OSTEOCHONDRAL FRACTURES OF THE LATERAL FEMORAL CONDYLE

A RESULT OF INDIRECT VIOLENCE TO THE KNEE

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Twenty patients with an average age of eighteen and a half years sustained osteochondral fractures of the lateral femoral condyle as the result of a sudden twist and valgus strain to the straight or almost straight knee. All the patients felt sudden pain at the moment of injury, all had a haemarthrosis, and yet the fracture escaped early diagnosis in one-third of the cases. Internal fixation of the fragment with early mobilisation is recommended if the diagnosis is made within two weeks of injury, and excision of the fragment if it is only later identified.

Osteochondral fractures within the knee may be caused by impaction, avulsion or shearing forces. Those caused by the shearing forces between tibia and femur from indirect violence receive little mention in the literature and are not well defined. It is our belief that these fractures are unrecognised rather than uncommon. The aim of this paper is to draw attention to the characteristic clinical features of this type of fracture, and to the advantages of early diagnosis.

PATIENTS AND METHODS

A review was carried out of the clinical notes and radiographs of all patients attending Addenbrooke's Hospital or Newmarket General Hospital with a recorded diagnosis of osteochondral fracture of the femoral condyle or loose body within the knee during a ten-year period. Any patients with a history of a direct blow to the knee, a ligament injury, an operation, a dislocation of the patella, previous trauma or other disorders of the knee were excluded from the study. Only twenty patients satisfied these strict criteria. It is interesting that although the clinical population changed little during the decade of study, six of the twenty fractures have been seen within the last twelve months, probably because of our own increased awareness of the condition and of its clinical presentation.

RESULTS

There were fifteen male patients (mean age 20.0 years; range 12–34 years) and five female (mean age 16.0 years; range 11–22 years). Their mean age was 18.5 years and seventeen of the twenty patients were under

the age of twenty-two years at the time of injury. Right and left knees were equally affected, and all fractures involved the lateral femoral condyle.

Clinical features. All patients had pain and swelling of the knee after twisting suddenly with the knee extended. Half of the injuries were sustained during a sporting activity of some kind, but great violence was rarely involved. One patient sustained an osteochondral fracture of his supporting knee while mounting the pillion of a motor cycle, and a student sustained his fracture as he turned abruptly while pacing his study deep in thought. Several patients heard or felt a "crack" within the knee at the moment of injury. Review of the notes showed that all patients noticed the swelling within one hour of injury, and that whenever the joint was aspirated, the effusion was found to be blood-stained and to contain fat globules.

Radiographs. All osteochondral fragments could be identified on the initial standard anteroposterior or lateral radiographs as a linear opacity or a small irregular loose body lying in the joint space (Fig. 1).

The defect in the lateral femoral condyle could not always be seen on the initial radiographs but became more obvious with the passage of time as the margin of the defect became sclerotic. Only one patient had an undisplaced fracture when first examined. In no case did additional tangential or intercondylar views, which are difficult to obtain in these painful joints, help with either the diagnosis or the subsequent management.

All the fractures involved the weight-bearing surface of the lateral femoral condyle. In four patients, whose knees were in valgus as well as extension at the

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Fig. 1

An osteochondral fragment is visible below the patella. The defect in the femoral condyle is indicated by an arrow.

time of injury, the fracture was more laterally situated and involved the lateral edge of the condyle as well.

Time of diagnosis. Ten of the fractures were diagnosed within two weeks of the injury. Of those diagnosed later, five were recognised at the first examination between one and forty-five months after the injury: the remaining

Table I. Time of diagnosis

	Number of patients
At first attendance in Casualty	4
At first attendance at Fracture Clinic	6
More than two weeks after first attendance	5
First attendance more than two weeks after injury (1-45 months)	5

five fractures were not identified when the patients were first seen and this group constitutes one third of all cases coming to hospital shortly after injury (Table I).

Undiagnosed osteochondral fractures of the lateral femoral condyle constituted 10 per cent of patients recorded as having loose bodies in the knee.

Treatment. Of the ten patients whose fractures were diagnosed early, five were treated by open reduction and internal fixation with Smillie's pins. In three of these five the knee was mobilised and weight-bearing was started as soon as the wound was healed (Fig. 2); all regained

full function. In the remaining two, the knee was immobilised in a plaster cylinder and weight-bearing prohibited until the pins were removed eight weeks after operation. It was then noted that although the fragment was soundly united in both cases, the overlying articular cartilage was softened, fibrillated and discoloured, and attached to the surrounding synovium by vascular adhesions; there was palpable crepitus but satisfactory function. In the remaining five patients whose fractures were identified within two weeks of injury, and in all those where they were identified later, the fragment was excised and the joint mobilised without delay. Three of these patients have had further problems. Two, now aged nineteen and twenty, have osteoarthritis (Figs. 3 and 4) of their lateral compartment. Another developed symptoms that led to removal of the lateral meniscus.

DISCUSSION

Most previous reports of osteochondral fractures include a mixture of fractures associated with direct blows, avulsion of ligaments, or dislocation of the patella (Rosenberg 1964; Siegel 1969; Morscher 1971); those produced by shearing forces between contiguous tibial and femoral condyles during violent twists are rarely mentioned. Kennedy, Grainger and McGraw (1966) included these fractures in their general classification of osteochondral fractures but met with little success in producing them experimentally. Milgram (1974) men-

Fig. 2

The fragment has united eight weeks after fixation with Smillie's pins. There are no synovial adhesions.

tioned them specifically but considered they were rare and that the medial femoral condyle was particularly vulnerable.

Mechanism. Most authors attribute all osteochondral fractures of the lateral femoral condyle to direct violence or dislocation of the patella (Coventry and Walt 1955; Rosenberg 1964; Milgram 1974; Smillie 1974). Pivoting on an extended knee, especially if there is an additional valgus stress, is a prime condition for patellar dislocation but the knee needs to be flexed to at least 90 degrees for the patella to strike the weight-bearing surface of the lateral femoral condyle.

(Kennedy *et al.* 1966; O'Donoghue 1966) on the assumption that because the fibrocartilage that fills the defect resembles articular cartilage macroscopically it will have the same biomechanical function. Convery, Akeson and Keown (1972) have shown that microscopic degenerative changes soon occur in cartilage opposite the healed defect and that the degree of change is roughly proportional to the size of the defect. Trephining the edges (O'Donoghue 1966) is therefore more rational than enlarging the defect by shaving.

Although the number of patients in each group is insufficient for useful statistical analysis, the review has

Fig. 3

Fig. 4

Lateral (Fig. 3) and anteroposterior (Fig. 4) radiographs demonstrate osteoarthritis of the lateral compartment of the knee in a twenty-year-old student seven years after removal of the fragment as a primary procedure.

We believe that these fractures are caused by the shearing forces between the convex articular surfaces of the lateral femoral condyle and the lateral tibial plateau as they pivot under load.

Diagnosis. Morscher (1971) has emphasised the diagnostic problems of osteochondral fractures in general. The factors influencing our low diagnostic accuracy appeared to be the history of apparently insignificant trauma, failure to appreciate the seriousness of a haemarthrosis in an adolescent, and failure to examine the radiographs meticulously. A full history, a careful clinical examination and routine radiographs should be sufficient to establish the diagnosis without recourse to arthrography or arthroscopy.

Treatment. If the fracture is not diagnosed within two weeks of injury the fragment cannot be replaced precisely and must be excised. This latter treatment has been applied to the acute injury by many surgeons

left us with the strong clinical impression that treatment by open reduction and internal fixation is preferable (King 1970; Smillie 1974). Early mobilisation of the joint is essential to nourish the cartilage on the fragment and prevent it gaining an alternative blood supply from the synovium (Landells 1957). This occurred in two of our patients and affected the results. The fracture should be protected from violent twists but we did not find it necessary to prevent weight-bearing, in accord with the experimental findings of Lane *et al.* (1977) that the thin shell of subchondral bone, although providing structural stability for the overlying cartilage, is sufficiently thin to be rapidly replaced by creeping substitution.

However, the most important factor in preventing both the development of degenerative arthritis and the problems of loose bodies in these young people is early diagnosis. This can best be achieved by recognition of the characteristic clinical features of this injury.

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