TRAUMATIC DISLOCATION OF THE KNEE
A Report of Forty-three Cases with Special Reference to Conservative Treatment


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Traumatic dislocation of the knee is an uncommon but serious injury, associated with extensive soft-tissue damage and the danger of neurological and vascular involvement. Kennedy (1963) described twenty-two cases, discussing the mechanism of production and the high incidence of popliteal artery involvement, particularly in anterior dislocations. Griswold (1951) and Quinlan and Sharrard (1958) described four and five cases respectively of irreducible dislocation treated by open reduction. In all cases there was complete rupture of the medial ligament and of both cruciate ligaments. The results were reported to be good regarding stability and movement after repair only of the medial ligament and capsule. There is general agreement that in irreducible cases operative reduction is essential, but there is no uniformity of opinion on the treatment of the uncomplicated case. Should some or all of the damaged ligaments be repaired, or will conservative methods suffice?

HISTORICAL ASPECTS

Most early authors emphasised the rarity and the serious nature of this injury. Sir Astley Cooper (1824) stated: "Of this I have only seen one instance, and I conclude it, therefore, to be a rare occurrence; and there are scarcely any accidents to which the body is liable which more imperiously demand immediate amputation than these." William Gibson (1825) commented that complete luxation was extremely rare and was generally followed by violent symptoms and even death unless treated by timely amputation. But all writers were not so gloomy. Heister (1743) described good results after immediate reduction. His advice on treatment is worthy of record, particularly in the light of the good results that have been obtained from conservative treatment. "The patient is placed on a bed or table. An assistant then holds the thigh firm above the knee, and another extends the leg. The surgeon, in the meantime, replaces the leg by his hands and knees in its natural place. If hands are not strong enough it is necessary to use pulleys and ropes. The limb is then bound in straw, and after a few days rest, gentle bending and straightening of the knee to prevent it growing stiff are allowed, till pains have gone off, and the limb has recovered its former strength."

Birkett (1850) was one of the first to attempt reduction under general anaesthesia using chloroform. This was an open anterior dislocation which was found to be irreducible: the limb was amputated. After the introduction of Listerian principles operations on joints became more feasible. In 1881 Professor Annandale of Edinburgh attempted open reduction of an eight-week-old dislocation, but the patient died from septicaemia. With the introduction of radiographs after 1895, more accurate diagnosis and description of these injuries became possible.

MATERIAL

This paper is based on forty-two dislocations in forty-one patients, treated in the sixteen years 1954 to 1970, except one who sustained his injury in 1935. There were thirty-one males and ten females. The right and the left knees were involved in equal numbers. The age range was from eight to seventy-seven years, the average being thirty-six. The highest incidence was in the third decade.
Diagnosis—The clinical diagnosis is not difficult. Careful examination should be carried out for signs of vascular insufficiency, damage to the common peroneal nerve, and, in cases of lateral dislocation, any indication that it may be irreducible. Irreducibility is suggested by a transverse medial furrow due to inclusion of the soft tissues; this furrow becomes more apparent on attempted reduction (Clarke 1942). Radiographs are taken to confirm the diagnosis and to exclude associated fracture.

Classification—All radiographs were carefully examined and the dislocations classified into five types: anterior (four), posterior (eight), medial (four), lateral (twenty-one) and rotary (three), with no classification made in two cases. The direction of the dislocation of course indicates the shift of the tibia in relation to the femur.

The low incidence of anterior dislocation in this series conflicts with the rather high incidence reported by most other authors. Thus, Robbins (1932) found 114 anterior dislocations in a total of 270 cases collected from the literature up to 1909. The paucity of anterior dislocation in this series may be explained by a change in the mechanism. In the early series mentioned many injuries were due to falls from horses and accidents with horse-drawn vehicles. Today most of the injuries occur in road traffic accidents (Table 1).

<table>
<thead>
<tr>
<th>Cause of Injury (Forty-two Cases)</th>
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<tr>
<td>Road traffic accident</td>
<td>24</td>
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<tr>
<td>Sport</td>
<td>6</td>
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<td>Work</td>
<td>7</td>
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<td>Falls at home</td>
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Mechanism—Dislocations are produced by direct or indirect violence, the direction of the force determining the type of injury sustained and this in turn the complications. Anterior dislocations are particularly liable to be complicated by arterial damage, medial displacements by common peroneal nerve injury, and lateral displacements by irreducibility.

Anterior dislocations are due to hyperextension of the knee and may result in rupture of both cruciate ligaments and of the medial and lateral ligaments (Fig. 1). Kennedy used a stress machine to determine in cadavers the sequence of events in various types of dislocation. He found that hyperextension of the knee consistently produced anterior dislocation. The posterior capsule was the first structure to rupture, at an average of 30 degrees of hyperextension. There followed stretching and then rupture of the posterior cruciate ligament, which allowed the tibia to ride forwards on the femur. The popliteal artery ruptured in half the cases.

Posterior dislocations are usually due to direct violence (Fig. 2). They occur when force is applied to the front of the upper tibia with the knee flexed. This mechanism was clearly responsible for the only example in this series of simultaneous dislocation of both knees: the driver of a small car was involved in a head-on collision, the front of each tibia being struck by the dashboard. Lateral dislocations (Fig. 3), medial dislocations (Fig. 4) and rotary dislocations (Fig. 5) are the result of direct or indirect violence producing a valgus, varus or rotary force respectively.

COMPLICATIONS

The complications of traumatic dislocation of the knee are common and often serious. Vascular damage is potentially the most serious, and presumably was the cause of the mortality associated with this injury by Sir Astley Cooper and William Gibson. In this series there
were five cases of vascular damage, two of irreducible dislocation, four of common peroneal nerve palsy and seven of open injury.

Damage of the popliteal artery is a most serious complication and requires immediate treatment. The artery originates at a tendinous hiatus of the adductor magnus muscle by which it is firmly held close to the femoral shaft. It leaves the popliteal space by passing beneath the tendinous arch of the soleus, where it is again firmly held. The artery is therefore firmly held at both ends, and when the knee goes into hyperextension leading to anterior dislocation the artery is stretched and may rupture. It should also be remembered that the collateral
vessels about the knee, sparse at the best of times, are also inevitably damaged. Urgent treatment is of utmost importance. The dislocation is first reduced, and this may restore the circulation. Of our five patients with arterial insufficiency on admission, two had a return

of circulation after reduction, and three had to undergo exploration. In the first, repair of the torn popliteal artery was carried out. In the second, the anterior tibial artery was avulsed, gangrene developed and amputation became necessary. In the third, the artery appeared
normal at operation, but gangrene set in and the limb had to be amputated. If the patency of the popliteal artery is in doubt, arteriography should be performed.

True irreducibility is a particular complication of lateral displacement of the tibia; it may be due to inturning of the torn medial ligament (Clarke 1942, Griswold 1951, Quinlan and Sharrard 1958) or to buttonholing of the medial ligament by the medial femoral condyle. One case of each variety was encountered. Apparent irreducibility may occur if the tendons of semimembranosus, semitendinosus, gracilis and sartorius are caught in the intercondylar notch, which may also occur with a lateral dislocation. But reduction in such a case is easy: the knee is flexed above a right angle to free the tendons from the notch, and the tibia is then pushed towards the medial side (Böhler 1935).

Lateral popliteal nerve injuries were encountered in four cases, three of lateral and one of medial dislocation. Two patients fully recovered but two patients had permanent foot drop. In general the prognosis of this injury—a traction lesion involving a long segment of the nerve—is poor.

**TREATMENT**

There are two views about the treatment of uncomplicated dislocation: one that all torn ligaments should be repaired (O'Donoghue 1955), and the other that conservative treatment gives good results (Mitchell 1930, Smillic 1962, Myles 1967).

**Operative treatment** In this series sixteen patients underwent open operation, most of necessity. Primary repair was undertaken in three cases only. In two a secondary procedure was carried out, and in one a Küntscher nail was used for stabilisation. Of the ten patients operated on from necessity, four had open injuries, two had irreducible dislocations, three had small fractures involving the femoral or tibial condyle which were thought to need replacement, and one required operation to free a trapped lateral popliteal nerve.

**Conservative treatment**—Conservative measures were adopted in twenty-five cases. After clinical examination and radiography the knee was reduced under general anaesthesia. Reduction was usually accomplished easily but care was taken not to hyperextend the knee and put more tension on already stretched vessels and nerves. After reduction, a well-padded plaster-of-Paris cylinder was applied with the knee slightly flexed. In only one case was the knee aspirated. Quadriceps exercises were then started as soon as possible, entailing continuous hard work on the part of both patient and physiotherapist. As the swelling subsided, the plaster was changed for a closer fitting cast. Immobilisation was continued between three and twelve weeks, the average being five and a half. Two knees required manipulation under anaesthesia.

We now recommend no more than six weeks of immobilisation because longer periods lead to stiffness. Myles reported seven patients all treated conservatively by immobilisation varying from two to six weeks; the final range of movement appeared to be inversely
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proportional to the time of immobilisation. Platt (1917) reported two cases of prolonged immobilisation: in one, five months in plaster and two months in a caliper were found at fifteen months to have led to firm ankylosis; in the second case, plaster for four months and then a caliper yielded a range of flexion of only 20 degrees. In contrast one patient in this series had a firm bandage and physiotherapy only, yet resumed international rugby football a year later.

RESULTS

Of the forty-two knees, forty were assessed between six months and ten years after injury, and one at thirty-five years.

The results were assessed on three factors, stability, movements and pain, and were classified as good, fair or poor. Good indicated a stable, painless knee with 90 degrees of flexion or more; fair, slight instability on straining, no pain, and range of flexion 60 to 90 degrees; poor, the remainder. In the conservative group of twenty-six, eighteen were classified as good, six fair and two poor. This is in contrast to the operation group with only four good, six fair and six poor (Table II). A straight comparison between those treated conservatively and those by operation is not possible, because only three patients were operated on for primary repair and the other thirteen for various reasons, mainly complications. In addition, the procedures carried out were too diverse to allow comparison.

Only one patient had repair of all the structures damaged, a man aged sixty-four with a posterior dislocation. At operation he was found to have a tear of the medial ligament and both cruciate ligaments, displacement of both semilunar cartilages, and a tear of the patellar tendon. The medial cartilage was torn in its anterior third and was used to make a new posterior cruciate ligament. The lateral cartilage was torn peripherally and detached posteriorly: it was made into a new anterior cruciate ligament. The medial collateral ligament and the patellar tendon were sutured. The end-result was good: at five years the knee was stable and painless, with flexion from 0 to 115 degrees.

Of four cases of repair of the medial ligament only, two were good, one fair and one poor. One patient, following release of a trapped lateral popliteal nerve, had repair of both the lateral and anterior cruciate ligaments, with a good result.

Conservative treatment was by reduction, immobilisation for variable periods and physiotherapy. For example, a man aged twenty-eight sustained a lateral dislocation of the right knee at football. The knee was reduced without difficulty under general anaesthesia, when he was noted to have complete rupture of the medial and anterior cruciate ligaments with hyperextension permitted to 30 degrees. A plaster-of-Paris support was maintained for six weeks and intensive physiotherapy was carried out. Five months after the injury the knee was stable and painless with flexion movement from 0 to 130 degrees.

Of two poor results from conservative treatment, one was in a case of posterior dislocation (Fig. 2) which necessitated arthrodesis two years later because of persistent displacement.

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COMMENTS

Traumatic dislocation of the knee causes severe soft-tissue damage, with rupture of ligaments and often of the posterior capsule. Nevertheless, it would appear that in the absence of special complications conservative treatment by reduction, immobilisation for up to six weeks and physiotherapy can produce good results, in this series as good as, if not better than, those obtained by operative methods. It would appear that conservative treatment can lead to spontaneous repair of ruptured ligaments.

We therefore regard conservative treatment as the method of choice for treatment of uncomplicated traumatic dislocation of the knee.

SUMMARY

1. The results have been reviewed of forty-two traumatic dislocations of the knee in forty-one patients, twenty-six of which were treated conservatively.
2. Primary operative repair was carried out in only three cases, although a further ten had operative intervention for various complications.
3. It was not possible to compare the results of operation with those of conservative treatment, because the operative procedures were so diverse in nature.
4. The conservative treatment of twenty-six dislocations yielded surprisingly good results with regard to stability, absence of pain, and range of flexion movement.
5. In general, immobilisation for long periods, like operative repair, led to reduced movement.
6. In the absence of complications, conservative treatment is the method of choice.

Our thanks are due to members of the North-West Metropolitan Orthopaedic Club and to the surgeons of the Princess Elizabeth Orthopaedic Hospital, Exeter, for their help in collecting this series of cases.

REFERENCES

Boston: Lilly, Wait, Carter and Hendee.