 15 per cent poor.

Localized Infected Tenosynovitis is relatively common owing to the early antibiotic treatment enabling Nature to limit the infection to a portion of the sheath by adhesions. In this instance the infecting organism is frequently a staphylococcus. Swelling and tenderness are confined mainly to one segment of the digit, rendering the differential diagnosis from infection of a mid or proximal volar space very difficult. In these circumstances, after a period of conservative treatment without marked improvement, it is expedient to open the pulp space through a lateral incision (*Fig.* 1437). If the pulp is free from pus the fibrous

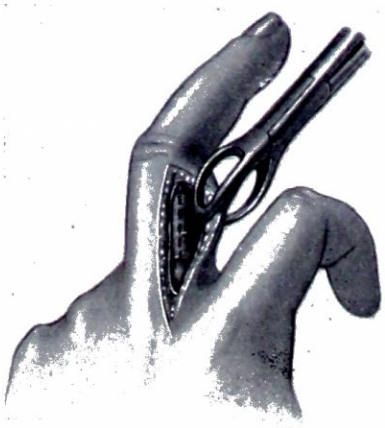


Fig. 1437.—Lateral incision for exposing the flexor tendon-sheath in the proximal segment of the middle finger. (*After M. Iselin.*)

pulley of the sheath is divided. The theca can then be seen clearly. Some of the fluid within it is aspirated and sent for bacteriological examination. Unless the fluid is perfectly clear, the theca is incised.

INFECTION OF THE ULNAR BURSA

Infection of the ulnar bursa is characterized by:—

1. Œdema of the whole hand, especially the dorsum, due to lymphatic spread.
2. Moderate swelling of the palm.
3. Sometimes a fullness immediately above the flexor retinaculum.
4. The flexed fingers resist extension, the maximum difficulty being experienced in the little, and the least in the index, finger.

5. Especially valuable is Kanavel's sign (*Fig.* 1438). The area of greatest tenderness is over that part of the ulnar bursa lying between the transverse palmar creases.

It should be noted that the ulnar and radial bursæ intercommunicate in 80 per cent of cases, and often when an untreated infection of one has persisted for more than 48 hours, the other becomes involved as well. As has been noted (p. 1016), in 11 per cent of cases the tendon-sheaths of digits other than that of the little finger communicate with the ulnar bursa. This little-known fact is of great surgical importance.

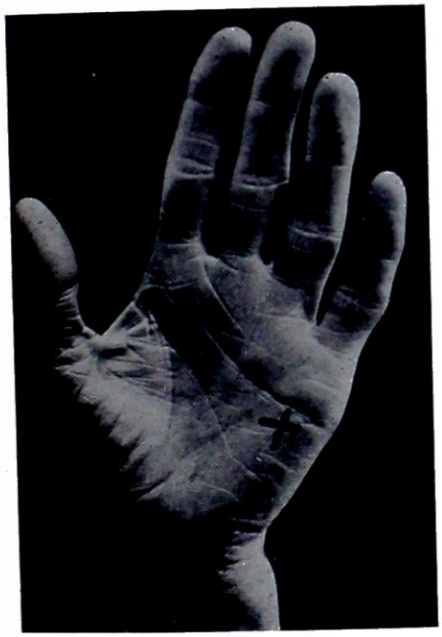


Fig. 1438.—Kanavel's sign for ulnar bursitis—point of maximum tenderness in the site marked with a cross.

Operation.—In addition to opening the involved tendon-sheath along the lateral aspect of the middle segment of the finger the following method of draining the ulnar bursa is recommended.

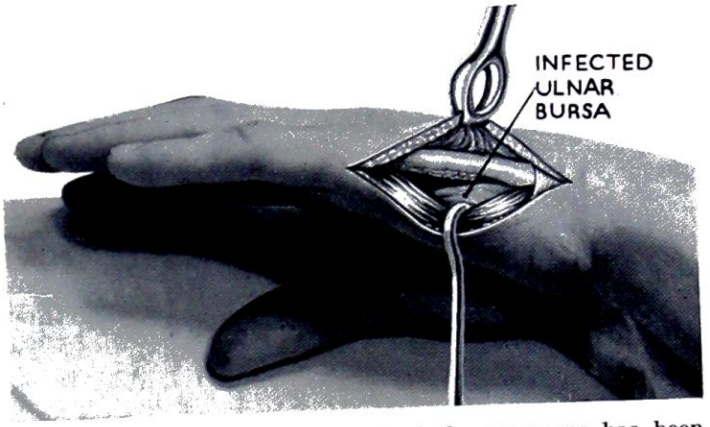


Fig. 1439.—The greater part of the opponens has been divided after retraction of the abductor muscle. Beneath the deep fascia lies the ulnar bursa.

Henry's Approach.—After the skin and deep fascia have been incised over the antero-lateral aspect of the fifth metacarpal (*see Fig.* 1436) the abductor and flexor digiti minimi are separated from the bone and retracted forwards, displaying the opponens, which is divided close to its attachment to the bone. The fascia deep to this muscle is incised, and the distended bursa bulges into the wound (*Fig.* 1439). If the bursa has been emptied via the infected tendon-sheath, a curved probe passed from the original incision will enable the wall of the bursa to be identified and incised.

INFECTION OF THE RADIAL BURSA

Infection of the radial bursa is characterized by :—

1. Flexion of the distal phalanx of the thumb. The thumb only is flexed—it is completely rigid and inextensible. The other digits can be extended fully.
2. Tenderness over the sheath of the flexor pollicis longus.
3. Sometimes swelling just above the flexor retinaculum.

Treatment.—While in early cases antibiotic therapy should be given a trial, the perils of leaving this sheath undecompressed include extension to the ulnar bursa and, because the sheath is particularly unyielding, necrosis of the tendon of the flexor pollicis longus.

Operation.—The sheath can be decompressed adequately by the incisions shown in *Fig.* 1436, being vigilant not to extend the proximal incision farther than $\frac{3}{4}$ in. (1·8 cm.) distal to the flexor retinaculum, lest the branch of the median nerve to the muscles of the thenar eminence be injured. Should pus well up when pressure is exerted over the wrist a ureteric catheter is passed down the sheath, and a third incision is made on to the catheter above the retinaculum. In this way the proximal cul-de-sac can be opened safely and drained through a small incision. Irrigations with saline solution followed by penicillin solution are carried out as directed on p. 1018.

LOCAL COMPLICATIONS OF INFECTED TENOSYNOVITIS

Sloughing of the Tendon.—If at the time of the operation a few fibres only are seen to be necrotic, these should be excised. When most or all of the circumference of the

tendon is yellow, and has lost its pristine glistening appearance, the incision must be extended downwards. If the length involved is limited, the first glistening (viable) proximal portion of the tendon is grasped firmly in a hæmostat, the tendon is transected distal to this, and again just above its insertion. A fundamental step of the operation is to transfix the tendon below the hæmostat with a needle carrying an unabsorbable suture, and by so doing to anchor the tendon stump to its sheath and surrounding tissues. On no account should the severed proximal end of the tendon be allowed to retract and possibly carry infection into the palm. The hæmostat is then removed and the crushed portion trimmed with scissors.

Another contingency is when a sloughing tendon is a cause of continued suppuration after an operation for infected tenosynovitis. The condition can be diagnosed with assurance if the radiograph is negative and involvement of another space has been eliminated. Having confirmed the diagnosis by re-opening the wound and extending it as necessary, if, as is usually the case, a greater part of the exposed tendon is non-viable, amputation of the affected finger through the metacarpophalangeal joint is the best course. Again a glistening (viable) portion of the tendon is grasped in a hæmostat before it is severed distal to the hæmostat. After the finger has been disarticulated, the divided proximal end of the flexor tendon is transfixed and stitched to the cut end of the extensor tendon, or to surrounding soft parts. In the case of the thumb the non-viable tendon should be excised with the same precautions regarding its retraction, but the digit is not sacrificed.

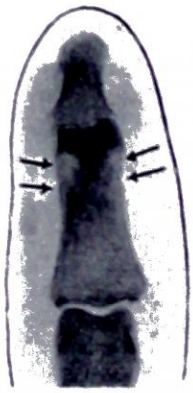


Fig. 1440.—Radiograph of a case of suppurative tenosynovitis of the index finger complicated by necrosis of the middle phalanx and suppurative arthritis of the terminal interphalangeal joint.

Osteomyelitis is a rare complication that attacks the middle more often than the proximal phalanx (*Fig.* 1440). If, after the tendon-sheath has been drained, pain, worse at night, persists, and there is no undue tenderness in other situations in the hand, the most probable cause is that osteomyelitis is proceeding in one of the phalanges. Careful palpation over the dorsal aspect is the best guide in the early stages. After the fifth day there will probably be sufficient bone destruction to afford radiological evidence. The presence of osteomyelitis is a clear indication for continuing antibiotic therapy. As soon as a sequestrum has formed, it must be removed through a dorsal incision.

Infected Arthritis can complicate infected tenosynovitis and either the distal or the proximal interphalangeal joint may be implicated by a deep prick which passes through the tendon-sheath and the tendon. The symptoms are similar to those of osteomyelitis, but the tenderness is most acute over the joint. If suspected, the contents of the joint should be aspirated (*see also* p. 905), and the pus sent for culture and sensitivity tests. For treatment, *see* p. 910.

Stiff Finger.—When the patient is left with a stiff finger provided the finger has been allowed to ankylose in a position of function, it is likely to prove a useful member in many walks of life. When the digit only 'gets in the way' it is better amputated (*see* p. 1000). A stiff ring finger, above all other fingers, holds back the other fingers from flexion and extension. This fact should be taken into consideration when debating whether or not to amputate (S. Bunnell).

Paralysis of the Median Nerve.—When signs of a median-nerve palsy develop in a case of infection of the hand, early decompression of the carpal tunnel by severing the flexor retinaculum is recommended by D. Bailey and J. F. B. Carter, who found the median nerve obviously compressed in two such cases. In these circumstances palsy of the median nerve is due to compression by inflammatory exudate in the radial or ulnar bursa or (more frequently) in both bursæ.

INVOLVEMENT OF THE FOREARM FROM THE HAND

When a radial or ulnar bursa, distended with pus, bursts, or an infected middle palmar space remains undrained, pus travels up the forearm between the flexor digitorum profundus ventrally, and the pronator quadratus and the interosseous membrane dorsally. It is here, in the space of Parona, that a quantity of pus can collect without giving rise to much swelling. There is, however, brawny induration above the wrist and great

tenderness on deep pressure, unless the original lesion has been incised and continues to discharge pus. Therefore, in cases of infection of the radial or ulnar bursa, if pus can be expressed by pressure over the wrist at the time of operation or subsequently, it is essential that the forearm be drained in the following manner:

Operation.—Commencing $\frac{3}{4}$ in. (1·8 cm.) above the styloid process of the ulna, an incision is made along the easily palpable anteromedial surface of the ulna: the incision, which should be nearly 4 in. (10 cm.) long, is deepened through the fascia. The tendon of the flexor carpi ulnaris is identified, and in the upper part of the wound fibres of the muscle are detached from the bone, allowing this muscle to be retracted. At this stage, if the ulnar bursa is distended with pus, its cul-de-sac can be seen (*Fig.* 1441). In any event the key to the situation is the pronator quadratus, and its fibrotendinous fibres, running in a transverse direction, must be displayed. With the pulp applied to the anterior surface of the pronator quadratus, the finger is inserted beneath the flexor tendons. Frequently pus escapes as soon as the space is entered because the ulnar bursa has burst already. If pus does not flow, the bursa is opened widely. When there is pus in the space of Parona a hæmostat is passed over the anterior surface of the pronator quadratus until its beak appears beneath the skin on the contralateral side. In this way through-and-through drainage (*Fig.* 1442) is established and maintained by a strip of corrugated rubber.

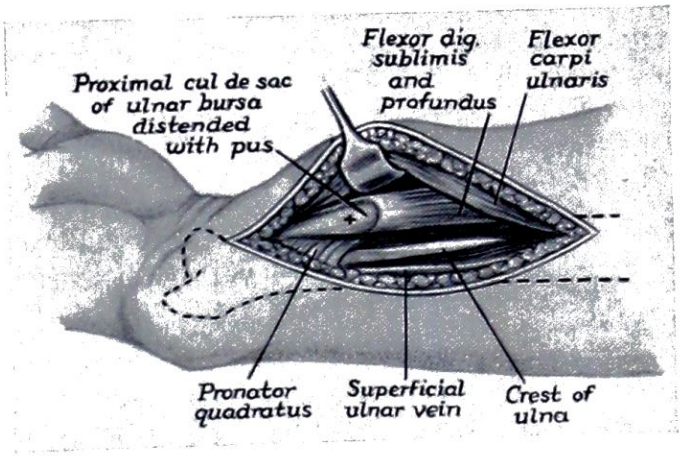


Fig. 1441.—Exposure of the cul-de-sac of the ulnar bursa in the forearm, which is also the method of draining the space of Parona with precision. (*After L-H. Farabeuf.*)

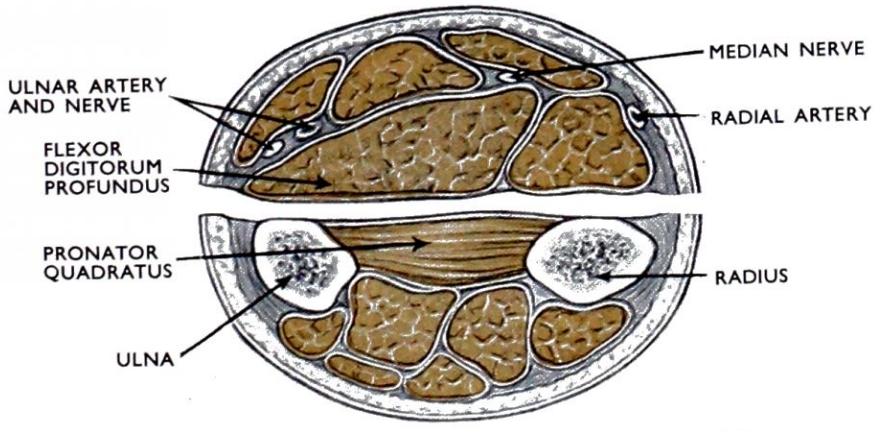


Fig. 1442.—Through-and-through drainage of the space of Parona.

SYMBIOTIC INFECTION

The combination of micro-aerophilic non-hæmolytic streptococcus and hæmolytic *Staph. aureus* produces a destructive lesion of the skin and subcutaneous tissues. The gross appearance is quite characteristic: there is an outer zone of erythema, an intermediate dark purple zone, and an inner zone of gangrenous skin. The centre of the lesion becomes a granulating ulcer, which in turn may become bright red and clean. The lesion continues to spread until the patient dies or the infection is brought under control. The usual antibiotics are of little avail, but F. L. Meleney has found that bacitracin is of considerable value. The usual treatment is wide excision and antibiotic therapy that is inimical to the organism present, as demonstrated by sensitivity tests. Occasionally, activated zinc peroxide is beneficial.

communicate with the ulnar bursa. When the symptoms and signs persist in spite of 24 hours of rest, elevation, and antibiotic therapy, there should be no hesitation in opening the flexor tendon-sheath throughout its length.

INFECTION OF THE SUPERFICIAL FASCIAL SPACES OF THE SOLE

Like the palm of the hand, the superficial lymphatics of the sole converge on the dorsum by the shortest route, i.e., through the webs. Thus, when pus lies either superficial or deep in the sole, inflammatory œdema is most evident on the dorsum. In most instances this œdema also involves the ankle; less often it extends to the lower part of the leg. Pitting-on-pressure distinguishes œdema of the dorsum of the foot from the indurated brawny swelling that is present when pus lies in the dorsal subcutaneous space.

INFECTION OF THE WEB SPACES

The web spaces—four in number—extend on to the dorsal as well as the plantar aspect of the foot (*Fig.* 1443), the space between the great toe and the second toe being

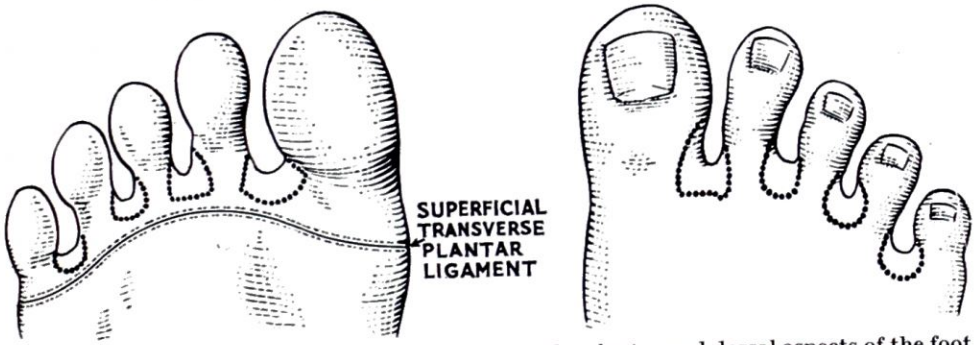


Fig. 1443.—The web spaces, showing the extent on the plantar and dorsal aspects of the foot.

larger than the remainder. The spaces are filled with fat. The digital vessels and nerves pass through the lateral parts of these spaces. Each space communicates with :—

1. The corresponding interdigital subcutaneous space beneath the superficial transverse plantar ligament.
2. The subcutaneous space of the related digits.
3. The dorsal subcutaneous space.

The diminutive lumbrical tendon passes through the proximal part of the space and, as in the hand, it can serve as a conductor of pus, in this instance to bring the web space into communication with the corresponding interdigital subcutaneous space.

Diagnosis.—There is localized tenderness over the dorsal and the plantar aspect of the web.

Drainage[1] is effected by making an incision through the plantar aspect of the space, care being taken not to injure the superficial transverse plantar ligament. When necessary, a counter-incision is made on the dorsum, and thereby through-and-through drainage is effected. A piece of corrugated rubber is always left in place for at least 24 hours.

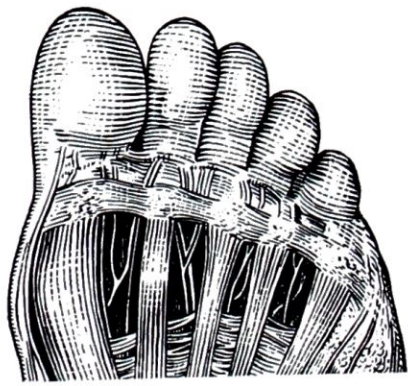


Fig. 1444.—The four interdigital subcutaneous spaces between the five slips of the central aponeurosis

The Interdigital Subcutaneous Spaces.—There are four interdigital subcutaneous spaces which lie between the five digital slips of the central aponeurosis (*Fig.* 1444); the most medial space is larger than the others. Each of these spaces is roughly pyramidal in shape, and is filled with fat. Within each space lies a digital nerve, and in the distal half of each space the digital vessels gain entrance by penetrating the floor of the space. Proximally, the interdigital subcutaneous spaces communicate with the most

[1] In the diabetic patient the treatment of web-space infection, which is not uncommon, and also suppurative tenosynovitis, by orthodox drainage is so disappointing that these infections should be regarded as an urgent indication for amputation of the relevant toe, the wound being left open.

INFECTIONS OF THE FOOT

The subject of infections of the foot does not lack importance. The world over, these infections are common. Infections of the sole are particularly frequent among coolies and those who work barefooted, while the other infections about to be described occur, for the most part, in those who go about their business shod.

That antibiotic therapy, and when possible antibiotic therapy that conforms with the bacteriological sensitivity tests of the organism or organisms isolated from the pus, will be employed in all cases, and that an incision into an œdematous—as opposed to an indurated—area will not be made, is assumed, for these cardinal injunctions have been emphasized so often in modern writings concerned with the sister subject—infections of the hand.

Infected Blister is one of the most common infections of the foot. When the temperature is normal and the contents of the blister appear doubtfully purulent, after cleansing the whole foot with soap and water, or preferably a detergent, applied with sterile gauze or cotton-wool, the blister can be aspirated. If the fluid is opalescent the patient should be given penicillin, and the fluid should be sent for bacteriological examination. When the blister is frankly purulent, it should be incised.

Paronychia, particularly of the great toe, is also common. It often occurs as a complication of an ingrowing toe-nail. An abrasion of the eponychium with contaminated scissors is also a frequent cause. The clinical features and the treatment do not differ from that of a paronychia of a finger or a thumb, with the exception that when an ingrowing toe-nail is present it is necessary to remove the corner of the nail that projects into the tissues. This is carried out with nail clippers which cut the nail close to the lateral margin for about ¼ in. (6 mm.). The freed portion of nail is then rolled from beneath the eponychium, and removed. In all cases washing (*see above*) is carried out each time the wound is dressed.

Infected Adventitious Bursa associated with a Corn.—The small bursa that forms between a corn and the projection of bone that causes the corn usually becomes infected as a result of improper chiropody. There are signs of inflammation around the corn. Even the slightest pressure on the corn causes excruciating pain. The prelude to treatment consists in thorough washings of the foot, as described previously. Drainage is then accomplished by trimming the corn with a sterile scalpel. The corn is pared until pus exudes; usually this can be undertaken without an anæsthetic. The remainder of the treatment follows general principles, but bed-rest and elevation of the foot must be insisted upon until the inflammation has subsided.

Infected Bursa over a Hallux Valgus.—The infection usually occurs through the skin. Frequently the overdistended bursa ruptures, to form a sinus; secondary infection then takes place. In a few instances the skin is calloused over the bursal area, and improper trimming results in infection. In cases not associated with a sinus the possibility of acute gout of the metacarpophalangeal joint must not be overlooked. One should search for tophi, and when possible have a blood uric-acid determination undertaken. If the diagnosis of gout is favoured, trial therapy with colchicum is valuable, but penicillin should be given as well until the diagnosis of gout is confirmed.

The treatment of this infected bursa follows general principles. It is highly important that removal of the bursa, together with the underlying cause, e.g., a hallux valgus, should not be carried out until several months have elapsed after all signs of inflammation have disappeared. Even then, the operation should be performed under antibiotic cover.

Terminal Pulp-space Infection is very uncommon as compared with this clinical entity in a finger or a thumb. Its diagnosis and treatment do not differ from that of its counterpart. When it occurs in the foot, usually it is the great toe that is affected.

Suppurative Tenosynovitis.—The flexor tendon-sheaths of the toes are short. Each extends only the length of the toe, and has no connexion with any of the synovial sheaths of the tendons around the ankle—facts which tend to reduce the incidence of complications of suppurative tenosynovitis of a toe when compared with a corresponding lesion of a finger or a thumb. Furthermore, should a partially or completely stiff digit result, the disability it occasions is infinitesimal when compared with that of a stiff finger or thumb.

Suppurative tenosynovitis of a toe is rare. The physical signs it produces are comparable in every way to infection of a tendon-sheath of a finger that does not

with the ulnar bursa. When the symptoms and signs persist in spite of of rest, elevation, and antibiotic therapy, there should be no hesitation in the flexor tendon-sheath throughout its length.

INFECTION OF THE SUPERFICIAL FASCIAL SPACES OF THE SOLE

the palm of the hand, the superficial lymphatics of the sole converge on the by the shortest route, i.e., through the webs. Thus, when pus lies either super- deep in the sole, inflammatory œdema is most evident on the dorsum. In most this œdema also involves the ankle; less often it extends to the lower part of Pitting-on-pressure distinguishes œdema of the dorsum of the foot from the brawny swelling that is present when pus lies in the dorsal subcutaneous space.

INFECTION OF THE WEB SPACES

The web spaces—four in number—extend on to the dorsal as well as the plantar of the foot (*Fig.* 1443), the space between the great toe and the second toe being

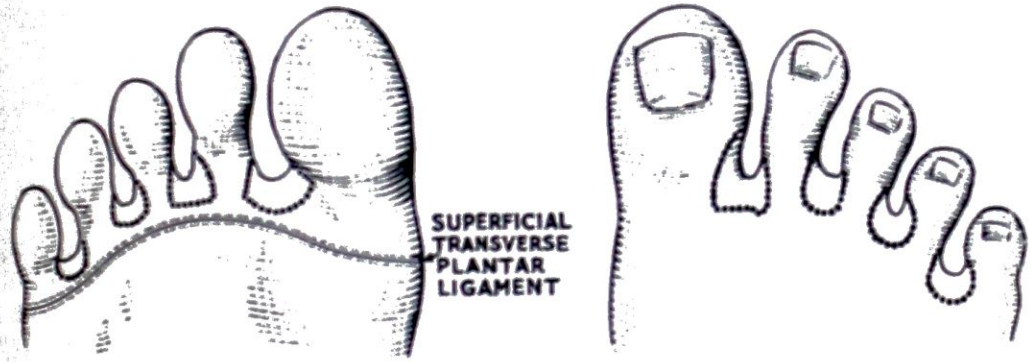


Fig. 1443.—The web spaces, showing the extent on the plantar and dorsal aspects of the foot.

than the remainder. The spaces are filled with fat. The digital vessels and pass through the lateral parts of these spaces. Each space communicates with :— The corresponding interdigital subcutaneous space beneath the superficial trans- plantar ligament.

2. The subcutaneous space of the related digits.

The dorsal subcutaneous space.

diminutive lumbrical tendon passes through the proximal part of the space and, the hand, it can serve as a conductor of pus, in this instance to bring the web space communication with the corresponding interdigital space.

There is localized tenderness over the and the plantar aspect of the web.

is effected by making an incision through the plantar aspect of the space, care being taken not to injure the superficial transverse plantar ligament. When necessary, a counter-incision is made on the dorsum, and thereby through-and-through drainage is effected. A piece of corrugated rubber is always left in place for at least 24 hours.

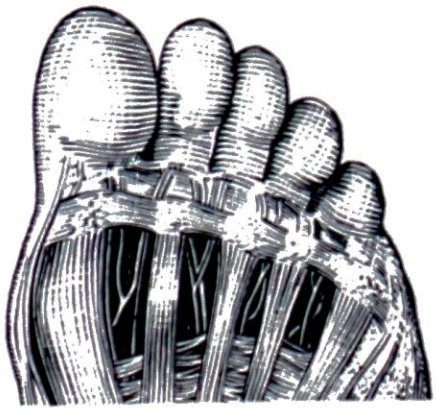


Fig. 1444.—The four interdigital subcutaneous spaces between the five slips of the central aponeurosis

The Interdigital Subcutaneous Spaces.—There are four interdigital subcutaneous spaces which lie between the five digital slips of the central aponeurosis (*Fig.* 1444); the most medial space is larger than the others. Each of these spaces is roughly pyramidal in shape, and is filled with fat. Within each space lies a digital nerve, and in the distal half of each space the digital vessels gain entrance by penetrating the floor of the space. Proximally, the interdigital subcutaneous spaces communicate with the most

In the diabetic patient the treatment of web-space infection, which is not uncommon, and tenosynovitis, by orthodox drainage is so disappointing that these infections regarded as an urgent indication for amputation of the relevant toe, the wound being

superficial layer of the central plantar Space I along the tunnels for the digital nerves. Distally each space communicates beneath the superficial transverse plantar ligament with the corresponding web space. A collar-stud abscess, with one abscess cavity lying within the calloused skin and the other occupying an interdigital space is present occasionally.

Infection of one of these spaces is more common amongst coolies and others who work barefooted especially in urban areas. Often the patient states that a sharp stone, a nail, or a thorn has penetrated the sole of his foot. At other times the cause is infection via the lymphatics from an infected crack in the calloused skin overlying the space. In 19 of 23 cases Rao and Kini reported that the infecting organism was *Staph. aureus*.

Diagnosis.—The patient complains of increasing pain between the shafts of the two metacarpals that bound the infected space. Soon he is unable to walk, and the general reaction is one of moderate severity. Exquisite tenderness over the infected space proclaims the diagnosis. When the pus has decompressed itself into the dorsal subcutaneous space, localization is more difficult.

Drainage must be placed away from the weight-bearing area of the sole. The best incision is that used for drainage of a web space (*see Fig.* 1443). A hæmostat is directed into the cavity filled with pus, and its jaws are opened. Tube drainage is required. In the case of a collar-stud abscess, both pockets must be drained separately through the same skin incision. When pus has burrowed posteriorly through the apex of the space an incision or a counter-incision is made in the line of the digital nerve in the pliable non-weight-bearing skin of the fore-part of the instep. In cases where an extension into the dorsal subcutaneous space has occurred, a counter-incision is required in the line of the tendons, nerves, and vessels, near to the base of a toe.

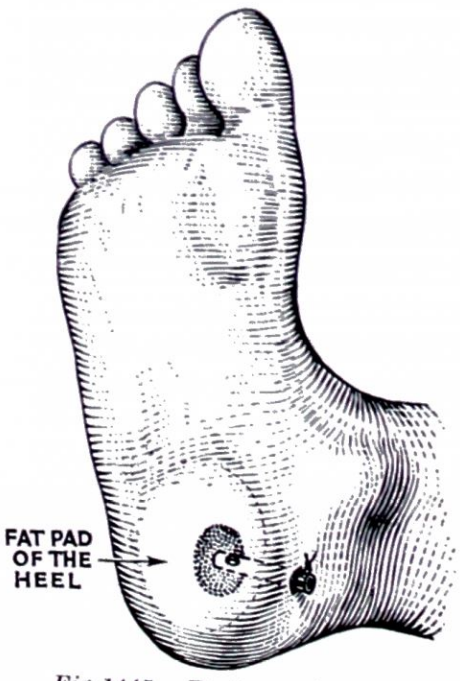


Fig. 1445.—Drainage of an abscess of the heel space. The incision is placed above the calloused skin covering the heel.

The Heel Space.—The fat pad of the heel, which is situated in the subcutaneous portion of the posterior third of the sole, is oval in shape, the long axis lying anteroposteriorly. Dense fibrous strands extend from the skin to the plantar fascia, so as to divide the fat pad into numerous small compartments; consequently the spread of pus from one compartment to another within the space is slow. Unexpectedly, infection seldom occurs as a result of such accidents as treading on a thorn; the usual portal of infection is a crack in the overlying calloused skin. In one-third of cases the pus is subcuticular; in the remainder the pus lies in the subcutaneous heel space proper. In a few cases a collar-stud abscess involves both these situations.

Diagnosis.—Steadily increasing throbbing pain is the leading symptom; it becomes so severe as to interfere with sleep. The patient dares not put his heel on the floor. Swelling of the soft tissues that cover one or both sides of the calcaneum is present, and in severe cases œdema of the ankle becomes manifest. Acute tenderness over the space, and possibly fluctuation, leaves no doubt as to the diagnosis.

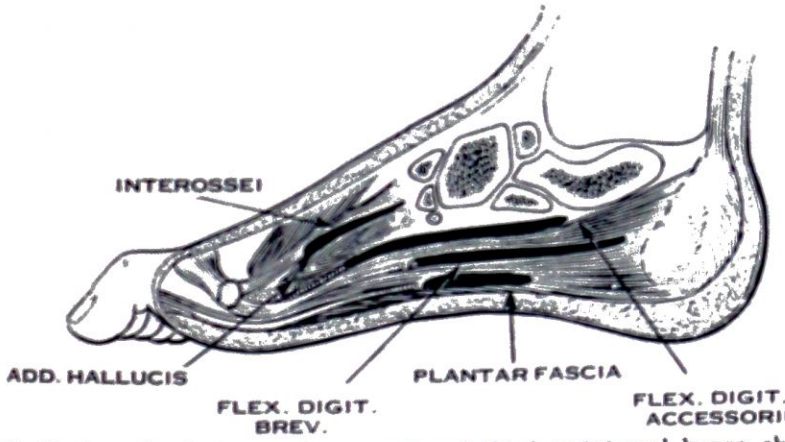
Treatment.—Usually by the time the patient presents, the abscess is ready for incision, which is made at the side of the heel so that the scar does not lie on a weight-bearing area. Fibrous septa within the abscess of the fat pad of the heel need division with a scalpel. When the abscess is subcuticular a small ellipse should be removed from one or other of the lips of the incision, in order to prevent the skin closing prematurely. In the case of a collar-stud abscess both pockets are opened through a single skin incision. In all cases tube drainage (*Fig.* 1445) is necessary for two or three days. For an abscess occupying the whole space, through-and-through drainage is best.

INFECTION OF THE DEEP FASCIAL SPACES OF THE SOLE

There are three deep fascial spaces in the sole of the foot—a medial, a central, and space. The medial and the lateral spaces are of subsidiary importance, for they comparatively rarely infected.

The Central Plantar Space is arranged like an apartment house of four stories. On) floor is plantar Space I, which lies between the plantar fascia and the digitorum brevis. On the second floor lies central plantar Space II, which is between the flexor digitorum brevis and the flexor digitorum accessorius. On floor is central plantar Space III, floored by the digitorum accessorius and by the adductor hallucis. On the fourth floor is central plantar Space IV, which by the adductor hallucis and roofed by the metatarsal bones, their ligaments, interosseus muscles.

Infection of the various floors of the central plantar space (*Fig.* 1446) becomes less common as we proceed from the ground floor upwards. The usual of infection of the central plantar space are a penetrating wound or, more frequently,



1446.—Sagittal section between the second and third metatarsal bones, showing the four compartments of the central plantar space. (*After M. Grodinsky.*)

from an undrained empyema of an interdigital subcutaneous space. Central Space IV can become infected from osteomyelitis or an infected compound of a related metatarsal bone.

Medial Plantar Space is situated between the abductor hallucis on the dorsal and the flexor hallucis brevis on the plantar aspect. It communicates with the subaponeurotic space around the medial side of the foot.

Lateral Plantar Space is situated between the flexor digiti minimi brevis on the aspect and the abductor digiti minimi on the plantar aspect. It communicates dorsal subaponeurotic space around the lateral aspect of the foot.

Diagnosis.—The most valuable guides to pus deep in the sole are swelling in the of the foot and tenderness of the instep. That the instep is acutely tender to distinguish the condition from infection of an interdigital subcutaneous space, one must be mindful of the fact that the central plantar space is frequently infected an interdigital subcutaneous space along the tiny tunnel that accommodates the nerve. When uncertainty prevails as to where the pus is situated, the foot should raised on pillows, antibiotic therapy administered, and another examination made in hours. Undue delay is dangerous, for, in addition to increasing toxæmia, one of following local complications is likely to supervene.

Complications of Infection of the Central Plantar Space.—When pus is present in Space II, and is not evacuated, the chances are that it will travel along the line resistance and spread from the sole to the medial space of the leg via the long tendons. Likewise, when pus in plantar Space III remains undrained, it tends along the tendon of the peroneus longus to the lateral leg space. Pus in plantar IV eventually decompresses itself between one or other sets of the interosseus into the dorsal subaponeurotic space.

Drainage of the Central Plantar Space.—An incision about 1 in. (2·5 cm.) long, parallel to and just above the medial border of the foot in the neighbourhood of the instep

(*Fig.* 1447), gives a direct approach, free drainage, and avoids leaving a scar on the pressure-bearing area of the sole. Keeping close to the bone, the incision is deepened until the intermuscular septum is reached (*Fig.* 1448); this is incised at a level near the sole, and Compartment I is entered. If pus is not present in Space I, the incision must be extended distally to the level of the base of the first metatarsal. The incision in the aponeurosis is extended, and the flexor digitorum brevis is exposed. Its medial border is identified, and a hæmostat is passed above the muscle and directed dorsally and towards the heel. Any one of the three deeper spaces can be explored through this incision. At the level where the pus is struck the hæmostat is directed towards the neck of the fourth metatarsal, well opened, and a drainage tube inserted.

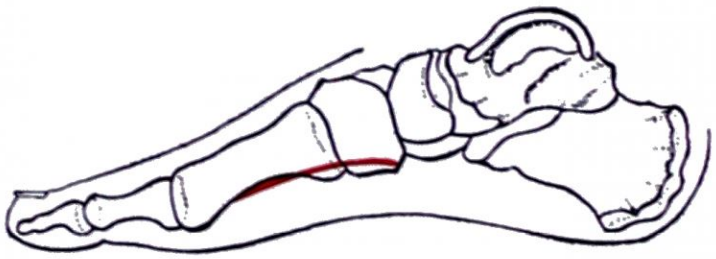


Fig. 1447.—Incision for draining the central and medial plantar spaces.

In the rather unusual event of plantar drainage proving insufficient a counter-incision is made on the dorsum of the foot in the fourth intermetatarsal space. The skin and subcutaneous tissues are opened, and the extensor tendon slips to the toes are identified. They are retracted, the aponeurosis is incised, and a hæmostat is thrust into Compartment III or IV of the central plantar space, whichever is the seat of the abscess. The jaws of the hæmostat are opened, and the space is drained through the dorsal incision. The dorsal approach should be used only if drainage through the medial incision described proves ineffectual after several days.

After-treatment.—Rest on a back splint, with the leg raised on pillows or, preferably, swung in a Bloxham's cradle, is maintained for two or three days, or until the pulse and temperature are normal. The patient should then be taken to the operating theatre

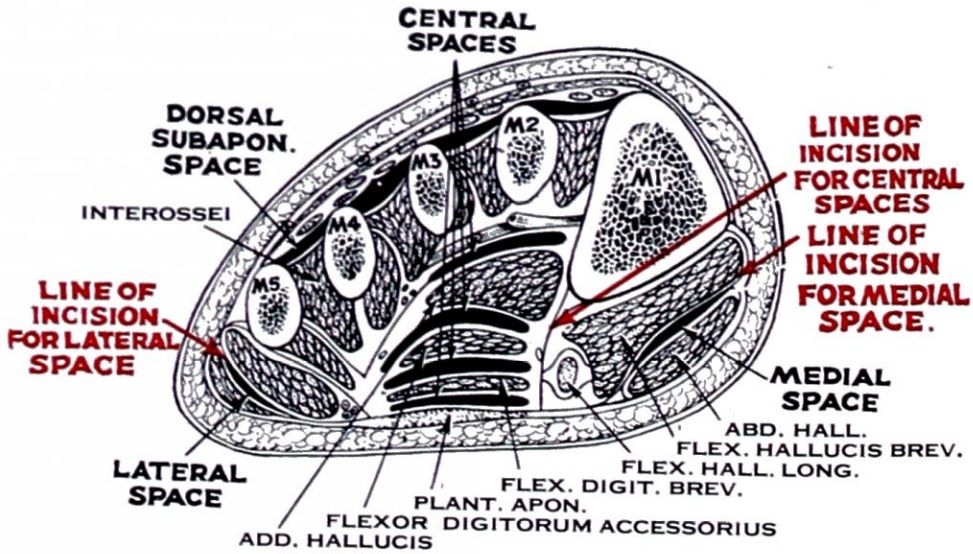


Fig. 1448.—Transverse section through the middle of the metatarsals, showing fascial spaces. The lines for opening the lateral, medial, and central spaces are shown. Note especially that each of the four compartments of the central space can be opened by the same incision if the fascial septum is incised. (*After M. Grodinsky.*)

and the wound or wounds are packed lightly with petroleum-jelly gauze, and a plaster cast applied. After the patient has been returned to bed, the limb is again elevated. Fixation in a plaster is most important, otherwise contractures are liable to occur, resulting in a considerable deformity of the foot that is most difficult, or even impossible, to correct. After ten days or a fortnight, unless there is some indication for doing so before, the plaster cast is removed and renewed. The patient can be ambulatory during this period, but the cast should be retained until the wound has healed. After removal of the plaster, œdematous swelling is prone to occur, and is most disabling, for although it is not usually associated with much pain, the increased size of the foot makes it impossible to wear an ordinary shoe. Swelling can be prevented by the application of

paste bandage to the foot and leg immediately after removal of the cast. The must extend from the base of the toes to the tuberosity of the tibia, and should on for six weeks or longer if the tendency to swell persists. When the bandage dirty, it is changed. In due course an orthopædic shoe will be required in most

of the Lateral Plantar Space.—To evacuate pus from the lateral space the shown in *Fig.* 1449 is employed. The incision passes through the skin and tissue, and the space is widely by incising the deep Corrugated rubber drainage

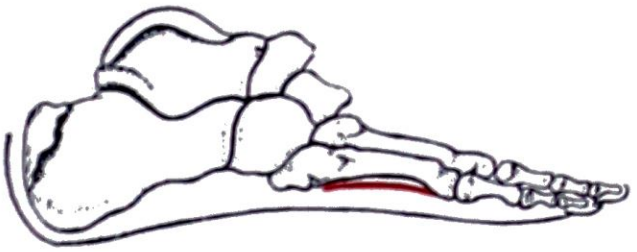


Fig. 1449.—Incision for draining the lateral plantar space.

of the Medial Plantar incision is almost the same advised for the central plantar *Fig.* 1447), but it should a little more towards the aspect of the foot, and over of maximum tenderness. It be the rule always to evacuate pus from the plantar aspect of the foot through an over either the medial or the lateral border of the foot. Such incisions not only adequate drainage, but ensure that the subsequent scar is well away from the area.

INFECTIONS OF THE DORSUM OF THE FOOT

The Dorsal Subcutaneous Space is usually infected from an extension of infection a subcutaneous interdigital space or from a web space. Occasionally localization of occurs in the space, when infection spreads from the sole to the dorsum by way ; such localization is always distal to the dorsal venous arch. The incision be placed parallel to the vessels or nerves, in order to avoid them.

The Dorsal Subaponeurotic Space.—While this space can be infected from direct it can also be involved from an extension of infection from plantar Space IV. infection of this space is suspected, aspiration should be attempted and the diag- confirmed before the incision is made. A longitudinal incision is then made along- the needle. The cavity is drained with corrugated rubber for 24 hours.

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CHAPTER LXXXVII

REMOVAL OF BROKEN NEEDLES

ALTHOUGH the removal of a broken needle is often a simple matter, it can be fraught with considerable (and unexpected) difficulties. Chief of these is that at open operation, even with radiographs before one, it is not unusual to be unable to locate the needle for some time, for when it is embedded in even a small amount of muscle, often the needle can neither be seen nor felt with a probe or the finger. There are occasions when these difficulties prove insuperable. Consequently it is highly desirable to dwell upon the problem beforehand, and consider :—

1. Whether exploration is really essential, i.e., what harm might accrue from leaving the fragment in situ?

2. How long should the search continue if the needle proves difficult to find?

Seeing that the operation frequently lasts longer than is anticipated, at any rate in children, in poor-risk subjects, and when the seeking of a small fragment seems of doubtful necessity, if a general anæsthetic is to be employed a predetermined time limit for the search should be agreed upon with the anæsthetist before the operation is commenced.

A 17-year-old seamstress broke a needle in her thenar eminence. Gas anæsthesia was employed, and as the needle could not be found, the search continued for an hour. Cardiac arrest then ensued, and the patient died on the operating table.

Unless the (hollow) needle was sterilized before introduction, a prophylactic injection of penicillin is given. If apparent with the naked eye or a magnifying glass, the point

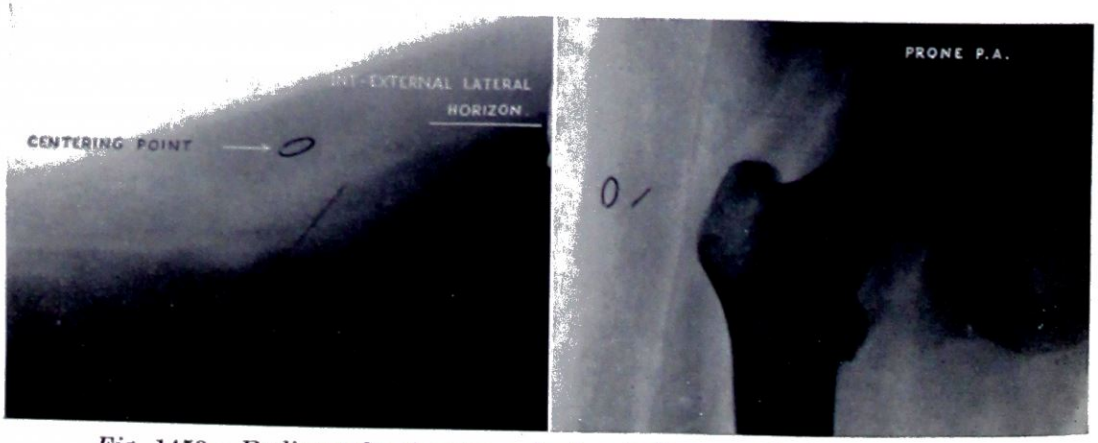

Fig. 1450.—Radiographs showing a broken hollow needle in the buttocks.

of entry should be ringed round, using preferably an indelible pencil, or ink. When the needle lies near a joint, the limb should be immobilized in the position it will occupy on the operating table.

Preparation of the Skin.—The surrounding skin should be shaved, if necessary, washed, wiped with alcohol, and covered with a sterile towel *before the X-ray examination.* Precise instructions must be given to the nurse-in-charge that if the point of entry has been ringed round she must provide herself with an indelible pencil (or pen and ink) and should the ring become faint during the ablutions she must re-mark the skin before this important guide becomes lost.

Radiological Localization.—It is hardly ever justifiable to undertake deep exploration for a broken needle without a preliminary X-ray examination. Radiographs, to be of value, must be in two planes (*Fig.* 1450). C. W. Cutler's method of placing two wires over the site of entry (*Fig.* 1451) and then taking radiographs in planes at right angles is an extremely practical aid for the recognition of the site of a broken needle, especially in the hand or foot. When the needle lies embedded in a large muscular mass, the radiographs should be obtained by movement of the X-ray tube, and not by movement of the

patient, the reason being that alteration of pressure on the soft parts may alter the apparent position of the foreign body considerably (Hodgson and Ramage). When possible, the part (especially the hand or foot) should be placed on the X-ray table in the same position as it will subsequently be placed on the operating table.

Fig. 1451.—Crossed wires are kept in place with adhesive plaster over the point of entrance. Antero-posterior and lateral radiographs are then taken.

Attempted removal of a needle in the radiological department under the fluorescent screen is seldom satisfactory. Apart from the real risk to the surgeon's hands, asepsis is endangered, and groping about in the dark is highly unsatisfactory.

Limited fluoroscopy for the sole purpose of determining the situation of the foreign body is, however, of signal service, and whenever possible one or more of the following methods should be invoked in addition to taking the usual radiographs :—

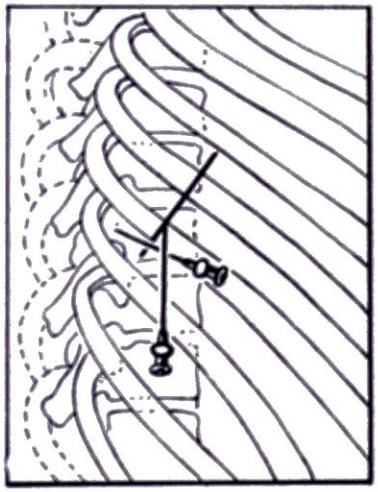

Fig. 1452.—Drawing of a radiograph showing slender hollow needles (preferably fine lumbar puncture needles) inserted through the soft tissues of the chest wall, so that they cross in approximately the same position as one end of the broken needle. (*After Gardner and Durham.*)

1. The site of the lost fragment is marked on the skin, the best method being to scratch the skin with a sterile needle or a fine-pointed scalpel and then rub in indian ink (P. Cave).

2. After raising a weal of local anæsthetic and introducing a fine hollow needle of suitable length in a plane horizontal to the table, lights are switched out and the X rays are switched on. Under the fluorescent screen the hollow needle is advanced until the point touches, and if possible moves, the foreign body ; ½ ml. of methylene blue is then injected, so as to stain the surrounding tissues. This is a real boon in indicating the approximate site of the needle at open operation.

3. In addition to the above, after injecting local anæsthetic, a second hollow needle is inserted directly over the foreign body, at a right angle to the horizontal plane, until its point also touches the foreign body. If this method is used, both the hollow needles (*Fig.* 1452) are left in situ, and the patient is transferred (with great care not to move these needles) to the operating table. After the patient is anæsthetized an incision is made between the two localizing needles.

Berman's Metal-locator.—For locating needles and other small metallic foreign bodies, Lambert Rogers has found Berman's metal-locator (*Fig.* 1453) invaluable.

Anæsthesia.—Never attempt to remove a needle under short gas or intravenous thiopentone anæsthesia. It may require much patience to find the object and the operator must not be hurried. Since the direct injection of local analgesic solution is prone to confuse the anatomy of the part, a regional nerve-block or full general anæsthesia must always be employed.

Broken Needle in the Hand.—In this common site for a broken needle, Cutler's aid to localization proves eminently suitable (*see Fig.* 1451).

When the patient has been anæsthetized, apply a pneumatic tourniquet and place the hand upon a side table and sit down to work. Make the skin incision obliquely over the line of the needle (*Fig.* 1454), then commence the search. Usually a probe is passed into the wound and moved about. A muffled 'ping' is heard. Many times have I seen a look of satisfaction on the operator's face turn to disappointment on finding that it is some tendinous structure which the probe has struck. The following is suggested as a better mode of procedure : make an incision large enough to allow the insertion of the little finger. Touch-corpuscles will detect foreign bodies when the probe will not. After feeling around systematically with a negative result, mobilize a tendon or muscle by blunt dissection, and holding this aside, introduce the finger once more and feel again. If this

is not successful, enlarge the incision and dissect carefully. With a reasonable knowledge of anatomy nothing of importance will be damaged, and the needle must surely be found.

Hollow Needle broken off in the Thorax.—

I was asked to see a young man whose doctor gave the following history. The patient had had pneumonia, and empyema was suspected. A hollow needle was inserted, and while the syringe was being adjusted the patient gave a violent cough. The needle broke, and about 3 in.

Fig. 1453.—Berman's metal-locator. (*Professor Lambert Rogers.*) (*The Lancet.*)

(7·5 cm.) remained in the chest. Radiographs showed the needle in the lower part of the chest above the diaphragm. Choosing the point of puncture as a guide, two adjacent ribs were resected under local anæsthesia. On opening the pleura the needle could be seen penetrating the diaphragm and moving to and fro with its excursions. The needle was seized and removed without difficulty. The lung appeared to be in a state of red hepatization, and did not collapse very much when the pleura was opened. The wound was therefore closed without drainage. A hollow needle was then inserted into the pleural cavity just beneath the incision and as much air as possible aspirated. The patient made an uninterrupted recovery.

Fig. 1454.—Incision for removal of a needle in the hand.

Needle in a Joint.—Arthrotomy must be performed in order to remove the needle. The best method of opening each joint is described on pp. 907–910.

Lumbar Puncture Needle broken in the Spine.—The first step is to take a radiograph in two planes, to ascertain the exact location of the needle, as the puncture mark in the skin is often misleading, and should never be relied upon. The second important step is to make a longitudinal midline incision, such as is used in laminectomy. It may be sufficient to dissect muscles off the spinous processes on one side only. At other times it is necessary to bare the laminæ on either side and to remove the relevant spinous processes : possibly the broken shaft of the needle will be located in the interspinous ligament after the spinous processes have been removed.

L. H. Landry's Case.—

The patient was a man of 34. The needle had broken off during lumbar puncture the day previously. The patient was complaining of severe pain radiating down the thighs. An incision was made over the third, fourth, and fifth lumbar vertebræ and the laminæ were exposed as for laminectomy. It was not until the spinous processes had been removed that the needle was found between the third and fourth vertebræ. Its removal was followed by a flow of cerebrospinal fluid.

Only in most exceptional circumstances is it necessary to remove the laminæ of one or more vertebræ.

Broken Needle in the Tonsillar Fossa is evidently not the almost unheard-of happening that might be supposed. Of 50 otorhinolaryngologists present at a meeting, 14 had had experience of the accident. More than half the broken needles were hollow needles used for injecting local anæsthetic; the remainder were sewing needles of one kind or another. Several of the hollow needles were removed by an electromagnet; most of the sewing needles were never recovered. Only one complication was reported, and that resulted in the death of the patient due to over-long general anæsthesia during attempted removal. There was mention of one needle that migrated to several places in the neck without symptoms. However, complications occurred in 12 per cent of cases compiled by J. A. Weiss. They included fracture of the hyoid bone during attempted removal, persistent glossopharyngeal neuralgia, infection of the pterygomaxillary space, and pain on swallowing.

As a result of another inquiry, 67 otorhinolaryngologists replied to a questionnaire that they had experienced this accident. Consequently it must be assumed that but few harassed operators record their tribulation.

Utilization of one hollow needle as a marker has been recommended, but there is a danger of piercing the carotid artery, which is difficult to avoid. One thing is certain —that this is a very difficult region from which to retrieve a broken needle. If an electromagnetic installation can be employed, arrangements to take advantage of this aid should be made. Not more than half an hour should be allowed for the search if an intra-oral approach is used, as it should be in the first instance. If this is of no avail, it would appear that a second attempt via an external approach is more likely to succeed. Having regard to the possible legal implications, an outstanding difficulty is explaining to the patient and his relatives why an external operation is necessary. Probably the best course is to explain the situation to a responsible relative, to see the patient at intervals, and to operate only if there are symptoms or if serial radiographs that the needle is migrating.

Lost Radium Needle.—For obvious reasons a lost radium needle must be removed as little delay as possible. On account of the comparatively large diameter of the the operation seldom, if ever, presents difficulty unless the anatomical site of the is deep.

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CHAPTER LXXXVIII

THE EYE AND THE ORBIT

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(In former editions this chapter was written by the late Eugene Wolff. A considerable amount of his text has been retained.)

FOREIGN BODIES IN THE EYE

1. In the Conjunctival Sac.—One of the most frequent emergencies that a surgeon may have to deal with is a foreign body in the conjunctival sac. If it has lodged under cover of the lower lid, it is readily removed by the patient or his friends. The patient looks up, the lower eyelid is pulled down, and the foreign body is usually easily removed with the finger, the corner of a handkerchief, or preferably with some cotton-wool moistened in boracic lotion and wound around the pointed end of a match-stick.

A foreign body underneath the upper eyelid is quite a different matter, for while in expert hands it is usually not difficult to evert the upper eyelid, it may prove impossible to someone not used to the procedure, especially if the patient is unruly, as is not infrequently the case. It is therefore strongly advised that the procedure of everting the upper eyelid should be practised at every opportunity.

Underneath the upper eyelid the foreign body usually lies in the subtarsal groove, some 2 to 3 mm. from the lid margin, and about half-way along its length where the tarsal plate is most concave. In this position, owing to the movement of the lid, it is continually rubbing on the cornea, which causes pain and watering of the eyes. A drop of ½ per cent pantocaine into the conjunctival sac will help greatly by taking the pain away, and giving the patient confidence, which makes everting the upper eyelid a much easier matter. This is done as follows :—

The surgeon stands in front of the patient who is told to look down ; this is an essential part of the manœuvre, and is made easier for the patient, if he is told to look at his feet with the unaffected eye, not turning his head down.

The surgeon rests the ulnar border of his index finger (right for the left eye and left for the right) along the upper lid and the thumb on the lower lid. The upper lid is then drawn gently away from the nose so that the lower lid can be slid under it by a slight upward movement of the thumb, continuation of which results in eversion of the upper lid, provided the patient continues to look downwards (*Fig.* 1455).

It will thus be seen that eversion of the upper lid is essentially a rotation of the tarsal plate around a transverse axis, so that its upper border passes between the lid margin and the globe. The removal of the foreign body once the lid is everted is usually quite easy and can be done with the finger or moist cotton-wool wound around a match-stick.

Double Eversion of the Upper Eyelid.—In order to bring into view the upper fornix where foreign bodies may also lodge, the upper eyelid is first everted in the usual way. While the patient looks down and the lid is held everted with one hand, the thumb of the other presses the globe into the socket : the fornix and retrotarsal fold will now roll into view. This procedure is known as double eversion of the upper eyelid. In some cases this manœuvre fails. In these the upper edge of the everted tarsal plate should be gripped with the forceps, held horizontally and gently turned upwards. Previous instillation of two more drops of ½ per cent pantocaine is advisable.

2. In the Cornea.—Light objects, such as wings of insects or husks of grain, may simply adhere to the corneal epithelium. Heavier objects coming with more force, such

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Subtarsal groove : The groove in the conjunctival surface of the upper lid, near its margin.
Fornix : The fold of conjunctiva uniting that covering the inner surface of the lids with that covering the eyeball.

as particles of steel or emery, penetrate to varying depths. All foreign bodies in the cornea result in pain, photophobia with its accompanying narrowing of the palpebral fissure, and diminution in the size of the pupil. *These signs, in fact, should make one look again for a foreign body or abrasion, even when a first examination has been negative.* In many cases the foreign body is better seen when the pupil is dilated with homatropine. In any case, when trying to find the foreign body, the surgeon must ask the patient to look in various directions. If difficulty is experienced, then the position of the foreign body may be shown up by a drop of 2 per cent fluorescein (*see* p. 1041).

Removal of the Foreign Body. The eye is anæsthetized with 4 per cent cocaine because of its softening effect on the corneal epithelium which allows the foreign body to be removed more easily than if pantocaine is used. If the foreign body is merely adherent, it may be removed with a piece of white blotting paper cut to a point, or better with some cotton-wool moistened in boracic lotion and wound tightly around the end of a thin glass rod. Even if the foreign body is embedded it may often be removed by the above technique, provided the surgeon will wait a few moments after cocainizing for the epithelium to soften.

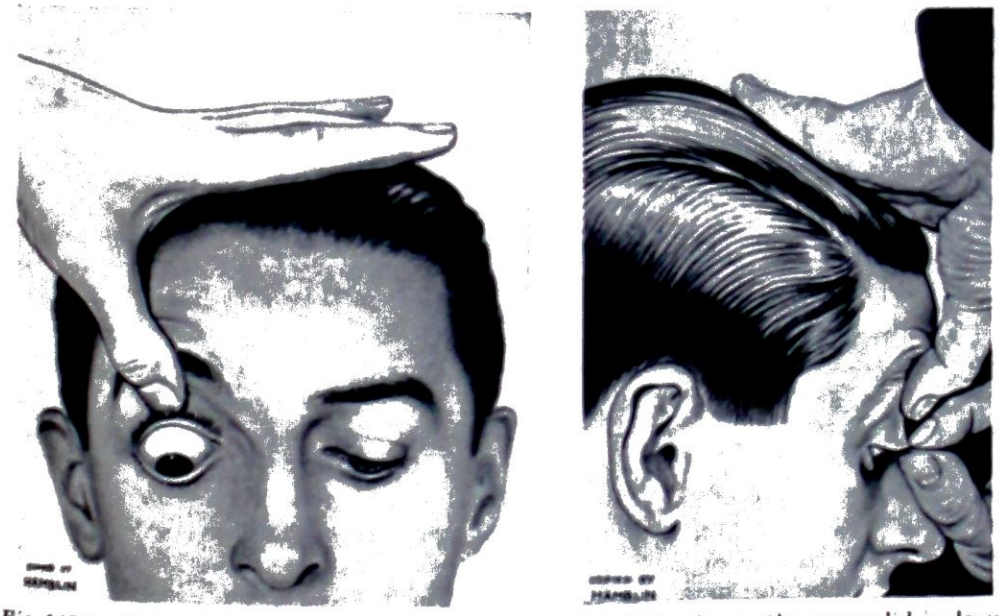

Fig. 1455.—Eversion of the upper eyelid. The patient looks down, the upper lid is drawn upwards as far as possible by the surgeon's thumb.

Should this fail, the foreign body has to be removed with an instrument. Various forms of 'needle' have been employed but a fine hypodermic needle attached to a 1-ml. syringe is as good as anything, since its bevelled point can be slid under the foreign body, so as to lever it out, with as little damage to the corneal substance as possible.

The patient, with the eye cocainized, lies on a couch, and the surgeon standing behind him, using preferably a binocular loupe, separates the lid margins with the forefinger and thumb of the left hand. The pulp of the finger is placed on the lid margins and not on the skin of the lids: in this way the globe can be steadied at the same time. Particles of steel and emery often leave a ring of rust. Experts will remove this ring, but attempts by inexpert hands to remove it will often result in more damage than the rust will cause.

After the removal of the foreign body the eye is covered with a pad and bandage, and in fact treated as an ulcer. Atropine is indicated where there is much redness, or where the wound that is left is deep or wide. In most cases homatropine and cocaine will suffice. As a rule the wound left by the foreign body heals in a day or two, but usually leaves some kind of opacity; also infection may supervene, resulting in a simple or even a hypopyon ulcer. (*See Fig.* 1469, p. 1043.) For this reason it is advisable to wash the eye out with some penicillin solution before covering it.

Fluorescein: A dye which stains green areas of the cornea denuded of epithelium.

Loupe: A small magnifying lens usually 8 or 10 × used for examining the cornea under oblique focal illumination. The binocular type is less powerful and is attached to the observer by a head band.

Hypopyon: A collection of pus, usually sterile, lying at the bottom of the anterior chamber.

NON-PENETRATING INJURIES

DIRECT WOUNDS OF THE CORNEA

The most common injury of the cornea is an abrasion ; that is, it consists in the removal of a portion of the epithelium by a scratch from some sharp object, such as the finger-nail, the edge of a leaf, a twig, etc. The injury is extremely painful owing to the involvement of the terminations of the corneal nerves and also the spasm of the iris which results. There is lacrimation, injection (redness) of the eye, and narrowing of the palpebral fissure.

In order to make a careful examination, it is nearly always advisable to put a few drops of pantocaine into the eye.

In extensive lesions the superficial defect is readily seen in the loss of polish and the slight difference in level between the abrasion and the surrounding cornea. Fine abrasions are often only seen when the lids are held apart for a time to allow the surface of the cornea to dry a little. The instillation of a drop of fluorescein (*see* p. 1041) will settle the question by staining the affected parts.

TREATMENT.—The most important part of the treatment is to keep the eye tightly bound up with a pad and bandage. In most cases—except in patients over 40 years of age, where glaucoma is feared—a mydriatic, e.g., 0·5 per cent atropine ointment, or in slight cases 1 per cent homatropine, is put in before bandaging.

With this treatment the abrasion, as a rule, soon heals by the epithelium growing over the defect, and if Bowman's membrane is not involved no scar is left. But a corneal ulcer or hypopyon ulcer may result from infection of an abrasion, especially if a mucocele of the lacrimal sac is present at the same time.

Deeper wounds of the cornea may be incised or lacerated. The margins swell due to imbibition of tears, and become cloudy. Later the epithelium grows over the defect, which is filled with scar tissue, and the result is an opacity or nebula of varying density. There may also be some consequent irregularity of the surface which gives rise to irregular astigmatism. The treatment of these wounds is the same as for an abrasion.

Recurrent Erosion.—This is the term applied to the recurrence of an abrasion, *without fresh trauma*, some weeks or even months after the original injury has healed. On opening the eye one morning it becomes painful and waters. An area which stains with fluorescein is usually found at the site of the original abrasion. This is probably due to the fact that the new epithelium over the wound had never become completely adherent to its bed and thus was liable to become separated from such a slight cause as the opening of the eye in the morning.

In some cases there is a recurrence of the symptoms without the formation of a superficial staining area in the cornea. In others, one or more vessels occur at or away from the site of the original lesion. It is believed that some of these cases are allied to herpes corneæ, and have, therefore, a neuropathic basis.

TREATMENT.—The eye is treated as for the original abrasion. It should, however, be kept covered for some days after it has healed. In addition, a bland ointment, such as ung. acid. boric., or petroleum jelly, is liberally applied to the conjunctival sac at night in order to prevent the lids from sticking and the patient is told to open his eyes very gently on waking in the morning. In some cases the abrasion continues to recur. It is then a good plan to curette it and apply pure carbolic acid. Ordinary vaccination with calf lymph may stop the recurrences. Contact X rays have latterly proved very effective. As a prophylactic, it is advisable to order a lubricant ointment to be inserted inside the lower lid every night for a period of a month or so after an abrasion.

WOUNDS OF THE CONJUNCTIVA

Wounds of the conjunctiva are usually accompanied by a good deal of ecchymosis. Otherwise they are of no significance.

Owing to the elasticity of the membrane, however, they tend to gape, and consequently healing may be complicated by the formation of granulation tissue, as occurs sometimes after operation for squint. Where the edges are widely separated, therefore, it is wise to bring them together with a suture.

Bowman's membrane : A structureless layer lying between the epithelium of the cornea and its substantia propria.

NON-PENETRATING CONTUSION INJURIES

Such injuries may affect the eye directly at the point of impact, or owing to the relative incompressibility of the tissues may injure the ocular contents indirectly at some distance from it. Injuries with a blunt instrument (e.g., the fist, or the edge of a table) such as cause contusions, come usually from below and the outer side, where the eye is least protected by the orbit.

The bulb is compressed and its tension raised. Whereas the outer fibrous coat (cornea and sclera) can withstand a considerable pressure, the middle and inner coats are far more easily injured; yet with sufficient force the fibrous tunic may be ruptured as well.

Hyphæma.—A very common result of a blow on the eye is a hæmorrhage into the anterior chamber. The blood settles down and is easily recognized as a red mass bounded above by a horizontal line.

TREATMENT.—The eye is tied up with a pad and bandage. If the hyphæma is large the patient is put to bed. Cold compresses ease the pain. Straining at stool must be avoided by attention to the bowels. The blood usually disappears rapidly, often without any ill effects. Not infrequently, however, when the blood disappears other injuries become visible.

Fig. 1456.—Iridodialysis. (*From Eugene Wolff's 'Diseases of the Eye'.*)

LESS COMMON INJURIES

Iridodialysis.—The iris may be torn from its attachment to the ciliary body, which shows itself as a dark crescent like a second pupil (*Fig.* 1456).

Dislocation of the Lens.—The pupil may be found dilated and inactive to light and accommodation. The iris may be tremulous as a result of *partial* or *complete dislocation of the lens* which normally supports it.

Partial dislocation of the lens may also be recognized by the fact that when the fundus is examined with the ophthalmoscope two pictures of it are seen—one through the lens and the other through the portion where no lens is present. Later the lens may become opaque.

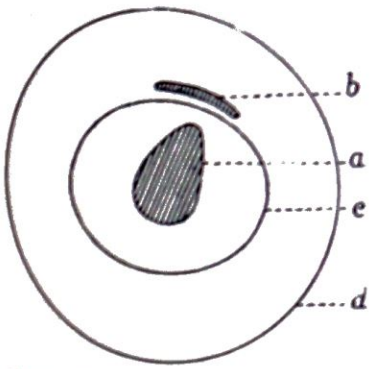

Fig. 1457.—Scleral rupture, right eye. Shows the situation of the most common type of rupture (right eye) as examined in daylight or by focal illumination. *a*, Pupil drawn upwards and inwards towards the rupture; *b*, Site and common extent of the rupture, just posterior to the corneoscleral junction; *c*, Corneal margin; *d*, Equator of the eye.

Hæmorrhage into the Vitreous.—This condition may be seen as a red mass by shining a light obliquely into the pupil, but often it can only be surmised by the fact that no red reflex is present on examination with the ophthalmoscope.

Hæmorrhage into the vitreous takes a long time—weeks or months—to absorb, but may eventually disappear without ill effects. Indeed there is a clinical aphorism which says, "Never despair of a vitreous hæmorrhage". But there may be accompanying detachment of the retina, or rupture of the choroid, recognized as a whitish crescent with pigmented borders usually to the outer side of the disc.

Rupture of the Globe.—The most severe result of a contusion injury is a rupture of the globe. The blow is severe and usually comes from below and the outer side where the eye is least protected. It may be from a fist or a thrust of a cane or cow's horn (a not infrequent injury among farmers). The rupture lies in the sclera, and is usually in the form of a crescent close to and parallel with the limbus. Often some of the intra-ocular contents, e.g., lens, vitreous, etc., are extruded through the wound. The iris in this region appears to be absent as if it had been removed at operation, i.e., by iridectomy (*Fig.* 1457).

Hyphæma: A collection of blood at the bottom of the anterior chamber.
Iridodialysis: Tearing of the iris from its peripheral attachment.

The conjunctiva over the rupture may not be torn and then the lens may form a mass under it (subconjunctival dislocation of the lens).

TREATMENT.—Most ruptures of the globe are so serious that immediate excision of the eye is the best treatment.

In certain cases, however, it may be possible to save the eye by cutting off the prolapsed iris, suturing the sclera, or bringing a flap of conjunctiva over the wound (*see* p. 1039).

PENETRATING OR PERFORATING INJURIES

In any injury to the eye it is extremely important to determine whether the wound is a perforating one or not; and if it is a perforating one, whether (1) there is a prolapse of the uveal (iris, etc.) or other tissue; and whether (2) a foreign body has been retained in the eye. Perforating injuries are always serious, as the injury may not only severely affect the function and form of the eye, but is prone to lead to infection or to sympathetic ophthalmitis. There is danger also of late results such as glaucoma, detachment of the retina, etc.

Signs and Symptoms of a Perforating Injury.—

1. Greatly diminished intra-ocular pressure is observed. This sign is extremely useful where the perforation is scleral and hidden by hæmorrhage and conjunctiva.

2. If the perforation involves the anterior chamber the latter disappears or becomes very shallow. Also the escape of aqueous may give rise to the statement, sometimes made by the patient, that he has felt 'hot water' coming from the eye.

3. Prolapse of the intra-ocular contents takes place, usually part of the uveal tract, which presents on the outside of the eye as a darkly pigmented mass (*Fig.* 1459).

Corneal Perforation.—This shows itself as a greyish area with swollen margins. In early cases there is no anterior chamber and the iris is therefore in contact with the cornea.

The extreme lowness or entire absence of tension constitutes one of the most important signs of perforation of the globe.

The diminution of vision will depend on the site of the scar and the amount of astigmatism produced.

If infection takes place other changes are seen. A hypopyon may appear and panophthalmitis may result.

Wounds of the Sclerotic.—These may be obvious, but not infrequently are difficult to recognize. This is especially the case where the eye has been wounded through the eyelid. The bruised and swollen lid makes examination difficult, and, moreover, blood under the conjunctiva may obscure the perforation. Reduction of ocular tension is the important sign. Large wounds are usually accompanied by prolapse of the iris, ciliary body, choroid, or vitreous.

Wounds of the Lens.—Wounds of the lens result in a traumatic cataract and render the prognosis more grave. The entry into the lens of aqueous, or vitreous, causes it to become swollen, cloudy, and opaque.

The further history depends on the size of the break in the capsule and the age of the patient. If the wound is small, as in those made by a pin or needle, the subcapsular epithelium may grow over the gap and the cataract may cease to progress. This is also more likely to occur in the case of older patients, when the lens is more sclerosed. A greyish white scar remains in the capsule.

In larger wounds of the capsule, the swollen and degenerate lens fibres make their way through the gap in the capsule and form flocculent masses in the anterior chamber, whence they are gradually absorbed. If the lens matter passes into the anterior chamber in great quantity it may block the angle and give rise to glaucoma. An increase of tension may also be produced by the swollen lens itself pushing the iris against the corneosclera.

In young people the lens may be entirely absorbed and only the capsule and its epithelium left.

Involvement of the Iris.—One of the most important points to be determined in any perforating injury of the eye is whether there is prolapse of the iris (*Figs.* 1458, 1459) or ciliary body. *Prolapse of uveal tissue constitutes an indication for operation, as soon as*

Uvea: A collective term including iris, ciliary body, and choroid.

can be procured, since, if left, it greatly increases the risks of septic infection
ophthalmitis, and, at best, greatly lengthens the time required for the
'settle down'.
certain fortunate cases, however, the iris may become adherent to the wound and
remain as part of a leucoma adherens, i.e., a white scar with iris adherent to it.
of the iris presents on the outside of the eye as a darkly pigmented mass.
is drawn up towards the wound and tends to become pear-shaped.
very large wounds the ciliary body may prolapse, or even the lens, choroid, and
which entails the loss of the eye.

of Penetrating Injuries.—If the eye is so badly injured that no useful vision
expected it should be excised at once.
useful vision is expected, and there is no indication of a metallic foreign body,
is cleansed with cotton-wool. If there is prolapse of the iris (*Fig.* 1459) it is

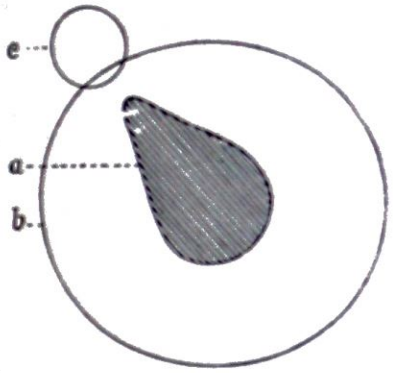

Fig. 1458.—The appearance of the pupil in a of penetrating wound at, or near, the corneo-junction in which the iris has prolapsed. Pupil drawn towards the wound; *b*, Corneal margin; *c*, The circle represents the situation of a bulge or prominence at the site of prolapse in examination by daylight or focal illumination. The prominence is usually black in colour (uveal pigment).

Fig. 1459.—Incised wound of cornea, parallel with limbus in 7 o'clock meridian. Pupil pear-shaped owing to prolapse of iris at one end.

important that this should be cut off (*see* ABSCISSION OF PROLAPSED IRIS,

Small wounds require no suture; large and gaping wounds should be closed by
passing superficially through the sclera or by bringing a flap of conjunctiva over

is put into the eye, which is tied up with a pad and bandage, and the
is put to bed.
the eye 'settles down', nothing further need as a rule be done.
a traumatic cataract develops this may be needled in the case of a child or young
or extracted in the case of a patient over 30 years of age.
the eye does not 'settle down', as shown by continued redness and irritability,
as a rule be watched for two weeks before deciding whether it ought to be excised
of sympathetic ophthalmitis. If there is no perception of light, excision is
much earlier.

SYMPATHETIC OPHTHALMITIS

ic ophthalmitis is a severe and often blinding inflammation of one eye
results from a penetrating injury of the other.
injured eye is spoken of as the 'exciting' eye, the other as the 'sympathizing'
long as the fibrous coat of the injured eye is intact, sympathetic ophthalmitis
occur.

of the corneoscleral junction are especially dangerous, for here portions of
ciliary body may become incarcerated in the wound. The danger is further increased
is wounded as well, and if there is a retained foreign body.

Leucoma adherens: A leucoma with uveal tissue adherent to it.
Limbus: Corneoscleral junction.

Sympathetic ophthalmitis is much more likely to occur if the patient is a child.

The condition is preceded by 'sympathetic irritation', as shown by watering and photophobia of the uninjured eye.

It occurs most commonly from four to eight weeks after the injury. Clinically it appears as a *quiet* iridocyclitis, hence the small grey dots of keratic precipitates (K.P.) (*see Fig.* 1474, p. 1046) must be looked for in the uninjured eye.

Prophylaxis.—The surest way to prevent sympathetic ophthalmitis is to remove the injured eye, and in cases where this is so damaged that useful vision cannot be expected there should be no hesitation; also the patient will usually readily agree. But there are many cases in which one is justified in hoping to obtain a useful eye. The danger-signals of its affecting the other eye are: the injured eye does not settle down; it remains irritable and red, and the tension as felt with the fingers is low. In these circumstances resort should always be made to a blood-count: a definite increase in the large mononuclears is held to be an indication of sympathetic ophthalmitis.

Treatment.—When once sympathetic ophthalmitis has started, except at the very onset, it is extremely doubtful whether removal of the injured eye is of any benefit, and it should only be done if it is sightless. Indeed, cases have been known in which finally the vision in the injured eye was better than the other. The iridocyclitis is treated with atropine, hot bathings, etc. A course of salvarsan or allied preparations may do good. The antibiotics and cortisone have helped in some cases.

PANOPHTHALMITIS

Panophthalmitis is most commonly the result of a penetrating injury, but it may occasionally be due to a metastatic choroiditis or retinitis coming on during pyæmia, especially in puerperal fever or, in the case of children, in meningitis.

In a typical case, the eye after a perforating injury seems to be recovering for 24–48 hours with perhaps only slight signs of inflammation. Then quite suddenly there is a change for the worse. The sudden change means that the septic material has reached the vitreous, through which it spreads with great rapidity. In fact, what is clinically a panophthalmitis is pathologically an abscess of the vitreous cavity.

Not only do the local signs and symptoms become much worse, but general symptoms appear. There is a great increase in the pain and the vision rapidly goes. The lids become swollen and red. There is marked chemosis of the conjunctiva. The eye is red from conjunctival and ciliary injection. The purulent vitreous is recognized as a yellow glow or reflex when viewed by illumination. The fundus can no longer be seen. Pus soon appears in the anterior chamber (hypopyon), and the cornea becomes cloudy. Later there is exophthalmos and limitation of movements of the eye due to involvement of Tenon's capsule.

As general symptoms there are fever, headache, drowsiness, and sometimes vomiting.

If left to itself the abscess bursts, as a rule through the sclera near the limbus, leading eventually to phthisis bulbi.

Treatment.—In early cases, in which the condition arises as the result of operation wounds (e.g., following the extraction of a cataract), it is justifiable to try to save the eye. The edges of the wound are touched with a galvanocautery and the anterior chamber washed out with hydrogen peroxide. The sulphur drugs and antibiotics have latterly proved very useful and have saved many eyes which would otherwise almost certainly have been lost. These are best given by subconjunctival injection (p. 1044). Cortisone can be given by the same route and is sometimes very helpful, 10 mg. 0·4 ml. of the usual solution. If hyaluronidase is added, absorption is aided.

In the majority of cases, however, after a perforating injury no attempt should be made to save the eye. The eye is usually eviscerated and not excised, owing to the possibility of meningitis resulting in the latter operation from the spread of infection along the optic nerve-sheath, though in early cases excision may quite well be performed.

ABSCISSION OF PROLAPSED IRIS

Instruments.—Speculum (*Fig.* 1460), fixation forceps (*Fig.* 1461), two iris repositors (*Fig.* 1462), two pairs of iris forceps (*Fig.* 1463), and de Wecker's scissors (*Fig.* 1464).

Ciliary injection: Engorgement of the vessels around the corneal margin.
Phthisis bulbi. Shrinkage of the eyeball—not necessarily tuberculous.

Previous to the operation an attempt should be made to dilate the pupil as far as possible by means of atropine, or, better still, 5 minims of mydricain may be injected sub-conjunctivally a few minutes before actually excising the prolapse.

Anæsthesia.—In a young child a general anæsthetic is given, but usually cocaine and retro-ocular novocain is preferable. The latter method often makes unnecessary the delay due to the patient having recently had a meal.

Operation.—The conjunctival sac is bathed and the speculum put in. The prolapsed iris is seized with iris forceps held in the right hand, and gently freed from the lips of the wound by an iris repositor. The iris is now drawn out of the wound and seized by a *second* pair of iris forceps held in the left hand as close to the cornea as possible. Having drawn on the iris again, the surgeon cuts it off close to the cornea with the de Wecker's scissors held in the right hand. The remainder of the iris usually retracts into the eye, but may need repositing.

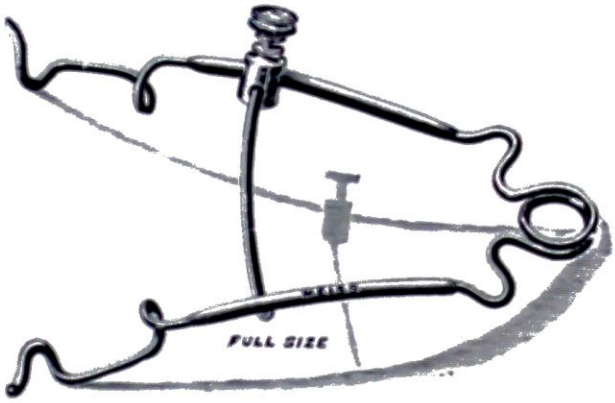

Fig. 1460.—Eye speculum.

Fig. 1461.—Fixation forceps.

Fig. 1463.—Iris forceps.

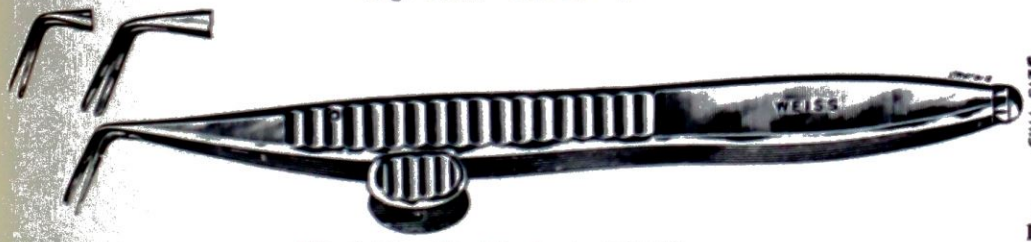

Fig. 1464.—De Wecker's scissors.

Fig. 1462.—Iris repositor.

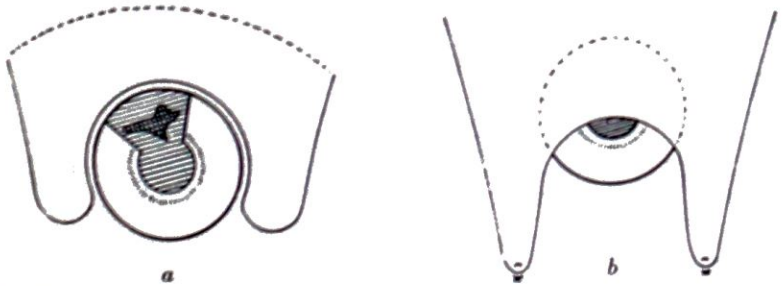

Fig. 1465.—Method of covering a gaping corneal wound with conjunctiva. *a*, Indicates the outline of the flap to be dissected up from below. The dotted line shows the extent to which the conjunctiva is undermined upwards. *b*, Indicates the position of the conjunctiva after two sutures have been inserted, drawing the flap down (like a blind) over the cornea.

Mydricain : Atropine sulphate, gr. $\frac{1}{60}$
Procaine Hyd., gr. $\frac{1}{10}$
Solution adrenaline, 1-1000 B.P. min. ij
Boric acid, gr. $\frac{1}{15}$
Sodium metabisulphite, gr. $\frac{1}{600}$
Aq. for injection, min. v

Atropine is put in and the eye covered with a pad and bandage.

Large and gaping wounds ought to be covered by a conjunctival flap. This should be prepared before abscission of the prolapse.

The conjunctiva is divided at the limbus for half or more of its circumference and dissected back off the sclera. Thus a large flap of conjunctiva is fashioned, to be brought over the wound after the abscission of the prolapse and held in position by stitches (*Fig.* 1465).

EXCISION (ENUCLEATION) OF THE EYE

Indications.—

1. A painful blind eye.
2. Perforating injury or ulcer: (*a*) The eye is so badly injured that no useful vision is likely to result; (*b*) Sympathetic ophthalmitis threatens.
3. Intra-ocular tumour.
4. Malignant growth of the orbit.

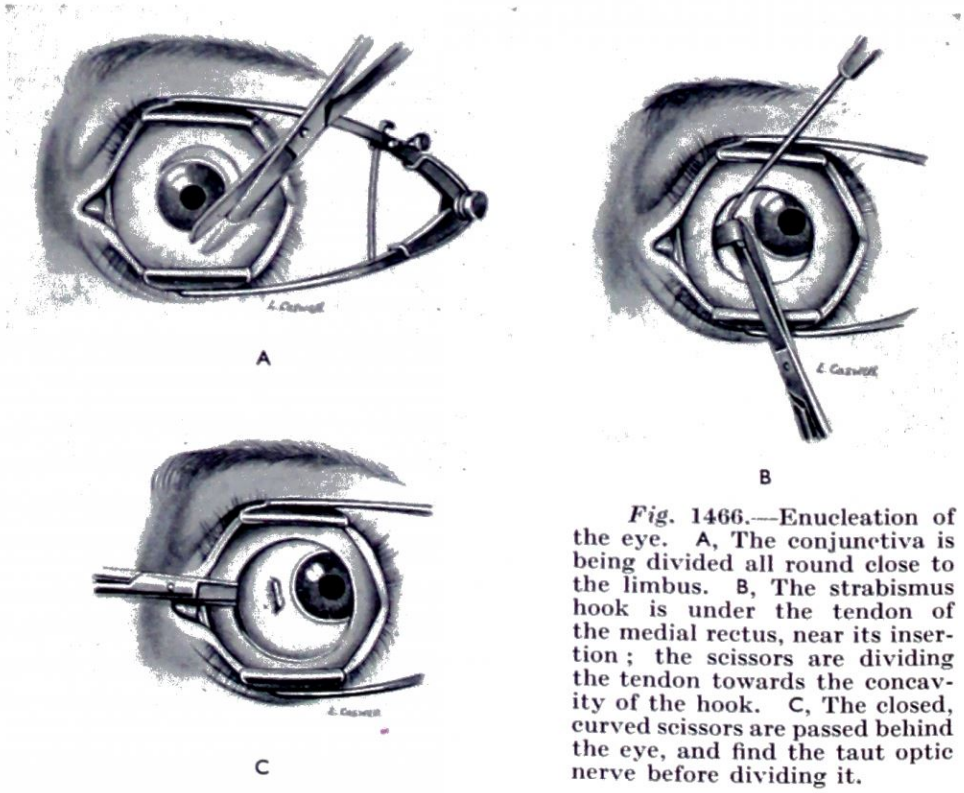

Fig. 1466.—Enucleation of the eye. A, The conjunctiva is being divided all round close to the limbus. B, The strabismus hook is under the tendon of the medial rectus, near its insertion; the scissors are dividing the tendon towards the concavity of the hook. C, The closed, curved scissors are passed behind the eye, and find the taut optic nerve before dividing it.

Instruments.—Speculum, two pairs of fixation forceps, straight blunt-pointed (strabismus) scissors, strabismus hook.

Anæsthesia.—The operation is done most often under general anæsthesia. It can, however, be done painlessly with retro-ocular procaine, as follows: three-quarters of an hour before operation the patient is given hypodermically $\frac{1}{4}$ gr. of morphine with $\frac{1}{100}$ gr. of atropine.

The actual retro-ocular injection is made with a fine needle 3 cm. ($1\frac{1}{4}$ in.) long. The needle passes through the lower lid just above the orbital margin and 1 cm. medial to the external canthus. It is directed backwards, upwards, and inwards, and pushed on for its full length. At this juncture 2 ml. of 4 per cent procaine and adrenaline is injected. After ten minutes the eye is bathed, the speculum put in, and a subconjunctival injection of procaine is given so as to produce a marked chemosis. After a few minutes the excision may be done quite painlessly.

Operation.—The eye is bathed and the speculum inserted. The conjunctiva is seized with fixation forceps, just above the upper limbus, and incised with the straight scissors. One blade of the scissors is now passed into the hole thus made, and pushed as far as possible round one side of the cornea underneath the conjunctiva, which is then divided close to the limbus (*Fig.* 1466). The conjunctiva is similarly divided close

Chemosis: Swelling of the bulbar conjunctiva.

to the limbus on the other side, and lastly it is divided below. The conjunctiva is then dissected off the globe with small snips of the scissors as far back as possible, and at least to the equator. (On this will depend the ease with which the eye will be removed.) In doing so the scissors are kept close to the globe and will necessarily open Tenon's capsule. A squint hook (*Fig.* 1467) is now taken and passed under the superior rectus, which is divided between the hook and the globe, and towards the concavity of the hook. (The superior is done first, as it is the most difficult, especially if the other recti have been divided ; and in dividing it, care should be taken not to buttonhole the globe.) The other recti are similarly divided. The squint hook is now passed all round to make sure that no rectus muscle has been left undivided.

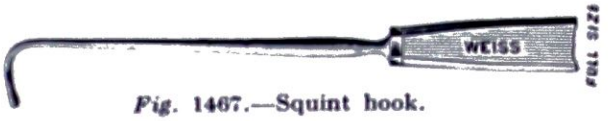

Fig. 1467.—Squint hook.

The blades of the speculum are now widely separated and pressed backwards. If recti muscles have been divided properly the globe will be dislocated forwards out of socket. The eyeball is taken in the left hand and the closed curved scissors are passed behind it and the taut optic nerve is felt. The scissors are withdrawn a little, opened, and pushed on again to divide the nerve close to the globe (except in the case of a neoplasm, when it is cut as far back as possible). The eyeball is now drawn farther out of the orbit and the oblique muscles are divided. There is a variable amount of bleeding, which usually easily stopped by means of pressure. No vessels are tied. The edges of the conjunctiva are brought together with fixation forceps. The lids are shut. An eyepad is applied, and over it is placed a medium-sized wad of cotton-wool. The bandage is applied firmly.

As a modification of the above operation, a glass or other ball may be inserted into capsule. This gives better movement to the artificial eye. The edges of Tenon's and the ends of the recti muscles are included in a purse-string suture of catgut. glass ball is introduced into Tenon's capsule by a special introducer and the purse-string drawn tight and tied. The conjunctiva is closed by interrupted silk sutures.

As a result of war experience, various types of 'implants' have been used in order provide a mobile artificial eye, and many satisfactory results have been obtained. The operation can be rendered practically bloodless if Foster's snare (*Fig.* 1468) is used in place of scissors for dividing the optic nerve. To use this instrument, the oblique muscles must be divided as well as the recti. The loop of wire is slipped over the eyeball when it has been dislocated forwards and is gradually tightened when it passes the equator, so as to slide backwards and grip the optic nerve. When this has been achieved, the wire is tightened further and left in situ for 30 seconds so as to compress the vessels in the optic nerve before giving the final twist to cut through it.

Fig. 1468.—Foster's snare.

Evisceration of the Eyeball.—In this operation the cornea is completely removed and contents of the globe are scooped out with a sharp spoon. Care is taken that no uveal is left behind, as sympathetic ophthalmia has followed this operation.

After-treatment.—The eye is kept tied up for two days in an attempt to diminish the of the lids and cheek which sometimes follows an excision. After this the sac is irrigated with normal saline from an undine once or twice a day, on the amount of discharge, and 10 per cent albucid drops instilled. An eye-shade gauze under it is worn after the third day.

The patient may get up the day after the operation.

CORNEAL ULCER

An ordinary simple corneal ulcer appears as a grey spot on the surface of the cornea. Over it the cornea has lost its gloss or polish, which depends on an intact epithelium.

The actual loss of substance may be obvious, but in many cases it is not. An invaluable means of deciding this question is afforded by the following method : a drop of 2 per cent fluorescein (preferably from a glass rod rather than from a dropper) is to the conjunctiva just above the cornea. As it flows over the surface it stains ulcer or an area devoid of epithelium a bright green. A few drops of 2 per cent

cocaine should then be employed to wash away the stain except from the affected parts. The cocaine also takes the pain away, giving the patient more confidence and thus making it easier for the surgeon to examine any lesion which may be present.

A corneal ulcer is accompanied by redness of the eyeball, which is usually ciliary in type, that is, it takes the form of a rose-pink ring around the cornea ; but in the more superficial type of ulcer the vessels may be conjunctival only ; often both types are present at the same time.

In cases where the ulcer has been present for some time a leash of superficial (conjunctival) vessels may be seen passing to it from the nearest point of the limbus.

A corneal ulcer gives rise to pain, lacrimation, and photophobia with its usual accompaniment of spasm of the orbicularis oculi, known as blepharospasm. All these, as well as the small pupil due to spasm of the sphincter pupillæ, are reflexly produced by irritation or stimulation of the terminals in the cornea of the first division of the fifth nerve.

The pain and photophobia are greater the more superficial the ulcer, since at this level there is irritation of the nerve fibrils, whereas in cases where ulceration goes deeper they are destroyed.

Blepharospasm is a common symptom and the condition is most marked in children with phlyctenular ulcers ; here the lids are tightly shut ; but in all cases the spasm is sufficient to cause a narrowing of the palpebral fissure, which is a characteristic sign of a corneal ulcer as well as of an abrasion or the presence of a foreign body on the cornea.

Treatment of Simple Corneal Ulcers.—Search should first be made for a possible cause, e.g., a foreign body, a conjunctival concretion, or a misplaced eyelash.

1. The next most important point in treating simple ulcers of the cornea is to keep the eye firmly covered, preferably with a pad and bandage. By fixing the lids the ulcer is put at rest, the symptoms of irritation are diminished, and healing is aided.

2. Atropine ointment 0·5–1 per cent is put into the conjunctival sac. (It is most important that the base of the ointment be petroleum jelly and not lard, which may be very irritating.) The guide to the number of times the atropine is to be used is the dilatation of the pupil. In certain cases, when the pupil dilates immediately, one application may be sufficient. The atropine overcomes the spasm of the iris, which is responsible for a large part of the pain, while the ointment also acts as an emollient and thus aids the healing of an ulcer. Where the pupil does not dilate, the atropine should be used twice daily or more often.

3. Hot bathing of the closed eye is always beneficial. The method is as follows : wrap a piece of cotton-wool around the bowl of a wooden spoon. With the patient bending over a large bowl of boiling water, the wool is dipped into the water, and brought up close to the eye, which must be kept shut. When the heat can be borne the wool is allowed to touch the lids ; when the pad cools it is dipped again, keeping the water as hot as can be borne by adding fresh boiling water ; this treatment is continued for a quarter of an hour. Heat may also be applied by a small hot-water bottle or an electric heater.

4. Whether the eye itself should be bathed depends on the amount of blepharospasm or discharge. In most simple cases it is unnecessary. In children, when blepharospasm is severe, more harm than good may come of it. The more copious the discharge the more often should the eye be bathed.

Simple lotions such as boric acid, 10 gr. to 1 oz., or hydrarg. perchlor. 1–10,000, should be used. Zinc sulphate is contra-indicated in most cases (except where the ulcer is caused by the Morax-Axenfeld bacillus) as it is too irritant. Nowadays antibiotics are often found effective, e.g., penicillin drops (2500 units per ml.) every 5 minutes for 2 hours, then hourly for 12 hours and 2-hourly for 24 hours ; chloramphenicol (1 per cent) ointment 3-hourly for at least 48 hours or drops (1 per cent) of the same substance 2-hourly for 2–3 days.

If much discharge is present the treatment must be modified. The bathing should be done more frequently and 20 per cent protargol or 1 per cent silver nitrate should be applied to the palpebral conjunctiva once a day. The eye should not be tied up, but protected from the light by a shade or goggles.

Blepharospasm : Spasmodic closure of the lids.

the Ulcer.—If the ulcer has a sloughy base and an infiltrated edge (dirty, progressing ulcer), or is slow in healing, it should be carbolized by the following : 4 per cent cocaine drops are put into the eye three times in 10 minutes, and the last drop is instilled some 2 per cent fluorescein is employed to demarcate the The eyelids are separated with the thumb and forefinger of one hand ; by placing not on the skin of the lids but actually on the lid margins, the globe can be steadied time. The ulcer having been dried with a piece of blotting-paper, a fine camel's- is dipped into pure carbolic (taking care that there is no droplet at the end may run over the cornea) and applied to the ulcer, paying particular attention to edge. Any excess of carbolic is dried up with the blotting-paper. Atropine 0·5 per cent is put in, and the eye covered. Carbolizing may have to be repeated of a day or more.

severe cases the electric cautery may be used to burn the edge and floor of the the ulcer may be heated to a definite temperature by means of an electrically thermophore.

ulcer continues to advance in spite of the above-mentioned measures, it may to free a neighbouring flap of conjunctiva and draw it over the ulcer.

is feared a corneal section (paracentesis) at the limbus, made with a may be resorted to in order to let out the aqueous and diminish the tension.

of Perforation.—

If the perforation is small the iris becomes applied to the back of the hole without through it. In these circumstances the patient is put to bed, atropine is put the eye, and a bandage is applied. If this is done, only a small anterior synechia forms which may later give way ; in very favourable cases no synechia forms all.

2. If a prolapse of the iris actually occurs this is cut off (*see* ABSCISSION OF PROLAPSED 1038), or burnt off by means of the galvanocautery.

Ulcer or Ulcus Serpens.—

.—Hypopyon ulcer, i.e., a corneal ulcer accompanied by pus in the anterior (*Fig.* 1469), is most commonly met with in aged debilitated persons, especially and is a disease rather of the poor than of It is more common in hot weather and during acute infectious fevers, such as measles, small- scarlet fever. While in adults hypopyon ulcer is serious affection, in children it is much less severe prognosis is much more hopeful.

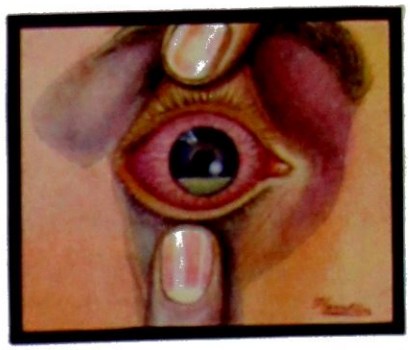

Fig. 1469.—Hypopyon ulcer of cornea, in the 4 o'clock meridian, adjacent to the pupil. Collection of pus at the bottom of the anterior chamber.

ulcer usually results from an infected the infection being derived either from the causing the injury, e.g., a piece of grit, or from sac. The latter is especially liable to of the infection if there is a septic lacrimal). The infective agent in 70–80 per cent is the pneumococcus ; staphylococci, strepto- gonococci, etc., also may be responsible.

A typical clinical picture is as follows : an elderly , with a fondness for alcohol, gets a foreign the eye, or sustains an abrasion of the cornea scratch of a twig. In the course of a day or two a dull pain is felt in the eye and The eye waters and cannot be used. The pain, as with many inflammatory condi- of the eye, is worse at night and keeps the patient awake. On examination the edges lids are found somewhat swollen and congested ; the conjunctiva is markedly con- the redness being both conjunctival and ciliary in type. There may be chemosis

.

The typical hypopyon ulcer forms a greyish-white or yellowish disc, situated near the of the cornea and having a depressed surface covered by slough. One edge of the advancing edge, is crescentic in form, more opaque than the rest, and yellowish

Synechia : Adhesion of the iris to the lens (posterior) or cornea (anterior).
Ulcus serpens : Corneal ulcer which creeps over the surface, usually associated with hypopyon.

in colour. There is usually severe iritis, as shown by the posterior synechiæ, discoloration of the iris, and intense ciliary injection.

TREATMENT.—The patient is ordered to bed. When the ulcer is first noted, the lacrimal sac is examined. If a mucocele is present, the sac is excised. The ulcer is kept clean by bathing with lotions of hydrarg. perchlor. 1–10,000, or quinine sulphate 0·5 per cent. Sulphamethazine, or another drug of this series, is administered systemically. Penicillin subconjunctivally or 2500 units to the ml., used as drops, is a great help. This is best given as follows: crystalline penicillin 1 million units; mydricaine min. 5; adrenaline 1–1000 min. 5; Aq. dist. ad 1 ml. It should be made up freshly and injected subconjunctivally after 2 drops of pantocaine. Atropine ointment 0·5 per cent is employed to treat the iritis.

The aim of the treatment is to prevent the ulcer from extending, and with this end in view the galvanocautery should be resorted to, the points being applied to the spreading edge of the ulcer and lightly over the remaining area.

Under the above treatment healing may result. If the hypopyon continues to increase, especially if the tension rises, it should be removed by paracentesis, or by means of Saemisch's section, which is carried out as follows: the cornea is punctured with a narrow Graefe knife, the edge pointing forwards at one edge of the ulcer; the knife is passed across the anterior chamber to make a counter-puncture in clear cornea just beyond the ulcer, and the cut is made forwards to open the anterior chamber. The viscid hypopyon is pulled out with iris forceps.

This course often saves the eye, but a dense leucoma and poor vision frequently result.

ACUTE PRIMARY GLAUCOMA

Symptoms and Signs.—The patient has an attack of very severe pain, which is felt in the eye itself, and also radiates along the branches of the first and sometimes the second division of the fifth cranial nerve; thus he may complain of pain around the eye, or down the nose, of headache, and even toothache. The pain is so severe that the patient vomits—a very characteristic symptom and suggesting a 'bilious attack'. The vision is soon reduced to the level represented by the perception of hand movements. The patient's general condition is usually severely affected.

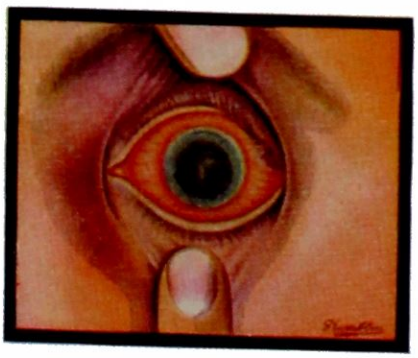

Fig. 1470.—Acute congestive glaucoma showing haze of cornea, pupil semi-dilated, and redness of the eyeball, most marked around the corneal margin.

The lids are slightly swollen and congested: the eye is red: there is marked ciliary congestion and the conjunctiva appears a dusky red owing to congestion of the veins (*Fig.* 1470). The cornea is steamy and anæsthetic. The anterior chamber is shallow. The pupil is oval, dilated, and fixed. No view of the fundus is possible owing to the condition of the cornea. The tension is raised, and the eye may become stony hard.

Treatment.—Eserine 1 per cent in oil is instilled into the affected eye every 15 minutes for an hour, and as the other eye is predisposed and the anxiety may bring on an attack there as well, a drop of eserine is put into it also. The instillations of eserine are then repeated every half-hour. The patient is given frequent hot-spoon bathings. Diamox[1], 250 mg. 6-hourly for 24 hours, and then twice daily by mouth, is very useful. If the patient is vomiting, it can be given intravenously.

A dose of calomel 2 gr. is given, followed by a saline draught four hours later or next morning.

If after some hours there is no diminution of tension in the eye and the pupil is not constricted, operation is indicated. The essential aim of the operation is to remove a large piece of iris (broad iridectomy) as peripheral as possible. Classically this is carried out as described in the section which follows, but the iridectomy may be performed by incision *ab externo* which makes this difficult operation a good deal easier and much safer.

Leucoma: A dense white opacity of the cornea, usually the result of a perforating ulcer or injury.

[1] Lederle Laboratories, Bush House, Aldwych, London, W.C.2.

it is impossible to do the operation, for instance, when no eye instruments a very good plan is to give the patient a retrobulbar injection of novocain

continued use of eserine the patient may be tided over till the operation can

IRIDECTOMY FOR ACUTE GLAUCOMA

Iridectomy may be done under general anæsthesia, or with retro-ocular procaine.

, fixation forceps (2 pairs), narrow (ground-down) Graefe knife 1471), iris forceps, de Wecker's iris repositor.

Fig. 1471.—Graefe cataract knife.

—The surgeon stands at the the table. The eye is bathed and put in.

stitch is placed in the superior rectus tendon. The eye is fixed by conjunctival slightly below the inner end of the transverse diameter of the cornea. The point enters the sclera 1 mm. from the corneoscleral junction, and about 3 mm. above diameter. The knife passes very carefully across the periphery of the anterior great care being taken that the iris is not caught by it, for it is very easy to wound the lens. The counter-puncture is made in sclera 1 mm. from the limbus. The surgeon now cuts upwards, the incision lying entirely in the sclerotic. A conjunctival flap is formed and turned down over the cornea.

The assistant then rotates the globe downwards by means of the stitch in the superior rectus.

The iris forceps held in the left hand is introduced closed into one angle of the wound and made to grasp a fold of iris close to the pupillary margin. This is drawn out of the eye and a radial incision made through it so as to include the pupil. The iris is drawn over to the other side of the wound, from its attachment to the ciliary body, and then finally The iris is reposited.

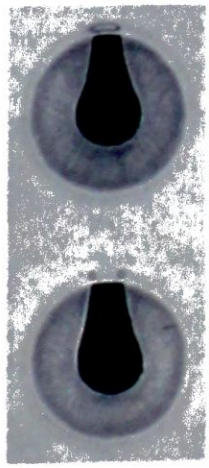

Fig. 1473.—Iridencleisis operation—conjunctival flap not shown for sake of clearness. A, Fold of iris prolapsed into scleral incision. B, The fold has been divided radially—the two halves impacted into the ends of the scleral incision and covered with a conjunctival flap.

1472.—The subconjunctival *ab externo* in glaucoma; the eye is fixed by a held in the left hand.

treatment.—The after-treatment is much like that following extraction. The eye is bathed with boric lotion and a drop of atropine instilled. It extremely important to instil a drop of eserine, 0·5 per cent, daily into the other the excitement of the operation is very liable to start an attack in it.

ab externo.—The above is the classical operation for acute glaucoma. The may, however, be done by incision *ab externo*. In this, one dissects down a in a trephine operation (*Fig.* 1472). A stitch is inserted under the upper margin al wound, so as to engage the fibres of the superior rectus at its insertion from the limbus) and the eye is pulled gently downwards. Then with a sharp or a Bard-Parker 15 knife placed at a tangent to the upper limbus and with the to the globe, one makes an incision directly into the anterior chamber. incision may be enlarged, if necessary, with narrow blunt-pointed scissors. The is then done as described above. An alternative procedure is to perform an

iris inclusion (iridencleisis). Often after the sclerocorneal incision has been made a sausage-shaped fold of iris may prolapse into the wound—if not it can generally be made to do so by gentle pressure on the upper margin with an iris repositor, and if this fails, it can be drawn out with forceps (*Fig.* 1473). The fold is grasped with two pairs of forceps, a small nick made in it, and the forceps separated so as to make a radial tear in the iris, reaching to the sphincter. The portions of iris held by the forceps are impacted in the ends of the wound and the conjunctival incision united with a running suture.

Hæmorrhage can be troublesome, but can be easily checked by touching bleeding points on the sclera with the point of a heated squint hook or with a cautery at dull red heat—provided the patient is not having an inflammable anæsthetic.

This operation can also be used for chronic glaucoma with satisfactory results. In these cases, it is advisable for the patient to have no miotic for 12 or preferably 24 hours before operation, otherwise there may be difficulty in causing the iris to prolapse. Also, unless the eye is obviously draining freely after operation, it should be massaged through the lower lid twice daily, after instillation of a drop of 2 per cent pilocarpine, and this should be continued for six months, until a permanent drainage channel is established.

IRITIS

Symptoms.—

1. Acute pain. The pain, which is usually severe, is felt in the eye, but is also very often referred to the orbit around the eye and down the nose. It comes on in exacerbations and is worse at night.

2. Photophobia and lacrimation, which are proportional to the pain.

3. Mistiness of vision in varying degree.

Signs.—

1. The eye is congested. The redness is mainly due to the hyperæmia of the episcleral vessels, which lie deep to the conjunctiva and give rise to a rose-pink flush around the cornea. This is known as ciliary injection. The redness diminishes towards the fornix.

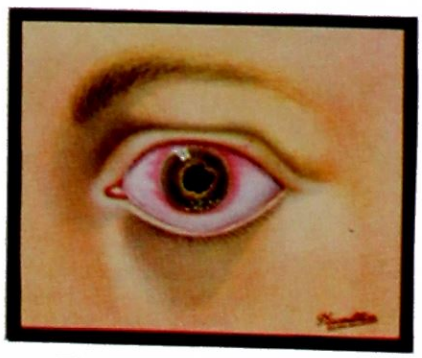

Fig. 1474.—Iridocyclitis, after instillation of atropine. Showing circumcorneal flush, adhesion of parts of iris to anterior lens capsule (posterior synechiæ), and dots of exudate on the back of the cornea (keratic precipitates or K.P.).

2. The iris is greenish and muddy, and loses its markings.

3. The anterior chamber is deepened.

4. The pupil is small and irregular, and reacts to light sluggishly or not at all. If a drop of homatropine and cocaine is put into the eye, the pupil may often be seen after a time to become crenated or festooned, owing to the fact that portions of its circumference are bound down to the lens (*posterior synechia*) and are thus prevented from dilating (*Fig.* 1474). As the pupil dilates, however, the adhesions in early cases tend to break down, leaving a deposit from the pigment epithelium of the iris on the front of the lens. In some cases the whole pupil is bound down and may not dilate at all.

5. The ciliary region of the eyeball is very tender to the touch. This sign must be elicited with great care by passing the finger over the closed eyelid from behind forwards. On account of the great pain which may be produced, this sign should not be used as a routine, but only in case of difficulty in differentiating iritis from conjunctivitis; in the latter this sign is absent.

Complications.—The main complication arises as a result of the whole pupillary margin becoming bound down to the lens (*ring synechia*). The aqueous, which normally drains from the posterior to the anterior chamber through the pupil, can no longer do so. As a result the iris is ballooned forward between its periphery and the adhesion to the lens, a condition known as *iris bombé*, and the tension rises.

Exudate into the pupil may obscure vision.

There is also a great tendency to relapse, especially if the patient does not rest the eye for a sufficient period.

Treatment.—Treatment is primarily directed towards breaking down the adhesions between the iris and the lens by dilating the pupil. Hence 1 per cent atropine is inserted, either as drops or as an ointment, every quarter of an hour for four or five times and

then four times a day. If this is not effective the atropine is combined with 2 per cent cocaine, which aids dilatation.

The atropine is continued for at least a fortnight after the eye is white. After all inflammatory signs have disappeared, however, the quantity is gradually reduced. The pain, as a rule, is relieved by the atropine. The effect is supplemented by the application of heat to the closed eyelids by means of cotton-wool wrapped around a wooden spoon, by a Maddox (electric) eye-warmer, or by other means, e.g., diathermy.

Protein therapy has been widely advocated, especially injections of milk. The milk is sterilized by boiling for three minutes and about 8 ml. injected subcutaneously over the recti abdominis muscles, or intramuscularly in the gluteal region or into the thigh opposite to that on which the patient usually sleeps. T.A.B. intravenously, starting with 25 millions, as fever therapy is often extremely useful.

Latterly sulphapyridine and similar drugs have proved of great help in those cases due to the gonococcus, streptococcus, or pneumococcus. Sometimes 0·4 ml. cortisone subconjunctivally may act dramatically.

Both eyes should be rested and no reading permitted; dark glasses are ordered, with a pad of cotton-wool over the affected eye to keep it warm. Alcohol is forbidden. Cold acts very adversely on the progress of cases of iridocyclitis; patients are therefore best treated in bed or at least confined to a room.

A Wassermann reaction is usually carried out and a search made for a focus of infection or other cause of the iritis.

ACUTE INFLAMMATORY SWELLINGS AT THE ORBITAL OPENING (*Fig.* 1475)

Hordeolum, or Stye, is a suppurative inflammation, a furuncle, of the sebaceous gland belonging to the follicle of an eyelash. It starts as a swelling in the line of the lashes and increases more or less rapidly, becomes red, and eventually the small abscess which

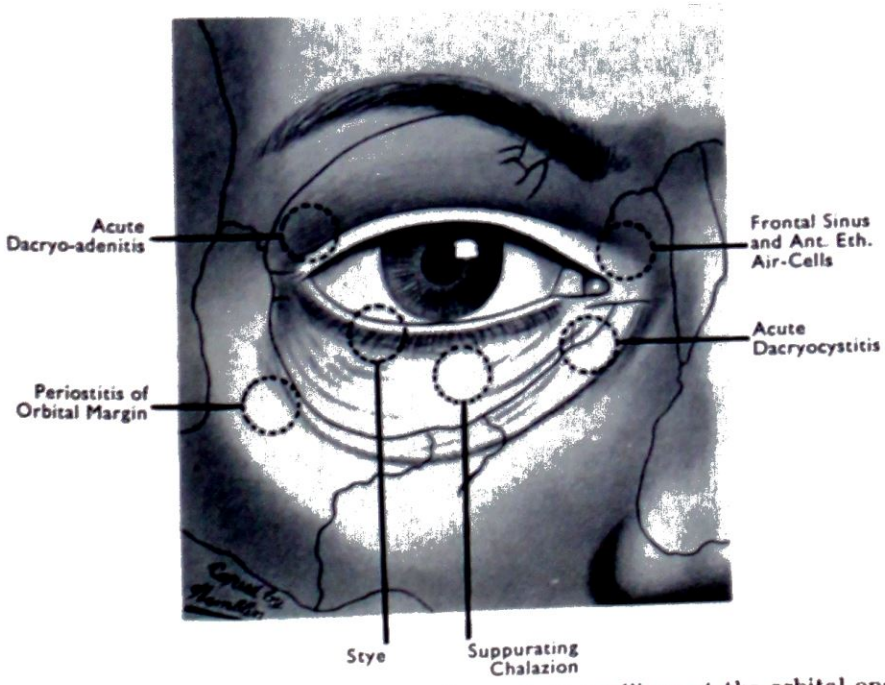

Fig. 1475.—To show the sites of acute inflammatory swellings at the orbital opening. (*Based on an illustration in Eugene Wolff's 'Anatomy of the Eye and Orbit'.*)

has formed, points and discharges. Then the inflammatory signs quickly subside. Sometimes the stye is accompanied by œdema of the lid margin or swelling of the whole lid. In these cases the site of the hordeolum may not be obvious, but it may be found by passing the finger along the lid margin and detecting the point of most acute tenderness.

Hordeolum may cause enlargement of the pre-auricular gland. It is accompanied by a variable amount of pain, which may be severe.

Suppurating Chalazion.—A chalazion may become inflamed, causing great swelling of the lids, enlargement of the pre-auricular gland, and marked chemosis. Its site may be diagnosed by finding the most tender point on the lid. Such a suppurating chalazion usually discharges after a few days, especially if aided by hot fomentations.

Acute Dacryocystitis.—At any time in the course of a lacrimal obstruction the lacrimal sac may become acutely inflamed. The skin over the sac becomes red and much swollen, and the inflammation soon spreads to the lower eyelid. The abscess formation is accompanied by considerable pain and some fever.

Treatment.—The abscess is opened by an almost vertical incision over the main swelling. If left to itself the abscess usually opens below and to the outer side of the lacrimal sac, and either heals or forms a fistula.

Acute Inflammation of the Lacrimal Gland (Dacryo-adenitis) is curious in that it often subsides without suppuration. If an abscess does form, it discharges externally and a fistula may result. Dacryo-adenitis resembles orbital cellulitis clinically, but with general swelling of the lids there is induration and tenderness below the outer part of the upper orbital margin. There is, as a rule, only slight fever, if any.

Periostitis of the Orbital Margin is not uncommon in young children, and is usually tuberculous. It may also be caused by trauma or syphilis. There is swelling of the lids and, later, abscess formation. The abscess may subside or open, leaving a sinus which leads down to bare bone. Ectropion may result from a band of scar tissue which attaches the lid to the bone.

ORBITAL CELLULITIS

(*Figs.* 1476, 1477)

Causation.—Orbital cellulitis is most commonly caused by ethmoiditis. The lamina papyracea of the ethmoid, which forms the main portion of the medial wall of the orbit

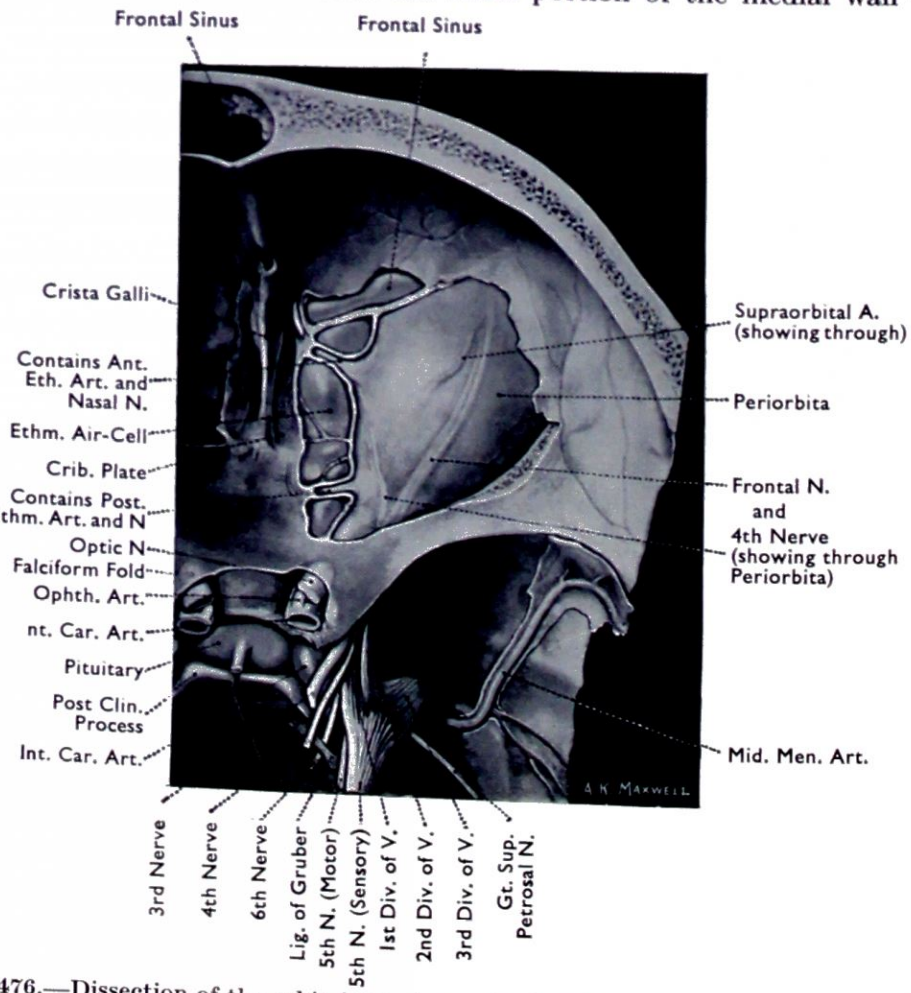

Fig. 1476.—Dissection of the orbit from above, to show the relation of the frontal sinus and ethmoidal air-cells to the orbital periosteum (periorbita).
(*From Eugene Wolff's 'Anatomy of the Eye and Orbit'.*)

Chalazion : Cyst of a Meibomian gland.

is, as its name implies, as thin as paper, and forms a poor barrier against ethmoidal disease. Infection from the frontal sinus also occurs.

Furuncles, erysipelas, and other infections of the face are often to blame; or the condition follows penetrating injuries or a septic operation. Rarely, orbital cellulitis may occur in pyæmia, typhoid fever, scarlet fever, etc., and it has been known to arise in dental sepsis. Orbital cellulitis may also come from the parts around, i.e., from a panophthalmitis, or a lid abscess, or a lacrimal abscess pointing backwards.

Fig. 1477.—Incision used for drainage in a case of cellulitis of the orbit. Recovery followed.

Signs and Symptoms.—There is much swelling of the lids, so that the eye tends to be closed. Chemosis also is pronounced. There is proptosis of the eyeball and diminution in its mobility. Vision is often reduced, due to pressure on or involvement of the optic nerve. If the optic nerve is involved anteriorly, papillitis results, though this is not common. There is much pain and fever.

Treatment.—In the less severe cases the condition often subsides with the treatment of the nasal condition, the application of hot fomentations to the eye, and the exhibition of sulphathiazole and similar drugs.

When an abscess actually forms and points, usually at the upper and inner portion of the orbit, it should be opened by an extensive incision up and in, or directly in along the orbital margin, and the abscess drained. Even if pus is not found the incision often does good (*Fig.* 1477).

BURNS OF THE EYE

Burns of the eye are usually produced by molten metal, steam, strong acids, or caustics such as lime or alkalis.

A not infrequent accident is a burn of the cornea from a curling-iron, an injury which is very painful. It is treated as an ulcer with atropine ointment and covered with a pad and bandage.

Among the severer burns there is a great difference between those due to hot metal and those due to caustics. In the case of a metal burn one can determine fairly closely the extent of the injury, but not so in burns produced by caustics. In the latter, soon after the accident there is intense conjunctivitis and chemosis, but the cornea may appear clear except in the worst cases. Fluorescein will show the extent to which the corneal epithelium has been burnt off. After a few days a slough may form which may lead to ulceration of the cornea and perforation of the globe. If the bulbar and palpebral conjunctiva are involved, two granulating surfaces may be opposed to each other and join. The eyelid may thus be tightly united to the globe, a condition known as symblepharon.

With a lime burn the opacity of the cornea tends to become whiter and denser as time goes on, due to the formation of calcium carbonate particles.

With a molten metal such as lead the film of moisture on the cornea acts as a protection. It reduces the temperature and causes the lead to slide off into the conjunctival sac. Thus the cornea may be but slightly damaged while a solidified piece of lead may be found adherent to the conjunctiva or lashes.

Treatment.—In the case of burns due to caustics, if the injury is seen early the eye is bathed with large quantities of fluid; preferably using weak alkali for acid burns (sodium bicarbonate 2 per cent) and weak acids for alkali burns (boric acid, 10 gr. to 1 oz.). In emergencies these solutions will not be immediately at hand and the face should be immersed at once in a basin of water, the eyes being opened if possible. Atropine ointment is put into the eye.

Papillitis: Inflammation of the intra-ocular portion of the optic nerve.
Symblepharon: Adhesion of the lid to the eyeball.

For lime burns, the pieces of lime having been removed, 10 per cent neutral ammonium tartrate is used. The eye is anæsthetized with 4 per cent cocaine drops three times in ten minutes, and then irrigated with the warmed tartrate solution, which is poured over the eye with an undine. The symptoms are rapidly relieved by this measure, and the tartrate also helps to dissolve any particles of calcium carbonate which have formed, and thus tends to lessen the degree of opacity which may result.

In an attempt to prevent symblepharon, the point of a glass rod covered with petroleum jelly is passed across the upper and lower fornices once a day.

SIMPLE DETACHMENT OF THE RETINA

Treatment.—The only effective treatment is by operation, which consists in finding and sealing the hole or tear and letting out the subretinal fluid.

While detachments have been put back months after their occurrence, there can be no doubt that the sooner they are done the better the prognosis.

Localizing the Hole.—This step may be easy or very difficult; in some cases no hole may be found. Often some assistance may be afforded by the type of case and the history. In high myopia there is most commonly a tear in the upper temporal quadrant; in hypermetropia and emmetropia, in the lower temporal quadrant. If the patient states that the first flashes of light appeared in the lower nasal field, and that this was followed by a shadow in the same part of the field, the hole is almost certainly in the upper temporal quadrant.

The sealing of the hole is effected by producing a plastic choroiditis, which causes the retina and choroid to adhere at the site of the hole. This is brought about by means of diathermy, applied at several points to the surface of the sclera over the site of the hole, or in a semicircle, the two ends of which are at the ora serrata; by a ball or other surface electrode (Larsson's method); or by Safar's points, which actually pierce the sclera. In the former method it is necessary to make one puncture with a diathermy needle to let out the subretinal fluid. This is aided by a suction apparatus.

Operation.—Procaine, 2 per cent, and adrenaline solution is injected under the conjunctiva, and under Tenon's capsule. An incision more or less concentric with the corneal margin, and about 6 mm. distant from it, is made through the conjunctiva, which is then dissected back off the sclera. To obtain adequate exposure it may be necessary temporarily to divide a muscle. Larsson's ball electrode is applied for 8 seconds with a current of 80 milliamperes. With Safar's method the current is passed for 2 seconds at 50 milliamperes and then the point is withdrawn.

The patient is put to bed in such a way that drainage of the subretinal fluid is easiest; thus, in a case with a hole on the temporal side of the right eye, the patient lies somewhat over towards this side. Both eyes are covered for a fortnight with just sufficient dressing to keep the eye clean and the pupil dilated with atropine. After this the patient is given special spectacles having only a central hole for vision.

PURULENT CONJUNCTIVITIS

Treatment.—The first thing to do in the adult is to prevent the other eye from becoming affected, bandaging the sound eye at once, or, better, excluding it by means of a Buller's shield (*Fig.* 1478). In the baby, in whom the disease is always bilateral, this is not necessary.

The advent of sulphonamides, and more latterly of penicillin and chloramphenicol, has revolutionized the treatment of purulent ophthalmia. It is, therefore, very important to start giving sulphathiazole, sulphadiazine, or similar compounds by mouth as soon as possible.

Penicillin drops kept in a refrigerator (2500 units to the ml.) should be instilled six or more times a day.

Apart from this the eyes are bathed with normal saline a sufficient number of times to prevent pus from accumulating under the eyelids. In this connexion, separating the eyelids should be done with great care as the pus may be under pressure and squirt into the surgeon's or nurse's eyes. They should therefore wear protective goggles and preferably rubber gloves.

The lotion is applied by means of cotton-wool, or an undine may be used if handled with great care. The bathing washes away the pus and thus prevents its solvent or macerating action on the cornea.

A bowl of 1–10,000 perchloride and a supply of swabs are put near the bed so that the patient can wipe away the pus in the intervals of bathing.

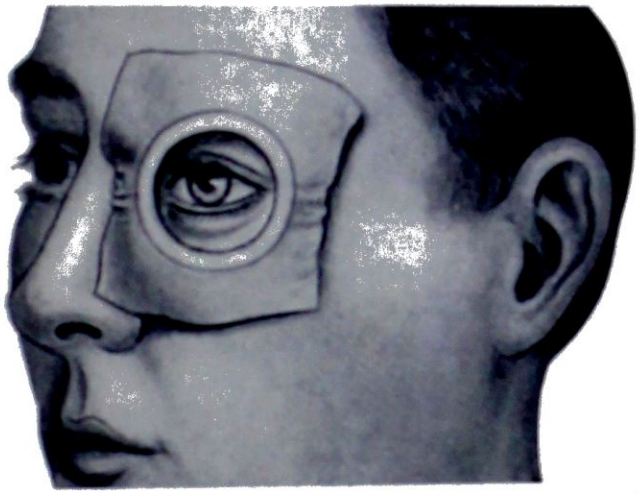

Fig. 1478.—Buller's shield for the protection of a healthy eye when the fellow eye is affected with purulent conjunctivitis.

TRICHIASIS OR INGROWING EYELASHES

Treatment.—If there are only a few eyelashes rubbing on the cornea they may be removed by means of a lash forceps (*Fig.* 1479). If a number of lashes are involved they are removed by electrolysis. Should there be any extension of the trouble, a plastic operation is necessary.

Fig. 1479.—Lash forceps.

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CHAPTER LXXXIX

THE EAR

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THE EXTERNAL EAR

Foreign Bodies in the Ear.—Small children sometimes insert beads, pebbles, peas, and similar foreign bodies into the ear. Adult patients with discharging and itching ears tend to forget pieces of cotton-wool and broken match-sticks, used for cleaning, in the depths of the auditory meatus. Children are usually brought by alarmed mothers as an emergency and treated as such, but it should be stated emphatically that unless the ear has already been injured by injudicious attempts at extraction of the foreign body, there is no need for alarm or haste. Practically all foreign bodies can be removed from the auditory meatus by syringeing and this should be done in the first place and in the usual way as for removal of wax from the ear. Adequate assistance is required. The water must be warmed to body temperature to avoid giddiness from caloric stimulation of the labyrinth.

Only if the attempt at washing out the foreign body should fail (and this is very rare) is mechanical extraction required. It is not only useless, but dangerous to attempt this in a frightened and struggling child, and cases are on record where glass beads have been crushed and pushed into the middle ear through the tympanic membrane and even into

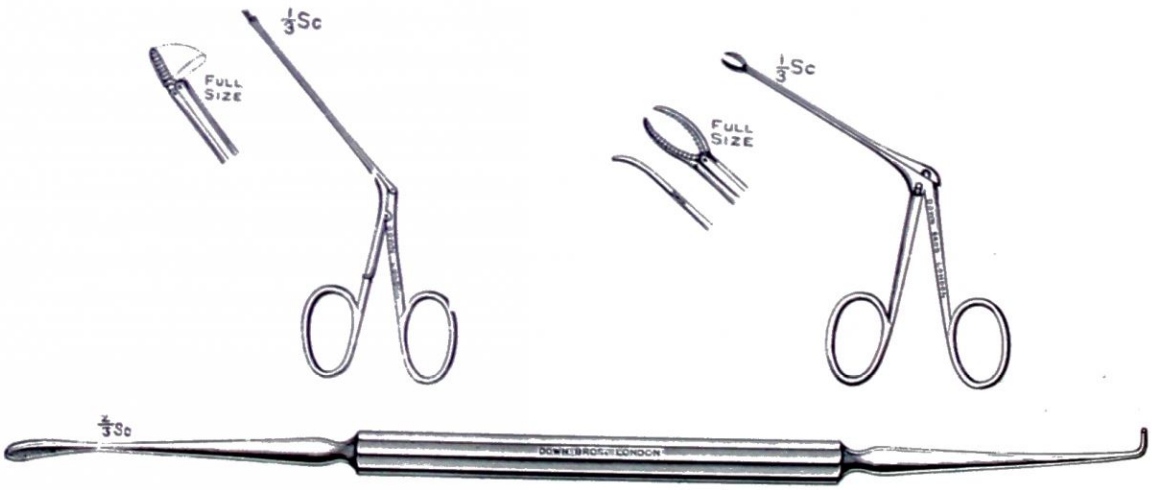


Fig. 1480.—Aural forceps with spud and hook.

the labyrinth in an ill-advised attempt at removal! A general anæsthetic is therefore necessary. This is one of the situations where ' a quick whiff of gas ' in the Casualty Department can lead to tragedy from inhalation of the contents of the stomach. It is therefore best to admit the child. After due preparation, a general anæsthetic is administered. Adequate illumination is essential. Suitable cupped forceps, or according to the shape and consistency of the foreign body, a spud and hook (*Fig.* 1480), as well as a suction apparatus, should be available. Great gentleness is required in order not to push the foreign body beyond the narrow isthmus of the auditory meatus and not to damage the tympanic membrane. If a hook is used, the end must be insinuated between the foreign body and the meatal wall, turned, and withdrawn, bringing the object with it.

If the foreign body has been pushed beyond the isthmus of the auditory meatus and cannot be removed in the way described, a small vertical incision is made into the auditory meatus from behind, close to the attachment of the auricle and the foreign body extracted under direct vision. After removal of the foreign body the tympanic membrane should be inspected carefully to make sure that it has not been damaged. The incision is closed

by two nylon sutures and the meatus packed lightly with ribbon gauze. If the tympanic membrane has been damaged, proceed as described in the next paragraph.

Traumatic Rupture of the Tympanic Membrane may occur by direct injury with a knitting needle, a hairpin, etc., or from pressure of air, as in explosions, or by blows over the ear. The tympanic membrane can also be perforated during syringeing of the ear, if the nozzle of the syringe is too long and is inserted too far into the meatus ; if the nozzle becomes detached and is projected by the force of the water against the tympanic membrane ; if the syringe, instead of being filled completely with fluid is partially filled with air, which is blown under pressure against the tympanic membrane ; if the tympanic membrane is thin from previous scarring.

On rupture of the tympanic membrane severe pain is experienced, blood appears the auditory meatus, and the patient complains of tinnitus. Deafness may be only The appearance of a *recent* tear of the tympanic membrane is typical and from the medicolegal point of view, it should be therefore noted specifically record. The edges of a fresh perforation are ragged and blood-stained ; in perforation the edges are smooth and free from blood.

the management of a traumatic perforation of the tympanic membrane the one aim is prevention of infection. If this objective can be achieved, the perforation a chance to heal spontaneously. Should infection supervene, inflammation of the is inevitable. The auditory meatus is not sterile, therefore the less manipulation auditory canal, the better : even the blood-clot should be left undisturbed. The is dusted lightly with chloromycetin powder and sterile cotton-wool inserted. A of systemic penicillin is given. *Syringeing is contra-indicated.* After two or three blood-clot or serum should be mopped out with sterile cotton-wool on an applicator. spite of these precautions infection supervenes, treatment as for acute otitis media) should be carried out.

of the External Auditory Meatus.—Patients with this condition often seek urgently because of intense pain. This is due to the rich nerve-supply of the skin auditory canal, which is tightly adherent to the perichondrium and devoid of sub- tissue. The auditory meatus may be occluded by the swelling, arising from the cartilaginous part of the meatus (a swelling of the *inner*, bony part of the meatus with of the upper and posterior wall, is suggestive of mastoiditis—*see* table below). tympanic membrane can be seen it will be found to be normal. Not infrequently auditory canal is occluded by the swelling, and hearing is impaired thereby. If the is opened by traction on the pinna, which causes pain, normal hearing will be restored. (In case of mastoiditis there is severe middle-ear deafness.) If the furuncle is on the *posterior* wall of the auditory canal, there may be post-auricular œdema and consequently the pinna may be displaced forwards as in a case of acute mastoiditis. the furuncle has burst recently it is probable that there will be a scanty, possibly blood- stained, discharge. A summary of differential diagnostic signs between furuncle and is given in the following table :—

Furuncle	Mastoiditis
History of boils elsewhere Sudden onset	History of a head-cold or tonsillitis followed by otitis media
Rare in children	Common in children
Pain on pulling the auricle and on mastication	No pain on pulling the auricle Pain on deep pressure over the mastoid process
Thick, scanty discharge, often blood-stained	Mucopurulent, profuse discharge
Swelling in the *outer*, cartilaginous canal	'Sagging' in the *inner*, bony part of the meatus
Hearing normal or little affected	Marked middle-ear deafness
X-rays show normal mastoid	Mastoid cells cloudy

Furuncle on the *anterior* meatal wall causes pre-auricular swelling and sometimes œdema of the lower eyelid. Otitis externa and pediculosis capitis predispose to furunculosis, because the patient tends to infect the skin by scratching.

Treatment.—Dry heat in the form of a hot-water bottle is beneficial because it helps to bring the furuncle 'to a head'. Systemic penicillin is justifiable because without it the condition may drag on and cause a number of sleepless nights. The auditory meatus is painted with 2 per cent mercurochrome solution in order to prevent re-implantation of organisms (staphylococci) when the furuncle bursts.

Penicillin ear-drops are useless in any ear condition and can only cause dermatitis. They should never be used. Chloramphenicol drops are a very powerful antibiotic but if used longer than a few days cause severe skin irritation (otitis externa).

Incision under general anæsthesia with a narrow-bladed scalpel through a slotted aural speculum is required occasionally when fluctuation is present and the boil is slow in bursting.

Post-auricular Adenitis.—The lymph-nodes overlying the mastoid process drain the scalp and are therefore often affected in infected abrasions of the scalp and in pediculosis capitis. Many a case of 'mastoiditis', diagnosed on account of the post-auricular inflammatory swelling, proves to be a case of post-auricular adenitis from head lice. The most important differential diagnostic sign, which can be tested even in the most adverse conditions, is the hearing: in adenitis, it is unaffected, in a case of mastoiditis a severe degree of middle-ear deafness is found. Further differential diagnostic signs are: in adenitis there is no history of otorrhœa; in acute mastoiditis otorrhœa has been present for several weeks. In adenitis the tympanic membrane is intact and quiescent; in mastoiditis there is a perforation of the tympanic membrane with a pulsating discharge. A combination of otitis media and post-auricular adenitis from pediculi capitis does occur in patients whose standards of personal hygiene are low.

Treatment.—In addition to antibiotic therapy for the adenitis, treat the scalp by cleansing it with D.D.T. emulsion. If the inflamed lymph-nodes break down and a fluctuating swelling develops, incision and drainage is required. In adenitis the abscess is subcutaneous; in acute mastoiditis (*see Fig.* 1483) it is subperiosteal.

THE MIDDLE EAR

Acute Otitis Media.—This condition is an emergency only in so far as the severe pain keeps the patient, very often a child, awake at night. The pain is due to pressure of the accumulated inflammatory exudate on the hyperæmic tympanic membrane. When examined at this stage the tympanic membrane is found red and bulging, at first usually in the upper quadrants. Later the landmarks (handle of the malleus) become indistinct and the whole tympanic membrane may bulge (*Fig.* 1481). Treatment consists in adminis-

A B C D

Fig. 1481.—A, Acute otitis media, mild. Convexity and injection of the tympanic membrane. (The right tympanic membrane is shown in each case.) B, Acute otitis media, severe. The membrane is bulging and scarlet, and shows a hæmorrhagic bulla in the posterior part. C, Acute otitis media with bulging of the membrana flaccida. D, Herpes oticus; the vesicle lies near the umbo and just overlaps the handle of the malleus.

tration of sulphonamides or penicillin in full doses. As soon as the acute infection is under control the mucous membrane of the middle ear becomes decongested and the inflammatory exudate reabsorbed or expelled via the Eustachian tube. Myringotomy is hardly ever required as an emergency procedure, as it used to be in pre-antibiotic days, and the author has not had to perform this operation as an emergency for a number of years. If the pain should continue and bulging of the tympanic membrane persist after 24 hours of intensive antibiotic therapy, the infective organism is probably insensitive to the antibiotic and myringotomy would be justified.

Technique of Myringotomy.—Under general anæsthesia the tympanic membrane should be incised, not simply punctured, in the postero-inferior quadrant (*Fig.* 1482). This is done through an aural speculum with a fine, sickle-shaped bistoury or with a special harpoon-shaped angled knife (myringotome), under illumination from a forehead lamp or light reflected from a forehead mirror. Alternatively an auriscope with the examination lens removed and the small operating lens attached to the side of the speculum is quite satisfactory. As the landmarks are often indistinct the operator must make sure that he is not incising the posterior meatal wall instead of the drum, and that he is not scratching the surface of the tympanic membrane only, but is penetrating all its layers. After the incision a swab is taken from the exudate or pus from the middle ear for bacteriological examination and a strip of ¼-in. (1·2-cm) ribbon gauze is inserted into the auditory meatus to absorb the discharge. The gauze has to be changed frequently.

Fig. 1482.—Line of incision for paracentesis tympani. (Right ear.)

Myringotomy should not be performed lightly, because in some cases the incision in the tympanic membrane does not heal completely and a permanent perforation results. Therefore, if there is any doubt about the necessity for myringotomy, do not operate.

When the Tympanic Membrane has ruptured Spontaneously.—If the patient is seen only at a later stage of acute otitis media, when the tympanic membrane has ruptured spontaneously and the ear is discharging already, the treatment should again consist of administration of antibiotics and dry mopping of the discharge. If the mopping is not done frequently enough the discharge is likely to produce irritation of the skin of the auditory meatus (otitis externa) especially in children. In the acute stage aural drops should not be used.

The sensitivity of the infecting organisms must be tested by taking a swab from the discharge for bacteriological examination. One week of systemic penicillin followed by one week of sulphonamides is adequate even in severe infections, but it should be emphasized that even if the discharge has ceased and the appearance of the tympanic membrane has returned to normal, the hearing must be tested. If the hearing does not reach its normal level, expert otological opinion should be sought without delay. It may be that accumulation of a viscid, although sterile exudate is the cause of the residual middle-ear deafness. Unless this is expelled by inflation of the Eustachian tube or by myringotomy, it is liable to become organized and eventually lead to adhesions, immobilization of the auditory ossicles, and to permanent deafness.

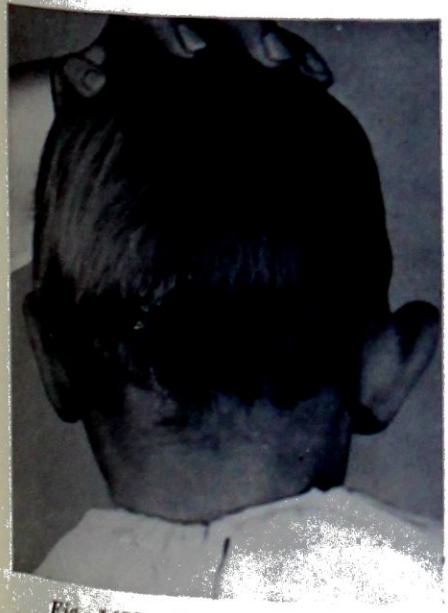


Fig. 1483.—Examination from the back in mastoiditis. Note that the ear on the affected side is pushed forward.

Facial Paralysis occurring during the Course of Acute Otitis Media is due to neuritis of the facial nerve. This is not an indication for operation. The condition must be differentiated from herpes zoster of the geniculate ganglion in which facial paralysis is accompanied by excruciating pain and eruption of vesicles in the external auditory meatus and on the tympanic membrane (*Fig.* 1481D).

ACUTE MASTOIDITIS

It is quite exceptional for an acute otitis media, which has been adequately treated, to develop into acute mastoiditis. It is important to realize that tenderness on pressure over the mastoid process is not synonymous with mastoiditis. The mastoid process is tender on pressure in *every* case of acute otitis media during the first two or three days of the attack and before rupture of the tympanic membrane has occurred a high temperature in children is the rule. Only when tenderness and pyrexia appear in a patient with otorrhœa of several *weeks'* duration, and the discharge is purulent, pulsating, and increasing in amount, are we justified in diagnosing acute mastoiditis.

Even if the patient is seen for the first time only after acute mastoiditis (*Fig.* 1483) has developed, there is no indication for an immediate operation. A swab is taken from the discharge and pending the result of bacteriological examination a massive dose of penicillin is given. This is changed to the appropriate antibiotic, if the result of the sensitivity test demands it.

Acute mastoiditis occurs in the well-pneumatized, cellular type of mastoid process, and pus therefore tends to find its way to the surface and may form a subperiosteal abscess; thus the possibility of intracranial complications is remote. A fluctuating collection of pus under the periosteum should be evacuated through a Wilde's incision (*see Fig.* 1485A) which passes down to, and includes, the periosteum. A small drainage tube is inserted for a few days.

CORTICAL (SCHWARTZE'S) MASTOIDECTOMY

Indications.—Very infrequently in acute mastoiditis. The writer has not found it necessary to perform cortical mastoidectomy as an emergency for several years. However, it is probable that in some parts of the world where antibiotic therapy is not administered early, the patient may arrive with sequestrum formation or impending intracranial complications, in which event a comparatively urgent operation will be necessary.

As will be described on p. 1060, the first steps of a modified radical mastoidectomy are identical with those of Schwartze's operation.

The Instruments for mastoidectomy are depicted in *Fig* 1484. Bone wax may be required in order to stop troublesome bleeding from the bone. A suction apparatus is invaluable. A good illumination from a forehead lamp is essential. The hair behind the

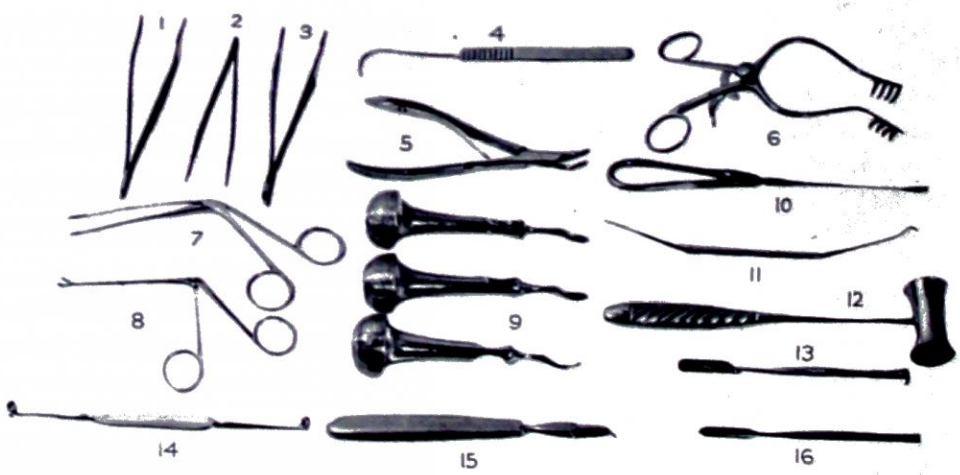


Fig. 1484.—Instruments for the Schwartze operation. 1–3, Toothed dissecting forceps; 4, Aneurysm needle: 5, Jansen's bone forceps; 6, Mastoid retractor; 7, Angular packing forceps; 8, Granulation forceps; 9, Hand gouges; 10, Retractor; 11, Pus seeker; 12, Mallet; 13, 16, Gouges; 14, Curette; 15, Faraboeuf's rugine.
Not shown: Scalpel, scissors, needles, 6 towel clips, and 12 hæmostats.

ear is shaved. The patient's head is steadied by means of a small sandbag placed beneath the opposite cheek.

Technique.—

1. A curved postaural incision is made (*Fig.* 1485). Bleeding vessels are caught in hæmostats and ligated or coagulated. Care must be taken not to incise the temporal muscle in the upper part of the incision, as this causes troublesome oozing during the operation.

2. The periosteum is incised and reflected forwards and backwards with a rogine, and a mastoid retractor is inserted (*Fig.* 1485B). The mastoid process is cleared of a few muscular or tendinous fibres of the attachment of the sternomastoid muscle, with scissors and the rugine.

3. Landmarks (*Fig.* 1486) are now identified. The cutaneous posterior meatal wall is separated gently with a periosteal elevator, so as to display Henle's spine at the junction of the superior and posterior bony meatal walls. Henle's spine indicates the level of the

mastoid antrum, which lies about ½ in. (12 mm.) beneath the surface. The suprameatal crest (prolongation of the zygoma) marks the lowest limit of the dura of the middle cerebral fossa. Macewen's triangle is another valuable surface marking of the mastoid antrum. Macewen's triangle is formed by the posterior superior arc of the external bony meatus, and the tangents drawn through the highest and the most posterior meatal points (*Fig.* 1486, *inset*).

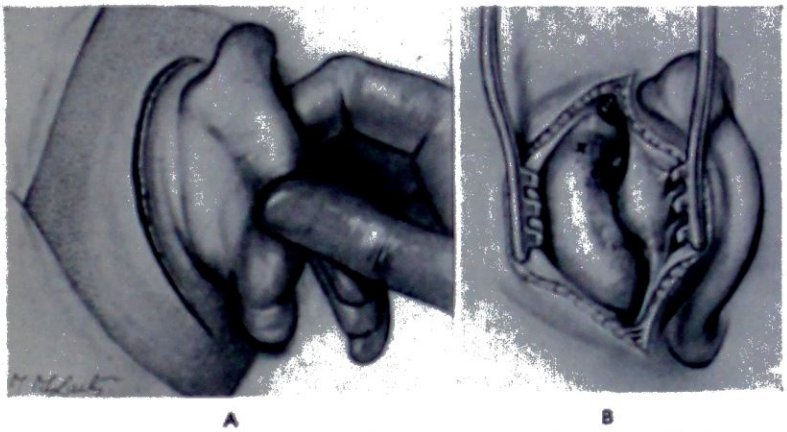


Fig. 1485.—Schwartze's operation (I). A, Postaural incision. B, Periosteum reflected and retractors inserted. The marking for the mastoid antrum is shown by an X.

4. The tip of the mastoid process is identified. In cases with subperiosteal abscess, evacuation of the pus and exposure of the mastoid cortex will reveal a fistula, from which pus is exuding, leading into breaking-down mastoid cells. Using a hammer and a mastoid gouge of moderate width, the fistula is enlarged and followed, removing the mastoid cortex (hence the name 'cortical mastoidectomy'), opening systematically groups of mastoid

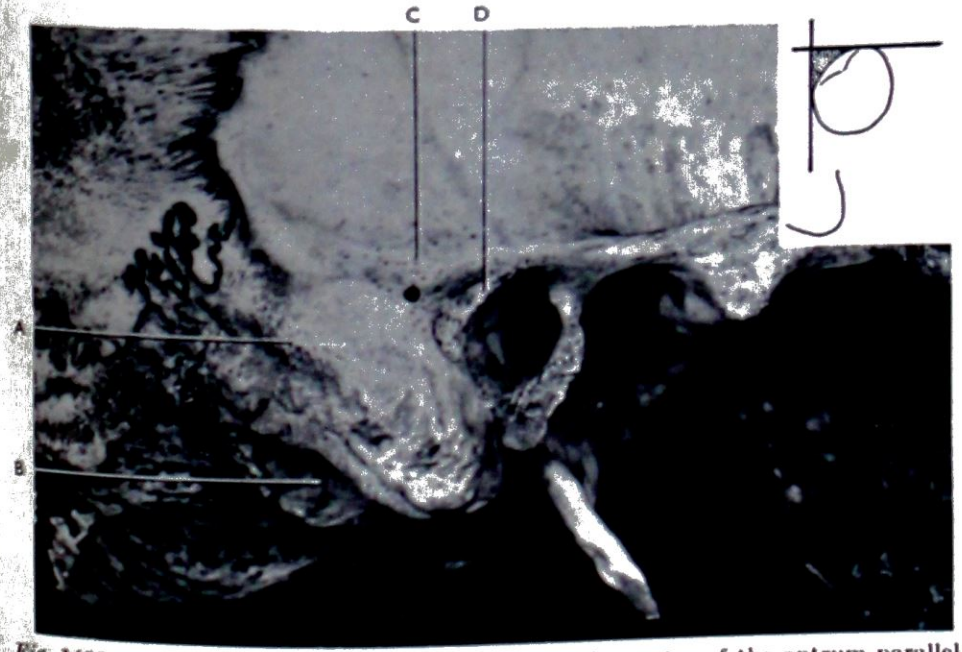


Fig. 1486.—A hole has been drilled outward from the centre of the antrum parallel to the axis of the external meatus; note that the centre of the antrum is on a level with the top of the meatus. A, Foramen for mastoid emissary vein; B, Petromastoid suture; C, Supramastoid crest; D, Spine of Henle. *Inset*, Macewen's triangle.

cells and removing granulations. Pre-operative radiographs of the mastoids are a valuable guide to the distribution of mastoid cells in a particular case.

If no fistula is found removal of the cortex is commenced from behind forwards, in the direction of Henle's spine. Further cuts are made from the mastoid tip towards Henle's spine and from just below the supramastoid crest to the spine. Bone chips are removed and, using smaller gouges, the cavity is deepened until the mastoid antrum is reached. The operator must work in a dry field. An assistant removes blood either by suction or by mopping with ribbon gauze held in an angled forceps (*see Fig.* 1484 (7)). The antrum is

identified by the fact that it leads into the aditus. The visible landmark on the floor of the aditus is the whitish prominence of the lateral semicircular canal.

5. Once the antrum has been opened widely so as to secure adequate drainage, systematic removal of mastoid cells is completed downwards, towards the tip of the mastoid, and backwards towards the sinus plate. On completion of the bone work a single, smooth-walled cavity should result.

6. A small rubber drainage tube is inserted from the region of the antrum to the lower end of the postaural incision, and the incision is closed by interrupted mattress sutures.

During the next few days the discharge from the auditory meatus should diminish rapidly, and cease completely. On the fourth post-operative day the drainage tube is shortened, but the wound is not allowed to close completely until the meatus is dry.

SPECIAL CONSIDERATIONS WHEN OPERATING UPON AN INFANT'S EAR

There are important differences in the surgical anatomy of an infant's ear compared with that of an adult :—

a. In infants, where the bony auditory canal is not developed, the tympanic membrane is almost horizontal. This must be realized when myringotomy is contemplated.

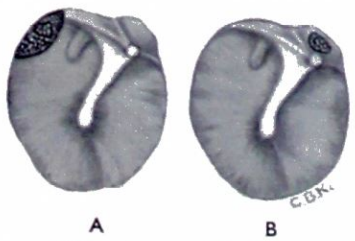
b. During infancy the mastoid process is rudimentary and the stylomastoid foramen is near the surface, unprotected by the mastoid process. Therefore, in infants and small children a postauricular incision must not be carried beyond the tip of the mastoid, otherwise the facial nerve is endangered.

* * * * * * *

Before closing this chapter a word of warning must be given about streptomycin in the treatment of aural infections. Streptomycin, and especially dihydrostreptomycin, is toxic to the eighth nerve, both to the vestibular and acoustic portion. The toxic effect is manifested by giddiness, tinnitus, and nerve deafness. Even an amount of streptomycin no larger than 2 G. daily for an adult is toxic if used for more than a few days. A safe daily dose for an adult is 1 G. (0·5 G., b.d.) for six days. Children tolerate the drug better than adults. In a patient whose hearing is already endangered by an infection of the middle ear, the added risk of possible toxic nerve deafness is only justified under the exceptional circumstances when the responsible organism is not sensitive to any other antibiotic.

ACUTE-ON-CHRONIC MASTOIDITIS AND ITS COMPLICATIONS

While *acute* mastoiditis develops in cellular mastoids, it is a well-established fact that *chronic* mastoiditis tends to occur in patients with a sclerotic, acellular type of mastoid process. This adds greatly to the technical difficulty of mastoidectomy since the antrum is small and placed deeply, often in solid bone, and the lateral sinus lies well forward, where it is prone to injury.



A B

Fig. 1487.—A, Marginal posterosuperior perforation of the tympanic membrane. B, An attic perforation.

The patient's history concerning the duration of an aural discharge is not always reliable and in cases of doubt radiographs of the mastoids should be taken ; these will display the degree of pneumatization present. When, in a patient whose history and physical signs suggest acute mastoiditis, the mastoid is shown to be well pneumatized this is strong confirmation of the diagnosis. On the other hand if the mastoid is sclerotic, it is probable that the case is an acute exacerbation of chronic middle-ear disease.

Chronic mastoiditis is characterized by continuous, although scanty, discharge, often of many years' duration from a marginal posterosuperior or an attic perforation (situated in the pars flaccida of the tympanic membrane, *see Fig.* 1487) with granulations or cholesteatoma in the attic or mastoid antrum and possibly with caries of the auditory ossicles. Although its treatment is surgical, chronic mastoiditis as such does not require an emergency operation.

Chronic mastoiditis is painless. If, however, free drainage of pus becomes impeded by granulations or accumulation of cholesteatoma, usually in the relatively narrow region of the aditus ad antrum or attic, retention of pus under pressure follows and acute symptoms develop.

Pain in a case of chronic mastoiditis is always a danger signal, because within a sclerotic mastoid process pus under pressure cannot find an outlet to the surface. Unless released by a timely operation it may find its way inwards and lead to intracranial complications such as extradural abscess, thrombophlebitis of the lateral sinus, meningitis, or brain abscess, singly or in combination. The second mechanism by which complications of chronic mastoiditis arise is the gradual increase in size of cholesteatoma, which does not find an adequate route of escape outwards through a small attic perforation and by its *pressure* erodes the bony walls of the Fallopian canal, leading to facial palsy, or the bony wall of the lateral semicircular canal, causing labyrinthine irritation with giddiness, nystagmus, and vomiting. The giddiness increases with movements of the head; the patient therefore

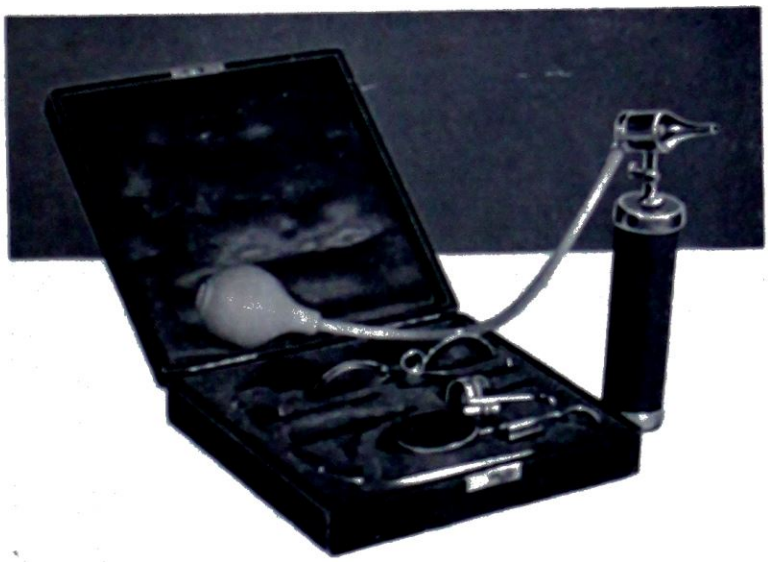


Fig. 1488.—Electrical auriscope with Siegle's speculum attached.

tends to keep the head resting quietly on the pillow. In case of erosion of the lateral canal the 'fistula test' is often positive: compression of air in the auditory meatus by means of Siegle's speculum (*Fig.* 1488) causes giddiness and nystagmus.

The signs and management of an *Extradural abscess* are described on p. 796.

Thrombophlebitis of the Lateral Sinus. The lateral sinus, lying behind and below the mastoid antrum, may become affected by spread of thrombophlebitis from small veins of the middle ear or by the juxtaposition of an extradural abscess (perisinus abscess). It should be emphasized that if a case of lateral sinus thrombosis has been treated with antibiotics, the classical symptoms of this condition (sudden rises of temperature to 103° or 104° F. followed by rigors and profuse sweating with comparative well-being in the intervals) may no longer appertain. Instead, a comparatively moderate rise of temperature, aching in the ear, and tenderness, with possibly induration along the course of the internal jugular vein (continuation of the sigmoid sinus), with torticollis are often the only signs of this serious complication.

Queckenstedt's test is useful for confirmation of the diagnosis. If, during the performance of lumbar puncture the internal jugular vein on the opposite side is compressed, the pressure of the cerebrospinal fluid, as indicated by a manometer, rises, but if the lateral sinus is thrombosed and the affected side is compressed, there is little or no elevation in pressure.

Cortical Venous Thrombosis. Thrombosis may spread to the tributaries of the dural sinuses, causing dramatic symptoms of focal epilepsy and hemiplegia.

Gradenigo's syndrome (otitis media associated with homolateral abducent palsy and deep-seated retro-orbital pain), which was formerly attributed to osteitis of the apex of the petrous pyramid (petrositis), is now considered to be due to thrombophlebitis of the inferior petrosal sinus (C. P. Symonds). Both the inferior petrosal sinus and the abducens nerve leave the posterior cranial fossa in a narrow sheath of dura mater (Dorello's canal), where the nerve may be compressed by the distension of the sinus, containing infected blood-clot.

Thrombosis of the *superior* petrosal sinus causes neuralgic pain in the distribution of the trigeminal nerve by irritation of the Gasserian ganglion.

Antibiotics alone cannot cure any of the complications of chronic mastoiditis enumerated above and are dangerous in so far as they may cause delay of an urgent operation. Thus, to summarize, in a patient with *chronic* mastoiditis earache without pyrexia is ominous, with pyrexia it calls for an immediate operation even in the absence of facial palsy, labyrinthine irritation and signs of a developing intracranial complication (extradural abscess, meningitis, cerebral abscess). In these cases drainage of the retained pus and removal of cholesteatoma is essential. This will entail opening the mastoid antrum (antrotomy) as an urgent measure.

In cases of *bilateral* chronic suppurative otitis media it is necessary to decide which ear is the seat of acute-on-chronic mastoiditis. If the patient is fully conscious this decision does not present any difficulty. In disorientated patients with intracranial complications it may be a problem; if both middle ears present similar pathology it is safe to assume that the ear which was the site of recent pain is the offending one. Even in an unconscious patient it is often possible to detect signs of fomentations and poultices, which were applied to one of the ears previous to his admission to hospital.

TECHNIQUE OF THE MODIFIED RADICAL MASTOIDECTOMY

After general intratracheal anæsthesia has been induced the retro-auricular tissues are infiltrated with a few ml. of saline-adrenaline solution in order to reduce hæmorrhage from the soft tissues (5 drops of 1–1000 adrenaline per 100 ml. of saline). As considerable pressure is required for the injection, a dental syringe will be found very useful. Be careful not to inject into the region of the stylomastoid foramen because infiltration of this region is wont to lead to an unpleasant, although transient, paralysis of the facial nerve. With the aid of an aural speculum the tympanic membrane or its remains is inspected, pus and debris are sucked out and a pledget of cotton-wool, soaked in adrenaline-saline solution, is inserted into the auditory meatus in order to reduce subsequent bleeding from granulations in the middle ear. The first four steps of the operation are much the same as for cortical mastoidectomy (*see* p. 1056). After insertion of the mastoid rectractor the soft tissues of the posterior meatal wall are gently separated from the bony canal and a pledget of wool soaked in adrenaline solution is inserted between the elevated soft tissues and the bony canal and left there during the excavation of the bone, in order to reduce subsequent oozing. As it is known that we are dealing with a sclerotic mastoid, do not look for mastoid cells but seek directly the mastoid antrum. Again the guides will be the spine of Henle and Macewen's triangle (*see Fig.* 1486). As the bone is hard, the gouges must be sharp. In case of difficulty in locating the antrum it is preferable to keep rather too high than too low, because exposure of the dura of the middle fossa has no untoward consequences, whereas if the excavation is made too low before reliable landmarks are identified, the integrity of the facial nerve is endangered. Depending upon the condition for which the operation is performed, on opening the mastoid antrum, pus under pressure may well up or a cholesteatoma or granulations appear. A swab from the pus is taken for bacteriological examination and sensitivity tests. Pus or cholesteatomatous debris is aspirated. A seeker (*see Fig.* 1484, 11) is now introduced into the mastoid antrum and with its aid the cavity is gently explored backwards and downwards, upwards and forwards, in order to determine its size and direction. The exploration *forwards* should be especially gentle in order to avoid dislocating the incus, should it still be intact. According to the information derived from the use of the seeker, the opening into the antrum is now enlarged with a small gouge until the whole cavity is fully displayed. We are now in a position to uncover the dura of the middle fossa above, if an extradural abscess is suspected (*see* p. 796) or the lateral sinus behind and below the mastoid antrum, if thrombophlebitis of the lateral sinus (*see* p. 1059) has been diagnosed.

In case of **Thrombophlebitis of the Lateral Sinus** the overlying bone (the 'sinus plate') must be removed cautiously with a moderate-sized gouge to allow inspection of the outer wall of the sinus over an area of about ¾ in. (2 cm.). The use of nibbling forceps in the proximity of the lateral sinus is dangerous, because it is easy to injure this large blood-channel with a splinter of bone. The ensuing venous hæmorrhage may be alarming. Should this mishap occur, a strip of gauze is packed over the site of the puncture and there it is kept pressed in position while the surgeon removes a piece of the temporal muscle, the

thumb nail. The gauze is withdrawn quickly and replaced by the patch of
is pressed firmly over the bleeding spot for several minutes. The area is
with ribbon gauze.

must be placed into the sinus itself. On completion of the operation the
gauze is left protruding from the wound, which is left unsutured, while the rest
is packed with BIPP gauze. When the gauze is removed after about six days
that no further bleeding from the lateral sinus occurs.

the postaural skin incision prove inadequate for an easy access to the lateral
be enlarged by an auxiliary incision at right angles to the first in the direction

.

the lateral sinus is found to be covered by granulations, its wall may be
or frankly discoloured, greyish-green and gangrenous or yellowish, and containing
or frank pus. In case of doubt its content should be explored by aspiration
attached to an empty syringe, care being taken not to penetrate the opposite
sinus. If fluid blood or uninfected blood-clot is found, the sinus is left undisturbed,
of blood is Nature's effort to localize infection. The use of heparin or other
is therefore contra-indicated. Should it contain pus, the lateral sinus is
and the pus evacuated by suction and mopping.

Ligation of the Internal Jugular Vein.— This is not advocated as a routine measure.
in the exceptional case, where temperature and rigors continue after an operation
sinus and when the operator is certain that there is no retention of pus within
must it be assumed that infective thrombi are breaking off in the distal part of
sinus. A positive blood-culture would confirm this suspicion. Only in these
or when metastatic lung abscesses develop and the infective organisms
to be insensitive to antibiotics, is ligation of the internal jugular vein indicated.

.—The greater cornu of the hyoid bone is located by palpation. An incision
cm.) long is now made, centred on the greater cornu, along the anterior border
muscle. The incision is deepened and the cervical fascia incised. The
is retracted backwards, the carotid sheath displayed and opened carefully.
of the common facial vein into the internal jugular vein is identified, the internal
is isolated by blunt dissection and a catgut ligature on an aneurysm needle is passed
above the point of entry of the common facial vein and tied. The wound is sutured
dressing applied.

labyrinthine irritation was the indication for the emergency operation, the lateral
canal must be carefully inspected, because this is the part of the labyrinth
exposed and therefore most commonly affected by the pressure of cholesteatoma.
fistula presents as a dark (brownish or black) discoloration of the normally
of the bony lateral semicircular canal. The cholesteatoma should be
but the fistula itself is not interfered with. Once the pressure of the cholesteatoma
relieved and drainage into the auditory meatus restored, the fistula in the bony
will heal spontaneously and the symptoms of labyrinthine irritation will rapidly
Operations on the labyrinth as an emergency procedure are never justified.

purpose of an emergency mastoidectomy is to evacuate retained pus or to relieve
of a cholesteatoma eroding the bony Fallopian canal or the lateral semicircular
at this stage of the operation the surgeon should pause and consider whether or
purpose has been achieved. *The remaining steps of a modified radical or radical*
are not an emergency procedure and may be completed later, in 2–3 weeks'
Especially if the operator is not skilled in otological surgery, he will be well advised
the operation at this stage, pack the wound lightly with ribbon gauze
in BIPP or acriflavine emulsion, and leave the incision unsutured. (Do not forget
the pledget of cotton-wool from the auditory meatus and from the space between
and bony posterior meatal wall.) Once adequate drainage is assured the
surgeon should not remove the auditory ossicles and remnants of the tympanic
lightly, as was practised formerly in the classical radical mastoidectomy. At
plastic operations aiming at reconstruction of the middle ear, damaged by suppura-
restoration of hearing (tympanoplasty) are under trial. These reconstructive
are facilitated considerably if there is even a remnant of the tympanic membrane
Its removal may prejudice the patient's future chances of having some useful
preserved.

The remaining steps of radical mastoidectomy and its modifications (removal of the bony "bridge", lowering of the facial spur, and cutting of the meatal flap) are beyond the scope of the general surgeon, and are therefore not described in this work. Indeed, they are never absolutely essential at the time of an urgent operation to save life in a case of acute-on-chronic mastoiditis.

Local Anæsthesia in Mastoid Surgery.—In some Continental clinics the surgeons prefer to employ local anæsthesia only, using 15–20 ml. of 1 per cent procaine solution for the postauricular injection and 3 more ml. for injection into the anterior meatal wall. Heavy premedication is necessary in addition. In cases of increased intracranial tension (e.g., cerebellar abscess) where there is considerable risk that general anæsthesia would cause a further dangerous rise in intracranial pressure, after evacuating the contents of the abscess through burr holes under local anæsthesia drainage of the mastoid antrum under local anæsthesia has obvious advantages.

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CHAPTER XC

THE NOSE, THE NASAL SINUSES, AND THE PHARYNX

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THE NOSE

EPISTAXIS

Arterial Supply of Each Nasal Cavity is derived from both the external and the carotid arteries.

The external carotid artery is responsible for the arterial supply of that part of the cavity lying below the upper border of the middle nasal concha. The terminal of the maxillary artery (*Fig.* 1489 A) is the sphenopalatine artery—a comparatively vessel—that enters the nasal cavity through the sphenopalatine foramen, and after supplies the lower part of the septum and the corresponding portion of the wall of the nose. The septal branch anastomoses with the septal branch of the labial artery, and the greater palatine artery, both of which are derived from carotid artery.

The internal carotid artery provides the arterial supply for the upper part of the nasal . Within the orbit the ophthalmic artery gives off the anterior and posterior arteries (*Fig.* 1489 C) which enter the nose through their respective foramina

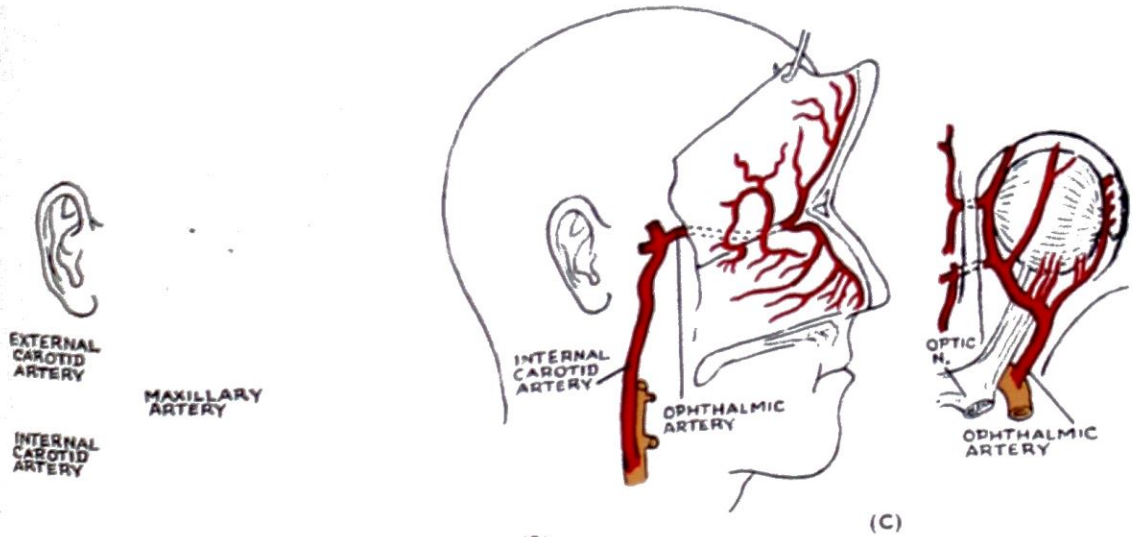

Fig. 1489.—The arterial supply of the nasal cavity. (*After R. T. Barton.*)

and are distributed ultimately to the upper part of the septum, the upper part of the lateral wall (*Fig.* 1489 B), and to the ethmoidal cells. It is stated that there is a fairly free anastomosis between the ethmoidal arteries (internal carotid) on the one hand, and the sphenopalatine artery (external carotid) on the other.

The above account exhausts the arterial supply of the nasal cavities proper, but the blood-supply of the *nasopharynx* must not be omitted. This is richly supplied by the pharyngeal and pterygoid branches of the maxillary artery. These anastomose with branches of the facial artery and the ascending pharyngeal artery, thus forming the naso-pharyngeal plexus.

Source of Bleeding.—

Anterior Bleeding.—In about 60 per cent of all cases of epistaxis the source of the hæmorrhage is from varicose veins of Kiesselbach's plexus (*Fig.* 1490) situated in Little's

area (*see Fig.* 1491) on the antero-inferior portion of the cartilaginous septum. Bleeding from Little's area is comparatively slight in children, but it is more severe in adults. Rarely the bleeding point is higher up, in which case the hæmorrhage comes from the anterior ethmoidal artery or vein.

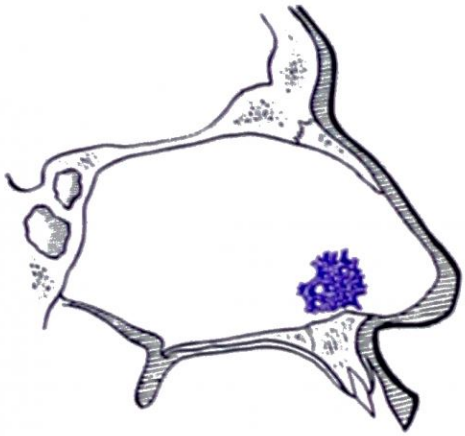

Fig. 1490.—Kiesselbach's plexus.

Posterior Bleeding.—Nearly always the patient is an adult. The hæmorrhage arises from either the posterior part of the lateral wall of the nasal fossa or from the septum. The bleeding is often arterial, and emanates from a branch of the sphenopalatine artery.

Aetiology.—In a large percentage of cases no cause for the bleeding (*see* Table) can be found, in which case, if the bleeding is coming from Little's area, picking the nose—epistaxis digitorum—is the probable explanation. In any event, when blood issues solely from one nostril, the cause is almost certainly local to that side of the nose.

The blood may escape in drops, or pour out so profusely[1] that several pints are lost rapidly. Usually epistaxis due to cardiovascular disease commences with a sudden and severe hæmorrhage. At this juncture it is helpful to be able to call to mind a *Table* of possible causes of epistaxis :—

CAUSES OF EPISTAXIS

TRAUMA	HIGH ARTERIAL PRESSURE	HIGH VENOUS PRESSURE	ATMOSPHERIC PRESSURE
Blow on the nose Fractured nasal bone Fractured base of skull Post-adenoidectomy After intranasal operations	Essential hypertension Arteriosclerosis Renal disease	Emphysema Bronchiectasis Chronic bronchitis Whooping-cough Mitral stenosis	Flying Caisson disease Mountaineering
SPECIFIC FEVERS	**NEOPLASMS**	**BLOOD DYSCRASIA**	**LOWERED PROTHROMBIN**
Typhoid Paratyphoid Influenza Scarlet fever Measles (Also rheumatism in children, especially at onset of acute episode)	Multiple hereditary telangiectasis Malignant polypi Nasopharyngeal angio-fibroma Carcinoma of the antrum Sarcoma of the maxilla	Purpura Hæmophilia Aplastic anæmia Leukæmia	Liver disease Anticoagulants Avitaminosis Scurvy Vitamin C lack

In every case where the cause of the hæmorrhage is not obvious the urine should be tested for albumin, and the blood-pressure taken. By the time the doctor arrives many hypertensive patients are found to have a normal or low blood-pressure as the result of shock due to hæmorrhage.

When an older person has a leaking blood-vessel, the vessel is liable to gape, because of sclerotic changes in arteries and veins ; for the same reason bleeding in older persons tends to recur.[2] Deficiencies in the clotting mechanism of the blood are seldom contributing factors in nasal hæmorrhage. Of 212 patients with severe epistaxis treated at the Mayo Clinic, in nearly all the bleeding commenced while the patient was at rest or asleep (O. E. Hallberg).

[1] Epistaxis, particularly that due to posterior bleeding, is often followed by massive hæmatemesis, due to vomiting swallowed blood.

[2] In hypertensive patients, packing the nose hurriedly has been followed (when the blood-pressure rises) by cerebral hæmorrhage (*M. Vlasto; E. Watson-Williams*).

Age of the Patient.—Epistaxis increases in frequency from the third year until puberty; it then becomes much less frequent until late middle life, by which time hypertension and arteriosclerosis are wont to have made their appearance. No less than 40 per cent of patients suffering from epistaxis are over 60 years of age, and 65 per cent of these suffer from hypertension (O. E. Hallberg).

From a practical standpoint, the treatment of epistaxis can be divided into that occurring in young persons and children, and that occurring in older and hypertensive patients.

Epistaxis in Young People and Children is due to *venous* bleeding originating in Little's area.

First-aid Treatment.—The patient sits upright, and with the forefinger of the corresponding hand compresses the ala nasi against the nasal septum for ten minutes. This treatment is uniformly successful in stopping the hæmorrhage, but more often than not it recurs with the next bout of sneezing.

Elective Treatment is either by thermocautery or by mechanical cauterization. Either method requires good illumination and a local anæsthetic. A pledget of cotton-wool soaked in a solution of 10 per cent cocaine with an equal amount of adrenaline 1–1000, and squeezed until it is only just moist, is inserted between the anterior third of the nasal septum and the inferior concha. The patient compresses the ala nasi against the nasal septum with his forefinger for ten minutes. The pledget is then withdrawn. If the skin of the vestibulum nasi, which is not anæsthetized, is protected, the nasal mucosa now numb and the veins of Little's area (*Fig.* 1491) can be cauterized. A large *aural* speculum is inserted into the nostril, thus protecting the whole circumference, and revealing only the septal mucosa of Little's area. The platinum loop of a thermocautery is heated to cherry-red, and the large veins at the periphery of Little's area are sealed off one by one, starting at the floor of the nostril. The cautery must be hot enough so as not to adhere to the mucosa (otherwise renewed bleeding will occur), yet not too hot (otherwise the mucosa will be cut through). The patient is warned that he will smell burning, but he is reassured that he will not experience pain. The actual process of cauterization should not exceed a few seconds. No special after-treatment is required, but the patient is exhorted not to pick the scab. If the nose itches, a little petroleum-jelly should be applied. Should a thermocautery not be available, a small amount of 50–100 per cent trichloracetic acid is applied with the tip of a probe until the mucosa becomes white. The surplus acid must be mopped up carefully.

Fig. 1491.—Site of bleeding from Little's area, which is situated on the antero-inferior portion of the septum. (*From A. Logan Turner's 'Diseases of the Nose, Throat, and Ear'.*)

Epistaxis in Adults originates from an arteriosclerotic *artery*, which may be situated anywhere in the nasal cavity.

First-aid Treatment.—Digital compression described above can be tried, but it is not often successful, in which event the patient should not lie down, but be told to sit in a chair. If bleeding is severe, he should lean forward and let the blood drip into a bowl placed upon his knees. He may say that he feels faint, but almost never does he lose consciousness. To lean forward farther still counteracts the effects of a fall in blood-pressure.

As soon as the opportunity presents, the nose is inspected with a view to ascertaining if the bleeding is from Little's area. If it is not, by drying the cavity or, better, with the use of a sucker, it is often possible to determine from what part of the nasal cavity the blood is issuing.

In a series of 80 cases of epistaxis associated with hypertension, O. H. Killen found that the bleeding point was :—

Posterolateral in 25,
Septal in 12,
In the roof in 11 ;

in the remainder the exact site of the bleeding could not be determined.

Elective Treatment.—When it is in an accessible area of the nasal septum, the bleeding point appears as a little reddish-brown prominence projecting above the surrounding mucosa. If seen, the artery is cauterized under local anæsthesia in the same way as described for venous bleeding. Should the artery be situated elsewhere, and cannot be seen, the plan of treatment is as follows :—

a. **Trotter's Method**: The patient is propped up in bed, inclined comfortably to one side. A large nest of wool is so arranged that he can dribble into it. A dental prop, or better a London Hospital airway (*see Fig.* 1149, p. 826), is placed between his teeth. The patient is exhorted not to breathe through his nose or to swallow. A substantial dose of morphine is administered. Blood transfusion is given as required. Vitamin K_1 can be administered, e.g., synkavit,[1] 1 ml. (10 mg.) intramuscularly. In children, vitamin P from lemon peel (rutin[2]), 60 mg. t.d.s. by mouth, is valuable.

The great advantage of this method is that complications resulting from packing do not arise, whereas with packing more than 30 per cent of patients develop complications, notably sinusitis, blood in the middle ear (which frequently leads to otitis media), and infection of clot sealing the bleeding vessel, and consequent secondary hæmorrhage. In 80 patients suffering from epistaxis associated with hyperpiesis admitted to the Royal Infirmary, Newcastle upon Tyne, 70 per cent were treated successfully by employing Trotter's method alone (O. H. Killen).

Fig. 1492.—Tilley's nasal forceps.

b. Packing the Nose: By adopting Trotter's method the number of cases requiring packing are relatively few; 16 out of 80 cases in O. H. Killen's series.

A single length of 1 cm. wide selvedge-edged gauze saturated with B.I.P.P.[3] is used. The pack is inserted best with a nasal forceps (*Fig.* 1492), starting high posteriorly in the nasal passage. The packing is conducted so that layer upon layer is inserted, filling each recess between the conchæ, and thereafter the vestibule, until the floor of the cavity is reached, when the proximal end of the gauze is left protruding from the anterior naris (*Fig.* 1493). Gauze impregnated with B.I.P.P. can be kept in longer than plain gauze, as it does not become infected readily. Usually the packs are removed in 24–48 hours, the nose being repacked if hæmorrhage recurs; nevertheless, some authorities leave the pack in place for much longer—even for so long as ten days. An antibiotic, usually penicillin, is administered for the whole of the period, and for four or five days after the pack has been removed. When bleeding continues in spite of packing, as a rule repacking with the addition of a post-nasal pack is carried out in less than 24 hours.

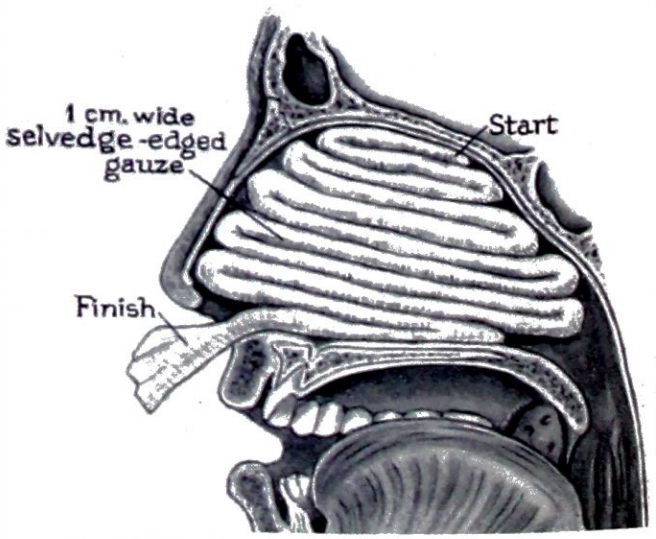

Fig. 1493.—Anterior nasal packing completed.

In the case of telangiectasia (Osler's disease), gauze packing should not be used, as it so frequently causes renewed hæmorrhage from traumatizing the mucous membrane at the time, or when the packing is removed. A finger-stall placed in the nasal cavity and then stuffed with gauze should be employed in these cases. Osler's disease is the only condition in which X-ray therapy for epistaxis may be useful. (*See also* Rex Blaubaum's Case, p. 1069.)

The Posterior Nasal Pack.—Unless the bleeding point is in the nasopharynx, the post-nasal pack acts only as a bung. With the nose packed anteriorly and posteriorly, blood may be forced into the nasal sinuses or along the Eustachian tube into the middle ear. Blood in the nasal sinuses is silent until it becomes infected, whereas a hæmotympanum, because of the pain it engenders, frequently calls for myringotomy. Blood can also be driven up the lacrimal duct into the conjunctival sac, with the disconcerting result that the patient weeps tears of blood.

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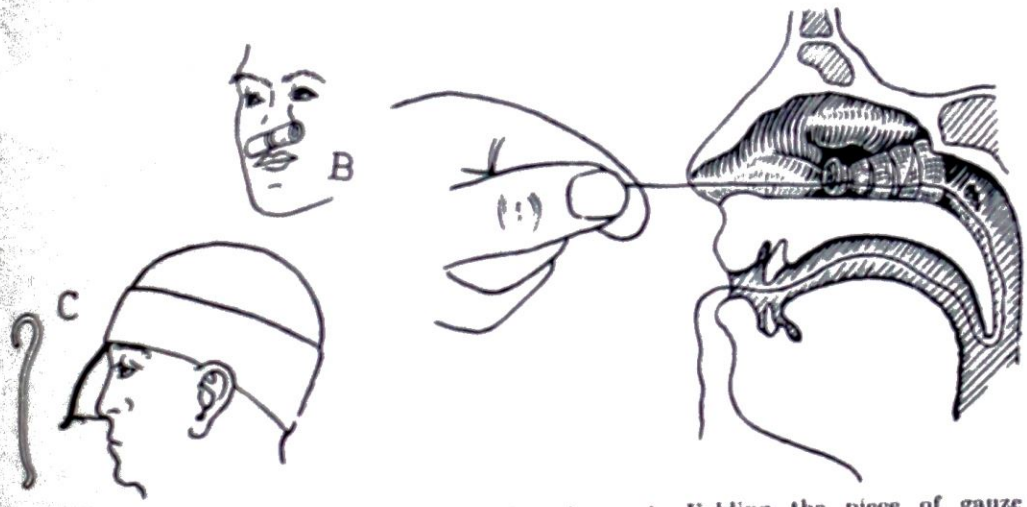
[1] Roche Products Ltd.
[2] Allen & Hanburys Ltd.
[3] B.I.P.P. = Bismuth, Iodoform, Paraffin Paste.

of these untoward possibilities, when persistent or recurrent bleeding is issuing part of the nasal fossa some form of local pressure on the bleeding area . Since the posterior nasal tampon described by J. K. M. Dickie, of been adopted at the Mayo Clinic, complications arising as a result of the pack, have become less frequent (O. E. Hallberg).

: A piece of sterile gauze 3 in. (7·5 cm.) wide is folded lengthwise 1 in. the edge (*Fig.* 1494 A). It is then rolled until the thick end is a little less (1·9 cm.), and the excess is cut away. Around its middle is tied moderately piece of strong silk. The ligature is then bound criss-cross around the thinner extremely tightly. A No. 8 rubber catheter is passed through the bleeding the throat, where the tip is grasped in a long hæmostat and drawn out of the One of the long ends of the silk is stitched or tied to near the extremity of the The catheter is withdrawn from the nose, together with the silk attached to it. the pack, which has been moistened with liquid paraffin, is drawn against the



1494.—The posterior nasal tampon in place. A, Folding the piece of gauze; the tampon by winding the string around a piece of rubber tubing; C, Alternative (*After J. K. M. Dickie.*)

(*Fig.* 1494). The string issuing from the nose is threaded on a strong needle to transfix a piece of half-inch wide drainage tube. The string is then drawn tubing until the desired tension is reached, and the excess is wound around 1494 B). An even better method is to incorporate a coat-hanger wire in a cap around the head (*Fig.* 1494 C). The wire is bent a little, and then the a number of times around the tube before it is tied. In this way the correct adjusted with ease, and maintained. Dickie leaves the pack in place for a account must the string issuing from the mouth be under tension, or it will palate. It remains dangling from the mouth, or fixed loosely to the cheek until it is required for withdrawing the tampon.

Procedures:

bag of a Foley's catheter is inserted into the nasopharynx, and after the bag inflated, moderate tension is applied by strapping the shaft of the catheter to the

A rubber finger-stall is inserted along the floor of the nasal cavity with alligator Ribbon gauze is then packed firmly into its distal end, which, having been rendered is kept in position by tying a ligature around the proximal end of the finger-stall the long ends of the ligature to the cheek.

of the External Carotid Artery is most likely to become necessary in older suffering from arteriosclerosis or hypertension, and particularly in cases where hæmorrhage is occurring from the posterior part of the nose. Ligation of the carotid, in these circumstances, is a life-saving measure, and many cases have been where it has proved successful after other measures have failed.

In coming to a decision whether or not to ligate the external carotid artery, the , the erythrocyte count, the availability of blood for transfusion, are all which must be taken into consideration. When daily transfusion of 1 to 3 pints

(0·57 to 1·7 l.) of blood fails to raise the hæmoglobin above 60 per cent and to maintain a normal blood-pressure, or when in spite of repeated packing and other intranasal treatment, profuse bleeding continues for more than three days, the operation should not be delayed.

Ligation of the External Carotid Artery.—For technique, *see* p. 855.

Ligation of the Contralateral External Carotid Artery in addition.—When, as occasionally occurs, profuse bleeding recommences in spite of ipsilateral ligation of the external carotid artery,[1] there should be no hesitation in ligating the remaining one. A. Wolferman and F. P. Dwyer found it necessary to undertake bilateral ligation on six occasions in eight years. Prior to the second ligation some of the patients were almost moribund; but in all cases as a result of the second ligation the patient recovered. A smaller number of similar cases have been published by other authors. It should be noted that neither unilateral nor bilateral external carotid ligation causes any temporary or permanent inconvenience to the patient. It should also be noted that ligation of the external carotid should not be undertaken if the hæmorrhage is certainly, or almost certainly, occurring from high up in the anterior portion of the nasal fossa, for here bleeding is issuing from the anterior ethmoidal artery—a branch of the internal carotid artery.

Ligation of the Anterior Ethmoidal Artery.—Only occasionally is it necessary to resort to ligation of this vessel. One of the main indications is in a fracture of the anterior cranial fossa, where the crevice extends through the ethmoidal or the fronto-ethmoidal suture.

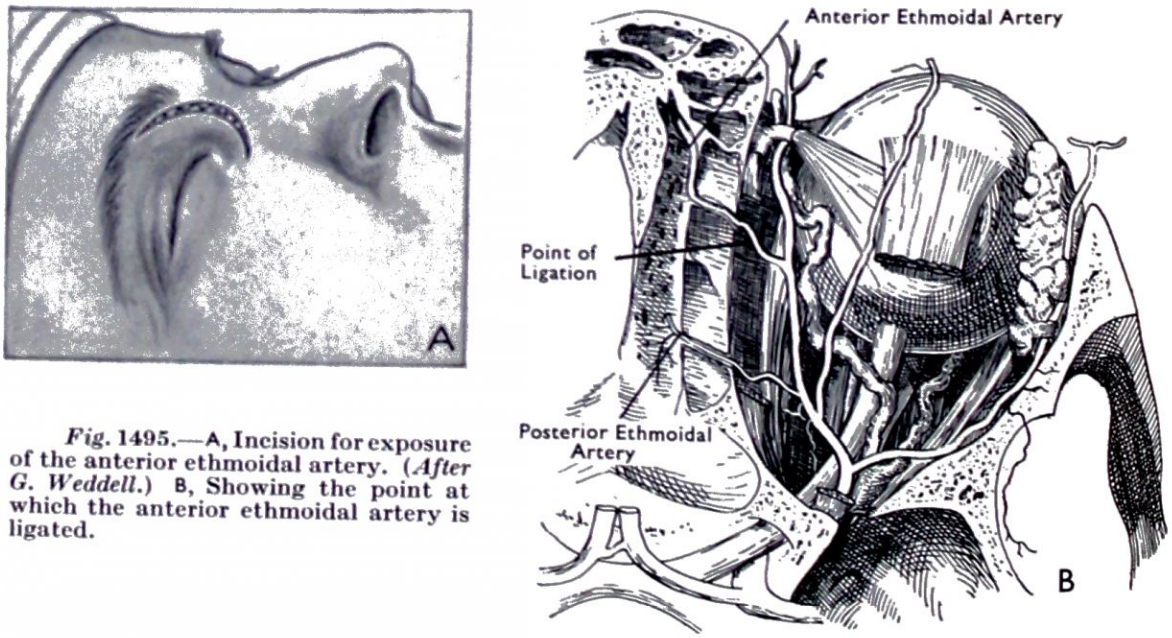


Fig. 1495.—A, Incision for exposure of the anterior ethmoidal artery. (*After G. Weddell.*) B, Showing the point at which the anterior ethmoidal artery is ligated.

Such a fracture is apt to tear the anterior ethmoidal artery in its bony canal, where the artery can neither retract nor contract. Sometimes bleeding comes on immediately, or, following infection, later. Another potent source of serious anterior ethmoidal hæmorrhage is a heavy blow on the nose where one or both ethmoid bones are fractured in addition to the nasal bones. Non-traumatic hæmorrhage from high in the anterior nasal fossa also occasionally calls for anterior ethmoidal artery ligation.

Operation.—The operation, which is not, as might be thought, particularly difficult, can be carried out under local anæsthesia with advantage. A curved incision is made, commencing at the base of the inner third of the eyebrow and passing to the inner quarter of the lower rim of the orbit below (*Fig.* 1495 A). The incision passes down to bone; considerable, if not disconcerting, hæmorrhage ensues. After bleeding points have been ligated, the periosteum of the inner wall of the orbit, together with the lacrimal sac and the ligaments related to it, is elevated, the secret of success being to keep close to the bone. It should be noted that the artery is ligated *within the orbit*; if the periosteum is raised, the pulley of the superior oblique will not be jeopardized. Deepening the dissection and keeping close to the bony wall of the orbit, it will not be long before the anterior ethmoidal

[1] The only explanation for the continued hæmorrhage is that the bleeding vessel is fed by the external carotid of the opposite side. It appears that the collateral circulation is established immediately after the ligation of one carotid artery.

artery (*Fig.* 1495 B) is encountered. To divide the artery between ligatures is extremely difficult, and it should not be attempted. To occlude its lumen with a metal clip used in intracranial surgery is ideal, but in the absence of this equipment, to catch the vessel in a fine hæmostat and then contact the shaft of the hæmostat with a diathermy electrode will ensure that the vessel bleeds no more. The wound is sutured lightly, glove drainage being provided if there is oozing.

There are occasions when both the external carotid artery and the anterior ethmoidal artery require ligation, even on both sides.

Rex Blaubaum's Case.—A woman aged 56 years suffered from gross familial multiple telangiectasia of the cavernous type (Osler's disease) present on the face and the nasal mucosa. During the previous four years she had had several attacks of epistaxis requiring cauterization, packing, and blood transfusion. In all she had received 72 transfusions and several courses of deep X-ray therapy. On this occasion she was admitted blanched and shocked. After blood transfusion, Blaubaum ligated the external carotid artery and the anterior ethmoidal artery on one side, and a week later ligated the corresponding arteries on the contralateral side. No serious hæmorrhage recurred up to the time of the report, three years later.

In two cases described by H. Oppenheim and others, ligating the anterior ethmoidal artery proved life-saving when tying the external carotid artery had failed.

Fracture of the Nasal Bone.—(*See* p. 810.)

FOREIGN BODIES IN THE NOSE AND NASOPHARYNX

Usually the patient is a child or a mentally abnormal person. The common site for a foreign body to become impacted is between the septum and the middle concha (*Fig.* 1496). On rare occasions a foreign body entering the mouth becomes projected into the nasopharynx (*Fig.* 1497). Food may enter the nasopharynx and the nose during the act of vomiting.

Treatment.—

In children the safest procedure is the administration of an anæsthetic and the removal of the foreign body by means of a forceps or scoop.

In adults and older children the nose should be sprayed with a solution of equal parts of cocaine 10 per cent and adrenaline chloride 1–1000, and then under direct vision an

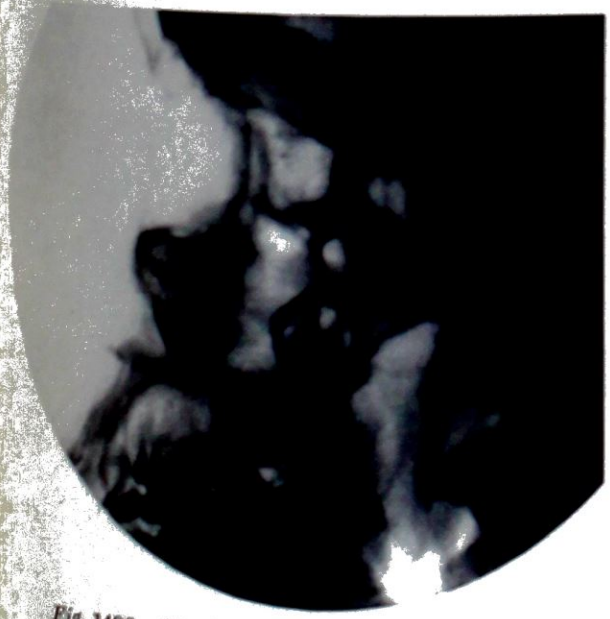


Fig. 1496.—Foreign body in the nose (a ring).

Fig. 1497.—Radiograph of safety-pin in the nasopharynx. Patient aged 3 weeks. (*E. Watson-Williams, 'Bristol Medico-Chirurgical Journal'.*)

attempt should be made to remove the foreign body. If it is unsuccessful a general anæsthetic will be necessary. The most useful instruments for removing foreign bodies from the nose are a forceps with scoop ends, such as the smallest Luc's forceps (*Fig.* 1498), or Desjardin's gall-stone forceps. Long fine aural dressing forceps or a blunt hook may be of service.

A body far back in the inferior meatus may be pushed into the nasopharynx, where a finger awaits it and steadies it until seized with forceps introduced through the mouth. In doing this, first extend the head over a pillow so that the foreign body does not slip

down the pharynx before it can be secured. A foreign body in the nasopharynx is usually delivered most easily through the mouth. Such bodies as safety-pins are, however, often impacted with the point downward (*see Fig.* 1497), and if there is any difficulty in securing the point, the object is best delivered through the nostril ; to allow the point to penetrate the wall of the pharynx is to incur a serious risk.

Fig. 1498.—Luc's forceps.

Maggots in the Nose.—In warm climates it is not uncommon for the eggs of the house-fly, saw-fly, or the bluebottle to deposit their eggs within the nasal cavity : usually the eggs hatch within 24 hours.

The symptoms are those of acute sinusitis. There is a purulent nasal discharge, often with odour. The maggots cling to the tissues with great tenacity, and if not removed quickly will denude the bone and cartilage ; even the cranial cavity has been invaded, with fatal results. The diagnosis is made by finding maggots or eggs in the nasal secretions or within the nasal cavity.

Treatment.—The most effective remedy is to stupefy the maggots by chloroform vapour, and dislodge them by syringing with a very weak solution of carbolic acid.

THE ACCESSORY NASAL SINUSES

ACUTE FRONTAL SINUSITIS

The majority of sufferers from acute frontal sinusitis are under 21 years of age, and fulminating cases are more frequent below the age of 15 years (W. J. McNalley and E. R. Stuart). Antibiotics do not appear to have reduced the incidence of this disease. In the course of a heavy cold the patient develops malaise, some elevation of temperature, and pain located over the involved sinus. It is the latter symptom that compels him to seek advice. Diving, and especially plunging into water from a height feet first, are also well-known causes of acute frontal sinusitis.

Usually the pain commences one or two hours after rising, increases in severity towards noon, and diminishes in the middle of the afternoon ; sometimes it radiates to the temporal area. Early in the course of the disease the mucous membrane lining the sinus becomes œdematous, and partial obstruction of the fronto-nasal duct results. Examination reveals tenderness over the floor of the frontal sinus, and frequently percussion elicits pain over the anterior wall.

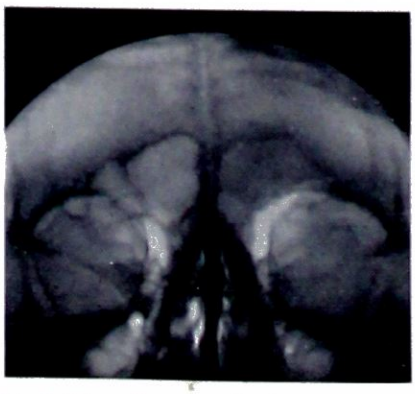


Fig. 1499.—Increased density of the shadow of the left frontal sinus.

Fig. 1500.—Œdema of the eyelids secondary to left-sided acute and ethmoidal frontal sinusitis. (*Mr. F. Bauer, Liverpool.*)

Examination of the Interior of the Nose.—If the natural ostium is not blocked, pus will be seen exuding over the front of the inferior concha.

Radiography is most helpful, and if possible should be carried out in every case. Not only is valuable information given as to the size and shape of the sinus, but sometimes opacity (*Fig.* 1499), or the presence of a fluid level is demonstrated.

So long as drainage can occur along the duct the symptoms remain comparatively mild; should drainage cease, often a rapid progressive fulminating inflammation sets in, and is heralded by an exacerbation of the general symptoms and signs of œdema with perhaps redness of the eyelids (*Fig.* 1500). Unless drainage is established, serious complications follow. These include orbital cellulitis or orbital abscess (*see* p. 1049), osteomyelitis of the frontal bone (*see* p. 1072), epidural abscess, subdural abscess, meningitis, brain abscess, and sagittal sinus thrombosis, which are described in Chapter LXX. A combination of acute frontal sinusitis and acute ethmoiditis (*see* p. 1072) is common.

Conservative Treatment. Penicillin and streptomycin, or a broad-spectrum antibiotic, is given while awaiting the result of cultures and sensitivity tests. The antibiotic selected should be continued for seven days after complete remission of symptoms. Codeine and aspirin usually control the pain. Pledgets of cotton-wool soaked in 25 per cent argyrol placed in the middle meatus, and left there for half an hour, will promote shrinkage of the mucous membrane. Such local treatment should be followed by suction. These measures are preferable to the application of a vasoconstrictor drug, which is so liable to be followed by vasodilatation. Sometimes moist warm compresses applied over the involved sinus prove comforting.

When the frontonasal duct is completely obstructed, external drainage of the frontal sinus should not be delayed. The operation is called for rarely except in cases of an acute exacerbation of chronic sinusitis.

External Drainage of the Frontal Sinus. General or local anæsthesia can be employed. Local infiltration with 1 per cent procaine and adrenaline 1 50,000 is used in either instance, and is effective in minimizing bleeding. With adequate pre-operative sedation, local

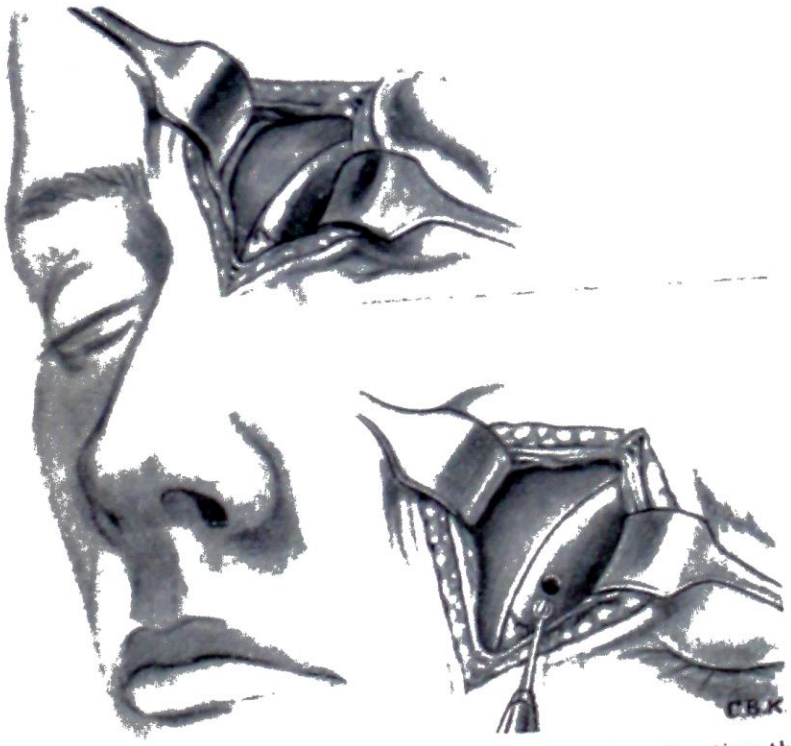


Fig. 1501.—The floor of the frontal sinus has been exposed by elevating the periosteum covering it. *Inset:* The floor of the sinus has been drilled, the hole being large enough to accommodate a No. 14 French catheter.

anæsthesia is preferable. The eyebrow is not shaved. The incision is commenced at a point mid-way between the inner canthus and the dorsum of the nose, and is carried laterally just below the eyebrow for a distance of 2 or 3 cm. The incision is made down to the periosteum, and after hæmorrhage from the angular venous plexus has been controlled the periosteum is incised throughout the length of the incision. The supra-orbital ridge is identified along its inner half, and a periosteal elevator is used to elevate the periosteum from the roof of the orbit. Small retractors will expose the denuded bone (*Fig.* 1501) with only

slight displacement of the globe. The next step is to enter the frontal sinus through the thin plate of bone that forms its floor.

The best instrument for this purpose is a dental burr, which can often be procured by arrangement with a dental surgeon. In the absence of this apparatus the smallest cranial burr can be employed. The opening in the bone should be no larger than will accommodate a No. 14 F. catheter. In most instances, as soon as the sinus is entered pus will flow under pressure. No suction is employed in the sinus lest part of the interior be denuded of its mucosa. The use of a probe or a curette is forbidden. No attempt is made to enlarge the opening sufficiently to inspect the interior of the sinus. The sole object is to establish drainage by means of a medium-sized catheter. Multiple sutures are unnecessary; only one suture is placed at each end of the wound, and one to anchor the tube. A light dressing is applied without pressure. No attempt is made to irrigate the sinus. As a rule the tube is removed on the fourth or fifth day. The deformity following this trephine operation is practically nil. The antibiotic therapy preceding the operation is continued for 12 to 14 days thereafter. In a consecutive series of 14 patients operated upon by this technique, B. J. Ronis had to reinsert the catheter in one case only, and that for a matter of three further days. The end-result in all patients was good with the continued use of antibiotics and antihistaminics over prolonged periods. In the rare event of bilateral infection of the frontal sinuses requiring external drainage, a 'spectacles' incision can be employed.

OSTEOMYELITIS OF THE FRONTAL BONE

Osteomyelitis of the frontal bone commences about 10 days after the onset of imperfectly treated acute frontal sinusitis. Since a direct communication exists between the veins of the upper part of the mucosal lining of the frontal sinus with those of the diplöe of the frontal bone, the reason for the involvement of the latter is not obscure. Osteomyelitis is characterized by considerable pyrexia, severe pain, tenderness, usually the development of swelling over the frontal bone and pitting œdema of the scalp over the site of the disease (Pott's puffy tumour). The classical swelling and pitting œdema are not always present. As elsewhere, radiographs are of no help in detecting early osteomyelitis.

Fig. 1502.—Incision for displaying the frontal bones. Note that this incision is entirely within the hair line.

Antibiotic Treatment.—In very early *acute* cases, provided drainage of the affected sinus is free, antibiotics may obviate the necessity for operation. In *subacute* cases the chances of a cure resulting from antibiotic therapy alone are much less. When bone infection has been present for some days before it is detected, while temporary respite is obtained with antibiotic therapy, the chances of smouldering foci lighting up are too great to justify temporizing.

Operation.—A coronal incision is made in the hair line extending from the top of one ear to a similar point on the opposite side (*Fig.* 1502). The periosteum is elevated anteriorly and a scalp flap is brought down over the face. All soft necrotic bone must be removed and not infrequently this exposes an epidural abscess. It is essential to excise all diseased tissue even down to the ethmoids. This completed, the flap is replaced and sutured into position with glove drainage at the most dependent points.

ACUTE SUPPURATIVE ETHMOIDITIS

Acute suppurative ethmoiditis is comparatively rare. Sinusitis in infants and young children is largely confined to the ethmoid, as it is the only sinus that is well developed early in life. As a rule one of the acute infectious diseases, such as scarlet fever or measles, precedes its onset. The constitutional symptoms are slight pyrexia, sometimes accompanied by mild toxæmia. The symptoms include headache with neuralgic pains radiating to the back of the eye. Unilateral nasal obstruction with anosmia is present, as also is tenderness over the globe.

Conservative Treatment.—Antibiotic therapy, together with the local application of heat, preferably with an infra-red lamp, often proves effective. Tampons of 10 per cent argyrol in the middle meatus, left in place for 10 to 20 minutes, promote drainage.

External Drainage of the Ethmoidal Sinuses.—

The Incision.—As in this condition it is usual for the frontal sinus to be infected as well, the steps of the operation are similar to those already described, with the following additions. The skin incision is carried a little lower down to the frontal process of the maxilla, as is shown in *Fig.* 1329 A. The steps of exposure and ligation of the anterior ethmoidal artery are precisely those described under ligation of that vessel (p. 1068).

Exposing and Entering the Sinus.—The mesial orbital wall, formed by the lacrimal bone and the lamina papyracea behind it, is now clearly in view. As a rule, some portion of the wall will be seen to be obviously diseased. If this is not the case, a small, sharp spoon is pressed against the posterior end of the lacrimal bone, which yields readily, opening the ethmoidal labyrinth. The infected air-cells are removed with the spoon and Luc's forceps, punch forceps being employed to enlarge the opening, as necessary.

ACUTE MAXILLARY SINUSITIS

As the maxillary antrum does not attain full development until the twelfth year, serious infections of this cavity are more likely to occur in patients past that age. Like frontal sinusitis, the most usual precursor is the common cold, but less frequently (but more resistant to conservative measures) are infections due to extension from an apical dental abscess or as the result of perforation of the floor of the antrum during extraction of an infected tooth. The teeth most commonly associated with either of these contingencies are the first, third, and second molar, and the premolars, in that order.

Diagnosis.—The constitutional symptoms are often severe, especially when the pus is confined by occlusion of the natural ostium. Pain in the cheek and the upper teeth, dull throbbing when the patient stoops, is characteristic. It is not so severe as the pain of frontal sinusitis, but it is more constant. Commonly the patient considers that the pain is due to toothache, and visits a dental surgeon. Frequently the affected side of the face is swollen and the lower eyelid is somewhat œdematous. Breathing through the nostril on the side of the lesion is impaired, and often obstructed completely. Not until the third or fourth day of the attack is a unilateral purulent discharge much in evidence. Local tenderness over the antrum is a less reliable sign than in the case of frontal sinusitis. Both transillumination of the antrum and a radiograph of the region (*Fig.* 1503) are likely to reveal relative opacity of the affected antrum. In cases of real doubt the diagnosis can be confirmed or disproved by puncturing the antrum with a hollow needle (*see below*)

Fig. 1503.—Considerable increase of the density of the shadow of the left maxillary sinus.

Treatment.—Drainage of the maxillary antrum is impeded by the position of its ostium high on the medial wall. Therefore, except in very early and comparatively mild cases, antibiotic therapy alone cannot be expected to bring about resolution. On the other hand, antibiotic therapy plus irrigation of the antrum, repeated as necessary at intervals of three or four days, brings about a cure in over 90 per cent of cases.

Puncture and Irrigation of the Maxillary Antrum.—The patient should be seated bolt upright with a nurse so steadying his head that he cannot extend it. The most satisfactory method of performing puncture of the maxillary antrum is by means of an 18-gauge ordinary 3½-in. lumbar puncture needle, after surface anæsthesia has been obtained high beneath the inferior concha with a tampon soaked in 4 per cent xylocaine-adrenaline solution. It is also necessary to apply a similar pack beneath the middle concha, to promote patency of the ostium. With the bevel of the needle directed laterally, to prevent the point slipping along the wall, the point of the needle is passed beneath the inferior concha in an upward, backward, and outward direction until the point impinges on the bony wall. Moderate pressure of the thumb (*Fig.* 1504) will enable this thin wall to be penetrated easily. The procedure is painless, and when the needle has been inserted into the cavity, approximately 1–1½ in. (2·5–3·8 cm.) of the shaft, including the base, remains protruding from the naris (*Fig.* 1505). The stylet is removed, and by aspiration with the syringe or, if necessary, by aspiration after a small quantity of sterile saline solution has been injected, a specimen for bacteriological examination is obtained. With the head tilted slightly forwards, sterile

normal saline solution is injected with a larger syringe, the overflow running into a kidney-dish which the patient holds. W. T. K. Bryan much prefers Ringer's solution for this purpose, as he claims it does less damage to the already damaged mucous membrane than normal saline solution. The injection is repeated until the solution is returned clear. Attention has been drawn to the danger of air embolism while irrigation of the antrum is in progress (*see* p. 107), and the surgeon must be vigilant that no air is injected along with the chosen irrigating solution. Usually the sinus is free from pus at the end of the second or third

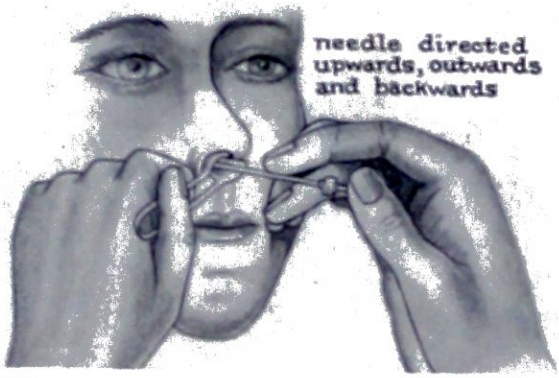


Fig. 1504.—Method of inserting the needle into the maxillary antrum.

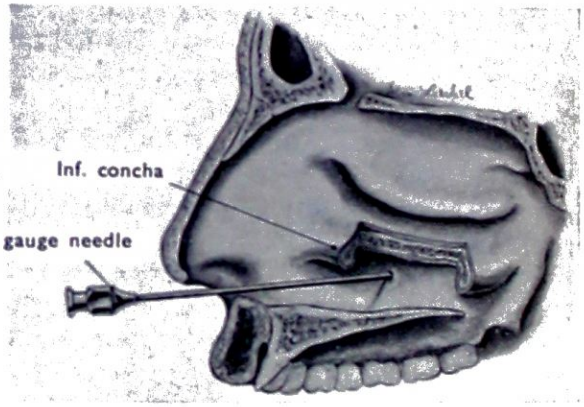


Fig. 1505.—Puncture of the maxillary antrum completed. (*J. A. B. Holt.*)

treatment by puncture and irrigation. An aqueous suspension of penicillin G procaine, 600,000 units in 2 ml. of sterile water, can be instilled into the cavity with advantage (J. Elsen).

From what has been stated already, it will be appreciated that the indications for open drainage of the maxillary antrum are few, and are confined practically to cases of severe infection of dental origin that do not respond quickly to the above measures, and when a detached root of a tooth has been driven into the antrum.

The Caldwell-Luc Operation.—Endotracheal anæsthesia is advisable, for it allows the post-nasal space to be packed: such packing is usually carried out by the anæsthetist.

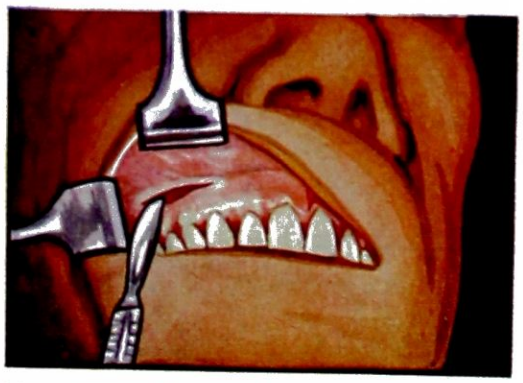


Fig. 1506.—The Caldwell-Luc operation. Making the incision.

Fig. 1507.—The Caldwell-Luc operation completed.

One per cent novutox or procaine-adrenaline solution, injected beneath the muco-periosteum of the canine fossa with a dental syringe will diminish subsequent bleeding.

An incision is made with a tenotomy knife in the sulcus between the gums and the cheek above the bicuspid and first molar teeth (*Fig.* 1506). Employing a periosteal elevator, the anterior wall of the antrum is exposed to within a finger-breadth of the infra-orbital foramen. The wall of the antrum is opened with a small gouge and hammer. The resulting hole (*Fig.* 1507) is enlarged by nibbling forceps, sufficiently to display the whole of the interior of the antrum. Pus is evacuated. Should the mucosa lining the canine fossa be intact, it is removed over the area denuded of bone. The interior of the antrum is lightly packed with gauze soaked in hydrogen peroxide for a few minutes, which allays oozing. The pack is then removed, and the interior is inspected. As a rule, in acute cases no attempt is

made to remove the lining from the rest of the cavity. Should the antrum be filled with polypi, as it might be in a case of acute-on-chronic sinusitis, it is probably advisable to elevate the mucous membrane with a Watson Cheyne dissector, and remove the diseased, polypi-bearing mucosa with Luc's forceps. According to the classical Caldwell-Luc operation a quadrilateral piece of bone, $\frac{1}{2} \times \frac{3}{4}$ in. (6 × 18 mm.), is now removed from the lateral nasal wall corresponding to the inferior nasal meatus without injuring the nasal mucous membrane. The latter is then cut as a window, with the base level with the floor of the nose, and allowed to lie on the floor of the antrum, a step that is not always possible, particularly in cases operated upon previously.

Drainage of the maxillary antrum into the nasal cavity is unnecessary for removal of a root of a tooth pushed into the antrum, but in the treatment of acute-on-chronic maxillary sinusitis that develops only when the internal ostium is blocked by polypi or adhesions, intranasal drainage is essential. The mucoperiosteal incision in the canine fossa should be repaired by two or three catgut sutures. Omitting this step favours the development of an oro-antral fistula. Unless there is troublesome oozing, the antrum is not packed. Most surgeons deprecate post-operative lavage of the sinus.

ORO-ANTRAL FISTULA

Traumatic oro-antral fistula of dental origin has become a common clinical entity owing, mainly, to the use of fine apical elevators in difficult extraction of teeth in relation to the antrum. When a small plate of compact bone is seen attached to an apex of a root of an extracted tooth that was in relation to the antrum, an oro-antral fistula should be suspected. Actually the mucosa is sometimes intact, but on blowing the nose a few days later, the mucosa gives way and a fistula results. For this reason, in relevant cases the patient should be warned not to suck the tooth socket or blow his nose for a week. In doubtful cases injection of a radio-opaque medium and radiography will confirm the presence or absence of fistula.

Treatment.—The immediate treatment of an oro-antral fistula is as follows: removing some of the alveolus, if necessary, sutures are tied across the gums anteriorly and posteriorly. A third suture is inserted across the middle of the socket, taking a deep bite of the tissue. A strip of ribbon gauze, moistened with acriflavine solution, is then packed lightly into the socket and the suture tied over it (*Fig.* 1508). It should be noted that the ribbon gauze is used as a cover, and not as a pack. If the patient wears a denture, so much the better; it can be used to protect the area. The gauze is removed on the third to the fifth day, and the sutures on the fifth or the seventh day. Unless the antrum has become shut off as the result of the temporary occlusion of the fistula, a more effective closure must be undertaken.

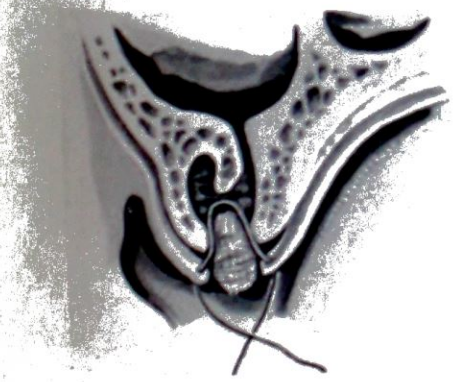


Fig. 1508.—Temporary closure of a traumatic oro-antral fistula. (*After B. W. Fickling.*)

Fig. 1509.—The mucoperiosteal flap operation for closing an oro-antral fistula. (*After B. W. Fickling.*)

Patients seen first with gross sinusitis are given an antibiotic parenterally, and the sinus is irrigated daily through the fistula. When the infection has abated, the sinus should be irrigated occasionally for six weeks, after which the fistula must be closed by a flap of mucoperiosteum, as shown in *Fig.* 1509. It is especially important that the base of the periosteum, and the periosteum only, be transected, so as to allow the flap to be slid sufficiently

to cover the defect without tension. Should the patient be seen within thirty-six hours of the accident, B. W. Fickling recommends that the slide operation should be performed as a primary procedure.

THE PHARYNX

HÆMORRHAGE AFTER TONSILLECTOMY

The volume of blood that can be lost by a patient in fairly good general condition without serious consequences varies with the patient's age, and is equivalent to one-tenth of the total blood-volume. So it comes about that in a child aged 2 years the loss of a teacupful (100 ml.) results in anoxia. Owing to the oligæmia, cyanosis is unlikely to be evident, and the only sign of anoxia is restlessness. Heavy sedation (for restlessness), further anæsthesia (to arrest the hæmorrhage), and possibly more (post-operative) sedation, without adequate blood replacement, is the most frequent cause of death in cases of serious hæmorrhage following tonsillectomy. Therefore: (*a*) When matched blood cannot be procured quickly enough to supplement the falling blood-volume intravenous dextran should be given; (*b*) The amount of sedation must be kept at the lowest level compatible with tranquillity as opposed to semi-consciousness; and (*c*) Sedation following a second anæsthetic is best confined to Mist. A.P.C.

Blood-supply of the Tonsil.—*Arterial.*—While, as can be seen from *Fig.* 1510, several named branches of the external carotid artery give twigs to the tonsil, the largest of these is one from the facial artery situated at the lower pole of the tonsil, close to the tongue. Like

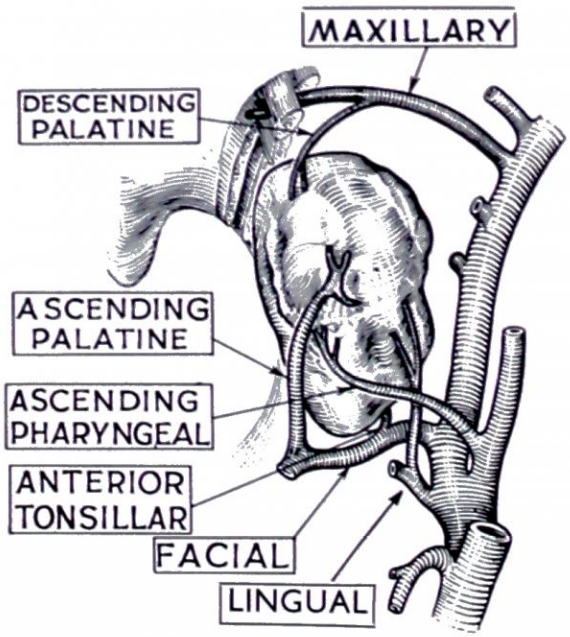


Fig. 1510.—The arterial supply of the tonsil. (*After R. H. Fowler.*)

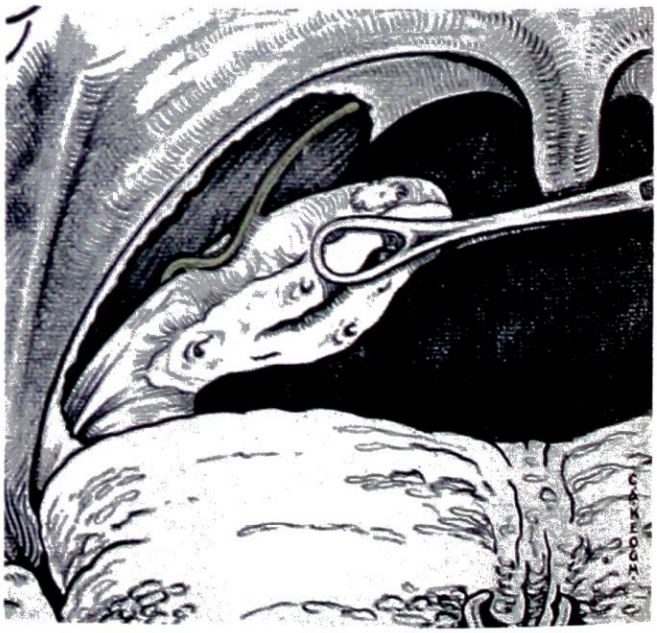


Fig. 1511.—The paratonsillar vein. (*Mr. Denis Browne.*)

all arteries about this size, after division the tonsillar arteries soon cease to bleed, owing to contraction of their walls, unless they are atheromatous.

Venous.—There is a vein unaccompanied by an artery in the tonsillar bed—the paratonsillar vein (*Fig.* 1511). Like other unaccompanied veins, it varies in size and may be double or treble (Denis Browne). When divided, the bleeding end retracts into the upper corner of the tonsillar fossa. Should the intravenous pressure rise (from respiratory obstruction) the lower distal end will bleed. Perhaps the most serious bleeding from this vein is due to its wall having been button-holed, but not divided completely. It is alleged that in the majority of cases serious hæmorrhage after tonsillectomy is venous. This would account for the fact that ligation of the external carotid artery is so often ineffectual in controlling tonsillar hæmorrhage.

Classification of the Bleeding.—Hæmorrhage is more profuse during the guillotine operation than during the dissection operation, and a certain amount of bleeding is to be expected during the first hour following tonsillectomy by either method. Surprising to relate, from his experiences at the Birmingham Children's Hospital, Stirk Adams found

that the risk of alarming post-operative hæmorrhage after the dissecting operation was three times greater than after the guillotine operation.

Hæmorrhage following tonsillectomy falls under one of three categories :—

1. *Reactionary Hæmorrhage*—that occurring within the first twenty-four hours after operation.

2. *Hæmorrhage during Convalescence*—that occurring most commonly on the fifth night or the sixth day following operation. This variety of hæmorrhage is associated with separation of the primary clot from the tonsillar bed, and also possibly the separation of ligatures, if these have been used (D. W. Ashcroft).

3. *True Secondary Hæmorrhage* occurs most often on the eighth post-operative day, but sometimes is delayed until one of the succeeding four or five days. This form of hæmorrhage is associated with damage to the muscular tissue of the tonsillar bed, and is due to sepsis and often necrosis, which results in sloughing of the wall of a blood-vessel.

MANAGEMENT OF A CASE OF HÆMORRHAGE FOLLOWING TONSILLECTOMY

Oozing, more evident after the guillotine operation than after dissection of the tonsils, is to be expected during the first hour following tonsillectomy. In order to minimize swallowing of blood, the patient is placed in the left lateral position, with the foot of the bed raised.

1. Reactionary Hæmorrhage.—When oozing occurs after the first hour, or should vomiting of fresh blood occur, the patient must be deemed to be suffering from reactionary hæmorrhage. If a post-operative sedative has not been given already, it must be administered forthwith—for an adult morphine ¼ gr. (16 mg.) subcutaneously ; for a child, nepenthe in an amount commensurate with the patient's age (i.e., 1 minim for each year of the child + 1). Unless the hæmorrhage is so alarming as to merit immediate attention, it is advisable to wait 20 min. for the drug to take effect when, as a result of diminished throat reflexes and allied nervous tension, examination of the tonsillar bed can be accomplished effectively. It should be an invariable rule to make the examination even if the patient (as a result of the morphine) has to be awakened from sleep.

Examination of the Tonsillar Bed.—

Armamentarium.—Adequate illumination must be obtained. A number of suitable swabs are prepared by rolling cotton-wool into a hard ball, and covering each ball with a layer of gauze, which is kept in place by a ligature or stitch. When they are to be used, the swabs are grasped in swab-holding forceps. A mouth gag, a tongue depressor, three long hæmostats, Luc's forceps, and a long dissecting forceps also are placed upon the tray. A gallipot for the reception of the operator's choice of styptic—hydrogen peroxide or stypven —for oozing ; thrombin topical or pure turpentine for bleeding are a usual choice.

Seeking the Bleeding Point.—The patient should be seated in an upright position, and if necessary supported in this position by a nurse. If old enough, he is given a tumblerful of cold water, and is asked to rinse out his mouth three or four times, and to eject the rinsings into a kidney-dish. A final mouthful is then taken, and swallowed. If there is no bleeding to be seen, no further action is taken for the time being. When there is bleeding the tongue is depressed gently but firmly by means of a tongue depressor held in one hand, and with Luc's forceps, or failing that instrument, a long hæmostat, *every particle of clot must be removed*, in order to allow the musculature of the tonsillar fossa to contract. In this respect the tonsillar fossa may be likened to the uterus (A. Lee McGregor).

Applying Compression to the Tonsillar Bed.—Pressure is applied to the bleeding area in the tonsillar bed with a swab on a holder, which is removed after a few minutes and replaced by another, the swab of which has been moistened with the chosen styptic. Firm pressure must be continued for 10 to 15 min., combined with gentle counter-pressure from outside beneath the angle of the mandible. These measures, carried out as detailed will, in the majority of cases, cause reactionary hæmorrhage to cease.

On Making Arrangements for Blood Transfusion.—Cross-matching should be carried out early so that if the blood-loss is deemed sufficient to merit blood transfusion, it can be carried out as soon as compatible blood is forthcoming. At the Birmingham Children's Hospital it has been found that 6 oz. (180 ml.) of whole blood is the most effective measure in the control of hæmorrhage that fails to cease soon after the above measures have been applied.

More Serious Hæmorrhage.—When it is obvious that a comparatively large artery is involved, or when bleeding continues in spite of the measures detailed above, or, more

rarely still, when trismus prevents efficient compression, the patient must be taken to the operating theatre. While on his way thither, his head must be kept strictly on one side, the bleeding side lowermost, with a swab on a holder compressing the tonsillar bed. Usually it is advisable to start a blood transfusion, or failing that a plasma or dextran infusion, before seeking the bleeding point. When all is in readiness, a small dose of thiopentone can be injected into the tubing of the transfusion apparatus. Before administering the thiopentone the patient should be placed in a head-down position to help to prevent blood entering the air-passages. It is most desirable to employ endotracheal anæsthesia with a cuffed tube. In the absence of these facilities one must rely on the tonsillar position, viz., the head held in an extended position, unsupported by the leaf of the operating table, which is lowered. This will prevent blood entering the air-passages; also this is the position *par excellence* for effecting hæmostasis in the tonsillar bed. Having inserted a suitable mouth-gag and drawn the tongue forwards, the tonsillar bed is inspected in a good light, and if a bleeding point can be seen it is seized in a long hæmostat. It is then under-run with a ligature on a needle or, if available, Irwin Moore's needle (*Fig.* 1512) can be employed for this purpose.

Fig. 1512.—Irwin Moore's tonsil suture needle.

When an obvious bleeding point cannot be found, the pillars of the fauces should be sewn together. A small piece of oxycel is placed in the cavity and stitches are inserted, as shown in *Fig.* 1513, care being taken to include muscle with each stitch. The stitches are removed after three days, and the remnants of the oxycel are allowed to become dislodged naturally.

In exceptional cases of definite arterial hæmorrhage it may be necessary to ligate the external carotid artery between the superior thyroid and the lingual arteries (*see* p. 855).

2. Hæmorrhage During Convalescence.—Bleeding of the delayed type, occurring nearly always on the fifth night following operation is, as a rule, not severe. Usually it ceases after a gargle of weak hydrogen-peroxide solution. Sometimes the hæmorrhage is associated with the presence of a piece of semi-detached clot that requires removal. Seldom is it necessary to transfer the patient to the operating theatre for this type of hæmorrhage.

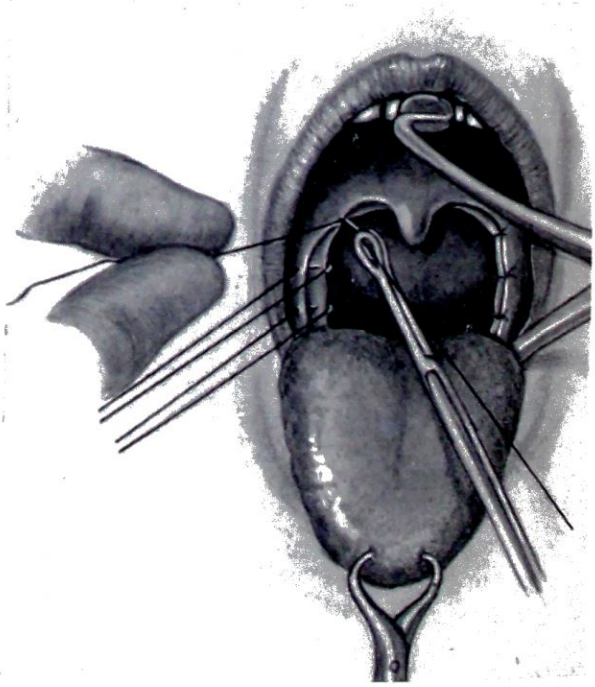


Fig. 1513.—Suturing together the pillars of the fauces.

3. True Secondary Hæmorrhage, which occurs about the eighth day after operation, is much more serious than the foregoing; fortunately, it is also less common. As a rule there are small warning hæmorrhages, followed within twenty-four hours by a larger one. Amidst the sloughing œdematous tissue that constitutes the bed of the tonsillar fossa it is difficult, and usually impossible, to secure a single bleeding point. Musgrave Woodman taught that the best method of treating secondary hæmorrhage was to apply pure carbolic acid to the tonsillar bed, without disturbing blood-clot. This he did on the initial sign of secondary hæmorrhage occurring at any time after twenty-four hours from the time of operation. Carbolic acid is a local anæsthetic, a local antiseptic, and, in his experience, its use always led to the cessation of this type of hæmorrhage. Should, however, a spurting hæmorrhage be seen it would appear that this is an occasion on which to ligate the external carotid artery without delay.

HÆMORRHAGE FOLLOWING REMOVAL OF ADENOIDS

The bleeding area should be examined, if possible visually, or digitally, for a tag of adenoid tissue. If such a tag is present, its removal with Luc's forceps will often result

ceasing. Should the bleeding persist, the nasopharynx must be plugged
described on p. 1066. In no case should the packing be left in place for
12 hours, otherwise serious infection of both middle ears via the Eustachian
follow.

PERITONSILLAR ABSCESS

are two varieties of peritonsillar abscess : (*a*) Anterosuperior, which is common ;
which is comparatively rare.

abscess is a complication of tonsillitis, but a relatively rare one. The
commences as *peri*tonsillitis. In the common anterior variety, almost certainly
of the peritonsillar tissue arises in one of
crypts which are slit-like, deep, and im-
the capsule of the tonsil. Pus unable to
the mouth of the crypt erodes the
into the superior part of the space
the capsule and the superior constrictor
1516). Thus the tonsil is displaced down-
towards the middle line (*see Fig.* 1514).

Fig. 1514.—The usual (anterosuperior) variety of peritonsillar abscess.

examination shows the infection
mixed one. *M. catarrhalis* is often the pre-
organism.

Peritonsillar abscess occurs most frequently between the ages of 15 and 40 ; although commonly encountered in children it is by no means a curiosity between the ages 15 years.

It is important to know that while the temperature is frequently 103° F. during the early stages of acute tonsillitis, by the time the pus has burst into space rarely does the temperature exceed 100° F. (37·8° C.) ; frequently it than 99° F. (37·2° C.). As the tension within the abscess increases, so does the muscles of mastication pass into spasm, and the patient cannot open his mouth to permit a full examination of the throat. Swallowing is so painful that saliva the mouth. This, combined with inability to turn the head without increasing characteristic of the presence of a peritonsillar *abscess* as opposed to When breathing becomes difficult and attacks of dyspnœa awaken the opening the abscess has been already delayed too long.

of a suction appliance is helpful in aiding visual examination. Swelling soft palate and displacing the uvula towards the opposite side (*Fig.* 1514) is . When the abscess is ripe, digital examination will reveal softening of the swelling.

of the Stage of Peritonsillitis is conservative. Confinement to bed, splinting bandaging over wool, nursing in the sitting posture with pillows on each side are fundamental principles. Hot alkaline mouth-washes will help to dissolve saliva so painful to dispel. Constipation must be avoided. The antibiotics have been determined as a result of swab culture with sensitivity tests. the report, penicillin and streptomycin, or a broad-spectrum antibiotic, administered. By the early use of antibiotics before actual formation of pus, for resolution to occur. Once an abscess has formed, operation is imperative.

the Abscess.—

ation.—Forty-five minutes before the operation morphine, ¼ gr. (16 mg.) is given.

Anæsthesia.—The injection of local anæsthetic should be condemned. It is liable to break down barriers of resistance to infection, and to devitalize tissues. Except in very young children, general anæsthesia is unjustifiable : breathing is endangered during the stage of induction, and intubation may prove to be impractical.

Armamentarium.—On the right-hand side of the operator there should be a tray on which has been placed :—

1. A gallipot containing a few drops of pure carbolic acid.
2. A sterile wooden applicator with flecks of cotton-wool wound firmly on both ends.
3. A thin spatula or a dessertspoon, the handle of which makes an excellent tongue

4. A scalpel with a sharp, but short, pointed blade, e.g., Bard-Parker No. 15 (*Fig.* 1515 A). Failing that, an ordinary pointed scalpel can be prepared as shown in *Fig.* 1515 B.

5. Long sinus forceps.

The patient is propped up on a bed-rest ; the light should come from over the operator's shoulder. The patient is asked to swallow, and open his mouth as best he can. Saliva is sucked from the base of the tongue. One end of the applicator dipped in carbolic acid is applied to the mucous membrane of the soft palate for a few seconds. Should any of the

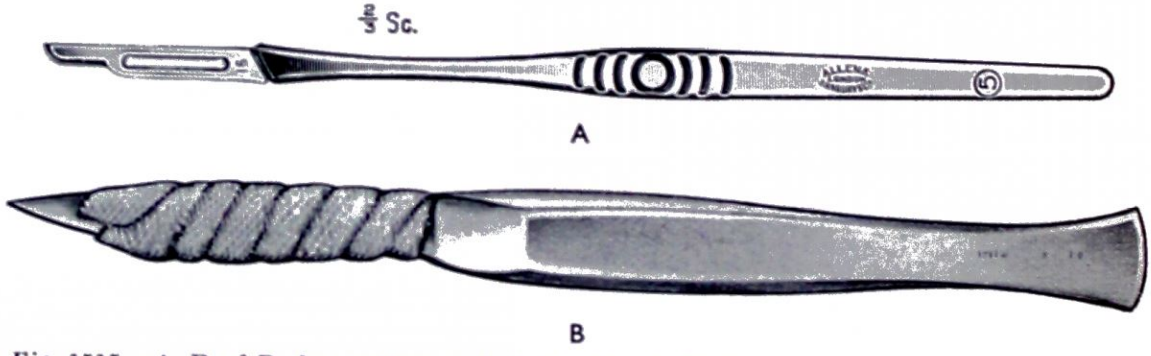


Fig. 1515.—A, Bard-Parker pattern scalpel No. 15 ; B, Method of winding adhesive plaster so as to render an ordinary pointed scalpel guarded.

acid trickle down, it must be swabbed away promptly with the dry end of the applicator. The painted tissues become blanched. The whole procedure is repeated. The patient is then told he can close his mouth, and swallow. After about a minute the mouth is again opened and a spatula inserted. The area is sucked dry. The point of the scalpel is stabbed[1] firmly through the blanched area to the depth of 1 cm., making a short vertical incision from the point depicted in *Fig.* 1516. There should be gush of pus and a little blood. The patient leans forward, spits out the discharge, and rinses the mouth. Usually the opening is widened by sinus forceps—a procedure that is not resented by the patient. Such enlargement of the incision is imperative if pus does not flow. Once the contents of the abscess have been evacuated, relief is immediate, and almost always convalescence is rapid.

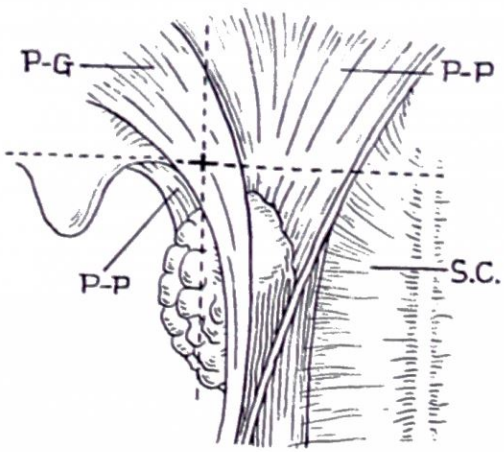


Fig. 1516.—The musculature of the peritonsillar bed and the imaginary intersecting lines that give the optimum point for opening a peritonsillar abscess. P-G, Palato-glossus ; P-P, Palatopharyngeus ; SC, Superior constrictor.

Following a peritonsillar abscess the tonsil is so damaged that it is vulnerable to further peritonsillar abscess. In due course, and after necessary dental treatment, tonsillectomy should be performed.

Peritonsillar Abscess in Children.—In countries where diphtheria is rife, the patient is often regarded as suffering from diphtheria. In view of the fact that the child presents symptoms of respiratory obstruction, often with rib retraction, together with an inability of the examiner to obtain a good view of the pharynx because of trismus, this mistake is understandable.

Treatment.—A general anæsthetic is to be preferred if circumstances permit. There is little danger of inhalation of blood or pus if the operation is carried out with the head and neck extended over a sandbag placed beneath the shoulders, and use is made of an efficient mouth-gag and a suction apparatus : if possible two suction apparatuses are employed for rapid evacuation of pus. Danger is lessened still further if the depth of anæsthesia is such that the cough reflexes are just returning at the time of the incision.

Posterior Peritonsillar Abscess.—Pain nearly always radiates to the ear of the involved side. There is but little swelling of the soft palate and the uvula. Posterior peritonsillar abscess tends to push the tonsil forward, and a view of the swelling it engenders is, at least

[1] Some surgeons make it their practice to aspirate before draining the abscess. Aspiration confirms the presence of pus before making the incision, and has much to commend it.

partially, hidden thereby. A century ago Trousseau pronounced that a peritonsillar abscess was almost never fatal. He referred, no doubt, to the common anterior variety of peritonsillar abscess; the posterior variety, unless dealt with promptly and efficiently, often gives rise to a parapharyngeal abscess, which is an extremely dangerous condition.

Parapharyngeal Abscess is dealt with fully on p. 848 under the title INFECTION OF THE PHARYNGO-MAXILLARY SPACE.

ACUTE RETROPHARYNGEAL ABSCESS

Acute retrophyrangeal abscess in infants is caused by suppuration of one or more of the lymph-nodes of Henle, which are situated in the retropharyngeal fascial space between the constrictor muscle of the pharynx in front, and prevertebral fascia behind. The space is divided in the midline into two compartments by the buccopharyngeal fascia, which binds the back of the pharynx firmly to the prevertebral fascia. Hence an abscess in this situation is always to one side of the middle line, and never central in position This feature helps to differentiate acute from chronic retropharyngeal abscess,[1] the latter being situated behind the prevertebral fascia. It is possible that in older children and adults acute retropharyngeal abscess is caused by perforation of the space by a foreign body, such as a fish bone, but more frequently it is a complication of otitis media and mastoiditis. The ear, as a primary focus, warrants investigation in every case of retropharyngeal abscess.

Age Incidence.—In older children the retropharyngeal lymph-nodes have usually disappeared; consequently acute retropharyngeal abscess is mainly a disease of infancy, 66 per cent of all cases occurring during the first year of life. Contrary to statements in many standard works, M. Davidson has found by a study of reported cases as well as a result of his own experience that acute retropharyngeal abscess in adults is not by any means the almost unheard of condition it is alleged to be.

Bacteriological Investigations have shown the infection to be due to mixed flora in the majority of cases, but hæmolytic streptococci usually predominate. When pure cultures are obtained, again they are of a hæmolytic streptococcus.

Diagnosis.—The collection of pus behind the pharynx interferes with deglutition and respiration. If the apex of the abscess is situated in a nasopharynx, interference with nasal respiration results, and frequently it is thought that the patient is suffering from adenoids. When the apex is opposite the glottis, interference with deglutition and respiration is more exaggerated and, in order to maintain an adequate airway, the child holds its head in full extension with the mouth open—a position considered by many to be pathognomonic of this disease. A lateral radiograph (*Fig.* 1517) frequently displays the abscess, and there is sometimes a forward displacement of C.2 on C.3, due to spasm of the retropharyngeal muscles (E. H. Townsend). If unopened the abscess ruptures into the oropharynx in 90 per cent of cases, but in 10 per cent death occurs from extension of the abscess into the mediastinum, pneumonia, or rupture of the abscess in such a manner as to asphyxiate the patient

Fig. 1517.—Radiograph showing an acute retropharyngeal abscess. (*Dr. E. H. Townsend.*)

Treatment.—The sooner an acute retropharyngeal abscess is opened the better. A child is wrapped and pinned in a blanket, so that its arms and legs are immobilized. The patient is held nearly upside-down, with the head grasped firmly by a second assistant. No anæsthetic is necessary. A protected scalpel (*see Fig.* 1515 B) is prepared. The mouth is held open by a tongue depressor; a mouth-gag is rarely required. The gloved index finger is used as a guide (*Fig.* 1518). A vertical incision is made into the swelling. The inverted

[1] Chronic retropharyngeal abscess secondary to tuberculosis of a cervical vertebra is central in position. Chronic retropharyngeal abscess secondary to breaking-down retropharyngeal lymph-nodes usually is to one side of the middle line.

position ensures that pus and blood are not aspirated. As a rule, drainage is satisfactory, but in order to ensure continued and complete evacuation of the pus, sometimes it is necessary to introduce a hæmostat into the incision and open its jaws a few days after the operation.

In older children and adults, when there is no serious dyspnœa, a general anæsthetic can be employed. The position of the patient is of the highest importance. It is the same as that described for peritonsillar abscess, when a general anæsthetic is employed. The

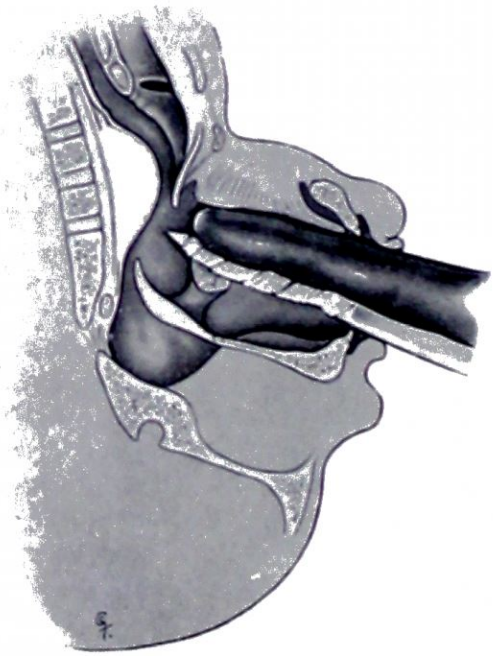


Fig. 1518.—Acute retropharyngeal abscess. With the patient held nearly upside down, the index finger acts as a guide and a guard; the finger reaches the abscess, into the middle of which the protected scalpel is thrust boldly.

mouth is held open with a gag, and the tongue drawn forwards with a towel-clip. A tongue depressor is useful for exposing a low abscess. The technique of opening the abscess does not differ from that depicted in *Fig.* 1518.

To employ, whenever possible, two suction apparatuses, is a wise injunction, for not only is the pus likely to be evacuated in half the time (thus minimizing the chances of it passing into the trachea), but should one sucker become blocked, the predicament of being unable to remove pus from the pharynx except comparatively slowly by means of swabs, is circumvented.

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CHAPTER XCI

SURGICAL EMERGENCIES IN THE TROPICS: GENERAL PRINCIPLES

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'Tropical' surgery embraces all well-known emergencies, as well as certain conditions unknown or uncommon in temperate climates.

Concomitant Diseases.—Many, if not most, patients admitted as acute surgical emergencies are also suffering from such tropical diseases as malaria, filariasis, chronic dysentery, bilharziasis, intestinal worms and parasites, leprosy, or kala-azar. A large number of them have also one of the more common cosmopolitan diseases, notably tuberculosis or syphilis. Obviously a surgeon cannot depend upon physicians to recognize these diseases for him; consequently it is quicker and more productive of accurate results when examining a patient to have the blood, fæces, urine and sputum, sent at once to the laboratory.

When possible, the following investigations are carried out:—

1. *Blood.*—Advances in tropical hæmatology make it necessary to obtain expeditiously a hæmoglobin estimation, a red-blood cell-count, or a white-blood cell-count, a P.C.V. (proportion of cells to plasma), and a report as to whether sickle cells or blood parasites are present.

2. *Urine.*—A report on the specific gravity, the chloride content, examination of a Gram-stained film, and an examination for the ova of bilharzia.

3. *Fæces.*—Examination for the ova of worms and for *Entamœba histolytica.*

4. The patient should be weighed and a clinical estimate of the state of dehydration or fluid retention is most important.

As a precaution against intercurrent malarial complications in surgical patients during the transmission season pyrimethanine 0·25 G. given once a week, or chlorguanide 0·1 G. daily, to each patient will prevent much diagnostic confusion, as well as many post-operative alarms.

MALNUTRITION

Evident or incipient malnutrition is the most important general factor to be taken into account in tropical practice. Rich and poor alike eat an unbalanced diet and suffer from protein and vitamin deficiencies, chronic bowel disease, parasites, anæmia, and poor liver or kidney function, and in women a constant drain of child bearing.

Added to the careful clinical examination of an emergency case, the following data will help to decide the state of nutrition: (1) Estimated proper weight, by tables; (2) Observed actual weight; (3) Plasma-protein ratio; (4) Diet and bowel history; (5) Urinary output and fluid intake history; and (6) the hæmatological data noted above.

Whenever the emergency permits sufficient delay, malnutrition should be combated, and incipient malnutrition corrected as far as it is possible during the time at one's disposal. The régime includes correction of fluid and electrolytic imbalance, the administration of protein hydrolysate intravenously, and blood transfusion in case of need. To every child and to every woman in the child-bearing period at least 200 mg. of vitamin B_1 (thiamin) should be given pre-operatively, and repeated twice daily for the first four post-operative days. Many cardiac fatalities are avoided by these means. Mixed vitamins are given, intravenously (*see* p. 31) at first, and as soon as practicable, by mouth; they are continued until the patient's discharge.

After operation, as soon as the patient regains consciousness, unless oral feeding is contra-indicated, the following routine is recommended. A Ryle's tube is passed transnasally, and tap water is gravitated into the stomach at the rate of 60 drops a minute for 24 hours. During the second 24 hours skimmed milk is added to this drip. The mixture is gradually reinforced with whole milk, protein digest, and dextrose until by the fifth day about 300 G.

of protein and 4000 calories are being supplied. The common fatal post-operative complications of malnutrition, i.e., post-operative shock, œdema, faulty wound healing, and oliguria, will be greatly minimized thereby.

The value of transnasal, intragastric, high calorie drip feeding has been proved among the chronically undernourished populations of the tropics.

Ultra-severe malnutrition in early childhood (kwashiorkor) sometimes causes lesions which simulate full-thickness burns or scalds of the skin: operation in such cases is almost uniformly fatal.

Acute Abdominal Emergencies arising from Primary Carcinoma of the Liver (*see* p. 1100).

DEHYDRATION

Every patient admitted as a surgical emergency in tropical practice must be viewed from the angle of fluid balance. Apart from losses consequent upon vomiting and/or diarrhœa, it must ever be before one that enormous losses result from sweating, especially during an operation and while the patient is still under the anæsthetic. The surgeon may lose 4 lb. (1800 G.) in weight in the course of one hour's work. What, then, must be the in a patient whose heat-regulating mechanism is impaired during that same hour, and some time post-operatively? Further, it must also be taken into consideration that these enormous losses are taking place in a patient whose fluid balance is chronically deranged by severe anæmia and plasma-protein deficiency. It is likely that the usually low of about 110/60 mm. Hg. encountered may be due to a chronically contracted With such a blood-pressure the hæmoglobin is often only 40 or 50 per cent normal, and the red blood-cells 3,000,000 per c.mm.; thus compensation has occurred, with dilution and contraction. Without blood-volume studies—not often available to a surgeon in tropical climates—no information can be obtained as to the extent of the in any given case.

With excessive sweating added to this state of affairs, the position becomes so confused that it is only with great care and resort to laboratory investigations that the surgeon will able to estimate the fluid needs of the patient. Haphazard administration of water and plasma-volume expanders, or whole blood must be eschewed, as too often over administration swings the pendulum against the patient's recovery. More and Centres in the tropics are now becoming equipped with laboratory facilities for checking patient's fluid, water, electrolyte, and whole-blood requirements. In the absence of facilities some empirical clinical rules are as follows:

1. **Blood Transfusion.**—In an adult blood transfusion should be given in increments 250 ml. only at a time, unless some fairly accurate estimate of the blood loss is possible, blood vomited; the increased weight of swabs soaked at operation.
In an infant, 10 ml. per lb. of body weight should never be exceeded, and only one- or one-third of this amount is transfused at one time.

2. **NaCl Replacement.**—The normal 10 G. daily requirement must be given slowly, which a clinical estimate is made based on the presence of moist lips and tongue, normal elasticity, the absence of œdema and thirst, a urinary output of at least 1000 ml. in with a specific gravity below 1020, and the presence of adequate chloride excretion. these criteria excessive doses of sodium chloride will be avoided.
The differentiation between the low plasma-sodium due to the dilution and that caused is summarized by Professor C. G. Rob as follows:—

	Dilution	Depletion
General appearance	Drowsy; mental change; fits	Alert; apprehensive
Tongue	Moist	Usually dry
Eye tension	Normal	Low
Pulse-rate	Normal	Raised
Temperature	Normal	Low
Blood-pressure	Normal	Low
Hæmatocrit	Low	High
Urinary—Volume	Normal	Usually low
" Specific gravity	Low	High
" Electrolytes	Low	Low

The maximum safe expansion of extracellular fluid spaces is roughly to the extent of 10 per cent of body-weight. Given the patient's weight in kilos, 5 per cent of this total can safely be given over 8 hours. The total should include water, salt, dextrose, and dextran, in proportions indicated by the nature of the individual case in respect of oligæmia and dehydration.

Intestinal obstruction and post-operative paralytic ileus are very common in tropical practice, hence in these conditions to the above requirements must be added a volume equal to that of the fluid aspirated via an indwelling gastro-intestinal tube. At all times the keeping of a very careful fluid-balance chart is imperative.

It is often said that in the tropics water can be safely given in almost any quantity, and on first hearing it one is inclined to accept such a statement because of the amount of fluid lost by sweating. Of all the rules of thumb to which from time to time we have recourse, this is the most dangerous. Acute water intoxication, with fits, coma and death, is as easily provoked in the tropics as elsewhere.

ACUTE ŒDEMA OF THE LUNGS; CHRONIC HYPOPROTEINÆMIA AND FEEDING

It is not uncommon to be called to see a patient recently operated upon, whether as an emergency or not, in whom fluid therapy has been instituted, and one is told that the heart is failing. In a population in whom chronic hypoproteinæmia is the rule, a constant and careful watch must be kept for patchy œdema around the buttocks, on the back and face, and œdema of the lungs. It may appear suddenly ; it may flit from place to place, or it may remain constant, and spread. In patients sufficiently dehydrated as to require plasma-volume restoration the replacement can easily be too quick, too generous, or too energetic for the particular case. Calculated plasma-protein may have been apparently normal because of hæmoconcentration. In such cases the diagnosis is not one of heart failure, but of reduced albumin fraction in the plasma. It is better to leave such patients slightly dehydrated whilst building up the albumin fraction.

Beef is a better plasma-protein builder than casein, since 100 G. of beef will give 38 G. of plasma-protein, while the same quantity of casein will only give 10 G. of plasma-protein. Lightly boiled and pounded liver, 300 G. daily, is a useful addition in these cases, having a beneficial effect within three or four days.

It is useful to bear in mind that surgical intervention or trauma causes a breakdown of body protein at the rate of about 2 lb. (900 G.) per day. In cases of intestinal obstruction, severe infection or heavy active parasitic infestation, this rate is approximately doubled. These remarks are poignant illustrations of how important is proper feeding in tropical practice.

BLOOD TRANSFUSION

The setting up of small blood banks at most of the largest tropical hospital centres gives great encouragement, being evidence that some of the racial, social, and religious barriers to the use of blood transfusion among native patients are breaking down. This does not mean that the high incidence of endemic disease can be disregarded ; the greatest care will always be necessary in the screening and grouping of donors and recipients. At present the scarcity of volunteers, both as donors and recipients, together with the distressing shortage of staff, are factors which militate against the rapid expansion of the Blood Transfusion Services in tropical countries.

The following data have been accepted as being practical (G. M. Edington) :—

1. Ignore the hazard of malaria, using amodiaquin (camoquin)[1] 0·6 G. as a single therapeutic dose by mouth, to both donor and recipient, immediately after completing the transfusion in partially immune individuals ; add 0·4 G. on the following two days in non-immunes. Chloroquin sulphate, 0·4 G. intramuscularly daily for two days, will protect those too ill to take the drug by mouth.

2. A rise of temperature to 99° F. (37·2° C.) within ten days of transfusion calls for a full hæmatological examination.

[1] Parke Davi Co. Ltd., Staines Road, Hounslow, Middlesex.

positive Kahn test should exclude a donor if possible. Otherwise a covering
[1] 1·2 mega units, with distaquaine,[2] 0·3 mega units, should be given
withdrawing blood.

there is no alternative, it is permissible to use sickle-positive blood, provided
is entirely suitable in all other respects.

renders the history of many donors unreliable, and so there is an increased
homologous serum jaundice. However, Edington reports no case of
in his experience.

for cross-matching must be withdrawn from the recipient before dextran or
volume expander is given; these blood substitutes cause rouleaux formation and
of compatible donor cells.

AS and AC blood[3] have been successfully stored and transfused.

The most likely cause of serious accident is overloading. Few patients have a
estimation of over 65 per cent, and the average is below 50 per cent. They
chronically hypoproteinæmic and long since have established a permanent state of
contracted blood volume (*see* p. 1085). Very careful judgement and personal
of the whole transfusion by the doctor is the only way of avoiding accidents.

9. The standard of care of apparatus, preparation of distilled water, washing of
etc., is so much lower than in Europe or America that a 10 per cent incidence of
reactions must be expected. The use of chlortrimeton,[4] 10 mg. per 500 ml. directly
the flask of infusion or blood, is advised for safety, unless the newer polythene sterile
are used, and discarded after use.

It should not be forgotten that for the average indigene the donation of 1 pint
) of blood is a *very* generous gift, and to him is due some care and attention after
in order to enable him to make good some of the loss involved to his probably
store of erythrocytes.

GUARDING THE (UNCONSCIOUS) PATIENT AGAINST THE EFFECTS OF EXCESSIVE CHANGES IN TEMPERATURE

conditions in the wards and in the operating theatre should be under
observation so that the patient is not subjected to excessive cooling in the one,
in the other, whilst his temperature-regulating mechanism is out of control
effects of anæsthesia. Carelessness in this precaution often precipitates shock in
acclimatized, but chronically anæmic, native, and shock and heat-stroke in
acclimatized foreigners.

wise to have close to the operating theatre a recovery room, in which the tempera-
intermediate between that of the cool operating theatre and the warm ward.

HEAT STROKE

Racial Differences.—Except under conditions of deep mining, heat-stroke is less common
dark-skinned races than among white persons.

From the description of treatment which follows, it will become apparent
one patient with heat stroke requires the undivided attention of one doctor and at
nurses or orderlies for a very long period. Lest, through want of forethought,
patients be stricken simultaneously, it is of cardinal importance that an efficient
is maintained to prevent wards becoming overheated. It is not possible to
with this vital administrative problem, but it is relevant to emphasize that a
practising in the tropics must inaugurate, in every ward under his charge, a system
a wet-bulb thermometer reading is recorded twice daily and reported to him when
is higher than 70° F. (21·1° C.) Another practical precaution is for the surgeon

All-purpose (John Wyeth & Brother Ltd., Clifton House, Euston Road, London,
This preparation of penicillin is given orally.
(Biochemicals) Co. Ltd., 8–12 Torphichen Street, Edinburgh, 3. Given intra-

[3] AS and AC refer to abnormal hæmoglobins. The A signifies the normal adult hæmoglobin
S and C two hæmoglobins that occur fairly frequently in tropical countries.
[4] Chlortrimeton British Schering Ltd., 229 Kensington High Street, London, W.8.
[5] Poviet Production N.V., Mauritskade, 14, Amsterdam, Holland.

on his daily round to make a practice of taking each patient's hand in his ; an individual whose skin is hot and dry is a candidate for heat stroke. It is of the greatest importance that night staff be reliable and specially instructed to watch that the system does not break down as well as to watch for suspicious symptoms in patients.

No matter from what the patient is suffering, if his temperature is rising, and he has a dry skin, headache, tachycardia, a sensation of warmth and dizziness, injected conjunctivæ, urinary frequency and polyuria, he should be regarded as suffering from heat-stroke, and treated accordingly. Investigations to eliminate other common causes of hyperpyrexia *follow*, and the first of these is repeated examination of thick blood-films for malaria parasites.

Treatment.—Remove the patient to a room cooled with fans. This room should be shaded, but it must be well ventilated, otherwise the air will become super-saturated with moisture. Place the patient flat on his back on a bed furnished with a light khus-khus[1] mattress that has been covered with a blanket. Under the bed is a large tub to receive the water which will drip through the mattress. An ice-cap is applied to the head and ice-bags to the neck and groins. Over the naked patient is placed a sheet, continuously wet with really cold water from a watering-can (*Fig.* 1519). Ice-water, i.e., water with lumps of ice floating in it, is too cold : the aim is to cool the patient less precipitously by evaporating the water in contact with his skin. To this end a table fan is so placed that a current of air is directed on to the patient.

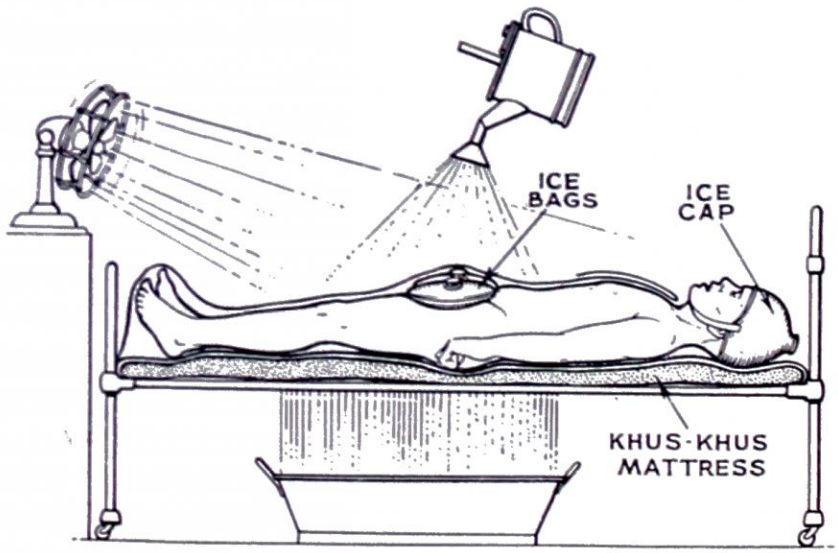

Fig. 1519.—Cooling system described in the text. Ice-bags to the neck are omitted for the sake of clarity.

Recording Progress.—The temperature is taken per rectum every fifteen minutes and recorded on a chart. In addition, the blood-pressure should be taken and charted hourly or more often if required ; fluid intake and output must be similarly recorded ; a note of the presence or not of albumin and chloride in the urine must be made ; the pulse-rate should be recorded graphically with the temperature. If circumstances permit *repeated* blood specific gravity, Na and K estimations, etc., should be carried out from admission, and this data, taken in conjunction with the remarks under dehydration, will provide a basis and guide to fluid therapy and response in the patient. This data should be recorded graphically.

By this means all the required data and the trend of the case can be seen at a glance. Wet-bulb atmospheric thermometric readings are also recorded on the patient's chart every six hours.

Treatment when the Atmosphere is very Humid.—When the wet-bulb reading rises to between 78° F. (25·6° C.) and 83° F. (28·3° C.) sufficient evaporation to cause adequate lowering of the temperature cannot occur. In these circumstances the patient must be placed in a bath of cold water, changing the water by a syphon system from a raised tub of ice-cold water. Vigorous massage in the bath, together with the administration of oxygen, is helpful.

[1] Khus-khus is a kind of straw.

Method of Reducing Hyperpyrexia.—The apparatus consists of a fine with a finger-stall (which, on inflation, will hold 250 ml.) tied securely on The other end is attached to a two-way tap connected to a 50-ml. syringe. connected to the side channel of the two-way tap, is placed in a bowl of about 39° F. (4° C.). The balloon-tipped tube is passed into the stomach and are carried out once every five minutes, each change of water remaining in the three minutes. The method reduces hyperpyrexia to normal limits within an Khalil and R. C. MacKeith).

Measures to be taken in Special Circumstances.—A systolic blood-pressure 100 mm. Hg and body temperature over 106° F. (41·1° C.), central nervous loss of knee-jerks, anginal pain, and a history of alcoholism indicate a very and call for the administration of noradrenaline as in cases of shock (*see* should be given to all comatose patients, and chloroquin 0·4 G. intra- is advisable in any patient whose temperature rises above 102° F. (38·9° C.). 50 mg., two to four-hourly is valuable in controlling hyperpyrexia, and advantage of not inducing or inhibiting sweating. Signs of cardiac embarrassment, angina pectoris, can be relieved by venesection. One pint (450 ml.) of s blood is allowed to gravitate into a sterile transfusion bottle, which is stored. the patient's condition improves, his blood is returned as a transfusion.

Heat Stroke and Cerebral Malaria can be clinically indistinguishable ; malaria definitely to heat stroke. In malignant tertian malaria, repeated blood-films may be for the first two or three days. For these very reasons the reader is strongly to add to his therapeutic régime in any case of hyperthermia :—

1. Chloroquin, 0·4 G. intramuscularly.
2. For a child :—1 year .. .. .. ¼ dose.
   1–3 years .. .. ½ ,,
   3–6 ,, ... ½ ,,
   6–9 ,, ... ¾ ,,

Parenterally : 5 mg. per kilo of body weight is a maximum.

Response to Treatment (all cases).—When the patient's temperature has been lowered 102° F. (38·9° C.) he should be dried and put naked into a dry bed. An ice-cap is still to his head. The longer the rectal temperature remains satisfactory, the more becomes the prognosis. Nevertheless, sudden relapses are common even after patient appears to be convalescent : consequently unremitting nursing attention is Relapses call for a resumption of the therapy as already detailed. Recurring warrant an increasingly poor prognosis.

Return to normal sweating requires at least four weeks, and often as long as twelve In these circumstances sudorific drugs fail to provoke sweating, and may exacerbate

crisis is over : A patient who has recovered from heat stroke often registers a for several days. Not infrequently he is mentally torpid, lacks the power to and suffers quite severe headaches. In the event of such symptoms persisting than a few weeks, the surgeon should recommend and insist that the patient leaves if that be possible. Occasionally definite signs of increased intracranial tension cerebral œdema become manifest. Cerebral œdema should be treated as described 98, 1106.

SUBDIVISION OF THE PHENOMENA OF HEAT STROKE

stroke can be properly divided into three categories :—

Heat fever, which is the most urgent and dangerous, and has been dealt with at

Heat exhaustion is more common than was formerly believed : a mild form is encountered in white people resident in the tropics.

Heat cramp.

Exhaustion may be the primary condition ; more often it follows heat fever, the crisis appears to be over. The patient's temperature falls to below normal, into a cold sweat, and the pulse becomes rapid, irregular, and thready. The simulates shock.

Heat exhaustion takes a more chronic, and less well-defined form in the dark-skinned peoples, therefore it is not so easily detected, but judging from empirically applied therapy, it does occur. The response, however, is less satisfactory.

Prevention.—I have encountered fewer of these cases since intravenous saline and oxygen therapy have been incorporated in the programme of treatment of heat fever.

Treatment.—Resembles in all particulars that of shock. Nevertheless, it must be constantly remembered that malignant malaria may simulate heat exhaustion exactly. Consequently, the only safe method of procedure is to take repeated thick blood-films and administer chloroquin together with treatment as for shock. A constant watch is necessary since incredible rises of temperature and changes in the clinical condition can take place in a matter of minutes. On promptitude in treating the exacerbation depends the patient's chance of survival.

Heat Cramp.—Unless sufficient water containing 10 gr. of common salt to the pint is imbibed by those doing manual work under conditions where the wet-bulb reading stands at 158° F. (70° C.) or over, muscular cramps soon develop. Naturally, the heavier the work and the higher the atmospheric temperature and humidity, the greater is the liability to this condition. I have experienced the malady myself after particularly arduous work in the operating theatre : now during the hot season I make a practice of drinking a pint of salted lemonade between operations.

SURGICAL EMERGENCIES AND MALARIA

Malaria in relation to Trauma and Sepsis.—Often even a minor injury arouses latent malaria. For instance, a man is admitted having received a trivial injury to his shin a day or two previously. He now has a high temperature and diffuse tenderness over the tibia. Should the blood-slide reveal benign or malignant tertian rings, chloroquin (150 mg. per tablet), 4 tablets at once in the partially immune, or 2 tablets t.d.s. for three days in the non-immune, will cut short the symptoms and signs within forty-eight hours. Patients suffering from sepsis *and malaria* recover more slowly if the malaria is not treated vigorously.

Slight trauma in infants and children native to the tropics, and especially where malaria is hyperendemic, may be followed by prodromal signs of cerebral involvement by the parasites. Treatment must be prompt and adequate, if tragedy is to be avoided.

Malaria and Acute Abdominal Condition: General Principles.—Malignant tertian especially may simulate any surgical abdominal condition, but more often appears concurrently with surgical disease than as the cause of simulation. Suspected or proved malaria is to be regarded as an unwelcome addition to be treated collaterally but never to outweigh any imperative sign present, e.g., rigidity. To open an abdomen unnecessarily is less regrettable than to treat an acute abdominal catastrophe as malaria.

Since parasites may be found in blood-slides without clinical signs, it is good practice not only to make routine pre-operative blood-slides but at operation to use any available visceral blood or blood-stained peritoneal fluid similarly. These sources may be positive when others are negative. Finding parasites will perhaps explain symptoms in the absence of surgical lesions, but, more important, will lead to treatment and avoidance of a worrying post-operative period for which such patients are candidates. Further, the surgical patient responds more quickly if a subclinical malarial infection can be found and eliminated.

Malaria as a Cause of Post-operative Pyrexia and Hyperpyrexia requires careful consideration, even when the pre-operative blood-smears were negative.

It is a good practice to give all patients who are to undergo an urgent operation chloroquin, 0·4 G. intramuscularly, regardless of clinical or microscopical evidence of parasites. This practice helps to avoid shock and other complications.

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CHAPTER XCII

ABDOMINAL EMERGENCIES IN THE TROPICS

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ACUTE APPENDICITIS IN THE TROPICS

Although acute appendicitis is not common among the natives of tropical countries, when it does occur inflammatory changes often proceed apace with early perforation and peritonitis. Not infrequently the patient will first present with rigors and jaundice due to pylephlebitis consequent upon delay in seeking advice.

It must be realized that an acute right iliac fossa syndrome in a native is commonly part of a more disseminated affection—e.g., amœbiasis, schistosomiasis, filariasis—and only rarely is it the condition known as 'appendicitis' in temperate climates. In this chapter the term 'appendicitis' is used descriptively only.

Appendicitis due to Bilharzia Ova is not an uncommon condition in those parts of the world where bilharzia is a prevalent infestation, i.e., North, West, East, and Tropical Africa, and in Venezuela. It is emphasized that every appendix removed in the Tropics and related areas should be scraped carefully, and the scrapings examined for parasites and ova. The discovery of bilharzia ova will lead to a full investigation of the patient with a view to finding and treating bilharzial polyposis and stenosis of the colon and rectum, which is so common in this condition.

Typhoid Perforation of the Intestine.—(*See* p. 208.)

Typhoid Perforation of the Gall-bladder.—(*See* p. 319.)

EMERGENCIES ARISING FROM 'COLITIS'

The term 'colitis' is employed here advisedly. It does not imply any particular disease, but embraces all of those inflammations of the colon, notably the dysenteries, intestinal schistosomiasis and worm infestations that abound in the tropics.

Acute Appendicitis or Colitis?—This is a constantly recurring problem requiring considerable surgical judgement. To operate upon a patient with amœbic dysentery is to invite an exacerbation of colitis that may prove fatal.

A nursemaid, aged 24, stated that she had had recurring attacks of right-sided abdominal pain. Careful inquiry did not substantiate a history of colitis. The present attack came on with great suddenness, and on examination I came to the conclusion she was suffering from acute appendicitis. Appendicectomy was performed, but the appendix appeared normal. All went well until 2 p.m. on the fifth day. A slight pyrexia, 99° F. (37·2° C.), suddenly gave place to hyperpyrexia with rigors. This was followed four hours later by a subnormal temperature. About this time profuse, bloody diarrhœa set in, and was followed four hours later by the expulsion of a slough of mucosa 18 in. (45 cm.) long, which in turn gave place to the passage of pure blood. In spite of all resuscitative measures, she died in agony in the early hours of the morning. At necropsy amœbæ were freely obtained from the mucosa of the terminal ileum and the large intestine.

This severe lesson, while being a warning, must not prejudice the surgeon. Although the differential diagnosis is difficult, it is not impossible.

In the case of the pseudo-appendicitis of colitis, rigidity is usually absent. As is well known, in acute appendicitis usually the pain moves to, and does not commence in, the right iliac fossa. Routine sigmoidoscopy is of great value in detecting signs of amœbic or bacillary infection. If real doubt still exists, 1 gr. (0·06 G.) of emetine hydrochloride in 20 ml. of normal saline should be given intravenously very slowly. If the condition is due to amœbic dysentery there is likely to be a substantial amelioration of symptoms within two hours. Occasions arise when there is no dramatic improvement, in which case it is safer to operate, in spite of the fact that amœbic infection has not been ruled out. Perforation of the base of the cæcum or appendix, or obstructive inflammation of the latter, frequently results from

ulceration causing local peritonitis that is prone to spread. Should the appendix to be comparatively normal on the outside, in due course the interior must be scrutinized. As soon as possible the organ is opened and scraped, and the material from the lumen examined microscopically for parasites; cultures should also be prepared. In cases of pseudo-appendicitis of dysentery it is of the highest importance to start a full course of emetine therapy combined with full doses of a long-acting penicillin preparation and thalazole (May & Baker Ltd.). It is equally important to realize that such therapy may be ineffective if readjustment of fluid and plasma protein, of carbohydrate, and mineral losses are not made good as soon as possible.

The Pericæcal Abscess of Colitis.—Entamœbic colitis can give rise to another syndrome. is admitted with a lump in either the right or left iliac fossa. When right-sided question of appendix abscess arises, but in this instance the decision as to the immediate is not so onerous as in the case of acute right iliac fossa syndrome without a lump, correct procedure is to adopt the Ochsner-Sherren régime (*see* p. 232). With emetine , a hypertrophic mass due to the entamœba unmistakably decreases in size and ; it is no exaggeration to state that the lump melts daily. The dose of emetine varies from ¼ gr. (16 mg.) to 1 gr. (0·06 G.) intramuscularly daily for 10–21 The minimum total dose is 5 gr. (0·3 G.) and the maximum total dose is 12 gr. (0·8 G.). of new therapeutic agents of great power e.g., chloroquin, camoform, erythromycin remains a drug unrivalled for the control of this condition.

Infestation of the Deep Iliac Lymph-nodes.—A mass which fails to resolve or suppurate due to filarial infestation of the deep iliac lymph-nodes a possibility that is worthy of full in certain areas of the Tropics. These masses arise with acute symptoms, suggesting of a deep abscess. Symptoms of acute intestinal obstruction are a not infrequent , but there is usually a good response to enemata. These masses resolve with heavy of penicillin, chloromycetin, or streptomycin, and appropriate body-weight doses of , given with regard to the local type of filaria.
in full doses with diethylcarbamazine have proved an effective combination.

Peritonitis accompanying Colitis. Adhesive pericolitis is so common that in cases colonic perforation sudden diffuse peritonitis seldom occurs. The perforation takes quietly because of veil-like pericolic adhesions, which limit the leakage for a number hours. The escape of such virulently infected fluid soon results in abscess formation, and the limiting barriers are thin and friable, it is not long before fæculent pus bursts another peritoneal pocket or burrows into an adjacent loop of intestine. Thus we are with the misleading clinical picture of a relatively uncomplaining cachectic patient really has a creeping intraperitoneal infection that Nature seldom seals off sufficiently eventual total involvement and disaster.

A colonic perforation must be strongly suspected in any patient giving a history of or diarrhœa:—

a. When his abdomen suddenly, or comparatively suddenly, becomes distended and If he suffered from diarrhœa, and this ceased at the time of the onset of the distension, further evidence of colonic perforation is required.

b. When his condition suddenly, but indefinably, changes for the worse. Often such is ushered in by shivering, a fall in temperature, and a rising pulse-rate. These are especially suspicious if accompanied by vomiting or hiccup.

c. While a sudden onset of violent abdominal pain is unusual, a complaint of abdo- pain calls for repeated abdominal examinations. It is by such constant watchfulness transitory localized rigidity, as opposed to tenderness, will be discovered. Localized in these unresponsive subjects indicates a hopeful prognosis, because the diagnosis not been delayed unduly.

Treatment.—Laparotomy should be undertaken as soon as emetine and penicillin therapy had time to take some effect (two hours or more) and the fluid balance has been General anæsthesia is employed if the services of a skilled anæsthetist are available. circumstances local anæsthesia, with thiopentone given into the drip if necessary, anæsthesia, is substituted. Either a vertical or a transverse incision centred over of maximum tenderness can be used. I prefer a transverse incision because of the access it gives to the paracolic gutters, which are so often the site of abscess forma- in this condition. Usually it will be found that the whole or part of the colon is thickened friable, with multiple sieve-like perforations, so that exteriorization after mobilization

is arduous or impracticable. Terminal ileostomy (*see* p. 526) should be performed and the abdomen closed with suprapubic drainage, and also drainage to the sites of perforation. Often these are extraperitoneal into one or other of the paracolic gutters.

Post-operative emetine, chloromycetin, and penicillin, given together, rapidly overcome the severe mixed infection. It should be borne in mind that natives are generally in a state bordering on vitamin-B deficiency, and therefore chloromycetin should be accompanied and followed by the administration of a resistant strain of *Lactobacillus acidophilis*.

Fig. 1520.—Patient six weeks after closure of his ileostomy with resection of the right half of the colon and ileotransverse colostomy.

At a later date the continuity of the intestine can be restored, if need be after excision of a stenosed segment (*Fig.* 1520).

Intestinal Obstruction associated with Colitis is very common; most frequently the subacute, as opposed to the acute, variety of this condition is presented. Consequently the greater number of cases fall into the category of quasi-emergencies, and there is ample time to investigate the large gut by means of stool examination, sigmoidoscopy, and, if facilities exist, by barium enema. In this way cases of colonic spasm, as opposed to an organic obstruction, can be segregated. While sometimes the obstructive symptoms are due to spasm alone, more often the spasm is associated with organic partial obstruction due to extra-intestinal inflammation (abscess or amœbomata), fibrotic stricture of the intestine, or an intussusception.

Amœbomata are of two varieties:—

1. *True amœbomata* are fibrolipomatous tumours involving the whole thickness of the intestinal wall; they are œdematous, hard, and nodular. They are persistent, only partially reversible, and are often confused with carcinomata.

2. *Ulcerative amœbomata* are penetrating ulcers surrounded by an intense inflammatory reaction. With vigorous treatment these lesions are reversible.

Both types of amœbomata are associated with hard mesenteric lymph-nodes; both cause intestinal obstruction by one or other means. The first type always requires resection of the involved intestine; the second type may resolve entirely, or leave residua requiring resection.

Usually the subacute character of the intestinal obstruction produced by amœbomata gives the surgeon ample time to correct dehydration, empty the upper alimentary tract, and give prophylactic emetine and thalazole.

While these preparatory and therapeutic measures are in progress, frequent re-examination of the patient is imperative in order to catch fleeting clinical signs of importance, e.g., rigidity. In all but the moribund, considerable improvement in the general condition is bound to occur. As in all cases of intestinal obstruction occurring anywhere on the globe, this general improvement must not lull the surgeon into procrastination in cases where clinical judgement dictates that an organic lesion is the underlying cause.

The surgeon, especially one without tropical experience, must beware of the adhesions he will find in the 'colitis abdomen'. These may be filmy, and swept aside easily. Quite often they are firm, and the colonic wall to which they are attached is of the consistency of wet blotting paper. So it comes about that unless the operator proceeds with the utmost gentleness, employing sharp rather than blunt dissection, and keeping well away from the wall of the gut, almost before he realizes it a rent will appear in the colonic wall. An outpouring of fæcal fluid into the peritoneal cavity, always a grave complication, in this instance is almost certain to determine a fatal issue.

The surgeon is also advised to regard the 'colitis abdomen' as a hotbed of latent, if not active, peritonitis. Consequently he should aim at disturbing adhesions as little as possible. Unless there is an obvious band or other easily remediable condition found causing the obstruction, it is often in the patient's best interest to make an early decision to perform terminal ileostomy, for it must be remembered multiple lesions are present throughout the colon.

(syn. **Disconnected**) **Ileostomy** is a splendid life-giving procedure in several surgical complications of colitis. The indications for its performance are :—

1. *Acute Colitis* (including acute relapse).—Persistently raised temperature. Deep over the whole colon. Frequent, foul, bloody stools. Rapid deterioration patient.
2. *Chronic Colitis.*—It may be urgent where threat of, or actual, cachexia, rapid loss large shreds of membrane in stools, much pus, repeated small hæmorrhages, and of pulse and temperature occur.

Complications of Colitis.—Intestinal obstruction, perforation, advancing pericolitis, or perianal conditions not responding to treatment.

4. Failure to respond to specific therapy.

While the operation is rightly looked upon as an emergency procedure, the patient be rushed to the theatre in an unprepared state. For its successful performance be prepared properly, by utilizing emetine and penicillin, sulphaguanidine or sulphatherapy, adjusting fluid balance, correcting hypoproteinæmia and anæmia. When symptoms are present the use of an indwelling gastro-duodenal tube is, of a necessity. The post-operative care should include a continuation of these measures to the patient's needs, as well as suitable chemotherapy. It is the performance without full regard to its accessory requirements which has brought the operadisrepute with some physicians.

ileostomy will often be the last step of an urgent abdominal operation upon a patient from colitis this is an occasion where it pays to hasten slowly, for everything depends a satisfactory stoma being established. The terminal 2–3 ft. (60–90 cm.) of the ileum and palpated for evidences of thickening or inflammation. It is not uncommon that this part of the small intestine is the seat of demonstrable dysenteric infection. of indubitably healthy ileum must be chosen for constructing the stoma. The of terminal ileostomy is described on p. 526.

A close watch must be kept on the skin surrounding the stoma for the appearance of which is likely to be amœbic in origin. With proper care of the stoma and of the underlying condition, this complication rarely supervenes.

Intestinal Obstruction due to Bilharzial Infestation.—While in the foregoing account has been placed on the complications that can, and do, arise frequently from colitis to *Entamœba histolytica*, the fact that other infestations such as bilharzia can give rise and its complications must not be lost sight of. Bilharzial infestation gives rise large or small pedunculated polyps (containing ova) which can often be seen within three months of infestation. Much fibrous tissue is laid down the colonic and rectal walls, and the rigid tubular-type stenosis with acute or chronic of the colon sometimes results. The urgent treatment of such obstruction is it by performing colostomy, cæcostomy, or ileostomy, according to the site of the As soon as the patient has recovered sufficiently, local treatment of bilharziasis be commenced. Retention enemata of 1 G. of tartar emetic in 200 ml. of water, rising G. in 450 ml. daily for six days results in much local improvement. Meanwhile, a course of anthiomaline, in accordance with body-weight, should be administered by In cases where local fibrous contraction of the colon or rectum has occurred. of the affected portion of the bowel is the only method of cure.

Acute Abacterial Plastic Peritonitis.—In the Tropics, when the abdomen is opened for peritonitis, once in 1250 cases no cause for the peritonitis can be found. In circumstances, in all probability the inflammation is due to abacterial peritonitis. greater part of the parietal and visceral peritoneum is covered with a thick, sticky and beneath the latter the intestine is red and congested. In such circumstances is closed. Cultures, smears, and biopsy for ova have so far proved negative. cetin causes the condition to resolve rapidly.

RUPTURE OF THE SPLEEN IN TROPICAL PRACTICE

All over the Tropics this is a frequent vital emergency, and one that calls for full of the surgeon's judgement, manual dexterity, and resourcefulness. The acute spleen is not much enlarged ; it is literally a bag of black, fluid, splenic pulp, and of it is nearly always rapidly fatal. Bilharzial and Bengal splenomegalies often as a result of a trivial accident, as do enlarged spleens due to kala azar and typhoid,

while occasionally, enlarged spleens due to splenic anæmia are encountered. In addition, there are many splenomegalies of unknown origin, the first intimation of which is rupture. In this condition the surgeon is committed to splenectomy, but in view of the unknown pathology of a great many cases of enlarged spleen in the Tropics, he should expect, and will often be taxed with, a very stormy post-operative period.

The delayed type of rupture following an injury causing a splenic hæmatoma (*see* p. 364) is very common, and if a timely correct diagnosis is made and the patient is splenectomized before a catastrophic intraperitoneal hæmorrhage occurs, the prognosis is inconceivably better, as the following figures of my cases substantiate :

Of 46 patients operated upon for splenic hæmatoma, 2 died. (Mortality under 5 per cent.)
Of 91 patients operated upon after the hæmatoma had burst, 65 died. (Mortality 66 per cent.)

The surgeon must constantly be on the watch for cases of splenic hæmatoma (*Fig.* 1521). The history of trauma may be trivial or absent. There is always some initial pain and tenderness in the left hypochondrium. Although the acute pain passes off, it is unusual for the patient to be relatively symptom-free in the interval between the initial rupture and the hæmorrhagic cascade that only too often results in the patient's exodus before surgical aid is forthcoming. This quiet interval, which varies from a few hours to even months, is undeterminable, but it provides an opportunity unequalled in the whole realm of surgery of forestalling inevitable disaster by a timely diagnosis and a well-planned operation.

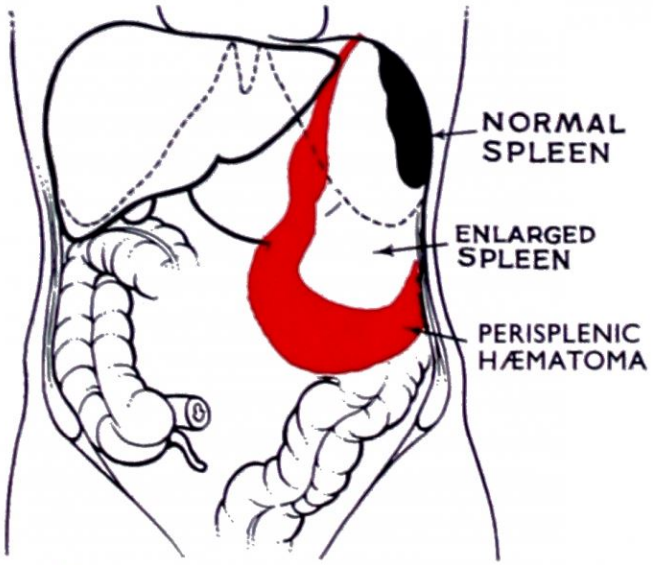

Fig. 1521.—Normal spleen, enlarged spleen, perisplenic hæmatoma. The splenic contour is lost when the capsule has ruptured.

The management and technique of splenectomy for rupture are dealt with on p. 365.

A point of difference between the removal of a spleen of a patient resident in the Tropics and that of splenectomy in temperate climates is that in the former the spleen is not only usually enlarged, but it is adherent. The operation is therefore more difficult, and to forestall probable torrential hæmorrhage in the case of a perisplenic hæmatoma the first step should be ligation of the splenic vessels. This can be accomplished without disturbing the mass of blood-clot by approaching the splenic artery lying along the upper border of the pancreas and the splenic vein situated just behind and below the upper border of the pancreas. The lesser sac is entered either above or below the stomach, whichever is the more convenient. In this way the splenic vessels can be identified easily, and ligated. Frequently it is possible to find a plane of cleavage between the parietal peritoneum and the muscle wall, in which case the spleen can be dissected free with less oozing than if intraperitoneal mobilization of the organ is attempted.

As soon as the spleen has been removed and it has been ascertained that the whole pedicle has been ligated securely, a large warm moist pack is pressed firmly into the cavity, and held there for five minutes. Various bleeding points will now be revealed, and can be ligated. If generalized oozing recommences, sometimes packing the cavity is necessary.

In weak or shocked patients when the spleen is very adherent to surrounding structures, after ligation of the splenic vessels, it is sometimes wise to conclude the operation. In such cases before closing the abdomen, light packing is inserted into and around the seat of rupture. The end of the gauze is brought through a special short left transverse incision. Blood, blood-clot, and necrotic splenic tissue continue to be extruded for a variable time. In 8 cases so treated massive necrosis of the spleen did not occur, and when the patient's general condition had improved, splenectomy was carried out successfully some days later.

Drainage of a Splenic Abscess.—Apart from such blood-borne causes as typhoid, staphylococcal pyæmia, infected hydatid cysts, and amœbic abscesses, this condition is

sometimes due to infection of a splenic hæmatoma; more frequently it is the result of suppurative perisplenitis. Extension of the abscess into the subdiaphragmatic space is not unusual, and when it occurs the treatment is that of a subphrenic abscess. Attempts to confirm the diagnosis by aspiration are to be condemned. Splenectomy is unsuited to all but special cases of central abscess. Exposure of the spleen, centreing the incision over the most tender spot is recommended. Having opened the abscess it should be drained by *soft* rubber tissue, as ordinary drainage tubes are liable to invite serious secondary hæmorrhage from pressure necrosis in the soft, friable splenic tissue. A length of petroleum-jelly gauze can be used in addition to help maintain free drainage.

Secondary splenectomy may be required for secondary hæmorrhage or multiple foci of infection.

Splenic neoplasms are not uncommon in children of the dark-skinned races. They spread rapidly, cause great pain, fever, and local swelling with œdema on invasion of the abdominal wall. Incision of such a swelling in mistake for an abscess will lead to a fungating necrotic sinus, or to a fatal hæmorrhage. If there is the slightest doubt about a splenic abscess it is better to open the abdomen away from the affected area, and to explore; the characteristic white nodules of malignant growth will be seen.

WORMS AS A SOURCE OF SURGICAL EMERGENCIES

Ascariasis.—Nearly 100 per cent of all children admitted to hospital have worms, and 25 per cent of these are admitted for complaints directly due to these parasites. About 10 per cent of the children admitted are surgical cases, 9 per cent of intestinal obstruction and 1 per cent of peritonitis. The incidence among adult patients is much smaller.

Intestinal Obstruction due to Worms.—Because of the usual delay in seeking assistance most of the patients with this condition are admitted in a state of serious dehydration, which accounts for the high mortality (about 10 per cent).

Treatment.—Emptying of the stomach and intestine by means of an indwelling aspiration tube, replacement of fluids intravenously, or subcutaneously with hyaluronidase added, must commence at once. This accomplished, a full dose of 1 *oz.* (30 ml.) of piperazine is injected down the indwelling tube, followed by sufficient normal saline solution to empty the tube of the drug. About an hour later laparotomy is performed (*Fig.* 1522).

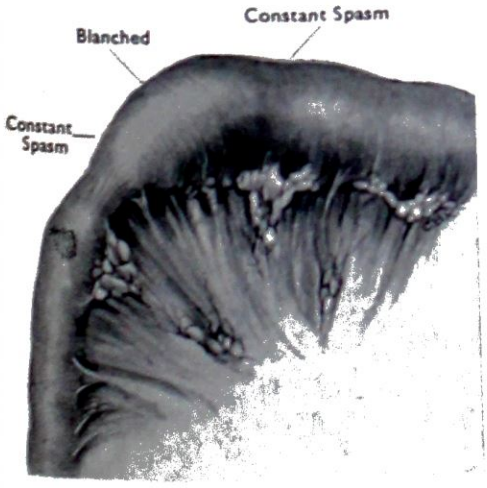

Fig. 1522.—A mass of worms causing obturation of the lumen, but from without constant spasm and blanching of the gut wall alone are visible.

Fig. 1523.—Operative findings in the case of a male patient aged 22, diagnosed as acute appendicitis. As far as could be ascertained the ascaris had penetrated the normal intestinal wall.

Until about five years ago the practice was to incise the intestine and remove the mass of worms; the mortality of this procedure was about 30 per cent. With the advent of piperazine it has now become the practice gently to milk the mass of worms into the cæcum, and there to disperse them, thereby relieving the obstruction and exposing individual worms to the antihelminthic given already. During these manipulations a gentle milking action is employed, for the intestinal wall is very friable, especially in late cases. Of 8 patients with intestinal obstruction due to worms operated upon in one year, incision was only required in one instance, and that patient died.

Should resection be required e.g., for an accompanying gangrenous volvulus or intussusception, the operation should be completed, not by restoration of the continuity of the intestine, but always by a double-barrelled enterostomy, to be closed later.

When intestinal obstruction is incomplete the administration of piperazine via the tube, with fluid replacement, is usually sufficient.

Peritonitis due to Worms is a very grave condition. In children, only 1 in 5 recover. Difficulty in diagnosis due to the absence of rigidity and sometimes the presence of peristaltic sounds is partially responsible for this high mortality. The sites of perforation are the jejunum, ileum (*Fig.* 1523), cæcum, or appendix. Through the perforation many worms escape into the peritoneal cavity, but at laparotomy relatively few of these are recovered. Those left may go on living, and, should the patient survive, they are liable to cause further trouble. A few patients come under observation with subacute signs only. When the abdomen is opened, a condition is displayed that at first sight resembles tuberculous peritonitis. Biopsy of the infected peritoneum will show ova of *Ascaris*.

In tropical practice, ' tuberculous peritonitis ' is not an uncommon diagnosis in children with subacute abdominal complaints. How many of these are due to *Ascaris* ova?

Post-operative Complications in Ascaris-infested Patients are common. Knowledge of the infestation gained from routine pre-operative examination of the stools—a practice never to be omitted, if possible, even in an emergency in the Tropics—will assist the surgeon in dealing with the copious vomiting these patients are prone to develop in the first twenty-four hours after operation. These painful and alarming episodes usually terminate with the vomiting of a number of ascaris worms. Similarly obturation by a mass of worms may explain early post-operative signs of obstruction, or a worm working its way through a suture line may account for peritonitis.

Acute diarrhœa after operation will rightly turn the surgeon's thoughts to that dangerous complication, fulminating colitis, but the episode may end abruptly with the passage of a number of round worms instead of the typical mass of discoloured blood and black slough expected.

I have seen a post-operative lung abscess following aspiration of an adult ascaris during recovery from a general anæsthetic.

Fig. 1524.—An appendix filled with *Enterobius vermicularis*.

Appendicitis caused by Worms.—Entry, or impaction, of a number of ascaris adults into the appendix is a not uncommon cause of acute obstructive appendicitis in both children and adults. In children *Trichuris trichiura* (Whipworm), and *Enterobius vermicularis* (Pinworm), (*Fig.* 1524) may cause symptoms and signs indistinguishable from those of appendicitis.

Other Abdominal Emergencies due to Worms.—In adults acute obstructive jaundice from lodgement of a worm in the common bile-duct is encountered from time to time. A mesenteric cyst found to contain worms is also a cause of intestinal obstruction. Perforation of the œsophagus into the pleura, due to *Ascaris*, has been reported.

Acute Abdominal Emergencies due to Ankylostome Infestation.—

A Hindu male, aged 25, was admitted six hours after sudden onset of acute upper abdominal pain. He gave a history of previous dyspepsia with remissions. The temperature was 97° F. (36° C.) and the pulse 120. Abdominal rigidity was so evident that the diagnosis of perforated peptic ulcer seemed assured. As he came from an ankylostome district, the possibility that the symptoms were due to this parasite was considered. His R.B.C. was 3,000,000 per cu. mm. and the Hb 55 per cent. The stools revealed a comparatively small number of ankylostome ova. At a second clinical examination the rigidity was still the same. Operation was decided upon. There was no perforation, but the duodenum was œdematous and of a dull red hue. Three days after the operation he was given 4 ml. of tetrachlorethylene in 2 fluid oz. (60 ml.) of a saturated solution of magnesium sulphate, with 1 ml. of oil of chenopodium shaken to an emulsion. This caused an immense number of worms to be passed per rectum, after which the symptoms abated.

On two other occasions patients with a profuse display of ova in the fæces were found on laparotomy to have perforated peptic ulcers. As a rule, it is not particularly difficult to diagnose the abdominal crises of ankylostome infestation, provided it is known that the patient comes from a district where the disease is rife. When rigidity, as opposed to tenderness, is present and persists for over an hour, it is imperative to explore.

Ankylostome infestation may simulate a bleeding peptic ulcer. Large tarry stools are passed, but the stools contain such a mass of eggs that the cause of the bleeding is seldom in doubt. In any case, whether the bleeding arises from peptic ulceration or ankylostomiasis, the question of immediate operation does not arise, but blood transfusion is indicated, just as in a case of bleeding peptic ulcer, a final decision as to correct procedure being arrived at when the patient has responded to blood replacement.

AMŒBIC HEPATITIS AND ABSCESS

The tendency to regard amœbiasis as a tropical disease has resulted in a number of cases being overlooked in temperate zones; amœbiasis occurs in all parts of the world. Another important point is that even in the Tropics fully a quarter of the cases of liver abscess encountered are not amœbic in origin, but due to helminths, bacteria, or cholangitis. Amœbic abscess occurs in children and is often overlooked, with fatal consequences.

Pain and tenderness over the liver, accompanied by fever, bring many patients with amœbic hepatitis to the physician before abscess formation has occurred. In this stage emetine gr. 1 (65 mg.) at once, with gr. 1 daily for twelve days; or chloroquin 600 mg. at once, and 300 mg. daily for 21 days, will cure the condition at this stage, which is probably only in the nature of a reaction to noxia reaching the liver from the intestinal lesions, rather than to actual lodgement of amœbæ causing diffuse hepatitis.

Fig. 1525.—Typical 'chocolate' pus aspirated from a liver abscess.

Principles in Treatment of an Amœbic Liver Abscess.—

1. Aspiration of the abscess (*Fig.* 1525) should be attempted in every case. It is not always easy to locate, and in about 25–40 per cent of cases either the needle fails to enter the abscess cavity or, if entered once, it is not located on subsequent occasions. In only 40 per cent of cases is the abscess solitary. In about half the cases seen the abscess has ruptured, or does so shortly afterwards—two-thirds into the lung or pleura, one-third into the peritoneal cavity, and an occasional one into the pericardium. It is to be borne in mind that of those patients suffering from amœbic abscess of the liver who die from this condition, over half succumb from abdominal complications of which bursting of the abscess into the peritoneal cavity is the most common—hence the importance of evacuating the pus before this catastrophe occurs. Secondarily infected abscess, and *abscess necessitans*, should be treated by aspiration in the first instance. Secondary infection can only be discovered by examining the pus removed at aspiration. Undetected bacterial infection is particularly lethal.

2. Radiography (anteroposterior and lateral positions) reveals a shadow almost pathognomonic of liver abscess.

3. Emetine (10 mg. per kg. = $\frac{1}{6}$ gr. per 2 lb. body-weight) should be administered for three days before aspiration is carried out.

4. After aspiration a full course of emetine (650 mg. per 68 kg. = 10 gr. per 150 lb.) with suitable treatment for bowel amœbiasis must be given.

Recent comparison of the results of treatment by emetine with those of chloroquin suggests that while in their immediate effects there is little difference, in their more remote effects chloroquin is inferior in the eradication of the parasites. The mortality among patients treated by chloroquin alone is greater than among those treated by emetine alone.

Aspiration.—Needle exploration should be carried out with a No. 13 exploring needle 6 in. (15 cm.) long. When an abscess is located, such liquefied material as can be aspirated is removed, and measured. The needle is left in place, and a second needle employed to seek a second abscess; if one is found the same procedure is repeated, after which, if considered necessary, a third abscess is sought in the same way. Where an abscess has been located a No. 2 (1 mm. bore) polythene tube is passed through the needle into the abscess cavity, and the needle withdrawn. A quantity of a preparation of streptokinase-streptodornase equal to the amount of pus aspirated is instilled into the abscess cavity. The tube is then

sealed and fixed in place. Twenty-four hours later the now liquefied pus is aspirated through the tube, and a further equivalent amount of streptokinase-streptodornase preparation instilled. In this way the whole contents of the abscess cavity can be evacuated in about five to six days. The polythene tube, or tubes, is then withdrawn.

Aspiration must be carried out with full aseptic precautions in an operating theatre. Some form of closed technique will prevent secondary infection, if such is absent. When secondary infection is present aspiration and, according to the organism present, the instillation of 250,000 units of crystalline penicillin in the cavity, together with full doses of systemic penicillin therapy, will often overcome established secondary infection. Even if this plan fails, and drainage of the abscess becomes necessary, as a result of these conservative measures the patient's general condition is usually benefited.

Technique.—

When the abscess is located in the anterior portion of the liver the needle should be inserted *just* beneath the anterior costal margin 2 in. (5 cm.) from the middle line (*Fig.* 1526 A).

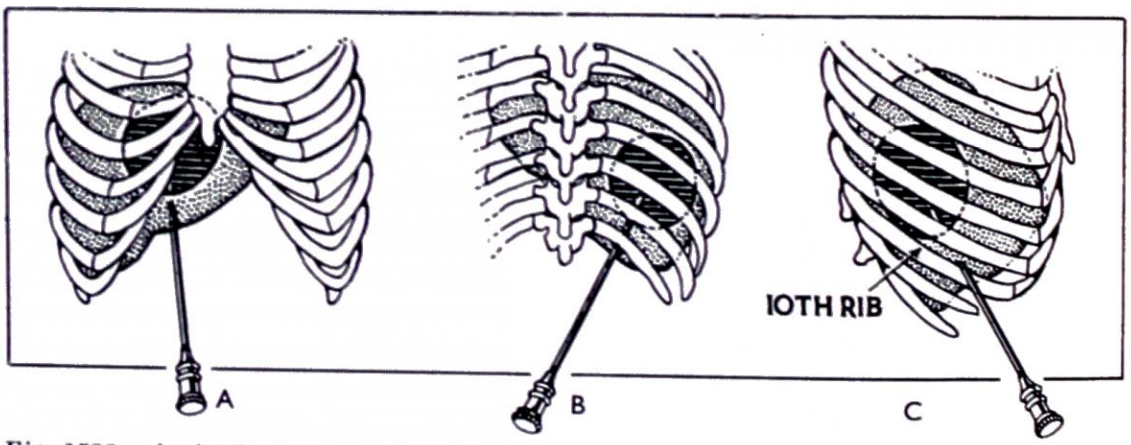

Fig. 1526.—Aspiration of an amœbic hepatic abscess. A, In the anterior part of the liver. B, In the posterior part of the liver. C, Located near the dome of the diaphragm.

When the abscess is located in the posterior portion of the liver, with the patient prone and lying over a pillow, the needle is directed superiorly and anteriorly from beneath the twelfth rib (*Fig.* 1526 B).

When the abscess is located near the dome of the liver the needle should be inserted through the tenth intercostal space in the anterior axillary line (*Fig.* 1526 C). A right-sided abscess in this position is most frequent.

Abscesses in difficult positions should be approached by an open operation and the polythene tube inserted under vision, the end being brought out through the incision, which is then closed. Treatment then proceeds as outlined above.

Spontaneous Rupture.—

When the pleural cavity is involved aspiration of the pleural collection of pus and of the contents of the abscess cavity proper, together with the use of penicillin and emetine therapy, will usually enable the surgeon to avoid an open operation. If an empyema develops, the principles of treatment described on p. 708 should be followed.

When the abscess has burst into the bronchus the aid of postural drainage should be invoked, in addition to the measures already indicated.

Bursting into the peritoneal cavity calls for laparotomy. Having aspirated and mopped up the pus in the peritoneal cavity, a needle should be passed through the parietes into the liver, and the liver abscess emptied of any remaining contents. While every effort should be made to avoid open drainage of the liver abscess, drainage of the peritoneal cavity is usually advisable.

Open Drainage is now rarely called for. Suitable technique is suggested on p. 711 and p. 719.

EMERGENCIES ARISING FROM PRIMARY CARCINOMA OF THE LIVER

Patients with primary carcinoma of the liver sometimes present with acute abdominal symptoms due to (*a*) hæmorrhage into the carcinoma ; (*b*) rupture of the neoplasm through the liver capsule. By the time the rapidly growing neoplasm has become thus complicated,

nothing useful can be done to avert a fatal issue. Packing can be resorted to as a temporary expedient.

SOME ANO-RECTAL EMERGENCIES

Alarming Rectal Hæmorrhage.—Too easy acceptance of internal hæmorrhoids as the source of hæmorrhage has often led to disaster. This is particularly true in the Tropics, for the majority of persons who have long resided in hot climates have at least some degree of varicosity of the inferior hæmorrhoidal plexus. Frequent causes of considerable bleeding are bacillary (*Fig.* 1527), amœbic (*Fig.* 1528), and malarial (subtertian) colitis. In certain

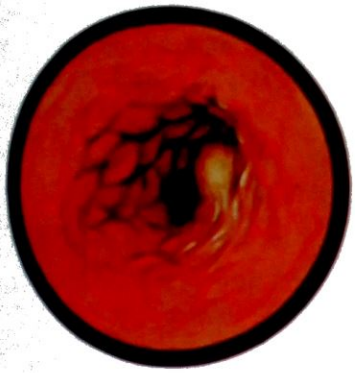

Fig. 1527.—Sigmoidoscopic appearance in bacillary dysentery. (*After M. A. Arafa.*)

Fig. 1528.—Sigmoidoscopic appearances showing ulceration in amœbic dysentery. (*After M. A. Arafa.*)

parts of the world bilharzial (in the lower bowel) and ankylostome (in the upper bowel) infestations must also be taken into account. Ankylostome infestation can cause copious bright-red hæmorrhage, b t more often it is a source of melæna (*see* p. 1099). Typhoid infections are more severe in the Tropics than in temperate climates, and alarming hæmorrhage may also be due to this cause (*see* p. 492).

Hæmorrhage due to Dysenteric Infections.—The hæmorrhages are either severe and single, or repeated and small, the former being commoner in amœbic infections. A single large hæmorrhage may herald or accompany perforation of the colon.

Fig. 1529.—Ulcer with fistulous track 8 in. (20 cm.) to the rectum and containing amœbæ. Healed with emetine and quinine irrigations of the track.

Treatment: Important as it is to obtain accurate information as to the site of origin and cause of the bleeding, treatment should be instituted at once, and follows the usual precepts in the management of bleeding peptic ulcer. Heroic efforts to reach the bleeding point are out of the question, unless diagnostic sigmoidoscopy, which should be performed, reveals it to be in the rectum, when after hot douching fulguration of the bleeding point with a cautery or a coagulating diathermy is excellent practice. An initial large single hæmorrhage usually responds to continuous-drip blood transfusion. Further hæmorrhages, especially if in diminishing amounts, should not be taken to imply that the bleeding is not coming under control; they are to be expected. Small repeated hæmorrhages are more persistent; treatment seems only to control bleeding temporarily. It is particularly in these cases that investigation to elucidate the source and cause of the hæmorrhage must not be delayed. While awaiting the result of these, and the commencement of specific therapy, I have found the old-fashioned starch and opium enema—2 oz. (60 G.) of starch made up to a paste with warm water until it just flows easily through a rectal tube, pulv. opii being added in the proportion of 1 gr. (0·06 G.) to each ounce of the starch used—invaluable. The patient is

placed on his right side with the foot of the bed raised. A sigmoidoscope is passed as far as possible, and through it a long wide-bore rubber tube is inserted into the colon. The warmed starch and opium paste is gravitated in fairly rapidly. The sigmoidoscope, with the tube, is withdrawn and the patient left in the position indicated for one hour before he is turned on to his back. As in all cases of hæmorrhage, a sedative is essential ; a large dose of one of the barbiturates is to be preferred, because morphine depresses the respiratory centre. I have not found cæcostomy or ileostomy of any value in the treatment of hæmorrhage from the colon or rectum. On the other hand the ' pus and blood ' stool seen so frequently during intervals between small repeated hæmorrhages of the second type, is an urgent indication for the operation of terminal ileostomy (*see* p. 526).

Perianal and Ischiorectal Abscesses and Fistulæ frequently have their origin in the rectum or even the lower left colon as a fistulous track from amœbic ulceration, or schistosomiasis of the colon, bladder, or urethra. If attempts to heal the fistula by operation are doomed to failure in these cases, local and general specific therapy is usually successful (*Fig.* 1529).

ACUTE RETENTION OF URINE DUE TO SCHISTOSOMIASIS

This is a common emergency in countries where the disease is rife. There may or may not be a history of previous dysuria. Sometimes the penis and perineum feel indurated ; more often rectal examination reveals a hard, ill-defined induration in the neighbourhood of the base of the bladder. However well it is lubricated, a urethral catheter does not pass easily into the bladder.

Treatment.—Frequently suprapubic drainage of the bladder is required. A cystoscope passed through a suprapubic stab incision in the exposed, but as yet unopened, bladder may reveal characteristic lesions. The urine must be examined for ova.

In a number of instances treatment with an antimony preparation (e.g., anthiomaline) causes the lesions to resolve, sometimes with restoration of free micturition. At others the resulting fibrosis of the prostate calls for transurethral resection to re-establish unimpeded micturition. Cases complicated by perineal fistulæ can only be cured by a block dissection of the fistulous tracks and that part of the urethra bearing the stricture.

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CHAPTER XCIII

APPENDIX

INTRAVENOUS FLUID THERAPY

Thrombophlebitis following Intravenous Infusions.—Clear evidence is provided by the Sub-committee[1] appointed to investigate the subject that the incidence of thrombophlebitis is much lower when plastic tubing is employed. Intravenous infusions given through red rubber tubing, and lasting for more than 12 hours, predispose to thrombophlebitis.

Modified Intravenous Drip Needle.—F. K. Boston[2] has had a hole bored in the shaft of the needle near its tip on the side away from the bevel (*Fig.* 1530) which obviates blockage of the needle, owing to its bevel coming up against the vein wall. The hole can be bored by any competent hospital-workshop technician.

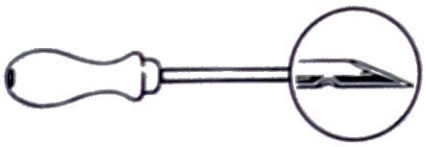

Fig. 1530.—Intravenous needle with an accessory eyelet to prevent blockage.

A Catheter for Exchange Transfusion in Newborn Infants.—A rounded-tip catheter[3] designed for insertion along the umbilical vein is now available. In addition to the suitable tip, its advantage over polythene tubing (P. L. Mollinson and J. P. M. Tizard)[4] is its greater flexibility.

Supplying a High-calorie, Non-protein Diet by the Intravenous Route.—W. H. Taylor[5] found that drip infusion into the inferior vena cava proved adequate for giving 50 per cent dextrose solution for periods as long as 11 days, but on necropsy in 3 patients so treated antemortem thrombosis of the saphenous and external iliac vein was found, extending into the inferior vena cava in 2 patients, despite the addition of heparin to the fluid entering the vein. It was concluded that drip infusions into the inferior vena cava are potentially hazardous, and should not be used if there is the smallest chance of maintaining a reasonable intake of fluid and at least 1000 calories a day, either by mouth, a stomach tube, or through a smaller vein (e.g., the saphenous or cephalic).

BLOOD TRANSFUSION

R. A. Zeitlin[6] has designed insulated containers[7] in which 2 (*Fig.* 1531) or 6 bottles of blood, having been removed from the refrigerator at 4° C. (39° F.), can be kept for three hours without reaching a temperature higher than 8° C. (46° F.).

Fig. 1531.—Zeitlin's insulated container for storing blood after it has been removed from the refrigerator.

A useful guide to the blood requirements in multiple injuries is :—

	Blood Deficit
Single fractures ..	20 per cent (2 pints) (1136 ml.)
Two fractures ..	20–40 per cent (2–4 pints) (1136–2272 ml.)
Three fractures ..	40 per cent (4 pints) (2272 ml.)

M.R.C. Publications, No. 277.[8]

Plastic Bags for Storing and Transfusing Blood have been issued by some Centres in the U.S.A. for a number of years, and a great stimulus to their more general use resulted from the very favourable report received from the Army Medical Services in the Korean War. The advantages claimed for plastic bags are less weight and smaller volume for storage, and particularly freedom from air embolism in pressure transfusion. H. A. F. Dudley and his colleagues[9] in Edinburgh have given these bags a trial. The only advantage they noted was the freedom from the danger of air embolism if pressure transfusion was considered necessary.

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[1] Medical Research Council's Subcommittee Report, *Lancet*, 1957, **1**, 595.
[2] Boston, F. K., *Ibid.*, 1956, **1**, 786.
[3] Edwards Surgical Supplies, 83, Mortimer Street, London, W.1.
[4] Mollinson, P. L., and Tizard, J. P. M., *Lancet*, 1957, **2**, 1285.
[5] Taylor, W. H., *Ibid.*, 1957, **2**, 703.
[6] Zeitlin, R. A., *Ibid.*, 1953, **2**, 379.
[7] Moulded Components (Jablo) Ltd., Mill Lane, Waddon, Croydon, Surrey.
[8] Grant, R. T., and Reeve, E. B., 1951, *Observations on the General Effects of Injury in Man*, M.R.C. Publications, No. 277. H.M.S.O.
[9] Dudley, H. A. F., et al., *Lancet*, 1958, **1**, 294.

Massive Blood Transfusion for Severe Hæmorrhage.—Despite much progress, the treatment of severe hæmorrhage is still far from satisfactory. A relatively high proportion of patients are lost for various reasons. For instance, the death-rate from severe hæmorrhage from a gastric or duodenal ulcer is still about 12 per cent. It is not unusual to observe, after an initial improvement, a gradual deterioration in the patient's condition in spite of continued transfusion. Often this is accompanied by a considerable rise in venous pressure, i.e., cardiac overload. As a result of experiments in more than 500 dogs, P. Firt and L. Hejhal,[1] of Prague, seem to have proved that almost invariably the overloading and failure of the heart during rapid intravenous transfusion is due not to the transfusion *per se*, but to the amount of citrate solution given simultaneously. Citrate, even in small doses, produces vasoconstriction of the pulmonary vascular bed, and in larger doses depresses myocardial activity, both effects leading to cardiac overloading and failure. If 10 ml. of a 10 per cent solution of calcium gluconate is given before the transfusion, and a further 15 ml. intravenously after the first 100 ml. of blood has been gravitated, this suffices to neutralize the effects of the citrate for 100 ml. of blood. A further 10 ml. of 10 per cent calcium gluconate accompanies every additional 500 ml. of blood. Procaine, 0·6 ml. per kg. of bodyweight of a 0·25 per cent solution is given at the same time as the calcium gluconate before starting the transfusion. A continuous drip of a 0·25 per cent solution is then run in at the rate of 5 drops per 10 kg. per minute. The combined action of the calcium and the procaine neutralizes completely the baneful effect of the citrate.

The same principles apply also to retrograde arterial transfusion.

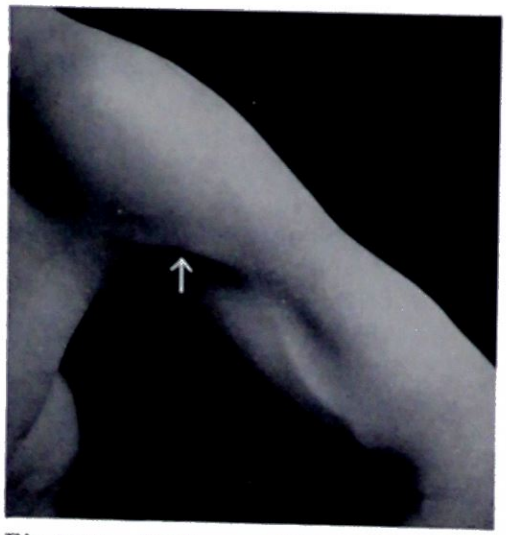

Fig. 1532.—Surface marking of the cephalic vein. (*Mr. E. G. Dolton.*)

Rapid Blood Transfusion through the Cephalic Vein.—E. G. Dolton[2] has cannulized the cephalic vein (*Fig.* 1532) with the gold-plated cannula illustrated in *Fig.* 25 in over 100 cases in 12 months, and has been enabled to administer 1 pint (568 ml.) of blood in four minutes without any form of pressure. As a result of this experience he recommends the method strongly to those who are engaged in major surgery and are not blessed with many assistants. The only disadvantage has been that on 9 occasions the cephalic vein has been absent from its normal situation. Such patients have a small transverse subcutaneous vein across the front of the shoulder, and he does not recommend exploration of the cephalic vein when such veins are present. After cannulization, he inserts a distal skin stitch which holds the cannula in its second loop, and a proximal skin stitch which, passing under the vein, is left long and untied until after the cannula has been removed.

Reactions after Transfusion.—Most hospitals report an incidence of 5 per cent pyrogenic reactions and 1 per cent allergic reactions (Annot., *Lancet*[3]).

Contaminants in Stored Blood.—The possibility that a patient may receive infected blood still remains one of the most serious and the least appreciated of the many dangers of blood transfusion. It is probable that this catastrophe is not as rare as the literature suggests, owing to understandable reluctance to publicize unfortunate accidents. M. G. McEntegart[4] gives details of 2 cases where during blood transfusion the patient became restless, developed rigors, and died. In one, at necropsy the only macroscopic abnormal findings were submucosal petechiæ in the ileum and a hæmorrhage into one adrenal gland. In both cases the suspected bottles of blood had been at room temperature for some hours. Both were found to be contaminated.

R. J. Drummond,[5] Director of the Welsh Regional Blood Transfusion Service, suggests that a possible source of contamination is that when the blood-taking needle is withdrawn from the cap of the blood bottle a film of blood may track through the cap. From the film of fluid beneath the metal screw cap organisms could grow along the film of blood left in the track and so enter the bottle. After collection, the surface of the cap and the diaphragm should be wiped dry with sterile gauze.

Intravenous Preparations of Vitamin K_1, e.g., mephyton,[6] are now available, and should it be necessary to raise the prothrombin level rapidly, large doses (e.g., 100 mg.) can be given intravenously. Following such injections, the prothrombin level has been known to rise to normal within 12 hours or less.

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[1] Firt, P., and Hejhal, L., *Lancet*, 1957, **2**, 1132.
[2] Dolton, E. G., *Ibid.*, 1955, **1**, 1052.
[3] Annotation, *Ibid.*, 1955, **2**, 180.
[4] McEntegart, M. G., *Ibid.*, 1956, **2**, 909.
[5] Drummond, R. J., *Ibid.*, 1956, **2**, 1267.
[6] Merck Sharp & Dohme Ltd., Hoddesdon, Herts.

of Blood-platelets.—Some blood transfusion centres supply blood-platelet concen- in cases of thrombocytopenic purpura. The benefit of the donor platelets often only a matter of a few hours, but, in cases where cortisone or ACTH fails a remission, transfusion of platelets often stays the hæmorrhage sufficiently for to be rendered fit to undergo urgent splenectomy with comparative safety (J. L. Pallis[1]).

Blood Transfusion in small children is praised both by K. H. Tallerman[2] and [3] The latter has given it an extended trial in Nairobi, where often conditions for blood transfusion into a vein. The blood must be cross-matched in the The intraperitoneal injection is made 1 in. (2·5 cm.) above the umbilicus, after cleansing the skin of the abdominal wall. The skin is grasped between the thumb and the fore- left hand and traction is exerted on it while the needle is pushed slowly and firmly cavity with the right hand. Immediately the needle has penetrated the skin clip on the giving set is opened fully, and as soon as the blood flows in a steady stream assumed that the peritoneal cavity has been entered. The transfusion is completed to 20 minutes and the amount of blood transfused at one time is between 60 to 300 ml. cells labelled with radio-active chromium into the peritoneal cavity, Tallerman and at the London Hospital have proved that the blood enters the peripheral circulation.

HÆMOPHILIA

Extraction in Hæmophilia and Christmas Disease.—J. A. Orr and A. S. Douglas[4] on 32 dental extractions in patients with hæmophilia or Christmas disease. The most time for hæmorrhage to occur is the third day after extraction, but in one case it was as days after the extraction. It is inadvisable to extract more than two teeth at a time. protective dental splint with a black gutta-percha inlay opposite the site of was employed in all cases. Two pints (1140 ml.) of fresh frozen plasma were infused before the extraction, and on the occurrence of bleeding, if this was severe enough. antibiotic therapy was given for five days from the time of the operation. Wishart et al.[5] describe a similar routine in 16 hæmophilics. They have, however, by come to the conclusion that it is safer to extract up to six teeth at one session, rather the patient who has to have a considerable dental clearance to multiple operations. succeeding operation the administration of AHG (antihæmophilic globulin) by plasma increasingly less effective.

SHOCK

in Shock due to Visceral Perforation. Three patients with visceral perforation perforated colonic diverticulitis and one with a perforated peptic ulcer) were in profound and all responded only temporarily to intravenous infusion of dextran, followed by blood . After operation, all were placed upon noradrenaline infusion, with remarkable and improvement. In reporting these cases, D. D. Davies[6] remarks that if the systolic remains below 70–80 mm. Hg for more than one to two hours, the chances of of a seriously ill patient are small. Therefore in such cases every endeavour must be the systolic blood-pressure to over 90 mm. Hg as soon as possible. The paramount of adequate oxygenation in shocked patients is also stressed.

Necrosis in Noradrenaline Therapy. G. E. Heard[7] draws attention to the frequency with skin necrosis follows noradrenaline fluid therapy. The best method of administering is through a polythene tube passed well up so that its tip lies in a vein of much greater than the one through which the tubing is inserted. The early administration by multiple injections of piperoxane hydrochloride in a dilution of 5 mg. in 20 ml. of normal saline is often followed by a quick return of the skin in the ischæmic area to normality. The is free from danger. Piperoxane elevates the blood-pressure only in the presence of a . (L. Pelmer ;[9] P. Dutton, and R. E. Forgie.[9])

Treatment of Shock by Intravenous Procaine. A. Brodetti[10] reports most favourably on of shock by intravenous procaine. The use of intravenous procaine reduces, or the necessity for giving morphine. Some striking improvements in the blood-pressure to 120) were observed following the injection, but the beneficial effect was maintained

[1] Pallis, J. L., *New Engl. J. Med.*, 1956, **225**, 541.
[2] Tallerman, K. H., *Brit. med. J.*, 1958, **1**, 338.
[3] Macdougall, L. G., *Ibid.*, 1958, **1**, 139.
[4] Orr, J. A., and Douglas, A. S., *Ibid.*, 1957, **1**, 1035.
[5] Wishart, C. et al., *Lancet*, 1957, **2**, 363.
[6] Davies, D. D., *Brit. med. J.*, 1957, **1**, 261.
[7] Heard, G. E., *Brit. J. clin. Prac.*, 1957, **4**, 260.
[8] Pelmer, L., *J. Amer. med. Ass.*, 1957, **165**, 444.
[9] Dutton, P., and Forgie, R. E., *Brit. med. J.*, 1958, **1**, 644.
[10] Brodetti, A., *Gior. ital. Chir.*, 1951, **7**, 551.

only for about half-an-hour; this, however, in many instances gives time for the introduction of a plasma volume-expander or blood to prevent relaaps. Procaine is rapidly destroyed in the circulation, so there is no danger of an accumulative effect. Brodetti injects 10–20 ml. of a 1 per cent solution of procaine slowly, taking at least two minutes over each ml. A. Berner[1] places 2 ml. of a 2 per cent solution of procaine in a litre flask of intravenous fluid. He does not recommend more than 2000 ml. of this mixture being given. Intravenous procaine should not be given to patients who are in a state of malnutrition, or to those with liver disease, and succinyl-choline should never be administered as a relaxant in the presence of intravenous procaine. All these factors interfere with the chemical breakdown of procaine in the body (D. Smart[2]).

Lightning Shock.[3]—The brain seems to be the most sensitive organ to the effects of lightning and electric shock. For this reason artificial respiration should be given to those apparently dead from lightning or electric shock. However, as soon as possible a physical examination is also necessary, since other potential fatal lesions, such as fracture of the skull, may result from the patient being hurled to the ground or on to another hard object by the force of the current. It is surprising that those who survive being struck by lightning do not often suffer permanent or striking disability. Minor sequelæ, such as headache and paræsthesia, are commonplace.

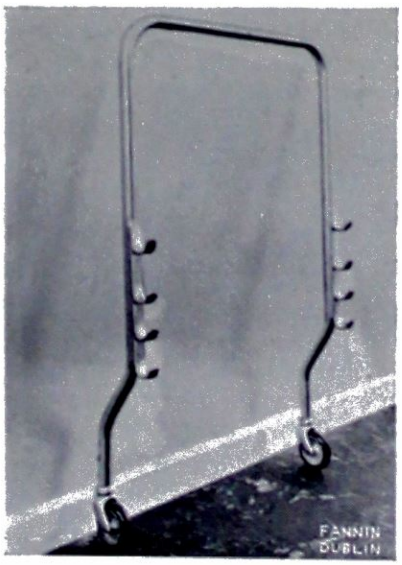

Fig. 1533.—The Meath Hospital bed elevator.

The Meath Hospital Bed Elevator[4] (*Fig.* 1533) is made of tubular steel and is fitted with ball-bearing castors. A nurse can easily raise single-handed either the foot or the head of the bed to the desired height, as directed. It fits all standard hospital beds.

CARDIAC RESUSCITATION

Cerebral Œdema after Cardiac Resuscitation.—Sucrose not being available, J. C. A. Raison[5] injected 25 ml. of 50 per cent dextrose. The dosage was repeated hourly for 5 hours, and slow but steady improvement took place. Sucrose is much to be preferred because it does not produce a secondary rise of pressure of the cerebrospinal fluid, as does dextrose. In addition, up to 50 per cent of the dextrose given may be stored in the body tissues, thus reducing its dehydrating value on the brain. Also, it can cause tissue œdema when water is given later. In a second case sucrose was employed, orders having been given for this solution to be always available in the operating theatre. Raison also comments on the inestimable value of tracheostomy in these cases of cerebral œdema. It enables the patient to be nursed in a sitting position while still unconscious, and remarkable improvement followed the adoption of this position, which probably aids cerebral dehydration.

Intracardiac Blood Transfusion for Cardiac Arrest.—J. I. Lawson[6] reports a successful case. The patient was a man of 73 years of age who became pulseless after a spinal anæsthetic. After the usual resuscitative measures failed to improve matters, subdiaphragmatic cardiac massage was performed without avail. A long wide-bore needle was then inserted into the heart through the fourth intercostal space 2½ in. (6·25 cm.) from the middle line, and 500 ml. of blood was pumped into the left ventricle in three minutes. The heart commenced to beat vigorously, and progress was maintained.

ACUTE NON-SPECIFIC INFECTIONS

Antibiotic-resistant Organisms.—Of 1346 strains of *Str. pyogenes*, all proved sensitive to penicillin (E. J. L. Lowbury).[7] However, in mixed staphylococcal and streptococcal infections, staphylococcal penicillinase produced by penicillin-resistant staphylococci, can prevent successful penicillin therapy for streptococcal infections (J. D. A. Gray).[8] Occasionally streptococci are isolated which have not only broken through the penicillin barrier, but are moderately resistant to both aureomycin and oxytetracyline. For these, erythromycin (which should not be used if any other antibiotic is effective) has, until recently, proved both non-toxic to the patient and lethal to the said streptococci. Now erythromycin-resistant organisms have emerged (E. J. L. Lowbury).[9]

Steroids in Septicæmia.—Steroids, plus the *correct* antibiotic, led to the resolution of some cases of septicæmia from a focus in the lungs or beneath the diaphragm by removing, as it were, the

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[1] Berner, A., *Helvet. chir. Acta*, 1949, **16**, 372.
[2] Smart, D., personal communication.
[3] Annotation, *Brit. med. J.*, 1957, **2**, 1168.
[4] Fannin & Co. Ltd., 41 Grafton Street, Dublin.
[5] Raison, J. C. A., *Lancet*, 1957, **2**, 984.
[6] Lawson, J. I., *Brit. J. Anæsth.*, 1956, **28**, 336.
[7] Lowbury, E. J. L., personal communication.
[8] Gray, J. D. A., *Lancet*, 1956, **2**, 132.
[9] Lowbury, E. J. L., *Proc. R. Soc. Med.*, 1958 (in the press).

barrier, and allowing the antibiotic access to the infected focus. This treatment is not without risk, but clinical circumstances may, on occasion, justify its trial. (W. F. Walker.[1])

Staphylococcal Septicæmia (Penicillin-Resistant) is becoming more common in neonates (H. Wallis[2]), and, as a complication of some other disease in adults. According to D. Rogers[3] the staphylococcus appears to have displaced the pneumococcus as the invader in terminal illness.

Abscess of the Breast.—Masking of signs of inflammation by antibiotics not infrequently leads to undue delay in opening a breast abscess (*Fig.* 1534), with a resulting excessive destruction of mammary tissue, sometimes amounting to a functional mastectomy. Now and then the excessive fibrosis thus induced and the absence of tenderness has caused the diagnosis to be revised in favour of carcinoma. Another disadvantage of undue delay is the deposition of a wealth of exuberant granulation tissue on the walls of the abscess: this has brought about profuse hæmorrhage when the abscess is incised. To obviate these untoward possibilities, when in doubt as to the presence of pus, the indurated mass should be explored with a needle and syringe under general anæsthesia, and incised if pus is found.

Fig. 1534.—Breast riddled with abscesses. No pain or other constitutional symptoms. A fool's paradise created by much penicillin and little clinical acumen. The left breast had been removed for fibro-adenosis six years previously.

Treatment of Pseudomembranous (Post-operative) Enterocolitis (Staphylococcal Enterocolitis).—There has been a disconcerting increase in the incidence of this alarming, and frequently fatal, variety of enterocolitis, an increase that coincides with the advent of broad-spectrum antibiotics. Nonetheless, post-operative pseudomembranous enterocolitis was known in the pre-antibiotic era; thus the oral administration of antibiotics cannot be held entirely responsible yet there is little doubt that it accounts for the increased frequency of the condition.

Aetiology.—Prevailing opinion indicates that the initial, and occasionally the only cause is intense vasoconstriction of intestinal blood-vessels consequent upon shock; this vasoconstriction imperils the vitality of the intestinal mucous membrane to such an extent that some of its cells perish. The other cause (which in some instances operates single-handed) is suppression of normal intestinal flora by antibiotics resulting in a preponderance of one or more species that assumes the role of a pathogen. Resistant staphylococci overwhelmingly predominate, but on occasions *B. proteus* cannot be exonerated.

Pathology.—In the most severe form, areas of necrotic mucous membrane are shed, or they remain as a pseudomembrane attached to the deeper layers of the intestinal wall. The lower ileum is chiefly affected.

Clinical Features.—The diarrhœa is often cholera-like, and commences abruptly or, in patients undergoing gastro-intestinal aspiration, the aspirate becomes foul and alarmingly excessive. Collapse in the peripheral circulation follows so rapidly that without effective treatment death may occur within 72 hours. Advanced age, lowered resistance, and malnutrition each can play an important part.

Treatment.—

First the broad-spectrum antibiotic having been discontinued, no effort is spared to restore the blood-pressure and the fluid and electrolytic balance. The amount of fluid loss in these cases is prodigious (10–20 l. per day) and this must be replaced. The administration of noradrenaline in adequate doses to maintain blood-pressure is important. Erythromycin is the most effective drug against staphylococcus, although there is a rapid increase in the number of strains resistant even to this antibiotic. Bacitracin can also be used. When the organism is isolated and its sensitivity investigated, the bacteriologist's report should influence the antibiotic given.

Secondly, the great loss of protein requires blood transfusion. The caloric requirements can be met in part by intravenous 10 per cent dextrose. The danger of disseminating the infection precludes the use of ACTH in the early phases, but it can be administered with safety and advantage when culture of the stools indicates that infection has been controlled. The oral administration of a preparation containing lactobacillus helps in the restoration of the normal intestinal flora (Hamilton Bailey and McNeill Love[4]).

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[1] Walker, W. F., personal communication.
[2] Wallis, H., personal communication.
[3] Rogers, D., *Ann. intern. Med.*, 1956, **45**, 748.
[4] Bailey, Hamilton, and Love, R. J. McNeill, *A Short Practice of Surgery*, 11th ed., 1958. London: H. K. Lewis.

Post-operative Wound Infection.—At the Edinburgh Royal Infirmary in a three-months' survey of the operation wounds of 673 patients, it was found that in 9·8 per cent, serious wound infection occurred and there was an additional 6·3 per cent of trivial infection. In no instance was death attributable to infection of the wound. J. S. Jeffrey and S. A. Sclaroff[1] came to the conclusion that the great majority of the infections originated in the operating theatre, and only a minority were due to cross-infection in the wards.

ACUTE SPECIFIC INFECTIONS

Tetanus.—The urgent problem of established tetanus is to control the convulsions. As R. A. Lewis et al.[2] state, in spite of the introduction of potent antitoxin, antibiotics, various relaxants, general anæsthesia, tracheostomy, and intermittent positive-pressure respiration in the management of tetanus, the problem of preventing death in severe cases is still unsolved.

R. Batten[3] reviews some of the modern methods of treating severe tetanus thus :—

Central depressants are likely to depress respiration, but comparatively large series of cases have been reported without a death.

Relaxants, advocated by so many workers in recent years, are likely to be needed in such large doses that the diaphragm also is paralysed. This, in turn, demands tracheostomy and positive-pressure respiration.

Tracheostomy diminishes spasms and facilitates the sucking-out of secretions. Nevertheless, pulmonary complications are not notably reduced. Continuous attendance by a doctor is almost essential and a great strain is thrown on the nursing staff.

Antitetanic serum : The quantity, route, and timing of antitetanic serum in published cases have been so varied that its value seems uncertain. Anaphylactic deaths from antitetanic serum are not very rare.

H. C. A. Lassen and E. Hendricksen[4] reported that the protracted administration of 50 per cent nitrous oxide and 50 per cent oxygen to patients with severe tetanus may lead to fatal aplastic anæmia. The noxious effect on the bone-marrow is caused by the nitrous oxide, and not by the oxygen.

Other Newer Methods of Treatment are.—

Chlorpromazine : R. S. Packard et al.[5] report two patients—a girl aged 12 and a boy aged 14 years—who were treated with large doses of chlorpromazine amounting to between 400 and 600 mg. daily, together with amylobarbitone, both given intravenously in the following way: a polythene catheter was introduced into the long saphenous vein and advanced into the inferior vena cava. All nutrition and drugs were administered by this route. The successive daily doses of chlorpromazine and sodium amylobarbitone in mg. were :—

Day :	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chlorpromazine	200	500	450	350	350	950	650	625	550	450	225	150	50	0
Sodium amylobarbitone ..	500	500	0	300	125	100	500	0	300	0	300	200	100	0

Hydrocortisone in Severe Tetanus.—R. A. Lewis et al.[6] speak most highly of the parenteral administration of hydrocortisone, 50 mg. added to an intravenous infusion of dextrose-saline, administered over about 4 hours, which can be repeated once, if necessary. Intramuscular injections of hydrocortisone were commenced at the same time, 25–50 mg. being administered every six hours, and the dose gradually decreased. If hormone is still required after ten days, oral cortisone is substituted to conserve the supply of hydrocortisone. Injected cortisone should be avoided as it aggravates spasms. The only other drugs employed were moderate doses of paraldehyde and antibiotics for the concomitant wound infection. After successful application of corticotrophin in 5 severe cases, these authors are full of praise for this form of treatment.

If there is dysphagia or total trismus, parenteral hydrocortisone is the best choice, but its action is inferior to that of cortisone by mouth.

Prognosis in Tetanus.—The length of the incubation period seems clearly to be related to the severity of the disease—the shorter the incubation period the worse the prognosis—but in the case of a patient admitted to the Birmingham Accident Hospital where the incubation period was only 36 hours, recovery followed, showing that a very short incubation period is not necessarily of grave import (R. Batten[3]).

[1] Jeffrey, J. S., and Sclaroff, S. A., *Lancet*, 1958, **1**, 365.
[2] Lewis, R. A., et al., *Ibid.*, 1956, **1**, 508.
[3] Batten, R., *Ibid.*, 1956, **1**, 231.
[4] Lassen, H. C. A., and Hendricksen, E., *Ibid.*, 1956, **1**, 968.
[5] Packard, R. S., et al., *Brit. med. J.*, 1958, **1**, 16.
[6] Lewis, R. A., et al., *Lancet*, 1956, **1**, 508.

Tetanus in Nigeria.—Tetanus is the third most common cause of admission to the adult medical wards of University College Hospital, Ibadan, Nigeria. D. D. Johnstone[1] describes the treatment employed for this condition at this Centre. A special nurse is detailed for each patient. Drinking is made easier for those with trismus by the use of straws. Penicillin is given intramuscularly until 24 hours after the cessation of spasms. Latterly the use of antitetanic serum has been discontinued. Various methods of controlling the spasms have been tried; latterly chlorpromazine and muscle relaxants have been the agents most favoured by the medical staff.

In spite of these modern methods and careful nursing, owing to the advanced state of the disease of many of the patients at the time of admission, the mortality is still very high. The report on the last 100 cases (1955 and part of 1956) shows a death-rate of 56 per cent.

Tetanus after Operation.—The power of tetanus to strike a hospital with sudden ferocity is reported from time to time. At the North Staffordshire Royal Infirmary, Stoke-on-Trent[2], 5 patients were attacked, and 2 died. More often than not, in spite of a most complete investigation, the source of the infection remains doubtful. Previous epidemics in various parts of the country have been attributed to dust entering the operating theatre, to catgut, to the use of other imperfectly sterilized material, and to infected hair used in the binding of plaster when the walls of the operating theatre were repaired.

Anthrax from Bone-meal Fertilizer. Six cases of anthrax occurring in Dundee and district are described. It was proved that imported bone-meal from the Far East was the source of infection in 3 cases, and it was highly probable that the remaining 3 were infected from the same source (W. M. Jamieson and D. M. Green[3]).

Gas Gangrene.—The prognosis in cases of infection by gas-forming organisms depends on its *early* recognition, and two signs are of paramount importance: (1) The presence of a rising pulse-rate in a patient who otherwise looks surprisingly well; and (2) The characteristic odour which, once encountered, is never forgotten; it resembles the smell of decaying apples, and is slightly sweetish. Examination of the wound shows a surrounding area of red, brawny swelling; the area is sometimes some distance away from the wound. The most common sites for gas gangrene are the adductor region of the thigh, and the buttocks. In the upper limb the subscapular region is the most frequent (B. McMurray[4]). Crepitus beneath the skin is not common, and in the diagnosis of otherwise suspicious cases the absence of this sign must never negative the diagnosis of gas gangrene. It is not unknown for gas gangrene to commence in a part of the body that has not been wounded, the organisms having been carried thither by embolic spread.

Cat-scratch Disease is thought to be due to a virus of the psittacosis-lymphogranuloma venereum group. The cat sharpens its claws on tree-trunks, and regularly licking its paws, transfers the virus from claws to mouth, thus explaining how the disease can follow a scratch or a bite. The virus is widely distributed on tree-trunks and other forms of vegetable life.

More often than not, cat-scratch disease presents as a well-defined clinical entity. As a rule the scratch or bite of the cat persists until signs of the disease are evident. These consist of pyrexia and tender enlargement of the regional lymph-nodes, which tend to break down and discharge sterile pus. Rose's intradermal test confirms the diagnosis, viz. 0·1 ml. of cat-scratch fever antigen Colindale is injected intradermally. The antigen is a relatively crude product made from a suppurating lymph-node of an infected patient, and uniform results need not necessarily be expected (R. Ll. Lyon[5]). The results of therapy are difficult to assess, as the disease is a self-limiting one. Chloramphenicol and oxytetracycline are thought to be of some benefit.

The disease is as common in Great Britain as it is abroad (T. A. Brand and K. C. Finkel[6]). E. Hinden[7] gives an account of 5 cases. In 2 the site of the disease was the axilla, in 2 the groin. One patient presented with conjunctivitis and pre-auricular adenitis.

In a patient who developed supratrochlear adenitis as a result of cat-scratch disease, pneumonia, which was presumed to be the result of viræmia, developed (G. C. Sheldon and H. Smellie[8]).

SNAKE-BITES

Only 7 fatal cases of viper bites have occurred in the United Kingdom during the last 50 years (P. Manson-Bahr[9]). It is therefore difficult for those residing in a temperate climate to realize the magnitude of the menace of snake-bites. In India and Pakistan it is estimated that the annual death-rate from snake-bites is between 20,000 and 36,000 (W. B. Roantree[10]).

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[1] Johnstone, D. D., *Brit. med. J.*, 1958, **1**, 12.
[2] Annotation, *Lancet*, 1957, **1**, 575.
[3] Jamieson, W. M., and Green, D. M., *Lancet*, 1955, **1**, 560.
[4] McMurray, B., *S. Afr. med. J.*, 1949, **23**, 207.
[5] Lyon, R. Ll., *Lancet*, 1956, **2**, 555.
[6] Brand, T. A., and Finkel, K. C., *Brit. med. J.*, 1956, **1**, 88.
[7] Hinden, E., *Ibid.*, 1957, **2**, 444.
[8] Sheldon, G. C., and Smellie, H., *Ibid.*, 1957, **2**, 446.
[9] Manson-Bahr, Sir Philip, *Ibid.*, 1957, **2**, 468.
[10] Roantree, W. B., *Ibid.*, 1957, **2**, 236.

The first-aid treatment of snake-bite has undergone complete revision. A tourniquet, incision, and laceration of the wound, together with suction, have been discountenanced in countries such as India and Brazil where snake-bites are commonly serious or fatal. At the Liverpool School of Medicine these measures are pronounced to be utterly useless (R. Burkitt[1]), and gangrene of an extremity following a snake-bite is more likely due to a misapplied tourniquet than to the lesion.

Sir Philip Manson-Bahr[2] draws attention to the modern first-aid treatment for Russell viper bites now used in India with apparent success. This is so simple that it should be known to every practitioner. It is harmless, and can now be said to be sanctioned by usage in thousands of cases. The area of the bite is smeared copiously with carbolic soap (e.g., Lifebuoy soap) and as soon as possible a 5 per cent solution of this soap is injected into the site of the bite and into the surrounding subcutaneous tissue. This delays absorption of the venom. The treatment has received the sanction of so great an authority as M. L. Ahuja.[3]

If effective antivenene is available the sooner it is given the more likely will it help the patient. In Malayan hospitals a 'snake-bite treatment box' with polyspecific antivenene, cortisone, adrenaline, and sterile syringes is immediately available in the dispensary. (H. A. Reid.[4])

THE ABDOMINAL WALL

Progressive Bacterial Synergistic Gangrene of the Abdominal Wall.—Four months before admission, a coloured woman aged 32 was operated upon for fibromyomata of the uterus. Suppuration in the abdominal wall ensued. Gradually the surrounding skin became gangrenous, and the process spread. Local applications of various kinds and the systemic use of the usual antibiotics were of no avail. In the course of two months the lesion involved almost all of the lower half of the abdominal wall, and spread down the outer aspects of the thigh (*Fig.* 1535). At this stage the patient was admitted to the Presbyterian Hospital, New York, under the care of Dr. F. L. Meleney.[5] Bacitracin was given intramuscularly in doses of 200,000 units every six hours, and the infected area was covered with gauze wet with bacitracin solution in a concentration of 1000 units per ml. The moist dressing was covered with a double layer of zinc oxide ointment on gauze, to prevent drying.

Fig. 1535.—Progressive bacterial synergistic gangrene of the abdominal wall and thighs occurring in a coloured woman aged 32. (*Dr. F. L. Meleney.*)

At the termination of 48 hours it was obvious that the progress of the disease had been arrested. Soon the gangrenous area on the right side of the abdomen separated, and could be lifted off as one piece. The systemic administration of bacitracin was terminated on the twenty-ninth day, but the local application was continued. Finally, epithelialization was hastened by the application of 2 per cent oxyquinoline in 5 per cent scarlet red ointment applied on gauze after bathing the granulations with bacitracin solution. The patient has remained in good health.

Disruption of a Laparotomy Wound (*syn.* Burst Abdomen).—A. Standeven[6] records that this complication ensued in 28 of 2039 laparotomies performed at the Royal Sussex County Hospital, Brighton, giving an incidence of 1·4 per cent. The cases fell into two groups—an early group, in which the disruption took place during the first seven days, and a late group, in which the wound burst asunder on the eighth or subsequent days. The former was the more frequent (18 cases). Standeven rightly has come to the conclusion that in many of these early cases the damage is done while the patient is still in the operating theatre, or before the patient regains consciousness in the ward. It occurs during the removal of an endotracheal tube or the aspiration of mucus through the tube when the plane of deep anæsthesia is lightening. These manœuvres bring on a most violent cough while the patient is still unconscious, and the explosive cough with the great rise in intra-abdominal pressure cause the deep sutures to break. Often the fact that the wound has burst asunder is not noticed until a few days later, when some of the skin sutures give way. In the late group every patient showed either a low serum-protein level or a hæmatoma

[1] Burkitt, R., *Brit. med. J.*, 1957, **2**, 159.
[2] Manson-Bahr, Sir Philip, *Ibid.*, 1957, **2**, 468.
[3] Ahuja, M. L., and Singh, G., in *Venoms* (ed. E. P. Buckley and M. Porges), 1956. Washington.
[4] Reid, H. A., *Brit. med. J.*, 1957, **2**, 26.
[5] Meleney, F. L., personal communication.
[6] Standeven, A., *Lancet*, 1955, **1**, 533.

wound, or both. Five of the 28 patients died: 1 from paralytic ileus; 4 from
A. Walsh[1] reminds us that bursting of the abdomen is always heralded
fluid that is often blood-stained.

Umbilical Hernia.—H. de Glanville[2] reports an example of this rare emergency in woman aged 30, seven months pregnant. A piece of greater omentum was protruding ruptured umbilical hernia. A Mayo repair was carried out under general anæsthesia. was uneventful, and she was delivered normally at home two months later.
reports a similar case in an elderly man who had had an umbilical hernia for years. After a bout of coughing the hernia ruptured, and many feet of small intestine colon protruded. This patient also made a good recovery after operation.

PERITONITIS

of Bacteroides in Peritonitis and in Infections of the Abdominal Wall.—The bacteroides), which are Gram-negative, anaerobic, non-sporing bacilli, require for their not only anaerobic apparatus, but an adequate carbon-dioxide tension in that and culture for more than 48 hours (W. A. Gillespie and J. Guy;[4] A. A. Gunn[5]). No doubt reasons that this group of organisms has escaped the bacteriologists and surgeons as causative organisms in notably that due to appendicitis or diverticulitis.
circumstances the bacteroides sometimes outnumber of the fæces by more than a hundredfold (W. W. C. and G. S. Wilson[6]). Two members of the genus are pathomainly responsible (usually in symbiosis with other for the lesions in question. They are:—

funduliformis (the causative organism of calf a coccobacillus 1–4 microns in length with a terminal (*Fig.* 1536), is the more virulent, and in some is the cause, not only of peritonitis, but of septicæmia A. Gunn;[5] J. M. Alston[7]). The diagnosis of infection organism is suggested by the peculiar odour like that of camembert cheese (J. M. Alston).

fragilis, a small bacillus which usually produces infections.

Fig. 1536.—Microphotograph showing *Bacteroides funduliformis*. (*Dr. Andrew F. MacCabe.*)

part played by the bacteroides in abdominal suppurative lesions is arrestingly presented and Guy[4] in their bacteriological study of 111 cases of peritonitis, including discharging wounds, occurring at the Royal Infirmary, Bristol. In this series the organisms isolated follows:—

Bacteroides	67
Coliform bacilli	66
Anaerobic streptococci	43
Aerobic streptococci	40
Gram-negative bacilli other than coliforms	15
Staphylococcus aureus	10
Micrococci and *Staphylococcus albus*	10
Clostridia	7

cardinal importance is the knowledge that bacteroides are completely resistant to the so widely employed in the treatment of peritonitis, to wit, penicillin and streptomycin
Fortunately, at present they are all sensitive to the tetracycline group. Surgeons
should combine to seek bacteroides in every case of peritonitis, intra-abdominal and discharging abdominal sinus.

in the Treatment of Grave Diffuse Peritonitis.—While the combined use of and adrenocortical extracts has proved life-saving in almost moribund patients with is, Waterhouse-Friederichsen syndrome, or pseudomembranous enterocolitis, it is importance to refrain from giving this combined therapy in peritonitis except in cases with very clear indications, and then only with an unwavering proviso—viz., *that operation will be performed if and when the patient is fit to undergo it.* Under these conditisone can be used to borrow time in which to replace fluid and electrolytes, and administer

[1] Walsh, A., *Lancet*, 1955, **1**, 673.
[2] de Glanville, H., *Ibid.*, 1955, **2**, 1321.
[3] Parker, G. E., *Ibid.*, 1956, **1**, 107.
[4] Gillespie, W. A., and Guy, J., *Ibid.*, 1956, **1**, 1039.
[5] Gunn, A. A., *J. R. Coll. Surg. Edin.*, 1956, **2**, 41; and *Arch. Dis. Childh.*, 1957, **32**, 523.
[6] Topley, W. W. C., and Wilson, G. S., *Principles of Bacteriology*, 4th ed. 1955 London: Arnold.
[7] Alston, J. M., *Brit. med. J.*, 1955, **2**, 1524.
[8] Garrod, L. P., *Ibid.*, 1955, **2**, 1529.

antibiotics. The adrenocorticotropic and adrenocorticosteroid hormones are known to exert an anti-inflammatory effect, and also a toxic-blocking action (G. C. Henigar et al.[1]). The dosage is similar to that advised in ultra-acute pancreatitis on page 338.

Not infrequently, so great is the improvement that the danger lies in postponing operation, with the result that as soon as the hydrocortisone is withdrawn, the patient relapses into a condition worse than that before the steroid was commenced. Therefore this form of therapy should never be employed in peritonitis unless it has been decided to operate. Cortisone prevents the walling-off of inflammatory processes by adhesions.

As ACTH and cortisone tend to accelerate the breakdown of protein, and to cause depletion of potassium and chloride and retention of sodium, electrolytic balance must be maintained with extreme care, potassium supplementation frequently being necessary (L. W. Kinsell[2]).

Fig. 1537.—Meconium peritonitis. Free air and fluid in the peritoneal cavity. Intra-abdominal calcification [↖]. Microcolon also shown by a barium enema. (*Dr. Jack Lester.*)

For an unknown reason, in some cases cortisone renders antibiotics impotent, and seems to exalt the virulence of the infecting organism. L. V. Phillips et al.[3] report 4 cases of fatal septicæmia following the exhibition of this combination of drugs in patients suffering from chronic skin lesions such as exfoliative dermatitis.

Meconium Peritonitis.—The characteristic signs usually commence immediately after birth. They are vomiting, abdominal distension, and failure to discharge meconium. The abdomen becomes increasingly distended. The diagnosis is confirmed by radiological examination. Free air, often in large amounts, is found in the peritoneal cavity, as also abundant abdominal fluid (J. Lester[4]). The most characteristic feature is areas of intra-abdominal calcification which occur in the cornified epithelial cells from the extravasated meconium (*Fig.* 1537).

Acute Chylous Peritonitis.—F. J. Wright[5] suggests that all cases are due to blockage of the main lymph-ducts by an inflammatory reaction around adult filaria (*Wuchereria bancrofti*).

Diffuse Peritonitis due to Perforated Carcinoma of the Colon.—Three per cent of cases of diffuse peritonitis are secondary to acute perforation of the colon resulting from carcinoma. The mortality is very high (over 80 per cent). (W. L. Mersheimer and E. M. Miller.[6])

Perforation of a Typhoid Ulcer.—During recent years R. L. Huckstep[7] has treated over 1000 cases of typhoid. In cases of perforation of a typhoid ulcer he has found that non-operative treatment similar to the Ochsner-Sherren treatment of late acute appendicitis, together with the administration of larger doses of chloromycetin orally, give results far better than those obtained by laparotomy, closure of the perforation, and drainage of the peritoneal cavity.

Acute Primary Mesenteric Abscess.—H. A. F. Dudley and I. F. MacLaren[8] report 2 cases of acute mesenteric abscess. One occurred in a male aged 42, who was admitted with signs of incomplete obstruction of the small intestine. The other, a male aged 32, was diagnosed provisionally as an appendix abscess. On laparotomy, in neither was a demonstrable focus found. In both the abscess was drained, and in each instance the patient recovered.

Periodic Peritonitis is characterized by abdominal pain and tenderness, mild pyrexia, polymorphonuclear leucocytosis, and occasionally pain in the thorax and joints. The duration of an attack is 24 to 72 hours, when it is followed by complete remission, but exacerbations recur at regular intervals. Most of the patients have undergone appendicectomy in childhood. The disease, often familial, is limited principally to Arabs, Armenians, and Jews ; other peoples occasionally are affected. At laparotomy, which may be necessary to exclude other causes, the peritoneum—particularly in the vicinity of the spleen and the gall-bladder—is inflamed. There is no evidence that the interior of these organs is abnormal.

Differential Diagnosis.—Patients with abdominal epilepsy do not have physical signs or pyrexia, and their attacks are usually controlled by anticonvulsive medication.

The aetiology of periodic peritonitis is unknown, and no form of treatment has been found to be of the slightest avail (G. S. Sturtz and E. C. Burke[9]).

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[1] Henigar, G. C., et al., *Arch. Surg., Chicago*, 1956, **73**, 804.
[2] Kinsell, L. W., *J. int. Coll. Surg.*, 1954, **21**, 230.
[3] Phillips, L. V., et al., *Antibiotic Med.*, 1955, **1**, 254.
[4] Lester, J., *Acta radiol., Stockh.*, 1956, **46**, 650.
[5] Wright, F. J., *Lancet*, 1956, **1**, 160.
[6] Mersheimer, W. L., and Miller, E. M., *Surg. Gynec. Obstet.*, 1954, **99**, 436.
[7] Huckstep, R. L., Thesis for the M.D. Cambridge, 1957.
[8] Dudley, H. A. F., and MacLaren, I. F., *Lancet*, 1956, **2**, 1182.
[9] Sturtz, G. S., and Burke, E. C., *Amer. J. Dis. Child.*, 1956, **92**, 390.

Pyocele of a Hernial Sac.—K. Cronin[1] and H. Ellis, Surgical Registrars at the Radcliffe Infirmary, Oxford, have encountered 3 patients with generalized abdominal pain and vomiting who also had an irreducible tender external hernia (two inguinal and one umbilical). In each instance operation showed that the patient was suffering from diffuse peritonitis with a localized collection of pus in the hernial sac. In two further cases a localized collection of pus in a hernial sac requiring drainage occurred in patients recovering from the acute episode of generalized peritonitis.

OTHER METHODS OF DRAINING THE PERITONEAL CAVITY

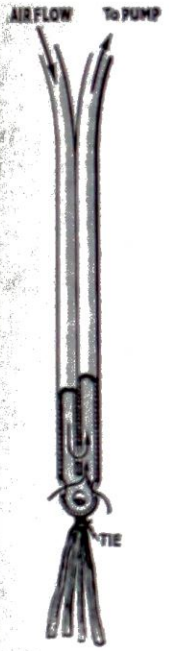

Fig. 1538.—The Chaffin rubber suction drainage tube.

The Chaffin Rubber Suction Drainage Tube[2] (*Fig.* 1538) was invented by Dr. R. C. Chaffin,[3] of Los Angeles. Within the abdomen the tails attract fluid to the bottom of the well in which the distal end of the tube is situated. Those who have used this tube speak most highly of it, and consider it is superior to all other types of abdominal drainage.

The Cofferdam Drain.—To construct a cofferdam, four Penrose wick drains 12 in. (30 cm.) long are arranged in superimposed pairs on two strips of petroleum-jelly gauze 3 in. (7·5 cm.) wide, of nearly the same length, laid side by side. On these is placed a half-inch drainage tube with two lateral holes cut in its distal end. All these are made into a loose bundle by tying three or four *plain* catgut ligatures around them (*Fig.* 1539). C. G. Lenhart and J. P. Fleming[4] recommend this form of drainage in cases of perforated diverticulitis when the mesocolon is much infiltrated. It is also useful in certain cases of tubo-ovarian abscess, and occasionally in a pelvic appendix abscess too high to drain into the rectum or by posterior colpotomy. In the case of perforated diverticulitis the cofferdam is placed on the medial side of the colon, care being taken to allow the bowel to rest upon the four Penrose elements. The drains are removed as follows: on the 5th day the tube is taken out; on the 6th, 7th, 8th, and 9th days one Penrose drain is removed; and on the subsequent two days a petroleum-jelly gauze strip is withdrawn.

Fig. 1539.—Construction of a cofferdam. (*After C. G. Lenhart and J. P. Fleming.*)

ACUTE APPENDICITIS AND CONDITIONS SIMULATING ACUTE APPENDICITIS

Never heed to the concept of the evils of a pocket of pus between the ligature and the purse-string suture used to invaginate the stump of the appendix. A few surgeons omit the ligature, and trust the purse-string suture to accomplish all. By ill luck, Willard Bartlett,[5] of St. Louis, who always employs the ligature, entrusted his son who had acute appendicitis to the care of a surgeon who believed in no ligature on the appendix stump. The boy nearly died of bright-red hæmorrhage *per rectum*.

Left-sided Appendicitis.—*Situs inversus viscerum totum*, a congenital abnormality where there is complete transposition of thoracic and abdominal viscera, occurs once in 35,000 individuals, and is more common in males. In such cases, of course, the vermiform appendix is situated on the left, as it is also in some cases of non-rotation of the mid-gut. What is important to know is that despite the position of the appendix on the left, the pain and tenderness of acute left-sided appendicitis are situated on the right. The explanation of the paradoxical phenomenon is unknown. Through lack of this knowledge, in spite of the fact that the apex beat was situated on the right, the operation for removal of an acutely inflamed left-sided appendix has, in almost every instance, been unduly prolonged and complicated because a right-sided incision was made. At least 100 cases of left-sided acute appendicitis have been reported. (Bailey and Love,[6] S. W. Giorlando.[7])

Acute Appendicitis in Infants.—The error to avoid is to fail to entertain the possibility of acute appendicitis in the presence of acute respiratory infection, one of the exanthemata, or

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[1] Cronin, K., personal communication.
[2] Supplied by E. O. Pratt Co., Los Angeles.
[3] Chaffin, R. C., *J. int. Coll. Surg.*, 1954, **22**, 683.
[4] Lenhart, C. G., and Fleming, J. P., *Ibid.*, 1953, **19**, 135.
[5] Bartlett, Willard, *Trans. west. surg. gynec. Ass., Chicago*, 1956, **64**, 69.
[6] Bailey, Hamilton, and Love, R. J. McNeill, *A Short Practice of Surgery*, 11th ed., 1958. London: H. K. Lewis.
[7] Giorlando, S. W., *N. Y. State J. Med.*, 1957, **57**, 948.

gastro-enteritis. Regarding the latter, there is a special group of cases of appendicitis associated with enteritis in which *Pseudomonas aeruginosa* is the predominating organism. Perforation occurs in over 80 per cent of patients with acute appendicitis under the age of 3 years. It is therefore inadvisable to attempt delayed treatment in patients under this age, except in the presence of unusually severe coexisting disease.

Pre-operative Hypothermia for Children with Acute Appendicitis Accompanied by a Very High Temperature.—In a series of 99 patients with acute appendicitis admitted to the Los Angeles Children's Hospital, 44 had a temperature of 102·3° F. (39° C.) or more. In 9 of these the temperature did not fall as a result of the usual pre-operative measures for acute appendicitis. The dangers of operating upon a child with considerable pyrexia include ether convulsions, circulatory failure, and hyperpyrexia. Therefore, *when the temperature fails to fall* as a result of the usual pre-operative treatment, D. Brayton[1, 2] employs hypothermia. The child receives a small dose of a barbiturate, an opiate, and scopolamine—small, because hypnotic drugs tend to depress hypothalamic function, decrease the moisture loss in respiration, and consequently raise the body temperature. Anæsthesia is induced with thiopentone, and maintained with endotracheal cyclopropane. A thermometer is placed in the rectum. The child is surrounded by plastic bags containing ice-cubes (*Fig.* 1540). Sufficiently deep anæsthesia is induced to control shivering. When the pulse-rate has fallen to 100 per minute (usually in about an hour) the temperature registers about 96° F. (35·5° C.) (*Fig.* 1541), and this has been found in practice to be the optimum temperature. The ice-bags are removed and the patient is made ready for operation. The immediate post-operative treatment does not vary from the usual.

Fig. 1540.—Child, aged 4, with acute appendicitis and a high temperature undergoing hypothermia. (*D. Brayton and G. B. Lewis.*)

[This section has been included at the request of a surgeon who found the method valuable. I would counsel against its use unless the child has some other condition contributing to the pyrexia, in addition to acute appendicitis, in which event it would be better to omit inhalation anæsthesia altogether.—H. B.]

In infants with acute appendicitis, the incidence of co-existing febrile disease, e.g., measles, chicken-pox, acute nasopharyngitis, and acute gastro-enteritis, is remarkably high. Such was present in 14 out of 38 consecutive cases reported by I. A. Fields et al.[3] The mortality of acute appendicitis in infants (at least 12 per cent) remains much higher than the overall mortality-rate (comprising all ages). In the case of infants, no reduction in this rate has been observed since the introduction of antibiotics (J. M. Dean).[4]

Incidentally, Brayton believes that when in doubt, drain the peritoneal cavity. Drainage was employed in 22 per cent of patients in the above series.

Acute Appendicitis in Pregnancy.—When appendicectomy is undertaken, the patient should be tilted on to her left side. A gridiron incision is recommended; the more advanced the pregnancy, the higher the incision, the level of the incision being determined by the level of the fundus of the uterus.

Acute appendicitis carries a general maternal mortality of over 20 per cent in the last trimester of pregnancy—ten times higher than in the first trimester.

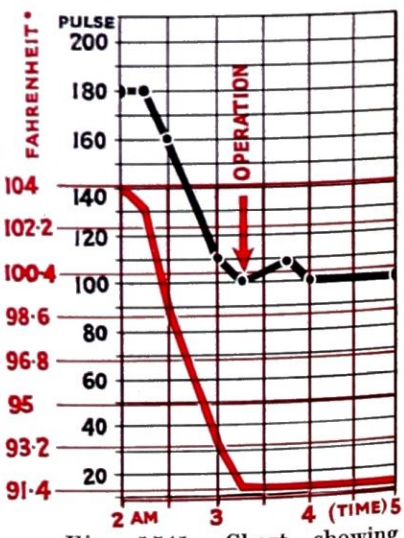

Fig. 1541.—Chart showing the result of hypothermia. (*After D. Brayton and G. B. Lewis.*)

R. B. Parker[5] gives details of 6 cases of acute appendicitis late in pregnancy. In no case was the infection localized. Many previous workers have commented on the fact that the peritonitis in these circumstances is almost always diffuse, and the following explanations have been offered. The main responsible factor is considerable upward displacement of the vermiform appendix during

[1] Brayton, D., *Calif. Med.*, 1956, **85**, 92.
[2] —— —— and Lewis, G. B., *Ann. Surg.*, 1957, **145**, 304.
[3] Fields, I. A., et al., *A.M.A. J. Dis. Child.*, 1957, **93**, 287.
[4] Dean, J. M., *Ann. Surg.*, 1952, **136**, 243.
[5] Parker, R. B., *Lancet*, 1954, **1**, 1252.

This prevents the inflamed organ from receiving enshroudment by the protective as also does the constant movement of the inflamed zone due to the enlarged contracting uterus in close relationship to it. Once the appendix has perforated, movement also distributes infection. In Parker's 6 cases, appendicectomy was in all and drainage was provided in 3 of them. One mother and 3 babies were lost.

of Acute Appendicitis to Carcinoma of the Cæcum.—Sometimes a carcinoma is discovered unexpectedly at an operation for acute appendicitis, or for an appendix 'fails to resolve'. On rare occasions the appendix *is* inflamed, or even gangrenous, to its orifice by the cæcal carcinoma. Although preliminary drainage is necessary where a foul abscess has been present for some time, in most instances, whether or not the is itself inflamed, the best chance of curing the patient lies in immediate right colectomy.

Perforated Colonic Diverticulitis.—H. E. Bacon[1] finds that rarely is the diagnosis made the abdomen has been opened. He recommends suture of the perforation in early cases, of the involved segment in later cases. In both instances the peritoneal cavity drained.

Diverticulum.—Of great importance is that in about 30 per cent of cases Meckel's is situated at a point 3–5 ft. (90–150 cm.) proximal to the ileocæcal valve. Conse- it is unsafe to pronounce that the diverticulum is absent unless the last 5 ft. of the ileum inspected. (J. K. M. Rawlinson.[2])

THE STOMACH

of the Stomach as a Cause of Vomiting in Infancy.—S. Eek and H. Hagelsteen,[3] report- the children's department of the University Hospital, Oslo, find that torsion of the stomach is about of equal frequency as infantile hypertrophic stenosis. Vomiting commences

Fig. 1542.—Daintree Johnson's gastric catheter.

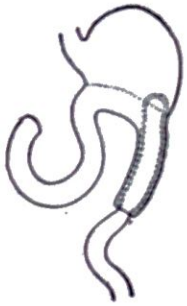

Fig. 1543.—Jejunogastric intussusception following Polya gastrectomy. (*After P. F. Early.*)

birth, at first in gulps, and later projectile. Of 54 patients, 18 gained weight in spite vomiting, in 21 the weight remained stationary, and 15 lost weight. From this it will that the symptoms are not so severe as those of hypertrophic pyloric stenosis. Further- pyloric swelling, of course, cannot be palpated.

Torsion is best displayed when the patient is examined in the upright position. is extremely simple. The infant, with its torso raised on a pillow, is nursed with of the cot elevated on blocks. Usually vomiting will cease at once, and in no case has necessary to resort to operation.

after Gastric Operation.—In patients who develop untoward signs in the early post- period, it is of the utmost importance at the earliest possible moment to confirm or exclude of intraperitoneal leakage. W. F. Walker[4] instils lipiodol down the intragastric has the patient radiographed for possible leakage. This is an adaptation of the use of in suspected perforated ulcer.

Gastric Catheter.—H. Daintree Johnson's[5] catheter (*Fig.* 1542) is useful particularly when iration is urgently required but the patient cannot swallow an ordinary soft tube. It is when the passage of a gastric catheter is necessary in an anæsthetized patient, in case it can be passed readily by the anæsthetist.

Intussusception.—When confronted with a patient bearing a scar compatible performance of a gastrojejunostomy or a partial gastrectomy who has symptoms of high obstruction, and especially if the gastric aspirate becomes blood-stained, think of jejuno- intussusception (*Fig.* 1543).

[1] Bacon, H. E., *Amer. J. Surg.*, 1956, **91**, 178.
[2] Rawlinson, J. K. M., *Brit. J. Surg.*, 1956, **43**, 555.
[3] Eek, S., and Hagelsteen, H., *Lancet*, 1958, **1**, 26.
[4] Walker, W. F., personal communication.
[5] Johnson, H. D., *Lancet*, 1957, **1**, 30.

P. F. Early,[1] reporting a case of jejunogastric intussusception following a Polya partial gastrectomy eleven years previously, records that the gastric aspirate did not become blood-stained until 34 hours after the onset of symptoms.

The mortality of cases of jejunogastric intussusception not subjected to operation approaches 100 per cent, and like all cases of intussusception, the earlier the operation the more favourable the outlook. After reduction (or resection) of the intussusception, no other procedure is required. Recurrence in cases complicating partial gastrectomy has not been reported.

Obstruction to the Afferent Loop after Polya Gastrectomy.—Distension of the duodenal stump due to obstruction of the afferent jejunal loop is a potent source of rupture of the duodenal stump. In a retrospective examination of the notes of eight cases of duodenal stump leakage, G. F. Henson[2] found that with the exception of one early rupture associated with inadequate closure, all patients exhibited slight but definite signs of some preliminary disorder before actual leakage commenced, the most constant finding being abdominal pain or discomfort associated with a rise in pulse-rate. There was no record of radiography of the abdomen save in one case, and in this instance the radiographs were taken after the duodenal stump had ruptured.

The value of early radiographic examination of the abdomen in patients with untoward symptoms following partial gastrectomy is stressed by Henson. He gives details of a case where a plain radiograph showed a gas-filled loop of bowel in which valvulæ conniventes could just be detected, and on these grounds obstruction of the afferent loop was diagnosed. The abdomen was reopened and an entero-anastomosis was effected between the afferent and efferent loops. It seems likely that unrelieved the obstruction would have proceeded to rupture of the duodenal stump.

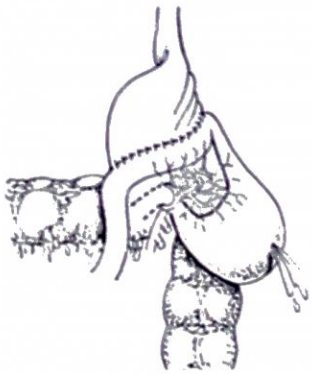

Fig. 1544.—Volvulus of the stomach leading to obstruction of the afferent loop and gangrenous perforation thereof.
(*F. C. Hoyte et al.*)

Afferent Loop Strangulation following Partial Gastrectomy.—A man, aged 47, underwent partial gastrectomy, and on the twenty-third day he experienced severe pain in the back and left side of the abdomen, which came on with dramatic suddenness. In spite of intravenous fluid therapy his condition deteriorated so rapidly that he appeared to be about to die. As soon as compatible blood was available, retrograde intra-arterial transfusion was performed, using the radial artery. As a result of this measure his condition improved. The abdomen was opened through a left paramedian incision. A gangrenous patch was seen on a coil of small intestine, which was greatly distended. The centre of the gangrenous patch had given way (*Fig.* 1544). Further search revealed that the stomach had undergone volvulus about its long axis, thus kinking the duodeno-jejunal juncture. The stomach was untwisted. The perforation was repaired and invaginated, and the loops were anchored by a few stitches to the parietal peritoneum, in order to maintain a *status quo ante*. The patient recovered. (F. C. Hoyte et al.[3])

Spontaneous Rupture of the Stomach.—T. Mc.W. Millar et al.[4] report 2 cases of spontaneous rupture of the stomach, both in female patients aged 71 years. One patient had pyloric stenosis and had refused operation; in the other case the pylorus would not admit a finger. Both patients died shortly after admission; in both cases necropsy showed a tear in the lesser curvature. These authors draw attention to a characteristic sign found in cases of spontaneous rupture of the stomach—it is subcutaneous emphysema—first detected in the root of the neck and later spreading over the thoracic wall. The sign was present in both these cases. It has been described before on several occasions in connexion with spontaneous rupture of the stomach. A probable cause of the subcutaneous emphysema is an extensive discharge of gas into the extraperitoneal tissues before the peritoneal coat gives way. The sign is well known in connexion with rupture of the œsophagus (*see* p. 742). Spontaneous rupture has occurred in the intrathoracic stomach of a child (H. Wallis[5]).

Rupture of the Stomach following Hæmatemesis.—D. E. Bolt and W. B. Hennessy[6] report 2 fatal cases, both in women, aged 56 and 74 years respectively.

HÆMATEMESIS AND MELÆNA

Operative Management.—Often the patient is elderly and very ill; the dangers of inhalation of blood are not inconsiderable. Therefore N. C. Tanner[7] employs local anæsthesia. He opens the upper abdomen through the midline. On rare occasions the xiphoid process is removed. When the patient is obese and the ulcer is duodenal, the incision is enlarged by making a transverse extension to the right. Should an ulcer not be discovered by inspection and palpation of the

[1] Early, P. F., *Post-grad. med. J.*, 1957 **33**, 193.
[2] Henson, G. F., *Lancet*, 1955, **1**, 595.
[3] Hoyte, F. C., et al., *Lancet*, 1957, **1**, 193.
[4] Millar, T. Mc.W., et al., *Brit. J. Surg.*, 1957, **44**, 513.
[5] Wallis, H., personal communication.
[6] Bolt, D. E., and Hennessy, W. B., *Lancet*, 1955, **2**, 485.
[7] Tanner, N. C., *Ann. R. Coll. Surg. Engl.*, 1958, **22**, 30.

stomach in the usual way an opening is made through the lesser omentum (hepatogastric ligament), and, after freeing adhesions attached to the posterior wall, the posterior wall of the stomach and as much of the duodenum as possible are palpated. The stomach and the first part of the duodenum are then rotated and their posterior surfaces *inspected*. Should these manœuvres not reveal the source of the hæmorrhage the second and third parts of the duodenum are examined. Next the gall-bladder is examined to see if it contains blood, and the branches of the cœliac artery are examined for an aneurysm. The pancreas is inspected and palpated, and the aorta is examined for an aneurysm (a dissecting aneurysm occasionally perforates the duodenum). The jejunum, ileum, and colon are scrutinized in that order, seeking particularly a level at which intraluminar blood becomes apparent, as well as seeking a Meckel's diverticulum.

Should all the latter sites prove non-culpable, the stomach and duodenum are again palpated, and then only is it justifiable to make a wide opening in the pyloric region so as to inspect the mucous membrane. A finger is passed in the direction of the œsophagus and down into the second part of the duodenum. From his unrivalled experience in this branch of surgery, Tanner gives instructions as to what to do in the varying situations that are encountered. The article should be studied for these details.

Melæna due to Colonic Diverticulitis.—The following criteria must be fulfilled to justify the assumption that bleeding is from a colonic diverticulum :—

1. The passage of bright-red or maroon-coloured blood.
2. Barium enema evidence of diverticulosis.
3. Absence of another lesion on proctosigmoidoscopy.
4. Radiographic evidence of a normal stomach and duodenum.

Most cases of acute hæmorrhage cease with conservative treatment. Occasionally bleeding necessitates urgent resection of the involved bowel. (H. E. Bacon.[1])

THE GALL-BLADDER AND THE BILE-DUCTS

Congenital Atresia of the Common Bile-ducts.—Warren H. Cole[2] has found that patency can be tested by aspirating the contents of the gall-bladder, followed by the injection of normal saline solution coloured with methylene blue. If the ducts are patent, the dye can be observed passing into the duodenum, but if doubt exists, the duodenum can be aspirated and the puncture closed with a 00000 silk purse-string suture.

Treatment of Gall-stone Colic.—If, for some reason, it is not possible to employ pethidine, e.g., some patients are violently susceptible to pethidine injections, a morphine injection given simultaneously with a tablet of glyceryl trinitrate by mouth is extremely effective (I. Macleod[3]).

Urgent Intravenous Cholangiocholecystography in the Diagnosis of Acute Intra-abdominal Conditions.—Radiographs after intravenous biligrafin are sometimes valuable in urgent differential diagnosis. The visualization of the common bile-duct in the absence of visualization of the gall-bladder is frequently associated with acute cholecystitis. The most reliable results are obtained in patients who have had symptoms for less than 24 hours. When symptoms have been present for a longer period there is a high incidence of non-visualization of the whole of the biliary tract caused by temporary depression of hepatic function. Biligrafin is particularly valuable for visualizing calculi in the common duct, but its inability adequately to visualize the terminal portion of the common bile-duct, an area of critical importance, limits its usefulness in this respect. (P. H. Jordan, jun.[4])

Cholecystectomy versus Delayed Treatment (and Cholecystostomy when necessary).—R. L. Mustard and H. R. Custer[5] state that in acute cholecystitis, hepatic function may be damaged so severely that there is little or no liver reserve left to cope with the hepatic depression imposed by a general anæsthetic (particularly if a muscular relaxant is employed) and an emergency operation. So many of these patients are obese, advanced in age, and suffering from some form of cardiovascular or renal disease that the added impact of an urgent operation could well prove fatal, whereas they might have been carried through successfully by delayed treatment.

R. Boller[6] has given up early cholecystectomy in cases of acute cholecystitis because of the very high percentage of patients so treated who develop the post-cholecystectomy syndrome. He quotes the experience of Ocklin, who speaks for surgeons of the Soviet Republic, and states that of 1500 patients operated upon for acute cholecystitis in the early period, only 75 per cent later were capable of full employment, again mainly owing to the post-cholecystectomy syndrome.

"To teach medical students and interns that the gall-bladder should be removed in 90 per cent of cases of acute cholecystitis as an emergency measure is to me a warning that we can expect many more injuries to the common bile-duct and the hepatic ducts than we have seen in the past." (A. M. Boyden.[7])

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[1] Bacon, H. E., *Amer. J. Surg.*, 1956, **91**, 178.
[2] Cole, Warren H., personal communication.
[3] Macleod, Ian, personal communication.
[4] Jordan, P. H., jun., *Surg. Gynec. Obstet.*, 1956, **102**, 218.
[5] Mustard, R. L., and Custer, H. R., *Ibid.*, 1952, **95**, 59.
[6] Boller, R., *Wein. med. Wschr.*, 1953, **103**, 907.
[7] Boyden, A. M., *J. Amer. med. Ass.*, 1951, **146**, 306.

Of 4 consecutive cases of ducts damaged elsewhere, 3 were injured during the course of early operation for acute cholecystitis. (Mustard and Custer.[1])

In view of the danger of duct injuries associated with cholecystectomy (*Fig.* 1545) one should seriously consider cholecystostomy as the operation of choice whenever the acute process makes for technical difficulties. A secondary cholecystectomy is a low price to pay for an intact duct system. (R. W. Buxton et al.[2])

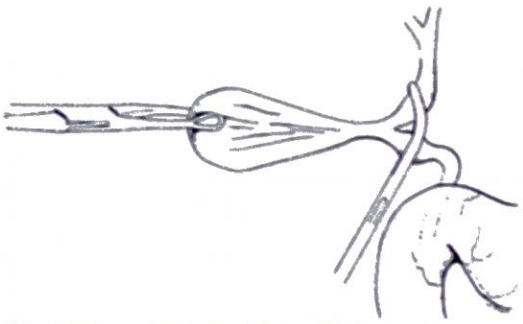

Fig. 1545.—A method by which the main bile-ducts are damaged during cholecystectomy.

In cases where it is necessary to operate urgently for acute cholecystitis, C. W. Cutler, jun[3]., has returned to cholecystostomy, even when cholecystectomy appears to be invitingly easy.

After conservative treatment of acute cholecystitis, the best time to operate is 4 to 6 weeks after the acute symptoms have subsided. Following cholecystectomy, to administer erythromycin intravenously is an excellent practice, for this antibiotic is concentrated in the liver, and excreted in the bile in high concentrations.

A New Synthetic Cholagogue.—Zanchol[4] appears to be harmless, and stimulates the flow of bile as observed in patients with a T-tube in the common bile-duct. Patients who previously had biliary obstruction, and whose bile was pale yellow in colour, soon discharge bile of a brilliant green hue, which usually is associated with excellent liver function. (J. M. McGowan.[5])

THE PANCREAS

Hypocalcæmia in Acute Pancreatitis.—R. T. Turner-Warwick[6] calls attention to the fact that the serum-calcium level in acute pancreatitis is sometimes reduced to a low level, owing to the formation of calcium-containing fat necroses. A level below 7 mg. per 100 ml. heralds a fatal prognosis. In a man aged 37 weighing 17 st. afflicted with acute pancreatitis, tetany developed, and was relieved by 20 ml. of 10 per cent calcium gluconate given intravenously twice a day. In cases of acute pancreatitis, clearly a serum-calcium estimation should be undertaken several times during the first week if a fall of calcium to a dangerous level is to be prevented regularly.

Delayed Treatment of Acute Pancreatitis.—A constant watch must be maintained for the development of a localized abscess, and this is true particularly if the patient is having a long course of antibiotics that mask the usual signs. Œdema and discoloration of the lumbar region are the most usual presenting signs of a peripancreatic abscess when the lesser sac has not been drained. (R. G. Holt.[7])

INTRA-ABDOMINAL INJURIES

Diagnostic Aspiration of Peritoneal Fluid is referred to on pages 203, 214, and 336. In the surgical wards of the Los Angeles General Hospital diagnostic tap has been undertaken in 100 cases of intra-abdominal injury, or suspected abdominal injury. Based on this large experience, R. V. Byrne[8] reviews the procedure, and voices the conclusion of himself and his colleagues in saying that in all cases of suspected intra-abdominal injury in which the symptoms are masked by shock, concussion, hæmorrhage, or acute alcoholism, a diagnostic abdominal tap is indicated. The great value of this procedure is that an early diagnosis of a ruptured abdominal viscus can be made in a patient with multiple injuries. A negative tap is valuable in confirming a suspicion of a retroperitoneal injury, with the reservation that a negative tap does not always indicate absence of intra-abdominal injury, and should the patient's general condition continue to give rise to anxiety, a repetition of the diagnostic procedure should be undertaken. As a result of the aspiration, in 61 cases blood or pancreatic or intestinal fluid was recovered, and a prompt diagnosis of intra-abdominal rupture was made possible. In 17 cases a negative diagnostic tap resulted in cases where there was, in truth, a ruptured viscus, the diagnosis of which was made on another date. These injuries comprised . . . . .

Ruptured spleen	8
Ruptured liver	5
Ruptured duodenum . .	2
Ruptured small intestine . .	2

[1] Mustard, R. L., and Custer, H. R., *Surg. Gynec. Obstet.*, 1952, **95**, 59.
[2] Buxton, R. W. et al., *Amer. med. Ass.*, 1951, **146**, 301.
[3] Cutler, C. W., jun., *Surg. Clin. N. Amer.*, 1949, **29**, 361.
[4] G. D. Searle & Co. Ltd., High Wycombe, Bucks.
[5] McGowan, J. M., *Surg. Gynec. Obstet.*, 1956, **103**, 163.
[6] Turner-Warwick, R. T., *Lancet*, 1956, **2**, 546.
[7] Holt, R. G., *Ann. R. Coll. Surg. Engl.*, 1954 **15**, 34.
[8] Byrne, R. V., *Surg. Gynec. Obstet.*, 1956, **103**, 362.

As is well known, in some cases of a tear of the spleen, and also in cases of similar injury to the liver, blood-clot seals the rent, or the hæmorrhage is subcapsular. These are injuries where delayed intraperitoneal rupture with torrential intraperitoneal hæmorrhage is imminent, and often, and quite understandably, in the pre-catastrophic stage abdominal tap is negative. Because of early walling-off, traumatic perforation of the duodenum and the small intestine is not revealed regularly by an abdominal tap.

The only contra-indication to the tap that has been found after four years' experience is the presence of pronounced abdominal distension.

Contrary to what is advised on page 362, diagnostic aspiration should be made in all four lateral quadrants of the abdomen unless the first, second, or third gives a positive result. The needle recommended is an 18-gauge spinal puncture needle, and it is introduced under local anæsthesia.

Technique.—No anæsthetic is necessary, but if considered advisable, 1 per cent procaine can be used. A 'snap' is felt when the needle passes through the anterior fascia, and another as it passes through the posterior fascia. The peritoneal layer may sometimes be felt as a less pronounced 'snap'. The danger lies, not in introducing the needle into the intestine, but in the aspirated intestinal contents being misinterpreted as peritoneal fluid. W. H. Moretz[1] performed 161 diagnostic peritoneal aspirations with no serious complication. The bowel was entered in 8 (small in 4, and large bowel in 4). S. D. Weakly[2] says that diagnostic abdominal tap is much safer than paracentesis thoracis.

Rupture of the Liver in the Newborn.—In the majority of cases rupture of the liver occurs during normal delivery, i.e., without any obvious trauma to the infant. A subcapsular hæmatoma forms, and gradually enlarges, and if the bleeding does not stop, the hæmatoma ruptures through the liver capsule and a great volume of blood pours into the peritoneal cavity. As a rule the diagnosis is not difficult. In J. L. Greaves's[3] patient, as soon as blood transfusion with group O Rh-negative blood was given, improvement set in. Laparotomy was performed, and the torn liver was sutured.

Rupture of the Diaphragm.—[4–6]Severe crushing injuries of the abdomen and the chest account for most cases of rupture of the diaphragm, the ratio of abdominal trauma to thoracic trauma being about 5 to 2. The cause of the injury is sudden increase of intra-abdominal or intra-thoracic pressure.

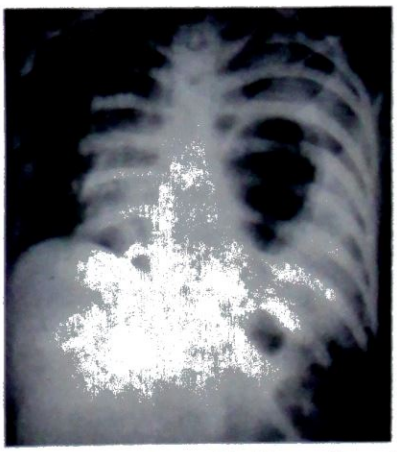

Fig. 1546.—Radiograph of the chest showing a high gastric shadow, collapse of the left lung, and fractured ribs. (*K. K. Sinha.*)

Most ruptures are of the left leaf of the diaphragm, the right being protected by the liver. As a rule the rupture extends from near the œsophageal hiatus, across the cupola, towards the costal margin. If the rupture is large, abdominal viscera, especially the stomach, often pass into the pleural cavity. It is to this that most of the symptoms are attributable and abnormalities of percussion and auscultation of the chest and occasional bowel-sounds heard through the chest wall help to suggest the diagnosis of this rather infrequent accident. A radiograph of the thorax shows absence of the diaphragmatic shadow on the affected side, partial collapse of the left lung, a pneumothorax, together with abnormal shadows of gas and fluid possibly within the viscus (*Fig.* 1546). While laparotomy is often required in order to attend to a ruptured spleen and/or to examine the abdominal viscera, all concur that the ruptured diaphragm can be repaired more effectively through a thoracotomy incision through the bed of the 9th rib than from below. Non-absorbable material should be employed for suturing the diaphragm.

INTESTINAL OBSTRUCTION

Differentiating Complete from Incomplete Intestinal Obstruction.—Inject 2 oz. (60 ml.) of liquid paraffin down the gastro-intestinal aspiration tube, disconnect the suction, and clamp the aspiration tube for three hours. At the expiration of this interval an enema is given and if paraffin is recovered it is obvious that the obstruction is incomplete. (J. A. Bollinger and E. F. Fowler.[7])

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[1] Moretz, W. H., *Amer. Surg.*, 1956, **22**, 1095.
[2] Weakly, S. D., *Ibid.*, 1957, **23**, 802.
[3] Greaves, J. L., *Lancet*, 1955, **2**, 1227.
[4] Sinha, K. K., *Ibid.*, 1955, **1**, 1001.
[5] Hamdi, F. A., and Sturdy, D. E., *Ibid.*, 1955, **1**, 1001.
[6] Wrigley, E. J., *Ibid.*, 1957, **2**, 19.
[7] Bollinger, J. A., and Fowler, E. F., *Arch. Surg., Chicago*, 1953, **66**, 888.

Dehydration.—When frank clinical dehydration is present it may be assumed that the patient has lost water equal to 5–7 per cent of his body-weight. Since the bulk of the fluid is lost in vomitus, which contains about one-half the concentration of sodium chloride in the plasma, this fraction of body-weight should be given, not as normal saline solution (which is often recommended) but as standard dextrose-saline solution. One-half this amount (or approximately 3 per cent of the body-weight) can be given safely in the first hour of treatment. (C. Dennis.[1])

The Abuse of Gastro-intestinal Suction Drainage.—Unless Nature is overcoming the obstruction, as announced by the relief of pain and/or the passage of gas from the small to the large intestine as shown by radiography, intestinal decompression should not be continued (as a substitute for operation) for more than 24 hours; indeed, in most instances it is safer to reduce this time-limit to 12 hours. Only in this way can many cases of strangulation be brought to light before peritonitis supervenes.

***Cl. Welchii* and the Toxæmia of Intestinal Obstruction.**—Thirty-three years ago B. Williams propounded the hypothesis that the toxæmia of acute intestinal obstruction was due to the absorption of toxins of *Cl. Welchii* from the contents of the obstructed intestine. In spite of the fact that the toxin was not isolated from obstructed intestinal contents, Williams and others claimed a substantial reduction in the mortality through the use of *Cl. Welchii* antitoxin as an accessory measure in the treatment of intestinal obstruction. This theory, and the treatment by *Cl. Welchii* antitoxin, fell into decline. Lately it has been revivified, at least on a small scale. M. H. Gleeson-White and J. J. Bullen[2] have isolated *Cl. Welchii* type D and also *Cl. Welchii* epsilon toxin from the intestinal contents of a patient who died from acute obstruction of the small intestine.

Suction-deflation of Distended Intestine at Operation.—It should be noted that the objective is to remove the gaseous, as opposed to the fluid, contents of the intestine. A. G. R. Lowdon[3] recommends that aspiration is effected through a hollow needle with a diameter of 0·7–0·9 mm.[4]. The selected hollow needle is connected by an easily assembled fitting (*Fig.* 1547) to the tubing of a sterile suction apparatus.

Fig. 1547.—Apparatus for suction-deflation of distended intestine. A, Tubing of suction apparatus; B, Glass connexion; C, Compressible tubing; D, Metal fitting to accommodate hollow needle; E, Needle, S.W.G. 20. (*After A. G. R. Lowdon.*)

Technique of Puncturing Intestine.—It is often advisable to aspirate at more than one point, in which case a fresh sterile needle must be employed for each puncture, because after inserting the needle into the bowel it is infected. Therefore, should a second puncture be required, the needle is grasped in a hæmostat by its hilt and detached from the apparatus, both the needle and the hæmostat being discarded in favour of a new needle. The needle is inserted through the bowel wall obliquely, so that its track passes through the muscular layers for about 0·5 cm. before the submucosa and mucosa are penetrated. As the needle is withdrawn the wall of the bowel is compressed on to the shaft of the needle by a swab moistened with dilute Dettol solution. The swab and the needle are then discarded. In the colon the puncture should be made through a tænial band; whether the punctured intestine be small or large intestine, *there is no need to close the puncture with a suture.*

In the colon, almost complete deflation can be obtained, especially when the laparotomy incision is large enough to permit two punctures—one at the midpoint of the transverse colon and one at the proximal end of the pelvic colon. *Puncture of the cœcum and ascending colon should be avoided*, because it involves the additional risk of low vitality of the cæcal wall. When about to aspirate small intestine, it is easy to tell by inspection and palpation whether the distension is gaseous or fluid. Care must be taken to keep the point of the needle out of the fluid. If these rules are observed, oblique entry of the small or the large intestine can be effected without danger. The method has been used with complete satisfaction in more than 100 cases.

G. A. Smith's Rapid Method of Peroral Intubation of the Small Intestine.—The method of Smith for intubation of the small intestine allows the surgeon to explore the abdomen of a patient suffering from acute intestinal obstruction within two to four hours after admission, with the intestinal aspiration tube in place and the distension greatly relieved.

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[1] Dennis, C., *J. Amer. med. Ass.*, 1954, **154**, 463.
[2] Gleeson-White, M. H., and Bullen, J. J., *Lancet*, 1955, **1**, 384.
[3] Lowdon, A. G. R., *Ibid.*, 1951, **1**, 1103; and personal communication.
[4] 0·7 mm. = 22 S.W.G., 0·8 mm. = 21 S.W.G., 0·9 mm. = 20 S.W.G. (the intravenous needle). S.W.G. = Standard wire gauge.

It requires the use of a special flexible stylet with a controllable tip.[1] The stylet (*Fig.* 1548 A), lubricated with petroleum-jelly, is introduced through the hole provided in the side of the tube to a distance of 1 in. (2·5 cm.) from the extremity of the tube. The patient is placed supine on the X-ray couch and the tube, with the stylet in place, is introduced through the mouth into the stomach. The tip, with the stylet, should be inserted into the patient's mouth with the natural curve of the apparatus directed towards the patient's right. A brief flash of the fluoroscopic screen will reveal the location of the tube. If the tube is pointed to the patient's left, it is withdrawn into the cardia, and the stomach is distended with 500–1000 ml. of air, and the controllable tip is turned to the right. The stylet and the tube are advanced along the greater curvature until the tube lies in the region of the pylorus. The controllable tip is manipulated until no curve is present. Rotating the tension sleeve of the handle to the right relieves tension on the small wires at the tip. Pressure is exerted on the thumb level to stiffen the stylet, and the tube is advanced into the second or third part of the duodenum. The stylet is then extracted 10–15 cm. and the tube is advanced correspondingly. The stylet is again extracted, but the tip of the tube is not advanced. The stylet and the tube are advanced until the tip of the stylet is in the second part of the duodenum. The stylet is then withdrawn completely, the balloon is inflated with 10 ml. of air, and the hole in the side of the tube through which the stylet passed is closed with a metal insert. The tubes (the bag is provided with a special small tube for inflation) are advanced 8 cm. each hour; at each time the larger tube is irrigated with 300 ml. of saline solution, which keeps it patent. The proximal end of the tube can be brought through the patient's nose in the manner illustrated in *Fig.* 264. (G. A. Smith.[2, 3])

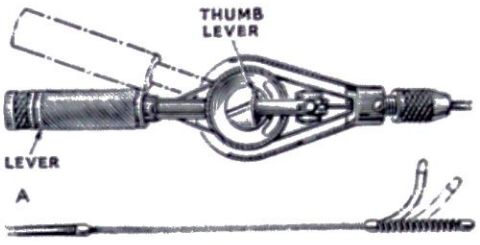

Fig. 1548.—Smith's apparatus for inserting a balloon-ended intestinal tube through the pylorus under radiographic control. A, Stylet.

Intestinal Atresia of the Newborn.—P. P. Rickham[4] finds that the secret of success in dealing with intestinal atresia lies in wide resection of the proximal distended gut. The proximal intestinal loop used for the anastomosis should be of nearly normal calibre. He prefers an end-to-back anastomosis, using one layer of inverting mattress sutures of 4/0 silk on arterial needles. The wide resection of the proximal intestine removes the dilated, hypertrophied, and often partly avascular segment. Infants stand resection, of up to one-third of their small intestine, well.

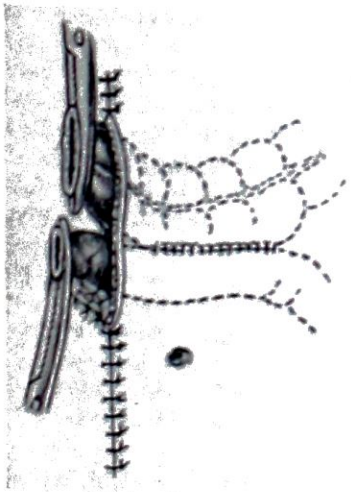

Fig. 1549.—Woodhall's operation for gangrenous intussusception.

Intussusception of Infants.—Thirteen cases of intussusception have been reported in patients under one month of age (O. F. Noel and L. A. Beasley, jun.[5]). The presence of slight or moderate pyrexia may mislead the clinician into diagnosing some acute infective condition unless he is aware that pyrexia often occurs in intussusception in infants. (S. E. Keidan.[6])

An intussusception in a baby less than six months of age is more difficult to reduce[7] than one occurring in an older child.

Operation for an Irreducible or Gangrenous Intussusception.—The most expeditious, and probably the best, method of carrying out resection and anastomosis of a gangrenous intussusception in an infant is by Woodhall's[8] ileotransverse colostomy[9] with exteriorization of the divided ends of the ileum and transverse colon. An ileotransverse colostomy is performed 2 in. (5 cm.) from the ends of the divided intestine and the abdominal wall is closed, leaving the clamps and about 1 in. (2·5 cm.) of the ends of the intestine protruding through the upper part of the incision (*Fig.* 1549). If distension occurs, as it often does during the first three or four days, this procedure permits removal of the clamp on the small intestine for a short time, with escape of gas and fluid fæces. After seven days the anastomos should be functioning satisfactorily, and the open wounds of the bowel can be closed ext peritoneally.

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[1] Manufactured by George P. Pilling & Sons, Philadelphia, U.S.A.
[2] Smith, G. A., *Surgery*, 1950, **27**, 817.
[3] — — *Ibid.*, 1952, **32**, 17.
[4] Rickham, P. P., *Brit. J. clin. Pract.*, 1957, **11**, 833.
[5] Noel, O. F., and Beasley, L. A., jun., *Amer. Surg.*, 1957, **23**, 252.
[6] Keidan, S. E., *Med. World*, 1955, **83**, 313.
[7] Annotation, *Lancet*, 1957, **2**, 132.
[8] Woodhall, B., *Arch. Surg., Chicago*, 1938, **36**, 989.
[9] Zachary, R. B., *Arch. Dis. Child.*, 1955, **30**, 32.

Bolus Obstruction is particularly liable to occur *after partial gastrectomy*.[1-8] It will be appreciated readily that after the distal half of the stomach has been removed insufficiently masticated articles of food are liable to be hurried into the small intestine, perhaps there to become impacted, whereas normally they would be retained in the stomach until they had become partially digested. Brussels sprouts, green figs, and particularly unmasticated orange pulp have caused intestinal obstruction in these circumstances.

Especially foodstuffs that swell, e.g., dried fruits swallowed in large lumps (as is likely in edentulous patients), and also articles that are poorly digested in the stomach, e.g., orange pith, can cause obstruction of the small intestine after escaping through a normal pylorus,[9-12] but a great variety of fruit and vegetables have from time to time been reported as causing bolus obstruction, among them being tomato skins, mango fibres, and a pickled onion.

Treatment.—Timely laparotomy is required. Often there is a considerable quantity of clear free fluid in the peritoneal cavity. An attempt should be made gently to squeeze the bolus onward into the cæcum, and there to break it up by kneading. Should the bolus be impacted so firmly that this manœuvre proves impracticable, after isolating the coil with abdominal packs enterostomy is performed. Following piecemeal extraction of the obstructing material, the opening in the intestine is sutured. The loop is mechanically cleansed before returning it to the abdomen, which is then closed.

Cæcostomy.—A. White,[13] of Bulawayo, Southern Rhodesia, only exteriorizes the cæcum when there is stercoral ulceration or gangrene. The method he has found admirable is as follows: Through a small gridiron incision the cæcum is deflated by suction-deflation via the terminal ileum close to the ileocæcal valve. The deflated cæcum is delivered, and controlled by a light clamp. The base of the bell of a de Pezzer catheter is cut off, so as to provide a wide opening. The catheter is introduced into the cæcum through a small stab incision, and retained in position by two purse-string sutures of catgut provided with eyeless needles. The clamp is removed and the cæcum returned to the abdominal cavity. The incision is closed around the catheter, which is anchored to the skin by a silk stitch. By this means the patient can be prepared for an elective resection, even when the neoplasm is as far distal as the pelvic colon. The tube gives watertight drainage for 10 to 14 days. The elective operation is performed within 14 days; the tube is then withdrawn and the orifice closes spontaneously.

Strangulating Obstruction.—In a patient with intestinal obstruction, a sudden onset suggests a *strangulating* obstruction. Palpation of a 'soggy' coil of intestine by bimanual pelvic examination is confirmatory evidence.

Radiographic studies show that a coil of obstructed small intestine in imminent danger of strangulation (if strangulation has not occurred already) is revealed on the film in only 50 per cent of cases. This is no advance on clinical methods, for in 50 per cent of cases such a coil is palpable.

W. F. Becker[14] analysed the notes of 1000 cases of acute intestinal obstruction. He found that in 60 of these strangulation was present, or supervened, but was undiagnosed as such for a varying period, and gastro-intestinal suction was persisted with for 12 hours or more because of apparent improvement of the patient with this form of treatment; this resulted in death in 40 of these patients. It is highly probable that a great many of these fatalities could have been averted by an earlier operation.

The Value of Antibiotics in Cases of Strangulation.—It is claimed that neomycin will sterilize a segment of intestine in 20 minutes. The survival period in experimental animals with strangulatin obstruction is greatly prolonged by the intravenous administration of aureomycin or terramycin. One of these antibiotics should be administered from the time of admission to hospital. (C. Dennis.[15])

Embolectomy for Mesenteric Arterial Occlusion.—Robert S. Shaw,[16] of Boston, Massachusetts, has performed superior mesenteric embolectomy for mesenteric arterial occlusion with a successful outcome on two occasions.

Case 1.—A woman, aged 54, with long-standing mitral stenosis with auricular fibrillation, was admitted to the Massachusetts General Hospital complaining of vague abdominal pain

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[1] Gall, W. J., *Brit. med. J.*, 1957, **1**, 1123.
[2] Colabawalla, B. N., *Ibid.*, 1957, **1**, 465.
[3] Corbett, J. T., *Ibid.*, 1957, **1**, 524.
[4] Ward-McQuaid, J. N., *Lancet*, 1956, **2**, 359.
[5] MacPhee, I. W., *Ibid.*, 1956, **2**, 359.
[6] Goodman, L., *Brit. med. J.*, 1957, **1**, 764.
[7] Davies, S. I., *Lancet*, 1956, **2**, 998.
[8] MacCarthy, D. F., *Ibid.*, 1956, **2**, 999.
[9] Cade, Irene S., and Qvist, G., *Brit. med. J.*, 1957, **1**, 948.
[10] Williams, R. J., *Ibid.*, 1957, **1**, 285.
[11] Rowling, J. T., *Lancet*, 1956, **2**, 289.
[12] Ross, J. A., *Brit. med. J.*, 1951, **2**, 196.
[13] White, A., personal communication.
[14] Becker, W. F., *Surg. Gynec. Obstet.*, 1953, **96**, 677.
[15] Dennis, C., *J. Amer. med. Ass.*, 1954, **154**, 463.
[16] Shaw, Robert S., personal communication.

of 15 hours' duration, accompanied by vomiting and melæna. The only physical signs were slight abdominal tenderness and subdued peristaltic sounds. Abdominal radiography was unremarkable, except that there was rather *less* than the usual amount of visible gas. She was submitted to laparotomy 25 hours after the onset of symptoms. The entire small intestine was blue-grey in colour, and without arterial pulsation. Arteriotomy, just distal to an embolus that was palpable in the superior mesenteric artery as it crossed the duodenum, was performed. The colour of the small intestine improved immediately. After a stormy convalescence she recovered. Aortography revealed that the main superior mesenteric artery was patent, as also its major branches, but there was occlusion in at least one peripheral radial arcade. A barium meal revealed multiple strictures of the intestine.

Case 2.—The patient was a man, aged 54, who was operated upon 12 hours after the onset of symptoms. The small intestine was blue-black and the transverse colon was also infarcted. Superior mesenteric embolectomy was performed, and the transverse colon was exteriorized. Forty-eight hours later the anterior wall of the exteriorized colon became necrotic, but the posterior wall was pink. The patient, whose convalescence was delayed by diarrhœa through the colostomy, eventually recovered.

Paralytic Ileus.—Most surgeons find difficulty in getting a balloon-tipped gastro-intestinal tube past the pylorus when the alimentary tract is immobile. A small stomach tube passed into the intestine is simpler, and L. P. Le Quesne[1] says that it is just as effective in preventing further entry of air into the intestine from air swallowing, and by its agency sufficient deflation can be achieved to allow recovery of peristalsis. On no account must any measure (administration of an ox-bile or turpentine enema; an injection of carbachol) be taken to endeavour to stimulate peristalsis. Morphine in adequate doses is a drug of the utmost value in this condition.

STRANGULATED HERNIA

Strangulated Inguinal Hernia during Infancy.—During the first year of life the ratio of females to males with a strangulated inguinal hernia is at least 5 : 1. The reason for this astonishing sex disparity is that so frequently it is an ovary that descends into the hernial sac, there to become strangulated. Among 50 examples of strangulated inguinal hernia occurring in females under 12 months of age, C. T. Kristiansen and W. H. Snyder[2] found the contents of the sac to be :—

Ovary only	28	Ovary and small intestine	4
Ovary and tube	16	Small intestine only	1
Greater omentum	1		

Rarely is it necessary to remove the congested, or even a blue-black, ovary. It can be returned to the abdomen where (apparently) often it survives. Oöphorectomy was resorted to only once in the above series.

Irreducible Hernia in Infants.—At the General Infirmary at Leeds, 17 patients with an irreducible inguinal hernia, the oldest being 2 years of age, were suspended by their legs from the foot of the bed or a Balkan beam (judgement of Solomon position) after having been given a sedative (I. Smith[3]). In 13 reduction was effected. Sedatives and suspension effected reduction in 75 per cent of 106 cases at the Boston Children's Hospital (A. Thorndike and C. F. Ferguson[4]). Suspension should never last more than three hours. The advantage of the method over taxis is that there appears to be no danger of gangrenous bowel being replaced.

P. G. McEvedy[5] recorded that 30 per cent of cases of strangulated femoral herniæ arrive in hospital without any diagnosis other than that of intestinal obstruction.

McEvedy's Operation for (Strangulated) Femoral Hernia.—A vertical incision is made over the swelling to 3 in. (7·5 cm.) above the inguinal ligament. In the lower part of the incision the femoral sac is cleared thoroughly. The rest of the incision exposes the inguinal ligament and the rectus sheath. The superficial inguinal ring is identified, and an oblique incision is made over the lower part of the rectus sheath, the incision commencing 1 in. (2·5 cm.) above the superficial ring and running parallel to the lateral border of the rectus muscle (*Fig.* 1550). The dissection is

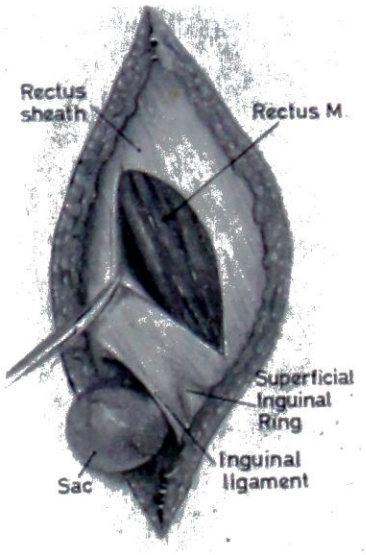

Fig. 1550.—Femoral herniorrhaphy. McEvedy's approach.

[1] Le Quesne, L. P., *Postgrad. med. J.*, 1957, **33**, 606.
[2] Kristiansen, C. T., and Snyder, W. H., *West. J. Surg.*, 1956, **64**, 481.
[3] Smith, Irvine, *Brit. J. Surg.*, 1954, **42**, 271.
[4] Thorndike, A., and Ferguson, C. F., *Amer. J. Surg.*, 1938, **39**, 429.
[5] McEvedy, P. G., *Ann. R. Coll. Surg. Engl.*, 1950, **7**, 484.

carried down between the transversalis fascia anteriorly and the extraperitoneal tissue posteriorly. In this way the neck of the femoral hernial sac is identified easily as a funnel-shaped structure entering the femoral canal. Attention is now directed to the body and fundus of the sac in the lower part of the wound. After the coverings of the sac have been incised, the sac is opened as described in Lotheissen's operation (*see* p. 513), and the contents of the sac are dealt with as necessary. Should resection of gut be required, the peritoneum is opened in the upper part of the wound and the released gangrenous segment can be withdrawn on to the surface, where there is ample room to carry out resection without hindrance. Having dealt with its contents, the empty sac is freed from the extraperitoneal tissue and the dissection continued until the bladder is identified, the empty sac being withdrawn from the femoral canal into the extraperitoneal space in the upper third of the wound. The sac having been ligated, the loose extraperitoneal tissue is drawn together over it with a stitch. An excellent view of Astley Cooper's (pectineal) ligament is obtained by inserting a Sargent's depressor into the upper part of the wound and retracting the extraperitoneal tissues. The conjoint tendon is sutured to Astley Cooper's ligament with two or three non-absorbable sutures. The subcutaneous tissue should be approximated with interrupted catgut sutures.

This operation, while gaining in popularity, is not performed nearly as frequently as Lotheissen's operation. Its advantage is that if resection is required there is ample room. Its disadvantage is that, especially if the wound becomes infected, it is sometimes followed by a very pronounced ventral hernia. (E. L. Farquharson.[1])

THE RECTUM AND ANAL CANAL

Reactionary Hæmorrhage after Hæmorrhoidectomy is much more common than secondary hæmorrhage. The hæmorrhage may be mainly or entirely concealed, but will become evident on examining the rectum. For its control G. R. Marshall[2] advises the following expedient: a 16 F. Foley's catheter provided with a 30-c.c. balloon is inserted through the anus towards the rectal ampulla for 4 in. (10 cm.); proctoscopy is not required for the insertion. The balloon is inflated with either air or water, and the inflation tube is clamped. Downward traction is exerted by strapping the catheter to a buttock (*Fig.* 1551) so that pressure is exerted above the anorectal ring. Counter-pressure from below is maintained by means of a perineal pad and a T-bandage. The balloon exerts pressure on the hæmorrhoidal vessels while the catheter permits the escape of flatus or blood, and, should bleeding recommence, its amount can be observed. Irrigation with 1 oz. (30 ml.) of saline solution from time to time will ensure patency of the catheter. The patient's blood is grouped, and preparations are made for blood transfusion should it be required.

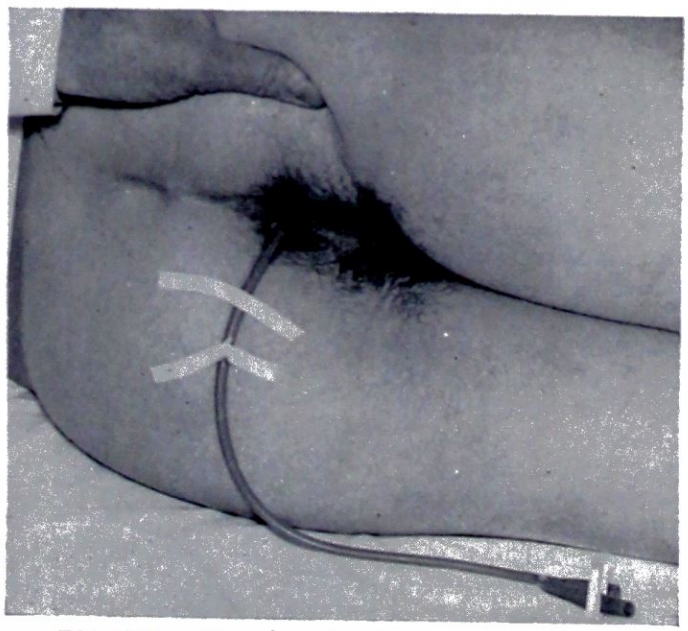

Fig. 1551.—The control of hæmorrhage after hæmorrhoidectomy by traction on an inflated Foley's catheter. (*G. R. Marshall.*)

As a rule the catheter can be dispensed with in 24 hours. Exceptionally, the patient must be taken to the operating theatre and the bleeding point secured by under-running it with a ligature on a needle. Should a definite bleeding point not be found, all suspected areas are under-run in this way.

Anorectal Abscess.—In a high percentage of cases (some estimate it at no less than 90 per cent) the abscess commences as an infection of an anal gland. Because the upper branch (there is often only one upper and one lower branch (*Fig.* 1552)) of the anal gland is tubular, it does not become the seat of an abscess so readily as the bulbous-ended inferior branch. In a bacteriological study of 25 cases E. J. Lowell, jun.,[3] found :—

	Per cent		
Esch. coli	60	Streptococci ..	17
Staphylococci ..	23	Proteus	11
Bacteroides	20	Diphtheroid ..	6
	Paracolic bacillus ..	6	

[1] Farquharson, E. L., personal communication.
[2] Marshall, G. R., *J. int. Coll. Surg.*, 1955, **24**, 97.
[3] Lowell, E. J., jun., *Amer. Surg.*, 1955, **21**, 189.

In 50 per cent of the patients the infection was mixed. In 6 per cent pre- and post-operative blood cultures were found to be positive.

On incising an abscess of rapid onset, it is not uncommon to find the abscess contains clotted blood in addition to pus. This leads to the conclusion that the inflammatory process has eroded a blood-vessel in the wall of the abscess.

S. Eisenhammer[1] has revised the classification of anorectal abscesses (*Fig.* 1553). Special attention is directed to (1) high and (2) low intermuscular abscess; (1) has not been described as such before, but as a submucous abscess (which most certainly it is not), while (2) was known as a peri-anal abscess. The other varieties of abscess do not differ from those described in Chapter XLVIII.

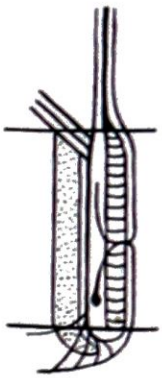

Fig. 1552.—An anorectal gland. The upper branch is usually a simple tube.

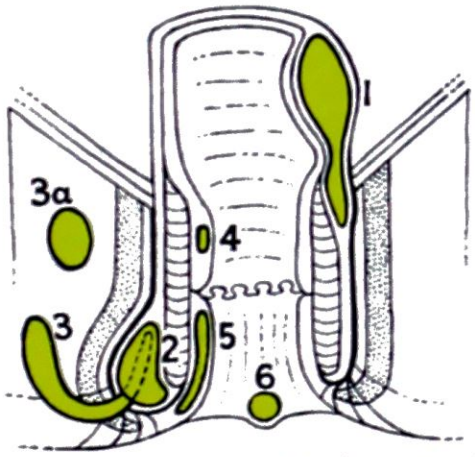

Fig. 1553.—Anorectal abscesses: 1, High intermuscular; 2, Low intermuscular; 3, Ischiorectal from an extension of (2); 3a, Blood-borne ischiorectal abscess; 4, Submucous abscess; 5, Abscess beneath anal canal skin; 6, Subcutaneous abscess. (*After S. Eisenhammer.*)

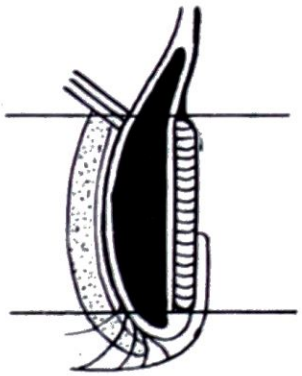

Fig. 1554.—Total infection of the intermuscular space. (*After S. Eisenhammer.*)

High Intermuscular Anorectal Abscess (10 per cent) is situated deep to the internal sphincter and occupies the upper part of the intermuscular space. Men between 40 and 55 years of age are the usual sufferers. Constitutional symptoms are pronounced, and the pain that the abscess occasions is considerable. If the pus is not evacuated the abscess either (*a*) bursts into the rectum by penetrating the internal sphincter and overlying mucous membrane, or (*b*) more often spreads to the whole of the intermuscular space (*Fig.* 1554), thenceforth to behave like a low intermuscular abscess. The diagnosis is made in the early stages by digital examination of the rectum, when an acutely tender, rounded cystic lump about the size of a walnut is felt above the level of the dentate line, generally in the posterior quadrant.

Treatment.—No time should be lost in evacuating pus in the following manner: when the abscess is still high, access to it is obtained by inserting a Sims' speculum into the anal canal. A short longitudinal incision is made over the lower border of the internal sphincter (*see Fig.* 1552) extending upwards for ½ in. (1·3 cm.). A blunt-pointed director is passed deep to the internal sphincter into the abscess cavity, and pus flows. The opening is enlarged sufficiently to allow digital exploration. This accomplished, the anoderm is freed bluntly from the internal sphincter, which is divided from below upwards under direct vision on to the director. The division is extended to the uppermost limit of the abscess cavity. Bleeding-points, which are not numerous, are controlled. No drainage tube is employed.

Low Intermuscular Abscess (80 per cent).—This, the most common abscess of the region, affects persons of all ages. Constitutional symptoms are less pronounced than in the high variety, and the pain is less severe. Untreated, frequently the abscess presents subcutaneously near the anal margin.

Treatment.—The principles of treatment differ in no respect from those described above. Should the abscess have implicated the peri-anal skin, it is best excised as described in Chapter XLVIII.

THE UROGENITAL ORGANS

Acute Renal Failure following Surgical Operation or Head Injury.—Usually acute renal failure is diagnosed by the sudden onset of signs of renal damage, of which the chief are oliguria, proteinuria, low specific gravity, and a rising blood-urea level. There is no agreed definition of oliguria for diagnostic purposes; the consensus of opinion is to regard 300 ml. a day as the urinary volume

[1] Eisenhammer, S., *Surg. Gynec. Obstet.*, 1958, **106**, 595, and personal communication.

below which there is oliguria. W. H. Taylor[1] recommends that after a serious operation, or a head injury, the blood-urea level should be estimated on the second or third day, and if it is about 100 mg. per cent the urine urea also should be ascertained. In 31 patients with acute renal failure from one of these two causes, the treatment instituted was restriction of fluid intake (fluid intake was restricted to balance fluid loss), 600–800 ml. being allowed for insensible water loss, and increased by 200 ml. for each degree of temperature above 100° F. (37·7° C.). When the serum-potassium level reached 6·5 mEq. per litre, an attempt to reduce it was made by injecting subcutaneously soluble insulin, 12 units eight-hourly. When the plasma-bicarbonate level fell below 10 mEq. per litre it was raised by intravenous infusion of sodium lactate solution. In the presence of oliguria, doses of antibiotics were reduced greatly. The provision of a high-calorie non-protein diet was attempted by mouth or by an indwelling intragastric tube in all patients except those who had undergone an abdominal operation. Ten per cent dextrose solution used alone, or with the addition of 5–100 ml. of double-centrifuged cream, proved to be the least nauseating of the diets yet suggested for this purpose. The mortality of acute renal failure in these circumstances is very high. In this series 26 patients died and 5 survived.

Spontaneous Rupture of the Bladder after Partial Cystectomy.[2]—A man, aged 64, admitted to the Royal Infirmary, Huddersfield, in a shocked condition, gave the following history. At the cinema that evening he was enjoying the programme. He desired to micturate, but did not wish to miss the exciting part of the film ; he sat on, and the desire eased. At the end of the performance he went to micturate. Suddenly there was a sharp pain in his lower abdomen ; he became intensely shocked and was removed to hospital. Lower laparotomy showed that the scar of the previous operation on the bladder had given way. There was no sign of recurrence of the neoplasm. The bladder was repaired and an indwelling catheter inserted. The patient made an uninterrupted recovery.

Spontaneous Rupture of the Bladder due to Prostatic Obstruction.—G. K. Thomas[3] encountered a case of spontaneous rupture of the bladder in a man aged 76. Six hours previously the patient had a strong desire to micturate but could not do so effectually. The abdomen was a little distended, rigid, very tender, and free fluid was detected therein. Laparotomy showed a rupture of the posterosuperior aspect of the fundus of the bladder which admitted three fingers. The prostate was much enlarged, prostatectomy was therefore carried out through the rent, which was then repaired. The abdomen was closed with drainage and the patient made a good recovery.

Fig. 1555.—Usually the left testis twists clockwise and the right testis anti-clockwise, owing to the spiral attachment of the cremaster muscle prolonged from the internal oblique on to the spermatic cords.

Urethrography in Suspected Rupture of the Urethra.—Umbradil viscous[4] is the best contrast medium for urethrography. It is water-soluble, of jelly-like consistency, and contains local anæsthetic.

Torsion of the Testis.—A. Wilfrid Adams and N. Slade[5] reaffirm that rotation is encouraged by a lively cremaster, and state that it is unlikely that torsion would occur towards the rigid septum dartos, but rather outwards. Thus the left testis usually twists clockwise, and the right anti-clockwise (*Fig.* 1555). In severe twists the total arrest of the spermatic circulation renders ischæmic necrosis of the testis inevitable unless manual detorsion is performed within an hour ; as a rule, it is only the attending practitioner who has the opportunity to carry out this measure early enough for it to be effective. If a surgeon is confronted with an acute scrotal swelling of uncertain origin, and explores, he will sometimes discover a torsion in which partial ischæmia allows effective untwisting under vision. The necessity for orchiopexy in such cases, as well as anchoring the testis on the contralateral side, is stressed.

Grave Hæmorrhage from the Bladder or from the Prostatic Bed.—W. Müller-Meernach[6] has performed bilateral ligation of the internal iliac artery in 37 cases of severe hæmorrhage from tumours of the bladder. Four additional ligations were performed for serious bleeding after prostatectomy. Fortified by this experience, this author has carried out bilateral ligation of the internal iliac arteries in a series of 121 prostatectomies as a preventive measure to serious bleeding. The internal iliac artery is ligated close to its origin from the common iliac artery by the retroperitoneal route. It is reassuring to know that no patient suffered any ill effects attributable to the bilateral ligation.

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[1] Taylor, W. H., *Lancet*, 1957, **2**, 703.
[2] Walker, W. F., personal communication.
[3] Thomas, G. K., *Brit. J. Surg.*, 1956, **44**, 328.
[4] Astrapharm Ltd., 3 The Mall, Surbiton, Surrey.
[5] Adams, A. W., and Slade, N., *Brit. med. J.*, 1958, **1**, 36.
[6] Müller-Meernach, W., *Z. Urol.*, 1956, **49**, 74.

ACUTE RETENTION OF URINE

Suprapubic Catheterization with a Foley's Catheter.—J. Swinney[1] has invented a piece of apparatus for introducing a Foley's catheter into a full bladder through a small suprapubic incision. The apparatus consists of a hollow metal tube with a sharp bevelled extremity, and it has a longitudinal slit along its whole length. This accommodates the inflation arm of the catheter while the cannula is being withdrawn (*Fig.* 1556 inset). The catheter (size 18 or 20 F.), stretched on a straight metal introducer, acts as a trocar. The incision is made 6 cm. above the symphysis pubis to the right or left of the middle line. The rectus sheath is incised, and the cannula, held as shown in *Fig.* 1556, is directed downwards, backwards, and slightly inwards, and the bladder is perforated; the straight metal introducer holds the catheter steady during the entry into the bladder of the cannula and the contained catheter.

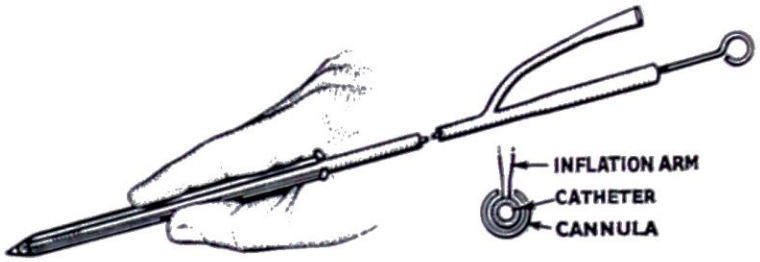

Fig. 1556.—Swinney's suprapubic Foley's catheter introducer.[2]

The metal introducer holding the catheter steadies the latter during the entry into the bladder. The catheter on its introducer is held in position while the cannula is withdrawn. The balloon of the catheter is distended with 10–20 ml. of water and the inflation arm is secured with a ligature, as shown in *Fig.* 918, p. 672. The introducer is withdrawn and the catheter is connected to a drainage apparatus. One stitch is sufficient to close the wound about the catheter.

Catheterization of the Urethra by a Fine Calibre Catheter.—N. Gibbon[3] reports that at Walton Hospital, Liverpool, the use of the Gibbon catheter (1·5 mm. portex tubing) (*see Fig.* 890, p. 652) has been extended from cases of neurogenic retention of urine to any cause of retention of urine when long-continued drainage is likely to be required, to wit:—

1. Cases of carcinoma of the prostate when orchiectomy and œstrogen therapy are to be employed in the treatment of the neoplasm in the first instance.
2. Cases of retention of urine due to benign hypertrophy of the prostate when the patient is unfit for early prostatectomy.
3. Stubborn post-operative retention, especially that following extirpation of the rectum. In the latter retention is anticipated and the catheter is inserted at the close of the operation.
4. Cases of retention when the urine is known to be infected.

THORAX

Flail Chest (*syn.* Stove-in Chest).—A crush injury causing multiple fracture of ribs and costal cartilages, producing flail or 'stove-in' chest with its paradoxical movement (*Fig.* 1557), is surprisingly rare. In an eight-year period, only 8 cases of this condition were admitted to the Birmingham Accident Hospital (H. Proctor and P. S. London[4]). Only 1 of these 8 patients

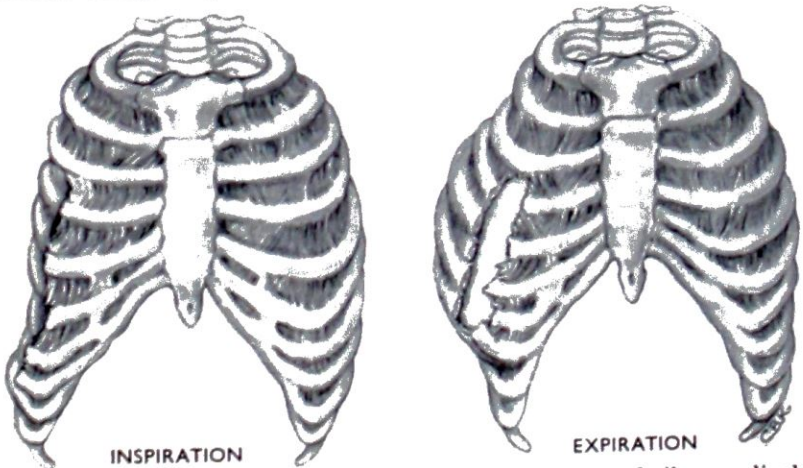

Fig. 1557.—Paradoxical respiration. The comminuted fractured ribs are displaced inwards during inspiration and outwards on expiration or cough. (*After F. P. Coleman and C. L. Coleman.*)

[1] Swinney, J., *Lancet*, 1957, **2**, 28.
[2] Made by Charles F. Thackray Ltd., 10, Park Street, Leeds, 1.
[3] Gibbon, N., *Brit. J. Urol.*, 1958, **30**, 1.
[4] Proctor, H., and London, P. S., *Brit. J. Surg.*, 1955, **42**, 622.

survived. In this condition there is loss of effective cough, with accumulation in the tracheobronchial tree of secretions, which increase the dyspnœa. Increasing dyspnœa results in more pronounced paradoxical movement and rapid deterioration in the patient's general condition. Tracheostomy, with repeated suction, will prevent these complications, and of two consecutive patients with a flail chest in whom tracheostomy was carried out soon after admission to hospital, both recovered (S. Hulman[1]). It is important that the tracheostomy should be carried out before the general condition deteriorates and the patient becomes restless, for it is necessary for the patient to lie supine and quite still for a few minutes while the operation is undertaken under local anæsthesia. Tracheostomy breaks the vicious cycle, and produces less paradoxical movement, better pulmonary aeration, less pain, less expenditure of energy, and easy aspiration of the tracheobronchial tree. In J. A. Rhind's[2] opinion, tracheostomy in these cases has rendered obsolete urgent operation of the screw, wire, or plate variety.

Fig. 1558.—Fowler's guarded sternal screw.

A. W. Fowler[3] and also J. E. Jacques,[4] while agreeing that tracheostomy is invaluable for symptomatic treatment, emphasize the necessity for adequate stabilization of the floating segment of the chest, be it due to comminuted fractures of the ribs or to fractured sternum. A few nylon sutures inserted blindly around the ribs at the centre of the flapping segment will provide effective stabilization in the case of ribs (*Fig.* 1559). A. W. Fowler[3] has designed a guarded sternal screw[5] (*Fig.* 1558). The rib sutures or sternal screw should be attached to weights passing over a pulley.

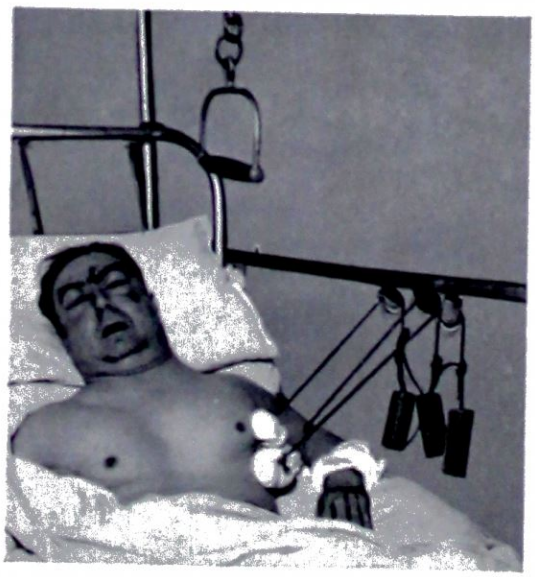

Fig. 1559.—A method of stabilizing the flail segment by pericostal sutures to which suitable weights are attached. (*Mr. H. J. Richards.*)

B. J. Bickford and A. F. Grant[6] recommend displaying the flail area (*Fig.* 1560) and fixation of the fractures by wiring, and in 5 cases there was 1 fatality (uræmia).

Injury to the lung is a common complication of stove-in chest, and the possibility of a concomitant hæmothorax[7] should always be considered. Distension of the veins of the neck is indicative of a rise in venous pressure, the underlying pathology of which is often compression of the heart by blood, tension pneumothorax, hæmothorax, or mediastinal emphysema. For these reasons F. P. and C. L. Coleman[8] advocate early operation with stabilization of the chest wall by wiring the fractures. As a result of these measures in 15 cases (in each the average number of ribs wired was six) only 2 patients succumbed, both from causes that could not have been accelerated by the method of treatment, viz., delayed rupture of the spleen and crush syndrome.

Fig. 1560.—Typical incision used to display both ends of the fractured ribs.

Oxygen Therapy.—It is absolutely essential that the tongue should be drawn forward when administering oxygen through an endotracheal tube in an unconscious patient.

At a Manchester inquest,[9] a verdict of death by misadventure was recorded in a woman who died of heart failure after an operation. The operation was a short one under general anæsthesia. When she had been returned to bed the ward sister noted that she was cyanosed, and commenced to administer oxygen through an endotracheal tube in the wider nostril; the other was obstructed by mucus. A few seconds later the patient expired. Necropsy revealed that one nasal passage was very narrow indeed, due to a broken nose during childhood. Because the tongue had fallen back, obstructing the mouth, and the second nostril was blocked, high pressure had been built up by administering oxygen, and both lungs had ruptured.

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[1] Hulman, S., *Lancet*, 1957, **1**, 454.
[2] Rhind, J. A., *Brit. med. J.*, 1957, **2**, 470.
[3] Fowler, A. W., *Ibid.*, 1957, **2**, 592.
[4] Jacques, J. E., *Ibid.*, 1957, **2**, 592.
[5] The Zimmer Orthopædic Ltd., Bridgend, Glam.
[6] Bickford, B. J., and Grant, A. F., *Ann. R. Coll. Surg. Engl.*, 1956, **19**, 371.
[7] Gueukdjian, S. A., *Brit. J. indust. Med.*, 1957, **14**, 209.
[8] Coleman, F. P., and Coleman, C. L., *Surg. Gynec. Obstet.*, 1950, **90**, 129.
[9] Reported in *The Lancet*, 1957, **2**, 1113.

HEAD INJURIES

After a head injury vomiting is common, and the inhalation of gastric juices may lead to death a few hours after the inhalation has taken place. It is for this reason that the advisory committee of the North East Metropolitan Regional Hospital Board[1] declares that "The patient should be kept on his side with a clear airway", as is illustrated in *Fig.* 1087 of this book.

A further point of importance is that as soon as practicable, the stomach must be emptied and kept empty, for ruptured œsophagus (due to explosive vomiting) is a rare, but potentially disastrous, complication of head injuries, and over 20 examples discovered at necropsy have been reported in the last few years.[2]

The question whether the patient with a serious head injury should be conveyed, if possible, to a neurosurgical centre at a distance, is commented upon in no uncertain terms by Professor A. A. McConnell,[3] who writes that there is certainly one type of case that the local surgeon should undertake himself. It is the patient who sustains a head injury without impairment of consciousness, or with only momentary impairment, who is apparently well for an hour or so, and who then complains of headache, *or* vomits, *or* becomes drowsy, *or* exhibits any neurological signs. Such a sequence must suggest an extradural hæmorrhage, and there is no time to transfer the patient or summon a neurosurgeon. Many fruitless journeys into the country have convinced him that the local surgeon must assume responsibility for these cases. "May I point out", he says, "that the clinical diagnosis is certain only when the patient is near death, and the only way to make certain before that stage is to make exploratory burr-holes."

Obstruction of the Superior Longitudinal Sinus following Closed Head Injuries (Traumatic Hydrocephalus).—J. Purdon Martin[4] describes 5 cases of this condition. Obstruction of a superior longitudinal sinus is usually incomplete, and gives rise to two syndromes that occur either separately or in combination. The obstruction of the sinus causes stoppage of the absorption of fluid and a consequent rise of intracranial pressure. In such cases the increased pressure of the intracranial fluid is the same outside and inside the brain, so that no dilatation of the ventricle results therefrom. The first syndrome, which is relatively common, is headache and papillœdema. The second syndrome is a paralytic one, resulting from obstruction and consequent thrombosis of the cortical veins that drain into the sinus. As the affected veins are often those that drain the superior portions of the motor gyri, the resulting signs consist of paralysis of the legs and partial paralysis of the trunk and upper arms, with sparing of the hands and face. Convulsions, sometimes of great severity and duration, may accompany the onset.

The treatment of both syndromes is conservative. Martin has had great success with dehydration therapy effected in the early stages by administering magnesium sulphate by rectum. When improvement sets in, and the patient can swallow and retain ingested fluid, the magnesium sulphate is given by mouth. In a case characterized by convulsions, an anticoagulant (tromexan) is prescribed in the hope of preventing further venous thrombosis.

THE NECK

Tracheobronchial Suction via a Tracheostomy.—In order to reduce damage to the mucous membrane, the method of performing tracheobronchial suction devised by F. Plum and M. F. Dunning[5] should be adopted everywhere. The equipment is simple. A Y-tube is intercepted in the tubing leading from the suction apparatus, and to the distal end of this tubing is attached a No. 12 or 14 whistle-tipped catheter (*Fig.* 1561). When not in use, the catheter is kept in a beaker containing 5 per cent sodium bicarbonate solution, and the nurse must be warned never to employ this catheter for aspiration via the nose. The head is turned to the right to aspirate the left bronchus, and vice versa (*Fig.* 1562). The Y-valve is left open during the insertion of the catheter, which is introduced to the full length of the bronchus. The catheter is then withdrawn 1–2 cm., to disengage the tip from the mucous membrane, before the Y-valve is closed with the thumb. Whenever the sound of suction

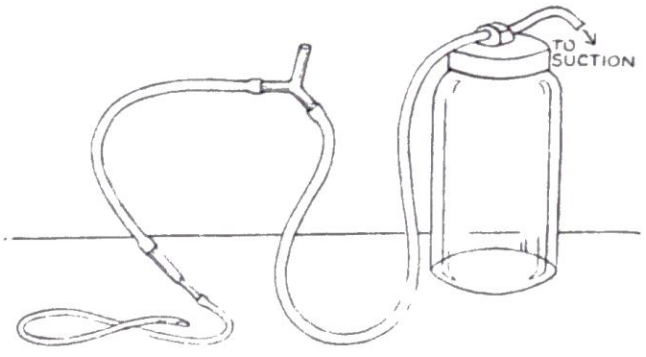

Fig. 1561.—The apparatus for tracheobronchial suction. (*After F. Plum and M. F. Dunning.*)

[1] Annotation, *Lancet*, 1955, **1**, 657.
[2] Leading Article, *Ibid.*, 1956, **2**, 1293.
[3] McConnell, A. A., *Ibid.*, 1957, **1**, 481.
[4] Martin, J. P., *Brit. med. J.*, 1955, **2**, 467.
[5] Plum, F., and Dunning, M. F., *New Engl. J. Med.*, 1956, **254**, 193.

ceases the vacuum is released by removing the thumb from the Y-tube (*Fig.* 1563); the catheter is then withdrawn a little before suction is re-applied. After the suction has been completed, the catheter must be removed slowly with a rotary movement, a full circle being effected during withdrawal, thumb pressure on the Y-valve being released the second that there is any tension on the catheter. Each aspiration should be limited to 15 sec. Unless the secretions are so voluminous as to threaten asphyxia, a rest of 3 min. is allowed between aspirations, so as not to induce hypoxia.

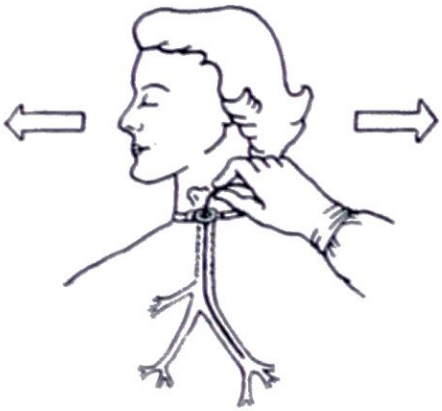

Fig. 1562.—Method of entering each main bronchus. (*After F. Plum and M. F. Dunning.*)

Fig. 1563.—Method of holding the Y-tube so that the thumb can start or stop suction at will. (*After F. Plum and M. F. Dunning.*)

Injection of the Stellate Ganglion is referred to on pages 59 and 937. The anterior approach is the most direct and when the ganglion is injected by this route, serious complications are most improbable. In a series of 2000 injections by this route, complications were limited to nausea and vomiting from intravascular injection, occasional hoarseness from implication of the recurrent laryngeal nerve, and partial paralysis of the upper extremities from overflow on to the brachial plexus; all were transitory, as short-acting agents were employed.

The patient lies in the dorsal recumbent position without a pillow, and with the neck fully extended in the middle line. The site of the skin puncture is two fingerbreadths lateral to the centre point of the sternal notch and two fingerbreadths above the clavicle. This should give the level of the transverse process of the 7th cervical vertebra, and after rotating the head to the contralateral side, that the transverse process which is felt *is* the 7th cervical is checked by (*a*) feeling for Chassaignac's tubercle (*Fig.* 1564) and (*b*) marking the lower border of the cricoid cartilage. The point of puncture is $\frac{1}{2}$ in. (1·25 cm.) below these landmarks, and it is marked on the skin by a ball-pointed pen. The sternomastoid muscle and the carotid sheath are displaced laterally by the fingers, the pulsation of the common carotid artery being felt on the lateral side of the fingers. The needle is inserted and directed posteriorly, until it impinges upon the 7th cervical transverse process, at a depth usually not greater than $1\frac{1}{2}$ in. (3·75 cm.). If bone is not encountered, or the patient experiences tingling down the brachial plexus, the needle must be withdrawn and directed more medially, or slightly upwards or slightly downwards, but this is seldom necessary. After impinging upon the transverse process, the needle is withdrawn $\frac{1}{8}$ in. (3 mm.) to disengage it from muscle. Aspiration is then undertaken to exclude the possibility of penetration of a blood-vessel, and as a double precaution a pause of 15–30 sec. is made after the injection of the first 2 ml. of anæsthetic solution (W. K. J. Walls[1]). Injection into the vertebral artery—a very near relation of the ganglion—is dangerous, since this artery vascularizes the hindbrain and cerebellum. Although it is probable that occasionally the needle passes through a portion of the thyroid gland, no sequel from this cause has been noted.

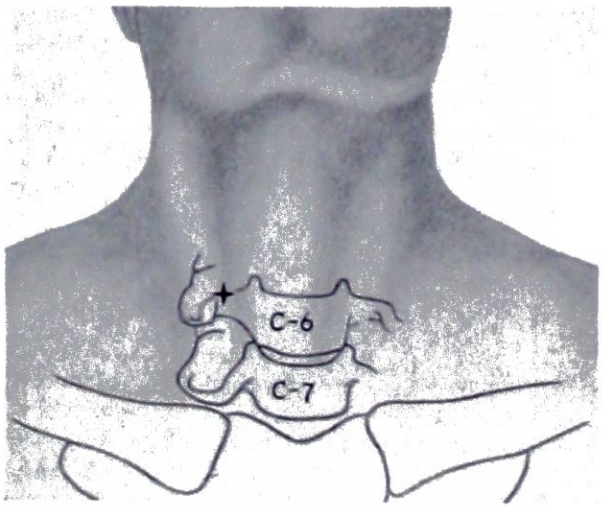

Fig. 1564.—The star indicates the site at which the palpating left index finger feels Chassaignac's tubercle. (*After J. Bonnet.*)

J. Bonnet[2] has found that xylocaine has a more prolonged effect, and that this local anæsthetic is less toxic and has a greater penetrating power than procaine. Usually 10 ml. of 1 per cent procaine or xylocaine is employed, but J. Bonnet has often injected 15–20 ml.

Chylous Fistula of the Neck.—Admittedly the occurrence of a cervical chylous fistula is infrequent, but the literature on the subject is particularly meagre. The flow of chyle from a complete fistula of the thoracic duct often exceeds 2000 ml. in 24 hours. Weakness, hunger, and thirst develop, and in a comparatively short time signs of wasting appear. Inadequately supplemented, this loss results in a decrease in the urinary output, a weak and rapid pulse-rate, and

[1] Walls, W. K. J., *Brit. J. Anæsth.*, 1955, **27**, 616.
[2] Bonnet, J., *Arch. Chir. Neerl.*, 1957, **9**, 1.

increasing apathy. Death from starvation occurs in from 14 days to 3 weeks. Little wonder, then, that it was for long believed that wounds of the cervical portion of the thoracic duct were nearly always fatal. Death in the early reported cases was usually caused by inanition and starvation resulting from inadequate nutrition due to the persistent and uncontrolled chylorrhœa.

It is now known that the thoracic duct can be ligated at any level with impunity, owing to its numerous collateral communications, but a number of erroneous beliefs concerning this condition and its treatment still abound. First and foremost is that it is best to treat the patient conservatively in the hope that spontaneous closure will occur. True, spontaneous closure not infrequently ensues, but too often it takes several months, during which time the patient becomes extremely emaciated and requires constant care to prevent death by inanition. Two cases reported by E. S. Judd, jun., and J. T. Nix[1] required two and ten months respectively for spontaneous closure.

Occasionally an operator becomes aware of the accident during the operation, by noticing a collection of milky or clear fluid in the wound, which sometimes appears in jets synchronous with expiration. In such cases the cut ends of the duct should be ligated with non-absorbable sutures.

D. P. Slaughter and H. W. Southwick[2] treated 2 cases successfully by the following method. No anæsthesia was employed because of denervation of the flaps of a block dissection of the neck.

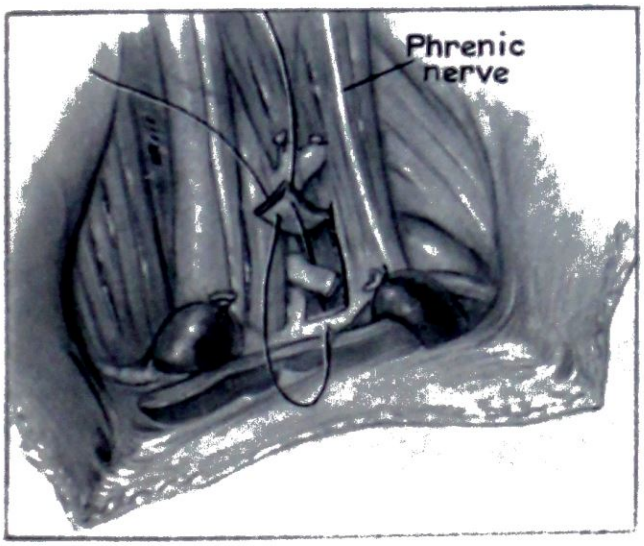

Fig. 1565.—Method of ligating a severed thoracic duct. The inclusion of the muscle-flap in the ligature is to prevent cutting out at the time of the ligation or, what is more common, hours or days later. (*After D. P. Slaughter and H. W. Southwick.*)

The scalenus anticus was split longitudinally to fashion a flap hinged superiorly, avoiding the phrenic nerve during the procedure. The flap was incorporated in an occlusive suture of No. 20 cotton, so placed as to encompass the opening of the duct and hold the muscle flap in juxtaposition to the duct (*Fig.* 1565), and thus avoid cutting out. If the operation is not performed reasonably early, the severed duct, bathed in chyle, becomes exceedingly friable.

General measures are also of importance. The patient losing chyle should be placed on a low-fat, high-protein diet, and kept strictly at rest. Fluid loss must be countered by the intravenous administration of plasma, protein hydrolysate, dextrose, and electrolytic solutions. Blood, electrolyte, and protein determinations must be undertaken frequently, and any imbalance corrected. (J. D. Gibson.[3])

Foreign Body in the Pharynx: Perforation of the Common Carotid Artery.—

A woman, aged 51, while eating her dinner felt a lump of meat stick in her throat. She experienced pain in her throat, and fearing a fragment of bone might have become lodged, she went to the Casualty Department of the hospital and was reassured. Over the ensuing weeks dysphagia persisted, but became less. Four weeks from the onset she coughed, and bright-red blood began to pour from her mouth. She fainted, and was admitted to hospital as a case of ? hæmatemesis, ? hæmoptysis. Following blood transfusion, her condition improved and an ill-defined firm swelling was discovered in the left side of her neck. Under general anæsthesia the pharynx was inspected with a long laryngoscope. A thread-like structure was seen lying against the posterior wall of the hypopharynx. This was grasped with forceps and pulled out. It proved to be a length of thread with a somewhat corroded sewing needle attached. Providentially the needle had remained threaded. (M. F. Butler.[4])

[1] Judd, E. S., jun., and Nix, J. T., *Surg. Clin. N. Amer.*, 1949, **29**, 1035.
[2] Slaughter, D. P., and Southwick, H. W., *Ann. Surg.*, 1955, **142**, 307.
[3] Gibson, J. D., *West. J. Surg.*, 1956, **64**, 247.
[4] Butler, M. F., *Lancet*, 1958, **1**, 141.

INTRA-ARTERIAL THIOPENTONE

Intra-arterial Thiopentone.—The incidence of this accident is about 1 in 50,000 administrations. In 80 per cent of cases the injection is made into the ulnar artery (*Fig.* 1566), which in 8 per cent of individuals is abnormal in that it arises above the level of the elbow-joint and is situated more superficially than usual. In 20 per cent of cases the injection has been made into the radial artery, which is abnormal in 12 per cent of individuals, in whom it arises higher than usual, and lies superficial, instead of deep, to the deep fascia.

In 24 recorded cases of this accident 9 have been followed by gangrene. Of these, 6 required amputation of the forearm and the remaining 3 lost one or more digits. (A. C. Forrester and R. C. O. Saunders.[1])

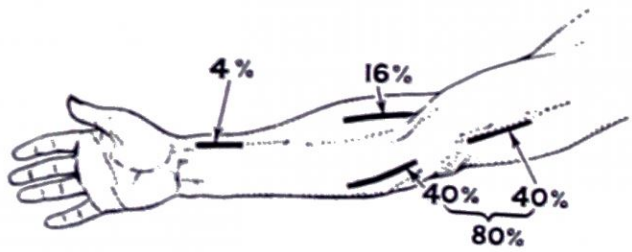

Fig. 1566.—Sites of accidental intra-arterial injection of thiopentone recorded in the literature. (*After A. C. Forrester and R. C. O. Saunders.*)

The first and imperative step is to inject 5 ml. of 2 per cent procaine (or better, xylocaine,[2] if it is available) into the artery, preferably without withdrawing the needle used for the injection of thiopentone. The next step is to induce a brachial plexus block, or better, a stellate ganglion block (p. 1130). This must be repeated up to 15 days if pallor returns. Stellate ganglion block with 1–1500 solution of cinchocaine when the effect of the first or second procaine or xylocaine block is wearing off, will ensure a long-lasting action. The early administration of pethidine by mouth will not only relieve the pain but help to reduce arterial spasm. Whether or not anticoagulant therapy is given depends on whether it is considered advisable to proceed with a cutting operation ; if no cutting operation is performed, full heparinization is carried out as soon as possible, and maintained for four or five days.

PHLEBOTHROMBOSIS

In a post-mortem study of a large number of subjects dying in hospital from various causes, N. M. Gibbs[3] found the greatest incidence of thrombosis occurred in the intramuscular veins of the soleus muscle (*Fig.* 1567). Warning leg signs were discovered in 23 of 100 patients who

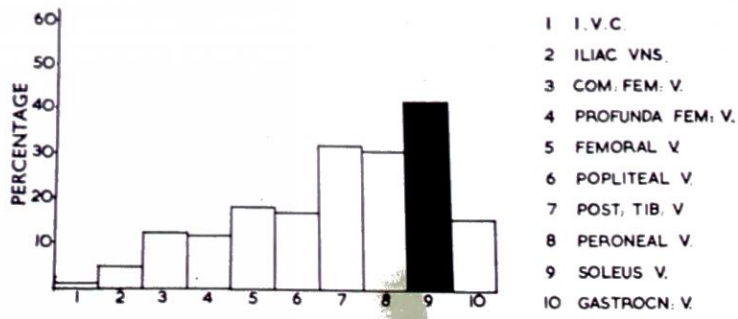

Fig. 1567.—Distribution of thrombi within the veins of 476 lower limbs (239 cases). Note that the greatest incidence of thrombosis occurs in the intramuscular veins of the soleus muscle. (*N. M. Gibbs, ' The British Journal of Surgery '.*)

sustained massive pulmonary embolism. Routine leg examinations, if practised, would give further increments. (C. Crane.[4])

In the majority of cases pulmonary embolism commences with phlebothrombosis in the legs. In the legs are two venous systems—the superficial (easy to examine) and the deep. The latter can be examined effectively by oscillometry. This simple method applied daily will show clearly by the deviation of the oscillometric needle the existence before or after operation of deep

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[1] Forrester, A. C., and Saunders, R. C. O., *Brit. J. Anæsth.*, 1955, **27**, 594.
[2] Duncan, Flockhart and Co. Ltd., 157, Farringdon Road, London, E.C.1.
Lignocaine is the approved name of xylocaine.
[3] Gibbs, N. M., *Brit. J. Surg.*, 1957, **45**, 209.
[4] Crane, C., *New Engl. J. Med.*, 1957, **257**, 147.

thrombosis of the legs. Pachon's oscillometer (*Fig.* 1568), in the opinion of N. Pines,[1] is the best. Incidentally, oscillometry is the only simple clinical method of defining the mean for effective blood-pressure, which is more important than the systolic or diastolic levels. W. Rudowski[2] advises the administration of heparin in amounts of 200 mg. daily, and states that if the treatment is commenced 6–24 hours after the production of thrombosis, further thrombosis will be halted. He also states that if a paravertebral sympathetic block is induced, further thrombosis will be prevented, provided the sympathetic block lasts for four days.

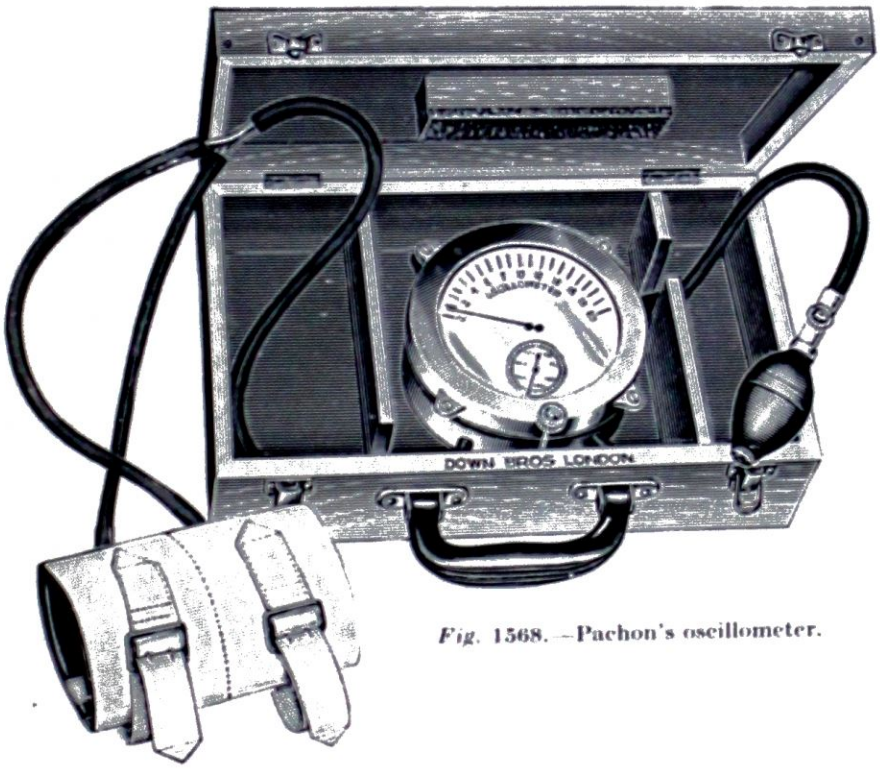

Fig. 1568.—Pachon's oscillometer.

PULMONARY EMBOLISM

Early ambulation confers many benefits, but the hoped-for reduction in the incidence of thrombophlebitis, and consequently of pulmonary embolism (*Fig.* 1569), is not one of them. Possibly this is due in some instances to the fact that early ambulation is interpreted as early sitting out of bed—a posture that increases, rather than diminishes, stasis in the veins of the legs.

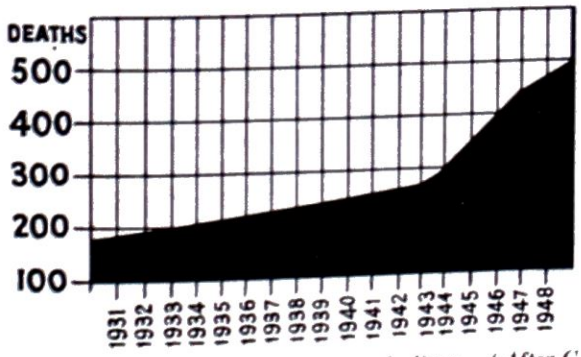

Fig. 1569.—Deaths due to pulmonary embolism. (*After C. Jones.*)

The cause of the increased incidence of pulmonary embolism (pulmonary embolism has become the most common disease of the lungs in a general hospital),[3-5] is not readily apparent. It is suggested that the much longer average time taken over operations is one of them. Another is the extended use of intravenous fluid therapy, in particular when polythene tubing is introduced

[1] Pines, N., *Brit. med. J.*, 1957, **2**, 1543.
[2] Rudowski, W., *Ibid.*, 1957, **1**, 626.
[3] Israel, H. L., and Goldstein, F., *Ann. intern. Med.*, 1957, **47**, 202.
[4] Short, D. S., *Brit. med. J.*, 1952, **1**, 790.
[5] McCarthy, H. H., et al., *Arch. Surg., Chicago*, 1957, **75**, 493.

far up the vein, where, if clotting results, the clot is more likely to become dislodged than w a short metal cannula is employed.

R. W. Wilkins and J. R. Stanton[1] apply elastic stockings to all hospital in-patients their care, with the object of decreasing the calibre of, and increasing velocity through, the veins of the legs. A significant reduction in the incidence of pulmonary embolism has occ thereby. The method is worthy of extensive adoption. On the other hand, W. C. Anlyan D. Hart[2] compute that 50 per cent of major pulmonary emboli arise from the pelvic and iliac ve and they draw attention to the frequency of pulmonary embolism after prostatectomy, a condi in which anticoagulants cannot safely be given because of the bleeding they engender. A H. Cohen and J. J. Daly[3] describe 10 cases of *unheralded* pulmonary embolism, i.e., none of patients had signs of peripheral venous thrombosis. A few of the patients were suffering conditions that favour deep pelvic thrombosis, e.g., one patient was recovering from diathe coagulation of a papilloma of the bladder; another was suffering from fractured pelvis. Se of the 10 patients recovered with treatment by anticoagulant therapy.

The symptomatology of pulmonary embolism is at variance with that which has been taught forsooth, that which is being taught. From an analysis of a large number of cases, H. L. Israel an Goldstein[4] have compiled a table of the leading symptoms and signs, which in round figures are

	Per cent
Pyrexia	79
Râles	63
Tachycardia	69
Tachypnœa	45
Hæmoptysis	29
Hypertension	26
Congestive heart failure ..	24
Friction rub	18

Tachycardia and tachypnœa out of proportion to the pyrexia and pulmonary congestion sh always suggest pulmonary embolism. Lack of response to antibiotic therapy helps to con this suspicion in doubtful cases of a small embolus.

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Twenty-two out of 23 patients had no further emboli after inferior vena cava ligation.

[1] Wilkins, R. W., and Stanton, J. R., *New Engl. J. Med.*, 1953, **245**, 1087.
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[4] Israel, H. L., and Goldstein, F., *Ann. intern. Med.*, 1957, **47**, 202.
[5] Roberts, S., *Proc. R. Soc. Med.*, 1957, **50**, 93.
[6] Byrne, J. J., *New Engl. J. Med.*, 1955, **253**, 579.
[7] Brookes, W. D. W., in *Diseases of the Chest* (ed. G. Marshall and K. M. A. Perry), 1952. London.
[8] Pilcher, R. S., *Lancet*, 1956, **1**, 104.
[9] Annotation, *Ibid.*, 1955, **2**, 1376.
[10] Anlyan, W. C., and Hart, D., *Ann. Surg.*, 1957, **146**, 499.

At the Peter Bent Brigham Hospital in a six-year period 126 patients underwent venous interruption (6 inferior vena cava ; the remainder bilateral femoral) ; 35 of these operations were on account of failure of anticoagulant therapy ; others were when bleeding was feared, or occurred. (C. Crane.[1])

Femoral vein interruption, which can be carried out with very little disturbance even when the patient is very ill, is unpopular in England, although in the experience of P. Petch[2] it is the only effective procedure in those cases of recurrent pulmonary embolism from the legs that occur from time to time.

AMPUTATIONS

Amputation in Patients with Vascular Disease.—When an amputation of a lower extremity is to be performed on a patient with advanced arterial disease, two fundamental principles must be insisted upon : (1) No tourniquet must be used ; (2) Equilateral flaps should be employed, the better to maintain nutrition of the margins of the flaps and to afford dependent drainage, if drainage be considered necessary.

The supracondylar amputation of Reeves and Quattlebaum[3] will be described ; the method can be employed equally well for a mid-thigh amputation.

The patient is placed on the operating table in a supine position, or even in a semi-Fowler's position if the cardiac condition so demands. The draping of the area and other preliminaries are the same as those described in Chapter LXXXIV. A long, sharp-pointed amputation knife is thrust directly backwards into the anterior aspect of the thigh 4–6 in. (10–15 cm.) above the superior border of the patella (*Fig.* 1570 *b*) until its point impinges upon the femur. The point of the knife is then worked around the lateral aspect of the femur and thrust posteriorly, until its

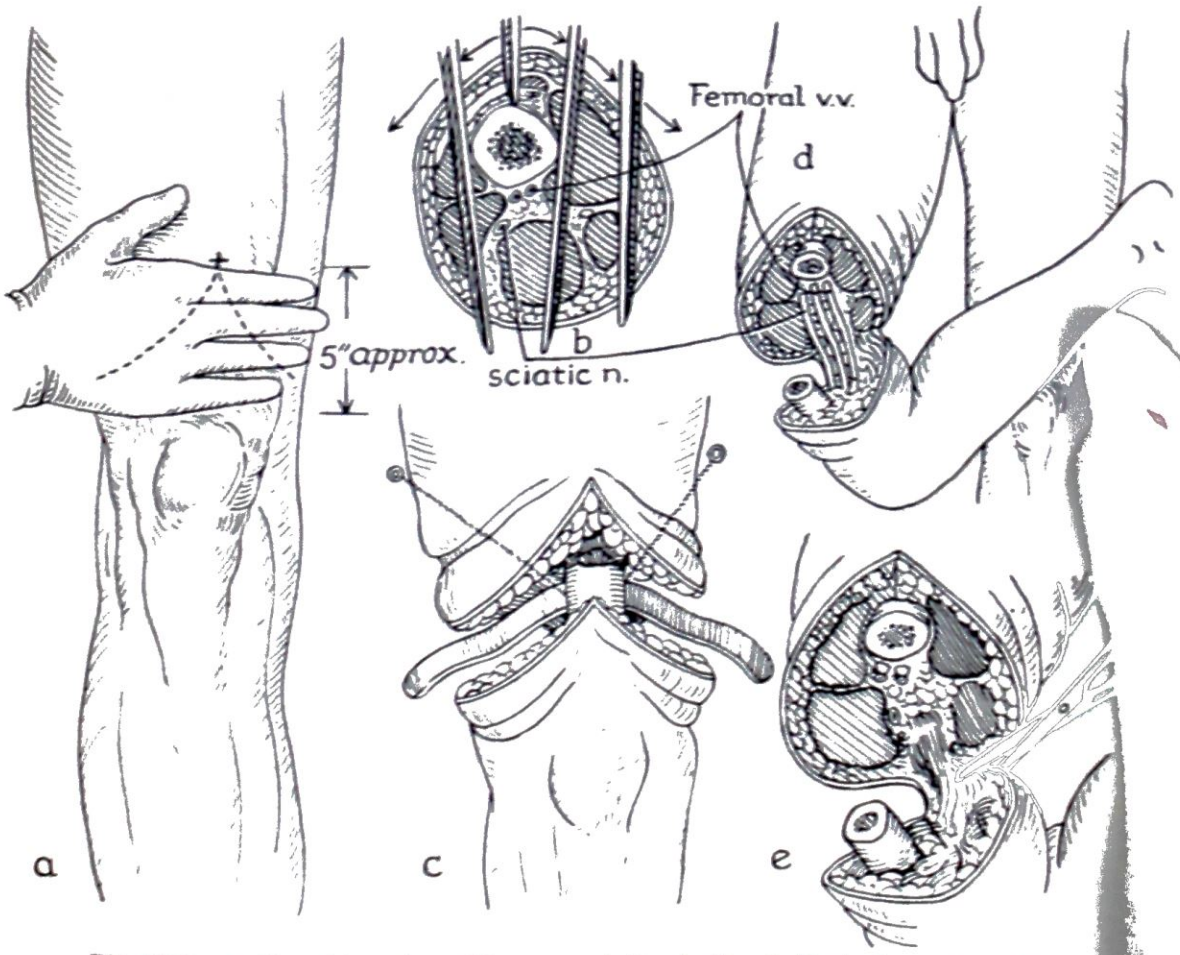

Fig. 1570.—*a*, Site of insertion of long amputation knife : *b*, Method of cutting the two lateral flaps (the femoral vessels and sciatic nerve are protected by the femur) ; *c*, Severing the bone with a Gigli's saw ; *d*, Rotation of the flexed leg to dispose the femoral vessels and nerve ; *e*, Severing the posterior bridge of fat and skin. (*After M. M. Reeves and F. W. Quattlebaum.*)

[1] Crane, C., *New Engl. J. Med.*, 1957, **257**, 147.
[2] Petch, P., *Lancet*, 1956, **1**, 53.
[3] Reeves, M. M., and Quattlebaum, F. W., *Surg. Gynec. Obstet.*, 1956, **102**, 751.

far up the vein, where, if clotting results, the clot is more likely to become dislodged than when a short metal cannula is employed.

R. W. Wilkins and J. R. Stanton[1] apply elastic stockings to all hospital in-patients under their care, with the object of decreasing the calibre of, and increasing velocity through, the deep veins of the legs. A significant reduction in the incidence of pulmonary embolism has occurred thereby. The method is worthy of extensive adoption. On the other hand, W. C. Anlyan and D. Hart[2] compute that 50 per cent of major pulmonary emboli arise from the pelvic and iliac veins, and they draw attention to the frequency of pulmonary embolism after prostatectomy, a condition in which anticoagulants cannot safely be given because of the bleeding they engender. Again, H. Cohen and J. J. Daly[3] describe 10 cases of *unheralded* pulmonary embolism, i.e., none of the patients had signs of peripheral venous thrombosis. A few of the patients were suffering from conditions that favour deep pelvic thrombosis, e.g., one patient was recovering from diathermy coagulation of a papilloma of the bladder; another was suffering from fractured pelvis. Seven of the 10 patients recovered with treatment by anticoagulant therapy.

The symptomatology of pulmonary embolism is at variance with that which has been taught and, forsooth, that which is being taught. From an analysis of a large number of cases, H. L. Israel and F. Goldstein[4] have compiled a table of the leading symptoms and signs, which in round figures are :—

	Per cent
Pyrexia	79
Râles	63
Tachycardia	69
Tachypnœa	45
Hæmoptysis	29
Hypertension	26
Congestive heart failure ..	24
Friction rub	18

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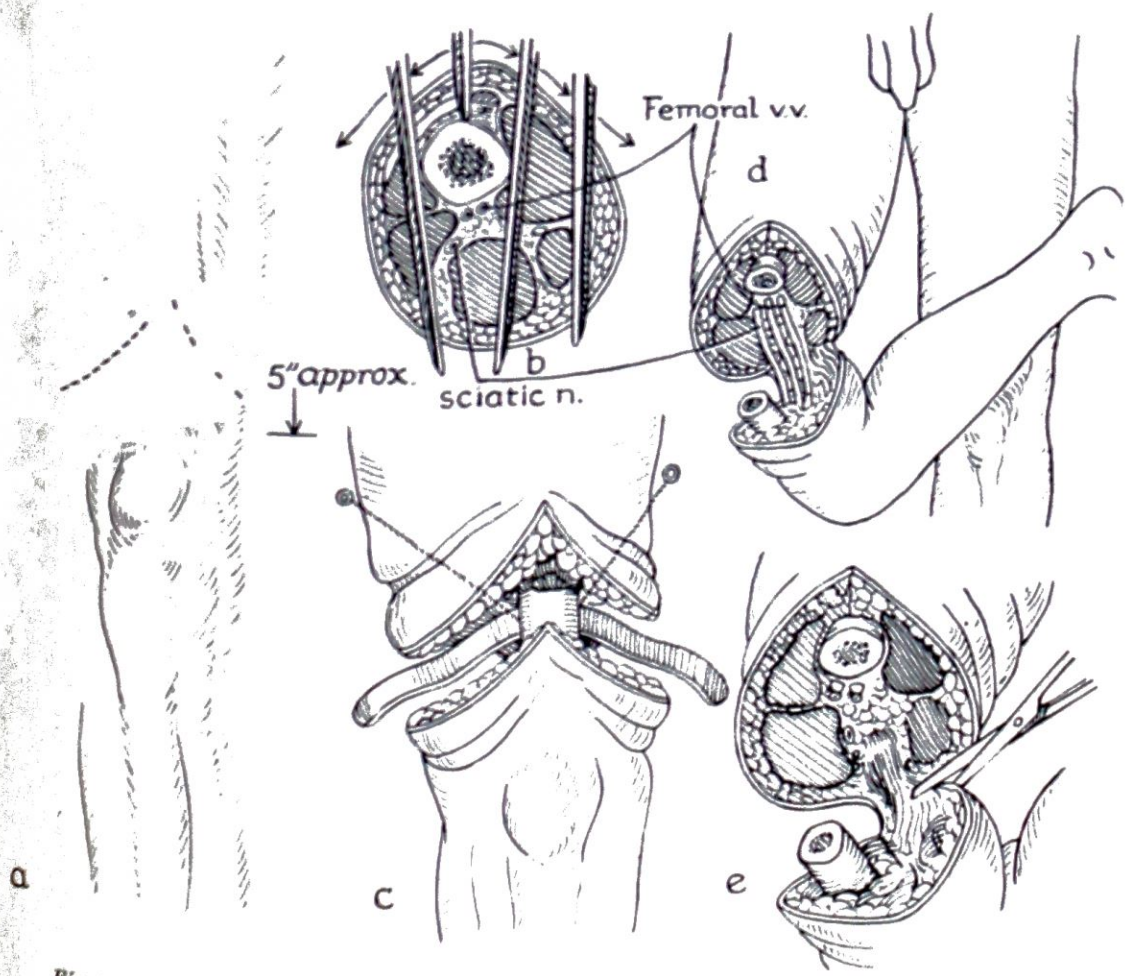

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point emerges through the skin as near the midline as possible (*Fig.* 1570 *b*). With a to-and-fro movement, the blade cuts distally and laterally, so that a flap of muscle and skin 2–3 in. (5–7·5 cm.) in length is formed. The blade of the knife is again placed in its original position, and a medial flap of muscle and skin is cut in the same manner. Using a periosteal elevator, the muscles are erased from the bone for 1½ in. (3·8 cm.) in an upward direction. A cloth retractor is used to

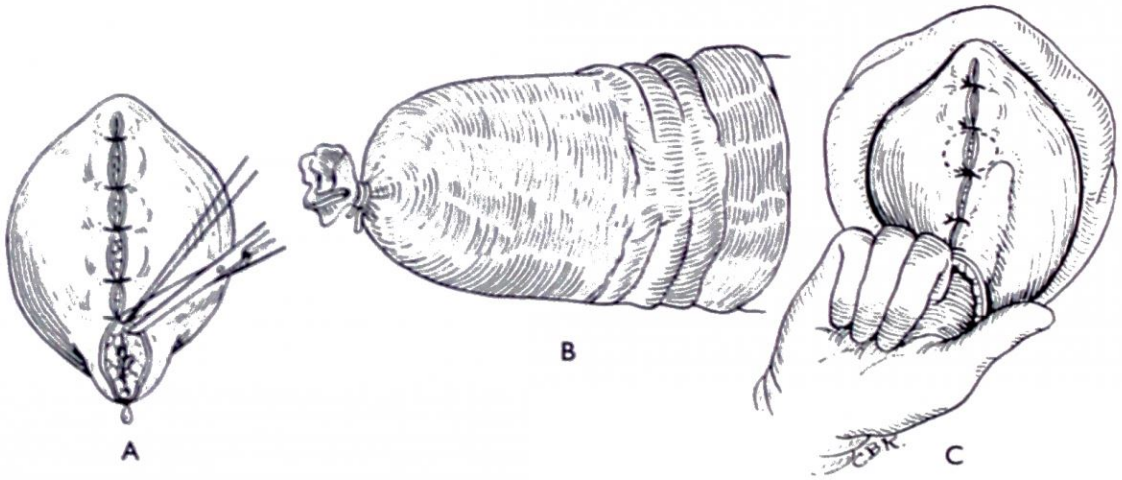

Fig. 1571.—A, The inferior third of the wound is left unsutured; B, Tubular stockinet fixed to the skin, ready for traction; C, Exploring the wound to evacuate a hæmatoma or collection of fluid. (*After M. M. Reeves and F. W. Quattlebaum.*)

display the bare bone. A malleable retractor is placed under the femur between the bone and the femoral artery and vein and sciatic nerve. The femur is then transected with a Gigli's saw 1½ in. above the apex of the incision (*Fig.* 1570 *c*). The partially detached leg is rotated and flexed to expose the femoral vessels and the sciatic nerve (*Fig.* 1570 *d*), which are dealt with in the usual manner. The remaining posterior bridge of tissue (*Fig.* 1570 *e*) is divided to complete the amputation. Bleeding vessels are ligated.

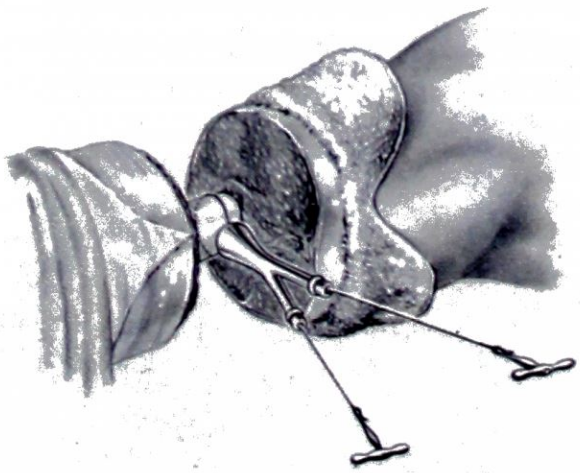

Fig. 1572.—The use of a metal bell-end of a stethoscope to protect the soft parts while severing the bone with a Gigli's saw. (*After J. Sarnoff.*)

At this juncture the cut muscles are viewed critically. Should they appear dusky and ooze but little, poor wound healing is likely to result, and a second amputation is performed immediately at a level approximately 4 in. (10 cm.) higher. Occasionally this must be repeated, until a level of indubitably viable tissue is reached, the criterion being that the muscle is beefy red, and has a goodly capillary ooze. The skin is then approximated in the anterior two-thirds of the incision, the posterior portion being left open for dependent drainage (*Fig.* 1571 A). No drain is employed, but a dry dressing is applied.

Skin traction is established by means of tubular stockinet (*Fig.* 1571 B), glued to the skin with collodion or one of its substitutes.

Post-operative Treatment.—For two days traction, by means of a 2 lb. (1 kg.) weight, is employed. In order to evacuate serum, blood, or blood-clot, on the third post-operative day the posterior portion of the wound is explored (*Fig.* 1571 C) with a sterile gloved finger as far as the cut end of the femur. This procedure is repeated daily until the wound has healed. During this period the stockinet is retained. If areas of non-viable tissue appear, these are excised.

According to Reeves and Quattlebaum, who have had an enormous experience of this operation, daily dressings of the wound and débridement of non-viable tissue reduces the incidence of infection.

Improvised Guard for a Gigli's Saw.—In order to prevent the Gigli's saw coming into contact with any of the tissues except the bone to be cut, J. Sarnoff[1] uses a metal bell-end of a stethoscope, (*Fig.* 1572), through which a Gigli's saw can be threaded readily to serve the purpose described. The rapidity with which the bone can be sawn through with the aid of this improvised guard for Gigli's saw is remarkable. The end of the stethoscope helps to steady the bone, guide the saw, retract the soft parts, and guard them from being injured. By holding the guard firmly against

[1] Sarnoff, J., *Ann. Surg.*, 1931, **93**, 792.

the bone it is so steadied that the disconcerting to-and-fro motion of the stump, ordinarily produced by pulling of the saw, is avoided.

Femoral Periarterial Sympathectomy for Delayed Healing after Amputation.—In 2 cases of arteriosclerotic gangrene where healing had not followed mid-thigh amputation, periarterial sympathectomy on the femoral artery at a second operation so improved the nutrition of the stump that rapid healing occurred. These cases are a reminder of the occasional usefulness of periarterial sympathectomy—an operation that is usually regarded as out of date. (R. Clarke and M. R. Fisher.[1])

THE HAND

A large part of the finger denuded of skin.—What to do for the best in these circumstances has been a problem which it would appear has been solved by C. R. McCash's[2] cross-arm bridge flap, the details of which are so clearly depicted in *Fig.* 1573 as to render a description superfluous.

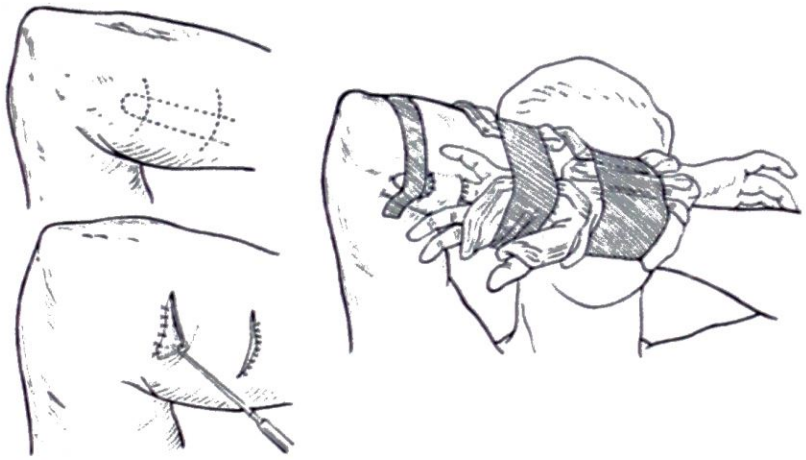

Fig. 1573.—The cross-arm bridge flap. (*After C. R. McCash.*)

Subungual Hæmatoma.—A wire paper-fastener or a safety-pin is straightened out, and heated to redness in the flame of a match or a cigarette lighter. The glowing point is held against the nail, through which it melts a hole. This requires anæsthesia, and A. W. Ashford[3] injects 1 ml. of xylocaine beneath the palmaris longus tendon around the median nerve ; this anæsthetizes all the digits except the fifth. The red-hot wire produces a rounded hole through which the blood can be evacuated by pressure. Sometimes it is necessary to make two holes (R. P. Robertson[4]). It should be noted that once a hæmatoma beneath a finger or toe-nail clots, evacuation is impossible. Complete clotting occurs in less than 48 hours.

Methods of drilling a hole through the nail, other than that recommended on page 1004, are by means of a dental drill or the electric burr used by chiropodists.[5]

The Ring and the Swollen Finger.—Many methods have been devised to remove a ring from a swollen finger. For lesser degrees of swelling a little soap and water may suffice.

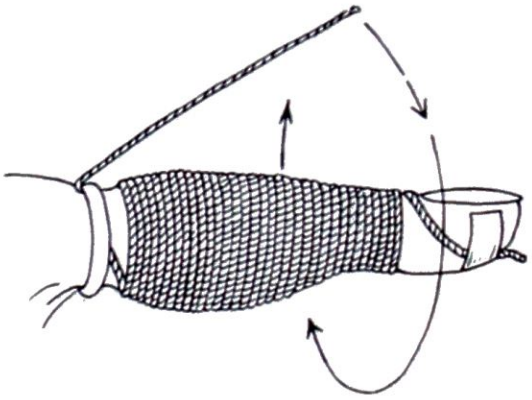

Fig. 1574.—A method of removing a ring from a swollen finger. (*After I. J. Macqueen.*)

C. A. Birch[6] advises reduction of the swelling by injecting 1000 Benger units of hyaluronidase (hyalase) in 1 ml. of procaine into the proximal portion of the swollen area and under the ring on all sides, then massaging gently to spread the injected solution. Should this be unsuccessful, a small aneurysm needle lubricated with soap is passed proximo-distally beneath the ring, and one end of a piece of stout ligature silk or string is drawn beneath the ring to the proximal side. The long end of the silk is then wound around the finger as shown in *Fig.* 1574, where the distal end of the silk is fixed by a piece of adhesive

[1] Clarke, Ruscoe, and Fisher, M. R., *Lancet*, 1956, **1**, 364.
[2] McCash, C. R., *Brit. J. plast. Surg.*, 1956, **9**, 25.
[3] Ashford, A. W., *Ann. Surg.*, 1957, **145**, 287.
[4] Robertson, R. P., *Lancet*, 1957, **1**, 888.
[5] Suvarna, R. R., *Ibid.*, 1957, **2**, 97.
[6] Birch, C. A., *Brit. med. J.*, 1954, **2**, 595.

plaster. The proximal end of the silk is then angulated as shown in *Fig.* 1574 and rotated around the finger so as to undo the spiral. Provided there is no underlying bony enlargement, this method seldom fails. (I. J. Macqueen.[1])

In the absence of an aneurysm needle, J. F. Filbee[2] has used with success a large darning needle passed eye first under the ring.

An important contra-indication to the method is evidence of sepsis in the affected digit. (R. J. W. Ryder.[3])

SURGICAL EMERGENCIES IN THE TROPICS

Drainage of a Tropical Abscess of the Liver.[4]—A number of surgeons find that extrapleural drainage of a posteriorly placed amœbic abscess of the liver gives quicker and better results than aspiration. French surgeons, in particular, have found that drainage of an amœbic abscess under antibiotic cover is no longer associated with a higher mortality or morbidity than more conservative measures. A posteriorly situated abscess is drained extrapleurally in a manner similar to the drainage of a subdiaphragmatic abscess (*see* p. 347). When laparotomy is indicated (central or anteriorly placed abscess of the right lobe and all abscesses of the left lobe) packs impregnated with a solution of erythromycin 1 : 1000 are so arranged as to isolate the liver. The presence of an abscess having been ascertained by needling, a trocar and cannula is thrust into the abscess cavity; pus having been evacuated, the cavity is irrigated with saline solution. The opening in the liver is enlarged carefully, and a suitably-sized de Pezzer catheter is inserted and anchored to the liver. An omental barrier is constructed before closing the abdomen.

After-treatment.—Every effort should be made to keep the drainage closed for as long as possible by connecting the tube to a water-sealed bottle. After the operation a full course of specific drug therapy is given, and an antibiotic is administered until the abscess ceases to drain.

THE SURGICAL CORRECTION OF ONE FORM OF NEONATAL RESPIRATORY OBSTRUCTION

Micrognathia.—The infant is born with a mandible the horizontal ramus of which is foreshortened. This renders the tongue unduly mobile, and results in tongue-swallowing with frequent attacks of dyspnœa and cyanosis, especially if a cleft palate is present as well. Attacks of cyanosis in a neonate with the characteristic profile shown in *Fig.* 1575 should be sufficient to enable any doctor who has heard of the condition to make a prompt and confident diagnosis.

Fig. 1575.—Micrognathia. An endotracheal tube has been passed. (*Professor A. Moncrieff.*)

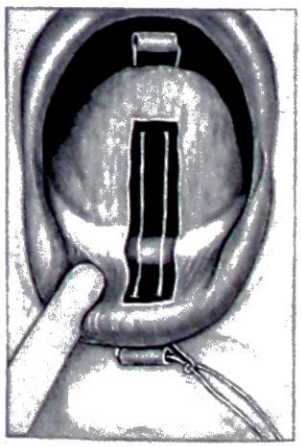

Fig. 1576.—Glossolabial fusion. (*After B. Douglas.*)

If the infant with this anomaly is permitted to lie on its back, its exitus is not long delayed. To keep an infant in a sitting position day and night for a period of many months throws a strain on the nursing staff, and is rewarded with comparatively scant success. In spite of every care in hospital, when treated conservatively at least 65 per cent of infants with this condition succumb to asphyxia or pneumonia during the first eight weeks of life.

The simple operation of glossolabial fusion (*Fig.* 1576), whereby a strip of the undersurface of the tongue, denuded of its epithelial covering, is kept in contact with a strip of the lower lip, bared similarly, by a mattress suture for ten days is eminently successful (B. Douglas[5]). The labial muscles soon hypertrophy, and eventually assist the tongue in its functions of deglutition and articulation.

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[1] Macqueen, I. J., *Brit. med. J.*, 1954, **2**, 471.
[2] Filbee, J. F., *Ibid.*, 1954, **2**, 595.
[3] Ryder, R. J. W., *Lancet*, 1955, **2**, 1140.
[4] Schapiro, M. M., *Arch. Surg., Chicago*, 1956, **73**, 780.
[5] Douglas, B., *Lyon chir.*, 1956, **52**, 420.