



## Insufficiency fracture of the tibial plateau : An often missed diagnosis

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The authors have performed a retrospective study of 8 patients, all elderly females, seen in the period 2002-2004 with insufficiency fractures of the tibial plateau. Their mean age was 74 years (range 70-84). There was a history of trivial trauma in all patients, except one. Three of the patients were referred to the orthopaedic department, as a fracture line was visible on the plain radiographs taken 3 to 6 weeks after the trauma. The remaining five patients presented immediately after the trauma, which explains why their radiographs were still negative or only showed osteoarthritis. In the same 5 patients a diagnosis of tibial plateau fracture was made by CT-scan in 3, and by MRI-scan in 2 patients. All patients except one had a DEXA-scan, which revealed osteopenia in 4 and osteoporosis in 3 patients ; all 7 were treated with bisphosphonates. All 8 patients were treated conservatively with a cast brace, for 6 to 12 weeks, with a good result.

Insufficiency fracture of the tibial plateau is an often missed diagnosis. Plain radiographs are frequently negative in the beginning. Delayed diagnosis can cause pain and disability to the patient and can lead to deformity of the knee joint, due to structural collapse. MRI is sensitive to bone marrow oedema/ bone bruising, even in the osteoporotic tibial condyle. Once the diagnosis is made, the results are good with non-operative treatment.

**Keywords :** insufficiency fracture ; tibial plateau ; osteopenia ; osteoporosis.

### INTRODUCTION

Osteoporotic fractures are a major cause of morbidity and mortality across the world. In the UK

over 3 million people suffer from osteoporosis, with one fracture occurring every 3 minutes (8). Insufficiency fractures occur when normal or physiological muscular activity stresses a bone that is deficient in mineral or elastic resistance (1, 4). The common causes for insufficiency fractures are post-menopausal osteoporosis, steroids and chronic inflammatory diseases, e.g. rheumatoid arthritis (1, 4). Insufficiency fractures of the tibial plateau are considered to be less frequent than those of the vertebrae, sacrum, pelvis and ribs (4). The aim of this paper is to report a series of 8 insufficiency fractures of the tibial plateau in osteopenic/osteoporotic elderly patients and to create awareness of its existence among orthopaedic surgeons.

### PATIENTS AND METHODS

This retrospective study reports a series of 8 patients who presented in the period 2002-2004 with pain and

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Table I. — Description of the eight cases studied

Case	Age (years)	Trauma	Duration of symptoms	Effusion	Risk factors for osteoporosis	Plain radiographs	Further imaging	DEXA-scan	Duration of cast brace (weeks)
1	77	yes	day 1	+	steroids	negative	MRI : intercondylar fracture	osteopenia	12
2	89	yes	day 1	-	nil	OA*	CT : postero-medial tibial plateau fracture	osteoporosis	12
3	84	yes	day 1	+	nil	OA*	CT : postero-medial tibial plateau fracture	osteoporosis	12
4	89	yes	day 1	-	nil	OA*	CT : medial tibial plateau fracture	osteoporosis	12
5	83	yes	day 1	-	nil	negative	MRI : lateral tibial plateau fracture	not done	12
6	78	no	4 weeks	-	nil	Lateral tibial plateau fracture	Not done	osteopenia	8
7	65	yes	6 weeks	-	nil	Medial tibial plateau fracture	Not done	osteopenia	6
8	74	yes	4 weeks	-	nil	Medial tibial plateau fracture	Not done	osteopenia	8

\* OA = osteoarthritis.

tenderness around the knee joint (table I). All 8 patients were females and their average age was 79 years (range : 65 to 89). The authors diagnosed and treated these patients for insufficiency fractures of the tibial plateau.

A review of case records, plain radiographs, CT-scans, MRI and DEXA-scans was carried out. The demographics of patients, the presence of any risk factors for osteoporosis, the mode of presentation, the investigations performed and the reasons for delay in diagnosis were also studied.

## RESULTS

There was a history of trivial trauma in 7 patients ; one patient had spontaneous onset of knee pain (table I). All patients complained of a painful knee with restriction of movement and difficulty in walking.

Clinical examination revealed tenderness over the proximal tibia in all the patients with painful

and restricted knee movement. Knee effusion was present in only two patients. One patient (case 7) presented with a valgus deformity of 10 degrees (fig 1) ; she had complained of knee pain for 6 weeks following a trivial trauma. The other 7 had no obvious deformities.

**Radiological examination :** Five patients were referred to the orthopaedic team immediately after trauma (day 1). These five patients were unable to bear weight and two were initially suspected to have an occult hip fracture ; the plain radiographs of their knee did not show any fractures, but only some osteoarthritis (fig 2) in three. In three of these five patients, the diagnosis was made by means of a CT-scan (fig 3) and in two by means of MRI (fig 4). The remaining three patients were referred to the orthopaedic department as they had persistent knee pain and difficulty in walking for 3 to 6 weeks. The plain radiographs of the knee



**Fig. 1.** — Delayed presentation of a lateral tibial plateau insufficiency fracture with correctable valgus deformity of 10 degrees (case 7).

performed on these patients at 3 to 6 weeks from onset of symptoms showed a fracture line; CT-scan or MRI were unnecessary.

Predisposing conditions for insufficiency fracture were old age (> 65 years) and gender (female sex) in all the patients. The associated risk factors included long-term steroid intake in one patient. The fracture site was the medial or posteromedial tibial condyle in 5 patients, the lateral tibial condyle in two patients and the intercondylar area involving the PCL insertion in one patient. A DEXA-scan was performed in 7 out of 8 patients. It revealed osteopenia in four patients (T score between -1 and -2.5 SD) and osteoporosis in

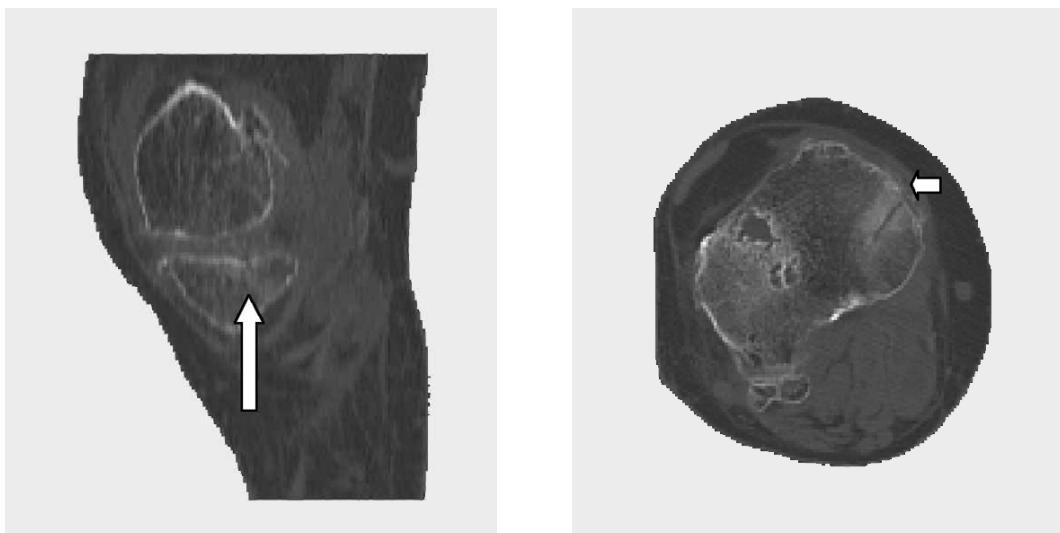


**Fig. 2.** — Lateral and A-P radiographs of the knee on day 1, showing osteoarthritic changes, but no fracture (see fig. 3).

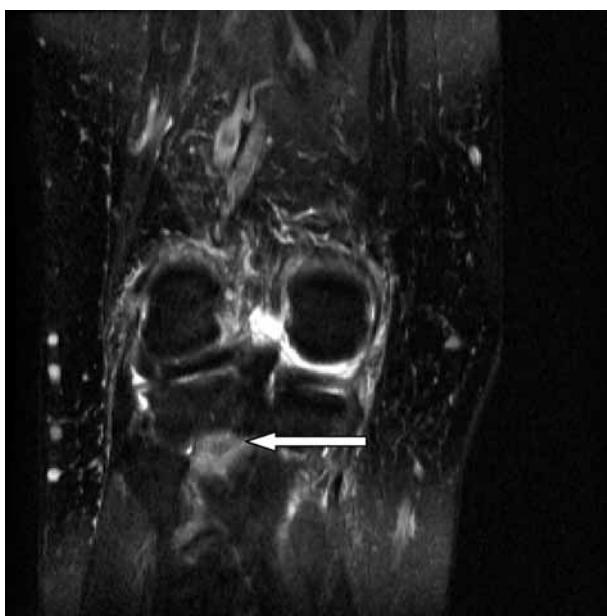
3 patients (T score < -2.5 SD). These patients were treated with bisphosphonates for osteoporosis. All the patients were treated conservatively with a cast brace for 6 to 12 weeks.

## DISCUSSION

Insufficiency fractures of the tibial plateau can cause knee pain and disability in elderly osteoporotic patients. Alonso *et al* (1) have reported 6 proximal tibial insufficiency fractures, between 1984 and 1997, in a series of 25 patients with insufficiency fractures affecting different parts of tibia and fibula. The current study reports 8 cases from one institution serving a population of 200,000 in a 2-year period. This suggests that proximal tibial insufficiency fractures are more frequent than generally appreciated, especially in an elderly female population. Previous reports have indicated that a typical history is often absent, and that the clinical picture may easily be confused with osteoarthritis or osteonecrosis (7). Most patients are elderly and many have radiological evidence of osteoarthritis, which should not be taken as the cause of their symptoms. A recent onset of knee pain in an elderly patient with a history of *trivial trauma* to the



**Fig. 3.** — Sagittal (left) and axial (right) CT-scan of the same patient showing a posteromedial tibial plateau fracture



**Fig. 4.** — Coronal MRI (fat suppression image) of the knee showing a lateral tibial plateau fracture in a patient who had an apparently normal plain radiograph.

knee should raise the suspicion of an occult fracture and should not be presumed to be caused by osteoarthritis. These fractures can also occur *spontaneously* in severely osteoporotic patients (3, 7).

Plain radiographs may not show an abnormality for 2-3 weeks, and sometimes never show any abnormality (10). After these 2-3 weeks an area of sclerosis is usually seen ; it is due to the fact that the collapse of cancellous bone in the tibial plateau is followed by osteoblastic repair (1, 7).

The imaging modalities, useful for the diagnosis of occult tibial plateau fractures, include radionuclide bone scan (4, 7), and especially CT-scan and MRI (4). A CT-scan is cheaper than MRI, but it is unable to detect a bone bruise, in contrast with MRI. Increased uptake during a radionuclide scan can be due to various other pathologies including osteoarthritis, osteomyelitis, inflammatory arthritis and metastatic bone disease. Although the pattern of uptake can be specific for an insufficiency fracture (7), the presence of osteoarthritis may obscure the diagnosis. Magnetic resonance imaging can demonstrate intraosseous trabecular disruption, or oedema and haemorrhage of medullary bone, or stress type injuries, all of which are radiographically occult (2). MRI also permits the reliable identification of associated intra- and periarthritis soft tissue injuries and is very useful in detecting occult fractures (6).

The long term results of cast bracing for minimally displaced tibial plateau fractures are good (5). The authors suggest that patients with suspected

occult insufficiency fractures of the tibial plateau should be treated, if further imaging is unavailable, by temporary splintage (e.g. bivalved cylinder cast) allowing knee mobilisation, followed by repeat plain radiographs after 3 weeks. Splinting is important, not only for pain relief, but also for preventing deformity and knee stiffness. All elderly patients with occult insufficiency fractures should also be investigated and treated appropriately for osteoporosis (9). Although this is a small series, it appears to be the largest reported series of occult insufficiency fractures of the tibial plateau.

## CONCLUSION

Insufficiency fracture of the tibial plateau is a rare diagnosis. Clinical findings are often non-specific and may simulate osteoarthritis. An initial radiograph may be normal. Delayed diagnosis can cause persistent pain to the patient and can lead to deformity of the knee joint, due to structural collapse. A high index of suspicion and a good clinical examination, including looking for tenderness over the tibial condyle, will definitely facilitate the diagnosis. MRI scanning is a sensitive tool for detecting these occult fractures in osteoporotic bone. Once the diagnosis is made, non-operative treatment is sufficient to obtain a good result.

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