MENISCECTOMY IN THE SOLDIER.

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The treatment of knee-joint disabilities constitutes a problem of no small importance in the present war. In one Orthopaedic Centre alone, over a twelve-month period, 628 patients were dealt with who had been referred for treatment of "internal derangement of the knee." Of this number, 325 were considered to have true semilunar cartilage injuries, and, of these, 206 came to operation. This article is based on such observations as were made in the management of these cases, and the methods of diagnosis and treatment which were adopted are described.

GENERAL CONSIDERATIONS.

A far greater proportion of semilunar cartilage injuries require operation in the Army than in everyday life. This follows from the fact that symptoms depend largely on individual activity. The professional footballer regards a cartilage injury as a serious disability, whereas the same lesion may be little more than a minor inconvenience to the sedentary worker. The latter may be forced to discontinue taking part in vigorous games because of "the knee which lets him down," but otherwise his disability may be soon forgotten. When such an individual enters the Services, however, choice of activity is no longer his own. The knee is subjected to strains and stresses which quickly reveal the latent cartilage lesion and confidence in the affected joint is lost. A large percentage of Army patients who come for treatment of knee-joint disabilities are in this category and a history of initial injury which took place five or ten years previously is not uncommon.

Meniscectomy in the soldier is undertaken with a view to preserving or increasing efficiency. It cannot be expected to succeed in the presence of gross arthritis or ligamentous damage nor is it likely to be of benefit when the diagnosis is at fault. Persistence of symptoms, following operation, is to be avoided for many reasons. In addition to the crippling of the individual's services, such an end-result will discourage more suitable patients from seeking treatment, and interference with the efficiency of many men will follow.

The decision to remove a semilunar cartilage, therefore, requires careful consideration of the case from every aspect. Accuracy of diagnosis, particularly, should be sought, since the operation of meniscectomy cannot always be relied upon to establish this. No more than the anterior half of the cartilage is seen on opening the joint, except in the case of centrally displaced "bucket-handle" tears. In lesions of the posterior half, the cartilage may appear completely normal until its removal is actually in progress. It is more profitable to be sure of the diagnosis than to employ an extensive, and perhaps damaging, incision in order to examine the joint interior.

DIAGNOSIS.

Diagnosis is based on a combination of the history and clinical findings. The patient is invited to tell his own story. Suggestion of the word "locking" is best avoided for the soldier will almost always agree that this has taken place on one or other occasion. He cannot be expected to appreciate the mechanism of locking, and the term simply appeals to him as a convenient way of describing any stiffness or painful motion which he may have experienced. If true locking has taken place, this will be evident from the patient's statements without the need for prompting.

The typical history is one of initial injury of the abduction-rotation type, which is accom-
panied by pain of a sickening character and followed some hours later by swelling. Swelling which appears immediately after the injury is interpreted as indicating a hemarthrosis. Locking is characteristic, as is the sudden unlocking which follows. The subsequent history is a repetition of this cycle of trauma, pain, locking, unlocking and swelling. As time goes on, the disability is noted after even minor trauma, and the patient becomes adept at unlocking the joint by his own efforts. Swelling tends to diminish with each successive attack, and in a case of some years' standing it may not appear at all.

In cartilage cyst formation, the common complaint is one of constant ache, worse at night, and the site of this ache is frequently indicated by a vague rubbing of the open hand over the affected side of the knee.

Although the history is not always straightforward, much can be gleaned from it as a rule and the clinical examination which follows is often required for confirmation only. Examination is carried out with the patient lying down and both legs uncovered. Inspection reveals the presence of wasting, swelling, thickening of the synovial membrane or cyst formation.

The range of active movement is examined by asking the patient to flex and extend the knee. A hand placed on the joint whilst this is being done will detect any osteo-arthritic crepitation which may be present. This crepitation is more easily recognized during active than passive movement and tends to be masked by a synovial effusion.

The integrity of the lateral and cruciate ligaments is examined by testing for lateral stability with the knee straight, and for antero-posterior mobility with the knee flexed to a right angle. Reference to the opposite limb is made whenever abnormal laxity is suspected. With the knee still flexed to a right angle, points of tenderness are sought at the attachments of the lateral ligaments and along the line of the joint itself. A strain of the internal lateral ligament is denoted by a point of tenderness which is almost always at its femoral attachment. A tear of the internal cartilage from this ligament is indicated by a point of tenderness over the line of the joint.

By this routine, a general impression is obtained of the knee under examination. In the presence of ligamentous injury, arthritis, chronic synovial or infrapatellar pad thickening, treatment is directed accordingly. If, on the other hand, no abnormality is discovered apart from quadriceps wasting, synovial effusion or joint-line tenderness, further investigation is required. Joint-line tenderness, by itself, is not accepted as conclusive evidence of a cartilage injury. Manipulation of the knee, according to the method of M'Murray, is of particular value at this stage of the examination. A positive finding with this test places the diagnosis beyond doubt and frequently indicates the nature of the lesion itself. It cannot be carried out, however, in the acute phase of a meniscus injury when full flexion is prevented by swelling or pain.

To perform this manipulation, the patient must lie comfortably and relaxed. The examiner stands on the same side as the affected limb and grasps the patient's heel with one hand whilst the thumb and index finger of the other encircle the line of the joint. The internal cartilage then underlies the index finger and the external cartilage is covered by the thumb.

The purpose of the manipulation is to manœuvre any loose cartilage or tag between the femur and tibia. This is achieved, essentially, by reproducing the mechanism of injury. In the case of a suspected internal meniscus injury, the knee is fully flexed, the tibia forcibly rotated externally and the internal lateral ligament is put on the stretch by abducting the leg. The internal cartilage is thus strained at all its attachments and pulled towards the centre of the joint. If the leg is now slowly extended, the internal femoral condyle will slip across any loose cartilage fragment and will be both felt and heard to impinge on the head of the tibia. The resulting sensation of touch and sound is unmistakable, and the patient often volunteers the information that his feeling of "giving-way" has been reproduced.

The nature of the lesion is indicated by the stage of extension at which this slip occurs. In full flexion, the injury is likely to be a posterior one. In mid-flexion, a central tear is
suspected and a slip occurring both in flexion and extension indicates a double lesion or "bucket-handle" tear.

When an external cartilage is to be examined, the same manipulation is carried out with the tibia internally rotated and the knee adducted.

X-ray examination is a necessary routine. It provides a check on such conditions as osteochondritis dissecans, osteo-arthritis, loose-body formation or abnormal calcification.

Should a cartilage injury be discovered, the question of operation is considered when a general appraisal of the case has been made. Such factors as age, attitude, general condition, associated lesions and present medical category are all taken into account. Meniscectomy is felt to be justified when a diagnosis is clear, the symptoms are sufficiently troublesome to warrant operation and no other factor is present which will negative the end-result. When two abnormal conditions are discovered in the same joint, individual judgment must decide whether the symptoms are due to one or both of these conditions—a decision not always easy to make. On the other hand, operation is advocated in those cases where dislocation of the cartilage frequently recurs—even in the absence of serious disability. This type of derangement, because of the repeated trauma, will almost certainly lead to osteo-arthritis which will be unlikely to respond to meniscectomy performed at a later date.

A number of knee-joint disabilities defy diagnosis when first seen, and these are given a course of provocative exercises before a final decision is made. The M'Murray test, performed under general anaesthesia, can be of much value in a doubtful case.

**Anæsthesia.**

Omnopon-scopolamine premedication with intravenous pentothal has proved ideal for meniscectomy. The following technique was devised by Major T. F. Crowley, R.A.M.C., and is now exclusively employed. The limb is elevated for three minutes and an intravenous injection of approximately 0.4 gram of pentothal is given. The tourniquet is then applied, and, when the operation field has been prepared and the surgeon is ready to begin, a further injection of 0.4 gram of pentothal is administered. As the operation proceeds, additional small amounts of the anaesthetic are given as required, and a total dosage of 1.2 grams of pentothal is seldom exceeded before the completion of the operation.

**Operation.**

Simplicity of technique, coupled with scrupulous asepsis, is regarded as the keynote of meniscectomy. A two-day preparation of the limb from toes to groin is carried out, and all contact with septic cases is avoided. The number of instruments to be used is reduced to a minimum and, scalpels included, these are sterilized by boiling and transferred to the instrument tray just before use. A tourniquet is routine—but not indispensable—and the non-touch technique is always employed.

A piece of fine muslin, soaked in spirit, is used to cover the knee, and the leg is allowed to hang over the end of the table. A sandbag, carefully positioned behind the knee, forces the head of the tibia forwards and brings more of the cartilage into view when the joint is opened. This sandbag is judged to be correctly placed when the leg hangs with the knee at an angle of 80 degrees.

The incision is made slightly obliquely from within outwards over the anterior joint-line, and midway between the lateral ligament and the edge of the patellar tendon. The inner joint-line is always identifiable and can be used as a guide to the outer joint-line which is frequently obscure. The incision is made through the muslin which does not gape in the line of the incision as does the skin itself. No skin, therefore, is exposed.

Length of incision depends on accurate diagnosis. When the operation is approached with the definite object of removing the cartilage, and not for the purpose of examining the joint interior, an incision of one and a half inches is adequate. This is important, since any procedure which involves division of the synovial membrane must, of necessity, inflict
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a traumatic synovitis on the joint. The more extensive the incision, therefore, the greater is the reaction likely to be.

On opening the joint, smooth, narrow Langenbeck retractors are inserted, and a blunt hook is slipped under the free margin of the anterior half of the cartilage. The point of this hook appears at the line of cleavage between cartilage and head of tibia. A scalpel is inserted horizontally at this point and the cartilage is divided from its anterior attachments to the tibia. As the anterior horn is cut through, the scalpel is directed vertically in order to avoid damage to the anterior cruciate ligament. The blunt hook then slips out, and the meniscus is firmly grasped in a cartilage clamp.

A hand-lamp, held behind the operator, illuminates the joint interior, and the cartilage is freed by vertical strokes of the scalpel back to, and from, the lateral ligament. Central displacement of the cartilage is now possible. The weak posterior coronary ligaments are torn through by forcing the meniscus centrally. The whole cartilage dislocates into the intercondylar fossa and the posterior half comes into view. A side-to-side movement is then imparted to the meniscus and a stout tenotomy knife is held against the posterior horn. In this way, the posterior horn tends to divide itself against the blade of the knife and damage to the articular cartilage at the back of the joint is avoided.

Throughout the operation, the anterior half of the cartilage—itself easily found and removed—is regarded as the instrument whereby purchase is obtained on the posterior portion and the latter brought into view by central displacement. Great care is therefore taken to conserve this anterior half and to avoid its separation from the rest of the cartilage. Should this occur, a posterior incision becomes necessary to remove the posterior horn, and the operation is needlessly complicated.

In actual practice, the meniscus does not require separation from all its attachments at operation. Much of this has already been done by the injury. In those cases where the posterior horn has been torn from its peripheral attachments, central displacement is automatic as soon as the anterior half has been freed. In "bucket-handle" injuries, the whole cartilage may be found lying in the intercondylar fossa when the joint is opened. Meniscectomy then consists simply of division of anterior and posterior horns, More usually, however, a thin peripheral rim remains, and this should be carefully removed along with the central portion.

Cysts of the meniscus are normally dealt with by ordinary meniscectomy. The cyst itself is ignored but is entered as the meniscectomy proceeds—the escape of clear jelly-like cyst contents showing when this has taken place. With removal of the cyst origin, i.e. the cartilage itself, recurrence is less likely to occur than if the cyst alone is removed.

As few instruments as possible are allowed to enter the joint during the operation, and nothing is traumatized by forcêps which is not to be excised. The leg is straightened to 45 degrees of flexion and a single strand of plain catgut is used to close, first the synovia and then the capsule. A running mattress suture everts the edges of the synovial membrane and leaves a smooth inner surface to the suture line with no inwardly-projecting tags. For this purpose, the Cole double-ended needle is useful. It requires a simple back-and-forth movement, well suited to the non-touch technique. No knot, or half knot, is tied until the closure of both layers is complete, as otherwise a firm hemostatic suture may not be obtained. Careful co-aption of the skin edges with silkworm or linen thread is followed by a dressing of dry gauze and the leg is straightened. A firm compression bandage is applied over a liberal amount of cotton-wool, and the tourniquet is then removed.

After-treatment.

Much importance is attached to the after-treatment. This is concerned mainly with the maintenance of functional activity in the quadriceps muscle, and is necessary to ensure adequate control when the patient is allowed to get up. In addition, it preserves the action of the subcruceous muscle in tensing the loose synovial structures in front of the knee. A
weakened subcruereus allows nipping of these structures between the femur and tibia when the knee is extended. This, in turn, leads to recurrent synovitis with haemorrhage and resulting fibrosis in the infrapatellar fatty pad.

When the quadriceps muscle is allowed to remain idle, wasting, particularly of the vastus internus, follows with astonishing rapidity, and a long period of re-education is required to restore its activity. In meniscectomy, preservation of muscle tone is aimed at, and as few opportunities as possible are afforded for wasting to occur. This demands complete cooperation on the part of the patient, who must be able to perform quadriceps exercises almost as soon as he has recovered from the anaesthetic. These exercises, moreover, require to be continued at frequent intervals until normal activity is resumed.

Such a regime is undoubtedly tedious and can have but small appeal to the average soldier. He neither finds it easy to perform isolated quadriceps contractions nor to understand why these should be required. Much is to be gained by explaining the purpose of those exercises to the individual patient and by segregating all such patients in the same ward. If a competitive spirit can be fostered so much the better. In this respect, an accurate check on the number of quadriceps contractions carried out can be obtained by attaching an ordinary mechanical tally-counter to the heel of a slipper which the patients can wear in turn throughout the day. Each elevation of the leg is recorded automatically, and the patients soon come to vie with each other in trying to achieve the largest number of contractions. In addition, sustained quadriceps contracture against resistance goes far to restoring confidence in the limb. Faradism is never employed.

The sutures are removed on the tenth day and the patient is then allowed to get up. No splint is used, for the joint is better controlled by active muscle power than by any form of artificial splintage. All reaction from the operation has now passed off and the patient quickly regains full movements by his own efforts. A course of weight-bearing exercises is then begun. These exercises are carefully graduated according to the joint response. Individual attention is imperative at this stage and any tendency to "class" instruction is discouraged.

Full movements with an efficient quadriceps and no synovitis is the rule three to four weeks after operation, and this is considered as the criterion of fitness for the final stage of "hardening." This stage is best carried out in a convalescent depot where general and specialized physical training are available under the guidance of a qualified instructor. If such facilities cannot be obtained, the patient is retained in hospital for a further few weeks before being returned to duty. Premature discharge of a patient following meniscectomy is seldom worth while.

There can be no hard and fast rule as to when full duty should be resumed. Each case must be judged on its own merits for there are seldom two patients who behave alike. The reaction to meniscectomy in an old-standing injury, for example, is trivial as compared with the persistent effusion which may follow the removal of a recently injured cartilage. Again, the length of time required to rehabilitate a patient after meniscectomy is much longer in the Army than in civil practice. The soldier must be fit to undertake whatever duties may be demanded of him when he returns to his unit, for he cannot absent himself at will as can the civilian. It should be unnecessary to impress upon him, on discharge, that he must continue to do his exercises by himself. He should long since have passed the stage of conscious quadriceps contraction before being considered for discharge.

It was the custom at one time to down-grade for a period of three months all patients who had undergone meniscectomy. This was intended as a precaution against too early participation in an assault course. Down-grading is no longer carried out, however, as there are excellent post-operative routines now available which re-introduce the patient to intensive training stage by stage. Any suggestion that the soldier must continue to "nurse" his knee after he has returned to duty may do much harm by fostering the thought that all is not yet well; and in this way the whole purpose of his treatment may be destroyed.
Of the 325 patients who were considered to have true meniscus lesions, operation was found inadvisable in 119 cases for the following reasons:—

- First offence—recent injury with apparent recovery
- Disability not sufficiently marked to warrant operative treatment
- Osteo-arthritis, ligamentous damage, chronic synovial thickening
- Dermatitis, malaria, dysentery, etc.
- Refused operation

The following operations were performed in 206 cases:—

- Right internal meniscectomy
- Left internal meniscectomy
- Right external meniscectomy
- Left external meniscectomy

(17 external meniscectomies were carried out for cartilage cysts. Of these, 15 were on the left and 2 on the right knee.)

Osteochondritis dissecans was encountered at operation on five occasions.

In a personal series of 100 consecutive cases 45 gave a history of initial injury at football. The remainder described a wide variety of initial injury.

- 10 sustained the initial injury less than a month before operation.
- 19 sustained the initial injury within the previous six months.
- 24 sustained the initial injury within the previous two years.
- 18 sustained the initial injury from two to ten years previously.
- 17 could not remember when they first had "knee trouble," and 12 stated that the disability "just came on."

64 gave a history of locking, and, in 31, synovitis with poorly developed quadriceps were present when the patients were first seen. Some degree of quadriceps wasting was noted in practically every case.

Operative findings were:—

- Bucket-handle tear
- Loose posterior half
- Whole meniscus torn from peripheral attachment
- Loose posterior half with secondary longitudinal split
- Loose anterior half
- Torn at centre and requiring posterior incision for removal of post. horn
- Pedunculated
- Congenital discoid—all external
- Cyst of meniscus—all external
- No abnormality found

Thirteen were returned to full duty direct from hospital within the first five weeks following operation and 10 during the succeeding five weeks. 57 were transferred to a convalescent depot within the first five weeks following operation and 20 between the fifth and eighth weeks.

Post-operative effusions were occasionally troublesome, but no other complications were encountered although the operations were performed during hot weather under conditions which were by no means ideal.

Conclusions.

Semitunicar cartilage injuries are seldom compatible with the active conditions of Army life. A high standard of recovery is required if the soldier is to resume his normal duties after meniscectomy. Operation is only justified when a reasonable guarantee of such recovery can be given. Diagnosis and operative technique demand much attention to detail, and the after-care requires to be intensive and prolonged. Treatment should be complete before the soldier is returned to his unit, and the convalescent depot is an invaluable intermediary between the hospital and ultimate discharge to duty.

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