SURGICAL PROCEDURES IN GENERAL PRACTICE

This is one of a series of articles contributed by invitation

PENETRATING WOUNDS OF JOINTS*

BY

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One of the most anxious problems with which the practitioner has to deal is the diagnosis and treatment of the penetrating wound in the neighbourhood of a joint—usually the knee-joint. Such a wound may vary from that inflicted by a pin to a large lacerating wound freely opening the joint and involving serious damage to surrounding bones and soft parts. It is essential to realize that the pin-prick is as potentially dangerous in regard to life and limb as is the severe injury, and that both wounds need treating promptly on the same principle—namely, by excision of the wound track and resting the damaged joint in extension.

There is no doubt that the proper solution to the problem, and one which greatly simplifies it, is that in all wounds of this nature there should be complete and free excision of the track. This must be carefully and promptly carried out, for to be efficient in preventing sepsis it must be performed within twelve hours of infliction of the wound and must include all damaged tissues around the track throughout its entire depth. In the performance of this operation it can be definitely ascertained whether the joint cavity has been penetrated or not. Such an operation, however, requires general anaesthesia and removal to a medical institution equipped with an efficient modern operating theatre where asepsis can be ensured. Though this procedure is advisable and in the opinion of all surgeons of experience necessary, it often seems to the patient and his relations, and even in some cases to the practitioner, to be out of proportion to the apparent slowness of the injury, and for this reason the medical man is urged and may be tempted to adopt expectant treatment—a course that is all too frequently attended with disastrous results. Should, however, such expectant treatment be decided upon the limb must be placed at rest and extension provided to keep the joint surfaces apart, with a protective dressing over the wound. In order to secure adequate rest some form of skeleton splint—such as Thomas's—must be employed, while extension is to be applied by adhesive plaster in the manner subsequently to be described; but one would again emphasize that this treatment is not advised and is often fraught with danger and disaster to the unfortunate patient.

It must be realized that the presence of effusion in a joint in the neighbourhood of a wound does not of necessity imply that the joint cavity has been penetrated, as such an effusion may result from the trauma accompanying the injury; indeed, the presence of a large tense effusion is not compatible with a wound of any severity. It may be possible, by pressing on the swollen joint, to extrude blood or blood-stained synovial fluid from the joint cavity along the wound track, though failure to elicit this does not mean that the joint is not involved.

Treatment

In performing excision enough tissue must be removed to ensure that all crushed and damaged muscle is ablated,

the guide to this being that muscle is a healthy colour and that it contracts, while the blood vessels will be found to spurt and not ooze. Care must of course be taken to preserve intact, or to repair if they are damaged, all important anatomical structures such as nerves and tendons in the track of the wound. Excision of the wound track is to be carried out in all cases, and if it is found that the synovial cavity has not been penetrated the tissues should be sutured layer by layer and the wound closed. It is advisable, even when the joint is not involved, to rest the limb by suitable splintage for twenty-four to forty-eight hours.

Wounds involving the Joint Cavity

Where the joint cavity is found to be involved and the synovial membrane penetrated, the edges of this membrane should be excised and the joint cavity inspected through the aperture so far as is possible. It cases in which no gross or extensive fouling of the joint has occurred it is not advisable to irrigate the cavity of the joint. The synovial membrane should be closed with a series of interrupted catgut sutures and the overlying tissues sutured in layers, drainage being left down to the joint cavity for twenty-four to thirty-six hours so that, should tension occur in the joint, effusion can escape, thus ensuring a free flow of fresh synovial fluid in the cavity.

Should the joint be grossly fouled, which is not likely except in lacerated wounds, or should there be gross bone damage into the joint cavity, the question of amputation will have to be considered, and this becomes imperative in all cases in which gross damage has occurred to the musculature or main blood supply of the limb. This is a serious decision, but it must be made promptly, and it is well for the practitioner to seek the advice of a colleague with considerable surgical experience. Should this not be possible it must be remembered that it is far safer for the patient, who may appear very fit apart from a rapid pulse, that the limb should be removed, as the appearance of wound shock in about twelve hours often leads to a fatal termination in those cases in which the limb has been preserved.

In less severe cases irrigation of the joint cavity with warm normal saline solution (sterile) must be carried out so as to cleanse the cavity thoroughly. Any loose fragments of bone or large foreign bodies must be removed and the synovial membrane closed in so far as this is possible without tension, any gap remaining being filled in with a graft of deep fascia.

Fixation and After-treatment

No matter what the condition, it is essential in every case that the joint be immobilized for at least three days subsequent to the operation, and, if the injury is at all severe, for a week to ten days. This immobility is best obtained by placing the limb in an extension splint of the Thomas type, in which it rests on a series of flannel slings. Extension is secured by applying strips of adhesive plaster to the shaven limb below the affected joint. The two strips are fastened round a wooden spreader and extension obtained either (a) of the fixed type, by the use of a Spanish windlass (Fig. 1), a method which must be employed in any case in which the patient may have to be

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transported after operation, or (b) by weight extension taken over the end of the bed on a pulley, in which case a weight of approximately 1 lb. will be required for each stone of body weight.

FIG. 1.—Spanish windlass for maintaining fixed extension when a Thomas splint is used.

Cases seen Late

After an interval of more than twelve hours excision is valueless as a means of combating infection, and in such cases all that can be done if there is a perforating wound is to place the limb in a suitable skeleton splint with extension and aspirate any effusion which may be present in the joint in sufficient quantity to cause tension or pain. Any such fluid withdrawn must of course be examined bacteriologically. If a lacerated wound is present all grossly damaged tissue must be removed and the wound dressed with 15 per cent. hypertonic saline, the limb being immobilized with splinting and extension as already indicated. In all such cases a careful watch must be kept for the onset of infection, the occurrence of which varies considerably in intensity both in relation to its local signs and in the severity of the general toxic effects. Should a cellulitis supervene or the joint fluid be found to contain streptococci, medication with sulphanilamide should be started immediately, best in the form of the oral administration of 1 gramme of prontosil album three times daily.

Joint Effusion

In the majority of cases in which the joint cavity has been penetrated, and, as has been stated previously, in many cases in which no penetration of the cavity has taken place, effusions of a greater or less extent occur within the first twenty-four hours, and, according to the tension in the joint, cause pain and even pyrexia. Where a tense effusion causes pain, or when doubt exists whether infection is present or not, the joint should be aspirated under all aseptic precautions. In the case of superficial joints, such as the knee, this operation may be performed under local anaesthesia; but with deeply placed joints, such as the shoulder or hip, general anaesthesia with gas and oxygen, if necessary supplemented by ether, is advisable. In every case the skin must be carefully cleaned with spirit and ether and a large-bore needle attached to a 10-c.cm. syringe be used to aspirate the joint. In most cases it is advisable to make a small incision through the skin, which can subsequently be closed by one suture, and insert the needle through this incision rather than puncture the skin with the needle direct, as thereby the chance of conveying infection into the deeper tissues is considerably minimized.

In the case of the knee-joint the outer side of the patella should be the point for aspiration, in the ankle-joint to the front of the internal malleolus, in the hip-joint to the outer side of the femoral vessels, in the wrist posteriorly in the joint line, in the elbow to the outer side of the olecranon process, and in the shoulder just anterior to the posterior deltoid edge; but the practitioner must use his own discretion in cases in which obvious effusion affords an easier line of approach to the joint

cavity. The fluid withdrawn should be submitted to a bacteriologist for examination and culture, even if not turbid, and if the effusion reaccumulates to any extent further aspiration must be resorted to daily until the condition settles, which it usually does in from two to three days. Provided no gross infection is present the absorption after the first day or so may be aided by allowing the patient to move the joint gently under supervision.

In all such cases it is essential that fixation of the joint should be secured on the lines already indicated, and the extension and fixation should be maintained for at least three days after the disappearance of all obvious effusion from the joint cavity. It will of course be necessary to slacken extension in cases in which the fixed extension is used, in order to allow the patient to move the joint where such treatment is thought advisable; but where the weight extension has been used over a pulley it is advantageous to make the patient move the joint against this resistance.

Suppurative Arthritis

Should infection arise and progress in spite of this treatment a very serious condition of suppurative arthritis has to be faced, and again the practitioner will be called on to decide whether it may not be in the interests of the patient to consider prompt amputation. This in many cases is a life-saving operation, and, as already mentioned, should be performed immediately in all cases in which extensive bone damage involves the joint, and especially when soft tissues and blood vessels are extensively injured.

As I have said, it is advisable to seek a surgical opinion before arriving at a decision which involves grave responsibility. The absence of a pulse in the vessels either above or below the affected joint, the presence of grossly pulped and blackened muscle tissue in the wound and around it, and, of course, any appearance of gas in these tissues, as well as extensive bone damage which is involving both the joint and the wound, give clear indication that the limb must be sacrificed, and that promptly; while the presence of severe toxæmia combined with frank pus in the joint cavity is also an indication for prompt amputation. There are, however, a large number of cases in which the decision is very difficult to make, and in which delay will mean loss of the patient's life or, at best, the preservation of a useless limb that will subsequently need amputation after a long and painful convalescence which frequently leaves the patient a complete nervous wreck.

If it is decided to attempt to save the limb it is essential that efficient drainage of the joint cavity should be provided immediately, and in order to be efficient all drainage must be from the most dependent point of the joint cavity as the patient lies in bed. Inasmuch as the knee is the joint most commonly infected it is well to use this as an illustration and to point out that incision beside the patella cannot possibly drain the joint adequately. The only adequate incision for draining it is one made in the postero-lateral side of the limb between the ilio-tibial band in front and the biceps tendon behind, about half an inch above and in front of the head of the fibula (Fig. 2). When this incision has been made the joint cavity will drain freely, but it is wise approximately to close the synovial membrane with one or two sutures.

In the case of deeper joints incisions must be planned to approach the joint cavity without causing undue damage to superficial structures, while at the same time ensuring drainage from the most dependent point of the joint cavity in whatever position the patient may be nursed. Thus in the case of the hip-joint the posterior

approach is essential. In all cases the joint should be secured in a skeleton splint with extension in such a position that it will be useful to the patient should ankylosis result. This is a complication that is almost

FIG. 2.—A, Incision for arthritis in front of biceps tendon. The figure also illustrates the method of applying adhesive plaster for fixed extension in a Thomas splint.

bound to follow suppuration in the joint cavity; but early active movements, once the acute stage of the infection is over, will do much to minimize the amount of adhesions formed and ensure a reasonably mobile joint, and the patient should be encouraged to make such movements two or three times a day soon after the establishment of efficient drainage.

In the case of deeper joints it is generally advisable to leave a drain down to the synovial membrane. In no case, however, must such a drain be placed within the joint cavity, otherwise dense bands of adhesions form around the track; these will produce marked limitation of the joint movement subsequently, as they cannot be broken down by manipulation without causing such a severe reaction that further adhesions will form before the patient can use the joint again.

It cannot, in conclusion, be emphasized too strongly that this risk of suppurative arthritis, with its extremely long and painful recovery and dire risks to the patient, can be avoided by early and proper excision of the wound track followed by rest of the joint, with extension and splintage. The practitioner is urged to realize this, and to advocate and carry out excision in all cases of wounds in the neighbourhood of joints, however trivial they may appear to be on first inspection.

The two figures above are reproduced from *Medical Organisation and Surgical Practice in Air Raids*, by Philip H. Mitchiner and E. M. Cowell, by kind permission of the publishers, Messrs. J. and A. Churchill.

On the whole it will probably be welcomed mostly by teaching bacteriologists and postgraduate students as a means of amplifying the necessary shorter historical accounts in the textbooks and settling chronological and related questions. For both these purposes the double index of authors and subjects renders it particularly useful.

SOME OLD MEDICAL BOOKS

In spite of the war, Messrs. Davis and Orioli, of Museum Street, W.C.1, have enough faith in the allegiance of book collectors to their hobby to send out a catalogue of old medical books, including many scarce items. When the Doncaster yearling sales of blood stock are imminent it is the frequent practice of the racing correspondent of the *Times* to amuse himself and interest his readers by picking out the various young horses he would prefer to buy if he were a racehorse owner with a bottomless purse. On the same principle, the following are some of the books—not necessarily the rarest or the most expensive—which would most appeal to one doctor into whose hands this catalogue has fallen. There are, for instance, the first German edition of the eight books of Celsus, published by Schöffer at Mainz in 1531, stamped pigskin over oak boards; the *Rich Storehouse or Treasure* of popular medicine in black letter, not in the British Museum, first compiled by "G. W.," and re-edited for the later edition now offered, of 1631, by "A. T.," the very rare first German edition of Vesalius's textbook of anatomy, published at Nuremberg in 1551 with forty plates. In another genre there is William Osler's first published work, a popular article in Hardwick's *Science Gossip* of 1869; some of us would rather have this comparatively inexpensive item than the ponderous tomes of the mediaeval authors. Smellie's set of Anatomical Tables, first edition, London, 1754, is another work not possessed by the British Museum; there is also a copy of the third edition, 1788, edited by A. Hamilton. Of great interest, too, is a tract championing Harvey's discovery of the circulation against certain detractors; this pamphlet has been hitherto unknown—it was published in a small town in Italy (Fermo) in 1680, and written by J. B. Scaramucci. Another rarity is the translation of Galen, published at Lyons in 1539, which is believed by the French experts to be from the pen of François Rabelais himself: this is naturally a somewhat expensive item. The last of the 678 items which space allows one to particularize is the volume by Thomas Willis, 1683, on *Two Disorders Concerning the Soul of Brutes*, of interest because in it he gives the first description of what has since been known as "paracismus Willisii," the condition in which certain deaf people can hear so long as a drum is being beaten in the vicinity.

Nova et Vetera

A HISTORY OF BACTERIOLOGY

Bacteriology. By William W. Ford, M.D., D.P.H. Clio Medica. (Pp. 208; eight illustrations; 2.50 dollars net.) New York and London: Paul B. Hoeber, Inc. 1939.

Attempts to popularize medical and scientific subjects vary as much in their mode of presentation as they do in the knowledge and ability of their authors. Some are so short and scrappy as to appeal to none but the most superficial of lay readers: others are so long and detailed as to repel all but the most serious-minded members of the professional classes. The present volume falls in between the two. It is a didactic account of the history of bacteriology from the earliest times to the present day, written by the late occupier of a well-known chair of bacteriology in a great American university. It discusses problems of classical importance, but it makes no great call on the reader's intelligence. In some respects it is elementary, yet it contains references to several hundred papers. Who will read it in this country it is difficult to say. Most doctors and medical students will find it too long, and few lay readers will find it sufficiently exciting.

MEDICAL EXPENSES IN THE 'EIGHTIES

There has lately fallen into the hands of a correspondent a set of domestic account books kept in beautiful script by a tuberculous clerk in Lincolnshire who was earning £2 a week in the early eighties of the last century. Every expenditure to the last penny is recorded. One entry in 1883 reads: "Paid Dr. P. (wife's confinement) £1 7s. 6d." In 1884: "Paid Dr. P. (wife's eyes) 17s. 6d." In 1885: "Paid Dr. P. for attending me, January, 1884, £2 16s. 0d." Then comes a consultation costing three guineas, but two of the three are spent on travel: "Expenses to London to see Dr. Williams, railway fare 35s. 7d., cabs 4s. 6d., doctor 21s., sundries 1s. 11d." In June, 1886: "Paid Dr. P. for attending me during 1885, £7 12s. 6d.," and again in 1886: "Dr. Lambert for bacteria remedies and commission, £2 2s. 4d." The amounts spent on medicines by this little family are interesting. In 1880 the sum of 6s. 6d. was spent on the following: "Black beer, castor oil, cough mixture, glycerine, horehound, infant's preservative, lime water, sweet nitre." Other drugs in subsequent years include balsam of aniseed, tincture of rhubarb, gripe mixture, Kayne's linseed, olive oil, peppermint, Spanish juice, pills, senna, and magnesia. The biggest entry is: "Congreve, balsamic elixir, 24s. 9d., and commission on order, 3d." The neat hand falters and the entries cease in 1886.