



## Transient osteoporosis of the knee

G. Vardi<sup>a,\*</sup>, P.J. Turner<sup>b</sup>

<sup>a</sup>*Droitwich Knee Clinic, St Andrews Road, Droitwich Spa, Worcestershire WR9 8YX, UK*

<sup>b</sup>*The London Knee Clinic, Emblem House, 27 Tooley Street, London SE1 2PR, UK*

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### Abstract

We report 12 cases of transient osteoporosis in 10 patients. The presenting symptoms, diagnostic investigations and management are considered here as well as a discussion on the aetiology and the pathology. Arthroscopic surgery was carried out in some of the patients to exclude intraarticular pathology. Resolution of symptoms occurred in all patients within 6 months and the MRI findings returned to normal.

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### 1. Introduction

Transient osteoporosis is a self-limiting cause of joint pain. It has been described most commonly in the hip but can also occur in the knee, ankle and foot [1]. The diagnosis can be suspected on the history and examination, but an MRI scan is required for confirmation. The cause is unknown, and therefore the condition can be referred to as Idiopathic transient osteoporosis (ITO). Resolution of symptoms and signs occurs spontaneously in all cases and therefore this has an implication on the management, prognosis and the need to avoid surgical intervention.

This is a retrospective study of 10 patients with ITO from initial diagnosis to full resolution of symptoms and signs.

### 2. Patients

A total of ten patients were followed up between January 2000 and February 2002. Four (40%) were male and six (60%) were female. The average age was 53 with the youngest being 32 and the oldest 70. Seven cases involved the right knee and four, the left. The medial femoral condyle was involved in eight cases and the lateral in four cases.

In one case (the oldest patient), the medial femoral condyle was involved initially and during the resolution phase of the condition, the lateral femoral condyle of the same knee became involved in the same way with pain being the main feature. Another patient developed a similar problem in the other knee after resolution of the symptoms in the first knee.

During the period of this study all patient's symptoms resolved completely. Most patients returned to normal pain-free activity within 4 months.

One patient was excluded because his symptoms persisted and ultimately a subsequent MRI scan confirmed the diagnosis of avascular necrosis of the lateral femoral condyle despite the initial MRI scans being suggestive of ITO. He was 80 years old.

### 3. Presenting features and special investigations

The presenting features were similar in all cases.

All patients presented with acute spontaneous onset of pain coming from the affected knee, in the area of the involved femoral condyle. Weight bearing was difficult and painful and mimicked a meniscal lesion. There was no history of trauma and none of the patients had any pre-existing risk factors for AVN such as excessive steroid usage or alcohol intake.

\*Corresponding author. Tel.: +44-01905-794-858.

E-mail address: [glen@vardi.freemove.co.uk](mailto:glen@vardi.freemove.co.uk) (G. Vardi).



Fig. 1. Typical MRI features of ITO. Note the area of decreased signal intensity (T1) of the femoral condyle.

### 3.1. Examination

Most patients had antalgic, flexed knee gait patterns. They were reluctant to squat but on supine examination range of movement was full. Signs of significant inflammation were not evident and most knees showed only minimal effusions, if any. Tenderness was located around the involved femoral condyle and also over the tibiofemoral joint line. Meniscal compression-rotation testing was painful in most cases, arousing our suspicion of meniscal or joint surface damage.

### 3.2. MRI scans

MRI scans were obtained on all patients and demonstrated the typical features of ITO: A diffuse area of decreased signal intensity relative to normal cancellous bone on T1-weighted images and increased signal intensity on T2-weighted images (Fig. 1) STIR images were most dramatic in demonstrating the lesion as an area of intense high signal. A focal area of abnormal crescentic signal intensity, which may suggest AVN, is uncommon but it has been described [2] (Fig. 2).

### 3.3. X-rays

X-Rays sometimes demonstrated a mild localised osteopaenia, usually not easily seen, and were considered unhelpful.

### 3.4. Blood tests

Blood tests to exclude other causes were carried out in all patients and where the MRI findings were suggestive of joint surface disruption or meniscal pathology, an arthroscopic assessment was made.

### 3.5. Arthroscopy

Five patients in this group underwent an arthroscopic procedure and it was noted in all cases that the joint surface overlying the involved femoral condyle was disproportionately unaffected with, at most, minor degenerative change and in four cases, the joint surface of the involved condyle appeared relatively normal. Other pathology, if present, was dealt with appropriately at the time. This included meniscal tears, usually degenerative in nature, a Baker's cyst in one case and joint surface degeneration in areas unrelated to the involved femoral condyle.

### 3.6. Radionuclide bone scans

A radionuclide bone scan was performed in two patients, which demonstrated a focal increased uptake in the involved area. This is in contrast to AVN where a decreased tracer uptake may be found.

All patients had almost complete resolution of symptoms within 6 months and MRI scanning confirmed a return of normal bony signal.



Fig. 2. A small focal area of abnormal crescentic signal intensity noted on this MRI, which can progress to AVN.

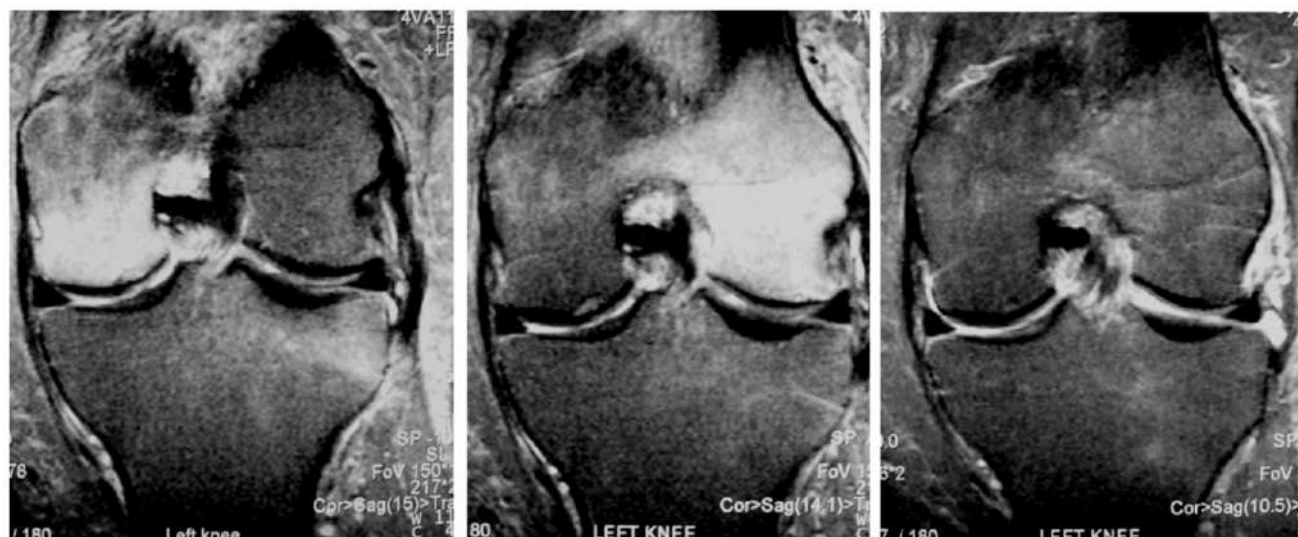


Fig. 3. A migratory form of ITO with initial presentation and MRI features showing medial femoral condyle involvement, then 4 months later migration to the opposite condyle and then 6 months total resolution of all symptoms and finds.

One patient had complete resolution of symptoms coming from his medial femoral condyle at follow-up assessment 3 months after initial presentation but similar symptoms were evident over the lateral femoral condyle. MRI assessment at this stage confirmed that the condition had migrated to the lateral femoral condyle. Five months later all symptoms had subsided and the MRI had returned to normal (Fig. 3).

Another patient had a similar migratory form of ITO, where the migration occurred from one knee to the opposite one after resolution of the initial symptoms in the first knee.

#### 4. Discussion

ITO of the hip (ITOH) was first reported by Curtiss and Kincaid in 1959 [3]. They described three patients who had hip pain accompanied by transient bone demineralisation occurring in women during the third trimester of pregnancy. In 1968, Lequesne [4] coined the term *idiopathic transient osteoporosis of the hip*. Numerous names have since then been used to describe the features of this disorder, i.e. bone marrow oedema syndrome or BMOS, hip algodystrophy, transient bone demineralisation, regional migratory osteoporosis and, even, reflex sympathetic dystrophy of the hip.

Although the early reports suggested that ITOH primarily affected females during pregnancy [5], a report by Lakhanpal et al. [6] showed that men in their fourth through seventh decades of life account for more than two thirds of reported cases.

The cause of ITO remains uncertain. The most commonly accepted theory is that microvascular injury causes tissue ischaemia, resulting in marrow oedema

and limited cell injury, which also occurs in AVN. This theory is supported by the finding of oedema of the bone marrow in biopsy specimens of ITOH. This theory also provides some rationale for the use of core decompression as treatment [7–9]. In a study by McCarthy [10], it was suggested that the histologic features of ITO are distinctive. They found marrow oedema, reactive bone formation and osteoclastic resorption. The absence of necrosis and the presence of osteoclastic activity suggest that ITO is distinct from AVN. They also suggested that the high turnover rate in ITO, as manifested by bone resorption and reactive bone formation, is more suggestive of a vasomotor response similar to that seen in classic reflex sympathetic dystrophy. Some authors believe ITO to represent the earliest form of a spectrum of disorders with the most severe being that of AVN [11].

Differentiation from AVN is sometimes difficult but has important prognostic and therapeutic significance. ITO, unlike AVN is typically a self-limiting disorder, usually with complete recovery.

AVN usually produces classic features that are not apparent in ITO:

1. A focal subchondral defect on XR and MRI scans with surrounding bone oedema.
2. The *‘Crescent’* sign. On T2-weighted MR images there is an high intensity rim inside a low intensity margin surrounding the necrotic lesion (Fig. 4). This is pathognomonic of AVN but a smaller crescent sign may be found in ITO. On repeated MRI scanning the crescent sign in ITO cases resolves.
3. Progression of symptoms and radiological features.

Ultimately the diagnosis of ITO is proven by its transient and relatively benign nature Parker et al. [2]



Fig. 4. Typical features of AVN, where the subchondral bone are starting to collapse.

have described a case of ITO that presented with radiological features of AVN, which reversed completely. We also had one such case.

Other than AVN, the differential diagnosis includes stress fracture, septic arthritis, malignancy, soft-tissue injury, tuberculosis and radiculopathy. A detailed history, clinical examination and special investigations will not confirm the diagnosis unless an MRI is performed. This is essential for an early diagnosis. Five patients in this group underwent an arthroscopic evaluation, where the intra-articular joint surface findings were minimal compared to the intraosseous MRI changes.

The treatment consists of observation, protected weight bearing and pain control. Protected weight bearing is important during the peak of symptoms to facilitate pain control. Non-weight bearing would be instituted for one or two weeks, with instructions to patients that they can resume weight bearing as soon as the acute pain starts to settle. The use of one crutch may be needed for a while until full weight bearing produces no/minimal discomfort. This may take a few more weeks. There is no conclusive evidence to suggest that weight bearing as tolerated will adversely affect the outcome.

All patients in this group settled down spontaneously within 6 months and were finally discharged from our care.

## 5. Conclusion

1. ITO of the knee is a self-limiting disorder and has distinctive MRI features.

2. Unless there are other indications surgical intervention should be avoided. The majority of patients with this condition will settle spontaneously with supportive treatment involving analgesics and reduced weight bearing.
3. Patients should be warned that it could take up to six months to return to normal.
4. Radionuclide scanning may be helpful in distinguishing this condition from AVN.
5. Repeat MRI scanning is not necessary, where symptoms have resolved or are resolving. This usually takes approximately 3–6 months. In this instance, a follow up MRI scan only serves to confirm the diagnosis and to reassure the patient (and the surgeon). In cases that are equivocal, such as those cases with a crescent sign on initial MRI or where symptoms have not improved by approximately 3 months, we recommend a follow up MRI scan to assess for possible progression to bony collapse, as seen in AVN (Fig. 4).

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