LESSON OF THE MONTH

Debilitating knee pain in a patient with “normal” radiographs

G K Meenagh, G D Wright

Case history

A 67 year old woman presented with a one year history of increasing pain in both knees which was worse on activity. Initial examination showed small bilateral cool knee effusions with retropatellar crepitus. Radiographs showed mild patellofemoral osteoarthritis. No other abnormality was detected in the locomotor system.

Initial management comprised advice on weight and cushioned footwear, simple analgesia, quadriceps physiotherapy, and aspiration and injection of both knee joints with 40 mg triamcinolone hexacetonide. Six months later she was admitted to hospital because of severe debilitating knee pain resulting in inability to weight bear.

Examination showed mild wasting of the quadriceps muscles with retropatellar crepitus and painful restriction of movement of both knees. Repeat weightbearing knee radiographs (fig 1) showed no obvious change from the initial study six months previously apart from the impression of a high density shadow in the

region of both lateral femoral condyles. Further questioning showed excessive alcohol intake and an episode of alcoholic hepatitis complicating a paracetamol overdose two years previously. There was no history of oral corticosteroid treatment, diabetes mellitus, hyperlipidaemia, or recent trauma.

Biochemical investigations showed a raised γ -glutamyltransferase 115 U/l (normal 11–51 U/l) and hypoalbuminaemia of 25 g/l (normal 35–50 g/l). Hepatocellular enzymes, serum bilirubin, urate, and calcium were normal. A fasting lipid profile showed hyperlipidaemia; triglycerides 3.5 mmol/l (normal 0.55–1.90 mmol/l) and cholesterol 9.6 mmol/l (normal 3.9–7.1 mmol/l).

In view of the clinical history and “normal” radiographs a technetium P-99 isotope bone scan and magnetic resonance imaging (MRI) scan were requested.

The isotope bone scan (fig 2) showed markedly increased uptake of isotope in the subcortical region of both lateral femoral condyles.

Figure 3 shows the T_2 weighted MRI image of the left knee with a well defined area of infarction in both the lateral femoral condyle and within the proximal tibia together with high

Department of
Rheumatology, Royal
Victoria Hospital,
Belfast
G K Meenagh
G D Wright

Correspondence to:
Dr G K Meenagh,
Department of
Rheumatology, Royal
Victoria Hospital, Grosvenor
Road, Belfast BT12 6BA,
UK
garymeenagh@yahoo.co.uk

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Figure 1 Plain weightbearing knee radiographs at the time of admission, which are essentially “normal”.

Figure 2 Technetium P-99 isotope bone scan showing marked isotope uptake in both lateral femoral condyles.

Figure 3 T₂ weighted magnetic resonance image with a clearly defined area of bone infarction and surrounding oedema within the left lateral femoral condyle together with a similar region within the proximal tibia.

Box 1 List of disorders which have known associations with osteonecrosis

Trauma
Systemic steroid treatment
Alcoholism
Haemoglobinopathies
Post-renal transplantation
Caisson's disease
Hyperlipidaemia
Diabetes mellitus
Systemic lupus erythematosus
Thermal burns
Irradiation
Gaucher's disease

signal intensity at the margin consistent with osteonecrosis. Images of the right knee were similar.

The patient subsequently underwent urgent bilateral total knee replacement, treatment with atorvastatin, a lipid lowering agent, was started, and she was referred to a local lipid clinic.

Discussion

Osteonecrosis results from impairment of circulation to bone.^{1,2} In clinical practice the commonest sites include the femoral and humeral heads. Isolated involvement of the knee (femoral condyles and proximal tibia) is rarely seen and bilateral knee osteonecrosis is uncommon. Numerous disorders have been associated with the condition (box 1).

Osteonecrosis exists in both primary and secondary subarticular forms. If identified at an early phase a conservative approach to management can be employed, including protective weight bearing and bone grafting. More advanced or severe cases require joint replacement.

Excessive alcohol intake has been aetiologically linked with osteonecrosis. One large study showed an incidence of 5.3% in 1157 medically treated alcoholics.³ Alcohol induces a

hyperlipidaemic state, which can lead to accumulation of lipids in osteocytes. This has resulted in experimental bone necrosis.¹ It has also been shown that intraosseous fat laden microemboli are formed in patients with high alcohol intake.

The femoral head is the most common skeletal site for alcohol induced osteonecrosis. Isolated involvement of the knee in such patients has not been reported but did feature as one site in multifocal osteonecrosis in 9% of cases.⁴

In this patient previously undiagnosed type IV hyperlipidaemia was discovered. The impact of the systemic effect of hypercholesterolaemia on the subsequent development of osteonecrosis has been underlined by Moskal *et al*, who showed that 16 of 19 patients with idiopathic osteonecrosis had significantly raised serum cholesterol concentrations.⁵

Intra-articular corticosteroid injection could be postulated as an aetiological factor in this case. There is little evidence, other than anecdotal, that intra-articular injection leads to osteonecrosis.^{2,6} Balch *et al* demonstrated in a retrospective study that the rates of radiographic deterioration in osteoarthritis were lower in those receiving repeated intra-articular corticosteroid injections over many years.⁷

This case illustrates the importance of the appropriate radiological investigation in cases where osteonecrosis is suspected from the history and clinical findings. One lesson from this case is that severe osteonecrosis can exist even when knee radiographs are essentially “normal”. The classical radiological feature of femoral head osteonecrosis is the so called “crescent sign”, which represents subchondral bone collapse in the anterolateral region of the femoral head. This appearance may not be present in the early stages of osteonecrosis and therefore cannot be relied upon. Plain radiographic evidence may in fact be considerably delayed by up to 10 weeks. The earliest features of distal femoral osteonecrosis seen on MRI include marrow oedema, typically in the subchondral bone of the medial femoral condyle and progressing to form a low signal rim around the infarcting region. MRI is the investigation of choice and has been shown to have a sensitivity of 97% when compared with plain radiography and isotope bone scanning in the diagnosis of osteonecrosis. The extent and exact location of osteonecrotic lesions can be detailed on MRI and this is of prognostic importance.⁸ MRI will also identify early osteonecrotic lesions at a stage when plain radiographs are normal,⁹ as in the case described.

The significance of debilitating joint pain in a patient with no history of trauma should alert the clinician to the need to probe further into the history to identify relevant risk factors for osteonecrosis. If suspected, MRI should be the investigation of choice.

The lessons

- Osteonecrosis should be considered in patients with severe joint pain and “normal” radiographs.

- Identification of all relevant risk factors for osteonecrosis is important for future management.
- MRI is the radiological investigation of choice to demonstrate osteonecrosis, particularly at an early stage.

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