2. Urines from sixty-five cases in which pregnancy diagnosis was required have been examined by the test. In all except one case the result was in agreement with that of the Friedman reaction. The advantages and disadvantages of the test as compared with the biological tests are briefly discussed.

In conclusion I have to express my warmest thanks to Messrs. Parke, Davis and Co. for a generous supply of pure crystalline oestriol (theelol), which has been used in this work as the standard control substance. My thanks are also due to Miss I. McPhee for her invaluable assistance in the carrying out of the many extractions, and to Dr. A. R. Berrie and Mr. T. Harvey of the bacteriological department, who kindly undertook the inoculations.

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ATHLETIC INJURIES OF THE KNEE-JOINT, EXCLUDING CARTILAGE INJURIES*

BY

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Of all athletic injuries those of the knee-joint are the most common. They often lead to prolonged unnecessary incapacity and absence from sport, especially if no definite programme of treatment is mapped out from the start. The athlete is usually a sane and sensible person as regards carrying out the treatment of his injuries, provided that the diagnosis, the difficulties of a quick recovery, and an active course of treatment in which his full co-operation is necessary are fully explained to him.* Athletic injuries to this joint, as in all other injuries, may be due to: (a) direct violence, or (b) indirect violence.

Direct violence, such as a fall on the knee, a knock, or a kick, may cause any of the following:

1. A traumatic synovitis.
2. Contusion of the quadriceps muscles or their expansions. In these cases a synovitis of the knee may follow in a few days, either from seeping of blood serum into the joint or irritation of the capsule and synovial membrane by the products of bruising. Efforts are naturally made to prevent this synovitis, but the patient is warned of its possible occurrence.
3. A prepatellar bursitis or bruising of the infrapatellar pad of fat.
4. Fracture of the patella or head of the fibula.

Therefore in cases in which there is tenderness in relation to a bone a radiograph should be taken immediately.

There are four main types of indirect violence:

1. Flexion, usually producing a synovitis.
2. Rotation, which in a mild degree produces a synovitis, but if severe causes cartilage injuries.
3. Lateral wrenches, in which the lateral ligaments are involved.
4. Extension, in which the anterior cruciate ligament, infrapatellar fat and alar folds, as well as the posterior capsular structures, including the popliteus tendon, may be damaged.

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Often the injury is due to a combination of two or more of the above.

Before considering in detail each variety of injury let me here stress the importance of giving the patient special instructions as to graduated remedial exercises and simple remedies which he can carry out himself. The patient is warned that at all costs he must avoid undue wasting of the quadriceps muscles and a stiff knee. A scale of graduated exercises starting with those avoiding weight-bearing includes:

1. Twitching and contracting the quadriceps muscles for two minutes every hour while lying on a couch.
2. With the legs dangling over the edge of a couch so that the knees are bent, alternately extending and flexing each knee. This exercise is carried out twice daily, starting with twenty complete movements, increasing by five movements each time.
3. Raising the extended leg by flexing the hip while lying flat; abducting the thigh at the hip and then adducting it. This exercise is designed to bring into action every muscle of the thigh and buttock.
4. Bicycling.

With each exercise the patient should be made to relax completely before starting the movement again, as it is the active contraction of the muscle from its completely relaxed state which is so important. As the patient improves and synovitis disappears graduated weight-bearing exercises can be started—such as:

5. Holding the back of a chair; heel raising and knee bending and straightening.
6. Skipping.

Simple home remedies include:

1. Sponging the knee alternately with hot and cold water, thirty seconds of each for five minutes.
2. Massaging the muscles above the joint with olive or castor oil.
3. The application at night of Scott's dressing, antiphlogistine, or lead and opium.

Let us now consider the various injuries in detail.

Internal Lateral Ligament Strains

The importance of having a clear outlook on these injuries cannot be emphasized too strongly, as they are one of the commonest causes of chronic knee complaints. The injury is caused by an abduction wrench such as takes place in turning while ski-ing, and is so common in Switzerland that it is vulgarly known as the "Swiss kiss." Sometimes rotation occurs in the injury, and an injury to the internal semilunar cartilage complicates the condition. This complication one might expect in mining injuries, but it is my experience that in athletic injuries it is uncommon for internal lateral ligament strains to be associated with cartilage injuries. In those cases though, in which the maximum tenderness is at the middle of the ligament, at or near the point of attachment of the internal cartilage to the deep surface of the ligament, and in which there is limitation of full extension from the start, damage to the cartilage should be considered as a likely complication of the strain.

Usually, however, there is marked tenderness at either its upper or lower attachment—the upper is more common—and external rotation is limited and painful. Sometimes a small flake of bone is separated from the attachment of the ligament to the internal femoral condyle. It is important, therefore, to radiograph all cases at once. The essential point to be sure of is whether extension is limited or not. In the early stages of an uncomplicated

internal lateral ligament strain we find that extension is not limited. In untreated cases, and in those in which no effort is made to prevent limitation of extension, it will be found that after a week the last five degrees of extension becomes limited and painful. This is due to the fact that injured ligaments always tend to shorten—a pathological principle which at present is apparently not properly understood. Otherwise so many of these cases would not be treated by supporting the ligament in its relaxed position—that is to say, in the case of the internal lateral ligament, supporting the knee in a slightly flexed position. The strong flexor group of muscles, already tending to flex the knee, have thus an added mechanical advantage, and fix the joint by spasm. If this position is maintained for long, secondary contracture of the ligament takes place, due to the formation of granulation tissue in and around it, especially between the ligament and the joint at the back.

For the sake of treatment and prognosis I shall classify these strains in three degrees—mild, moderate, and severe. As a general working rule, even with intensive and properly directed treatment, mild degrees will take at least six days to recover completely, so that the patient is able to carry out full exercises. Moderate degrees take six weeks and severe degrees six months.

Treatment of Mild Degrees

Heat and massage over the ligament and surrounding muscles are started at once. A tendency will be found for the products of bruising to spread down the ligament and around the muscles at the back of the joint. The quadriceps are stimulated by graduated faradic contractions for twenty minutes daily from the beginning, and the constant extension of the knee by these contractions helps to prevent the tendency towards slight flexion of the joint. Gentle daily manipulative movements concentrating on the involuntary joint movements, such as moving the patella from side to side, the tibia forwards on the femur, and rotatory movements within the limits of movement without pain, while tension and countertension are applied, are of great value in that they overcome the spasm of the muscles strapping the inner side of the knee. In addition anodal galvanism or diathermy can be given.

Treatment of Moderate and Severe Cases

Skiagrams may reveal a small flake of bone detached from the surface of the internal condyle, or rupture of the ligament may be suspected by undue lateral mobility of the joint. The knee should be placed in a plaster-of-Paris cast in full extension for a period varying from three days to three weeks according to the degree of injury. A pad of felt is first placed over the length of the internal femoral condyle and the ligament. The cast consists of a back plaster holding the knee in the fully extended position and maintained by two plaster bandages, one above and one below the knee. A third bandage is wound round the knee in a figure-of-eight so as to exert lateral pressure over the pad of felt and the internal lateral ligament. Care is taken to leave the patella free, so that this can be moved from side to side and up and down daily. There is ample space above the top of the plaster in which to stimulate the quadriceps by faradism daily. Unless there is a rupture of the ligament or separation of the flake of bone weight-bearing is allowed and the patient encouraged to contract the quadriceps voluntarily. In this way traumatic effusion is massaged away from the ligament by the firm pressure pad, the tone of the quadriceps is helped, and full extension is maintained.

When the plaster is removed, and for a varying period afterwards, flexion of the knee may be markedly limited and painful, but this will gradually return with remedial exercises, faradic contractions, massage, and gentle manipulative movements. No forced movements should ever be attempted, and a manipulation under an anaesthetic is only justifiable as: (a) a diagnostic procedure to rule out an associated misplaced cartilage; and (b) in cases of several months' standing, in which all tenderness has disappeared from over the ligament and it is felt that any limitation of joint movement is due to formation of adhesions. Early forcible manipulation in these cases will often only give rise to disappointment and aggravation of the condition. As soon as walking is allowed the tread and heel of the shoe should be raised a quarter of an inch on the inside to prevent strain on the ligament.

Patients with a moderate degree of sprain treated for a short period in plaster have returned to football two weeks after the injury. Comparison with untreated cases and with those treated by other methods show their recovery period to be about one-quarter as long. Severe strains complicated by separation of a flake of bone or rupture of the ligament do take a long time, but recovery is helped by periodic courses of diathermy and faradism. Massage is not given in these cases over the ligament or condyle.

External Lateral Ligament Strains

These are often associated with sprains of the biceps tendon, ilio-tibial band, and external quadriceps expansions, and frequently are due to direct injury. Swelling appears on the outer side of the knee in connexion with the biceps tendon and insertion of the ilio-tibial band and external quadriceps expansion into the external tibial condyle, and is often mistaken for a cystic condition of the external semilunar cartilage.

Treatment consists of heat, massage, graduated faradic contractions, and gentle manipulative movements, to which may be added anodal galvanism or diathermy. Radiographs should exclude a crack in the head of the fibula.

Bruising of Infrapatellar Pads of Fat and Alar Folds

These may be caused by hyperextension or direct violence and give rise to swelling and tenderness below the patella and on each side of the ligamentum patellae. There is limitation of full extension and pain on coming downstairs. Owing to early wasting of the quadriceps often a vicious circle is started, as weakness of the crureus and subcrureus allows further pinching of these structures by not pulling them from between the joint surfaces in full extension. Treatment should consist of deep massage over the pads combined with faradic contractions and anodal galvanism or diathermy with the terminals arranged in an antero-posterior direction.

Often violent hyperextension is associated with strain or rupture of the anterior cruciate ligament and the posterior capsular structures, including the popliteus tendon. If a strained or ruptured cruciate ligament is suspected, as shown by undue forward mobility of the tibia on the femur, the knee should be put in plaster for three weeks—weight-bearing is not allowed, but during this time the quadriceps are treated with faradism. If the structures at the back of the joint are strained the treatment should be divided between the front and back of the joint, and heat, massage, and faradic contractions should be given to the gastrocnemii, popliteus, and hamstring muscles as well.

Synovitis

I have left synovitis to the end intentionally, as it is often a complication of all the preceding conditions; naturally, if present, it should be treated first.

Aspiration of the joint, especially if the effusion be partly haemorrhagic, which it usually is, will give instantaneous relief. Under strict aseptic technique the outer side of the suprapatellar pouch is anaesthetized with 2 c.cm. of 2 per cent. novocain or novutox. Through this anaesthetized area a small scratch is made with a tenotome and a large-bore needle is pushed into the joint and the synovial effusion aspirated. There is no risk attached to this procedure provided it is carried out under conditions of strict asepsis, and it will prevent granular lumps of inspissated blood collecting in the suprapatellar pouch. It is these which so often give rise to adhesions and chronic capsulitis with marked quadriceps wasting. As a result of aspiration and the use of a local anaesthetic there may be slight pain in the joint after about four hours, but by the next day this has passed off and the condition has eased. A slight return of effusion may be expected, and as long as this persists weight-bearing should be avoided, since the synovial membrane is so sensitive and inflamed at this stage that any weight on the joint is apt to produce more effusion and swelling.

As soon as the joint has been aspirated pressure is applied by a firm bandage over lint or wool soaked in lead and opium. The next day treatment consisting of heat, massage, faradic contractions, and gentle manipulative movements is started. If the amount of effusion is small and aspiration is not considered necessary anodal galvanism or diathermy may be added.

The length of time in recovering will vary according to the severity of the synovitis—from a few days to a month—but even the severest degree of traumatic synovitis should have completely cleared up in this time, provided there is no complication such as a lateral ligament strain or cartilage injury. Slow recovery should arouse suspicion of some underlying septic focus, and the patient must be carefully examined to exclude this.

Chronic Knee Strain

There is a type of strain which appears frequently in middle-aged and overweight patients, often following prolonged exercise, such as thirty-six holes of golf or a long day's shooting. Sometimes patients give a history of an old injury to the joint, or the x rays may show slight early osteo-arthritis changes. Synovitis is present, the quadriceps are atonic, and the extremes of joint movements may be limited.

Treatment consists of heat, massage, graduated muscular contractions, and the limitation of active exercise until movements and muscle tone return to normal. These cases usually clear up completely at the time, but often tend to relapse and require further treatment some years later. If they are neglected synovial changes occur, the muscles waste further, and definite osteo-arthritis of the joint sets in.

Quadriceps Insufficiency

This condition has long been recognized as a common cause of recurrent synovitis or of an unstable knee. Very often this type of knee is labelled as due to a torn cartilage, but is no better after the cartilage has been removed, since the cause of the condition has not been corrected. Quadriceps insufficiency should be divided into three types, and each type gives rise to different symptoms:

1. Vastus Internus Insufficiency.—Pain and a strained feeling are felt on the inner side of the knee.
2. Crureus and Subcrureus Insufficiency.—Symptoms are referred to the infrapatellar pads and alar folds.
3. Vastus Externus Insufficiency.—This is often associated with a slack ilio-tibial band. Pain and instability of the outer side of the joint may lead to the diagnosis of a damaged external cartilage. Careful examination will reveal in which part of the quadriceps there is most wasting, and every endeavour must be made to correct the wasting by graduated faradic contractions and special exercises.

Frequently quadriceps insufficiency is associated with limitation of movement. If this be so the joint must first be manipulated under full anaesthesia, followed by daily routine treatment. A joint may apparently be free in movement but painful on playing football or running full out. This type of joint is often completely cured by a forcible manipulation.

Conclusion

I will end by stressing the following points:

1. Severe internal lateral ligament strain takes a long time to recover and treatment cannot be forced.
2. Quadriceps insufficiency may be divided into three parts—inner, middle, and external.
3. Remember that Sir Robert Jones emphasized the importance of trying the effect of forcible manipulation on a knee-joint before labelling it functional or before removing a doubtful cartilage injury.
4. Always give the patient remedial exercises to carry out. He then feels that he is taking an active part in his own recovery.

Clinical Memoranda

Expulsion of a Placenta Praevia in Advance of the Foetus

A careful search of the literature has elicited only four references to the expulsion of a placenta praevia in advance of the foetus. On the Continent Magnani (1931), Laviano (1932), and Cambon (1935) have each recorded a case, while in this country Petch (1924) gave details of a case he encountered some thirteen years ago. The last-mentioned, on arriving at his patient's bedside in response to an urgent summons, found the whole placenta lying in the bed and the foetus evidently not yet born. Examination showed that the foetus was occupying a transverse lie. Though the expulsion of the placenta had apparently been preceded by a heavy loss of blood, the patient's condition was good enough to permit of internal version and the pulling down of a leg under anaesthesia. She made a satisfactory recovery.

The placenta in the case which came under my care, and the details of which follow, was noticed, though not recognized as such, by me in process of extrusion, and a minute or so later was seen and recognized without difficulty lying in the bed. I was engaged in washing up in the intervening moments, and I therefore was not actually a witness of its complete birth; but there was certainly a minimal loss of blood accompanying the process or, for that matter, following it.