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Nine cases of osteonecrosis in elderly patients following arthroscopic meniscectomy

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Abstract We report nine cases of osteonecrosis of the knee after arthroscopic meniscectomy between 1992 and 1996. In five women and four men aged between 58 and 82 years (mean 69 years), magnetic resonance imaging (MRI) demonstrated a meniscal tear for which arthroscopic meniscectomy was performed. MRI was done between 3 days and 72 weeks after the onset of symptoms. Signs of osteonecrosis were not present on the initial MRI scan. Postoperatively, all patients experienced persistent knee pain and joint effusion. A repeat MRI scan 6–48 weeks after meniscectomy confirmed the diagnosis of osteonecrosis. In eight patients osteonecrosis was located on the medial, in one patient on the lateral femoral condyle. Our report supports the results of recent studies which have related osteonecrosis to arthroscopic meniscectomy. Further studies need to be undertaken to determine the aetiology of the osteonecrosis related to this procedure in the elderly. Until the results of these studies are available, we recommend considering carefully before performing arthroscopic procedures in the elderly.

Key words Osteonecrosis · Meniscectomy · Arthroscopy

Introduction

Osteonecrosis of the knee was first reported by Ahlbäck, Bauer and Bohne in 1968 [2]. It is characterised by the sudden onset of sharp pain in the knee of an elderly patient, usually on the medial side of the knee joint. Involvement of the lateral femoral condyle and the medial part of the tibial plateau has also been reported [8, 19].The aetiology of the osteonecrosis remains unknown. Sickle cell anaemia, Gaucher disease, caisson disease, corticosteroid treatment, systemic lupus erythematosus and alcohol abuse have been described as causative factors [6].

Two main theories attempt to explain the aetiology of osteonecrosis [1]. The traumatic theory presupposes that repeated microtrauma in porotic bone leads to stress fractures and successive necrosis. The vascular theory describes alterations in the microcirculation with increased bone marrow pressure and decreased blood flow [9, 14] due to microemboli [11, 15] or an increase in lipocyte size [29, 32]. Osteonecrosis has also been associated with meniscal tears [24]. Recent publications report osteonecrosis of the knee following arthroscopic surgery. Muscolo et al. [23] reported eight cases, Brahme et al. [5] seven cases and Santori et al. [28] two cases. Three articles describe several cases of osteonecrosis after laser-assisted arthroscopic surgery [10, 12, 27].

Case reports

We report nine cases of osteonecrosis of the knee in five women and four men aged between 58 and 82 years (mean age 69 years) (Table 1). All patients had a magnetic resonance imaging (MRI) scan performed 3 days to 72 weeks (mean 22 weeks) after the onset of pain. Meniscal tears were confirmed in all cases. No signs of osteonecrosis were demonstrated at this stage by MRI.

Arthroscopy without the use of a tourniquet was performed in all cases under general, spinal or epidural anaesthesia. All nine pa-

Table 1 Demographic and clinical characteristics of nine patients with a meniscal tear who underwent arthroscopic meniscectomy and were diagnosed with osteonecrosis subsequently (1992–1996) (*CM* chondromalacia, *lat* lateral, *LFC* lateral femoral condyle, *MFC* medial femoral condyle, *m.m.* medial meniscus, *MTP* medial tibial plateau, *ON* osteonecrosis, *post.* posterior, *TKR* total knee replacement, *UKR* unicompartmental knee replacement)

No.	Sex, age (years)	Trauma	Side	Duration of symptom	Meniscal test	MRI	Cartilage shaving	CM II - III	Time to diagnosis of ON (weeks)	Treatment
1	M, 64	Yes	R	4 weeks	Negative	Tear post. horn, m.m.	No	MTP	48	UKR
2	M, 75	Yes	R	10 days	Negative	Tear post. horn, m.m.	No	MTP	16	Conservative
3	F, 58	No	R	4 weeks	Negative	Tear m.m.	No	MFC	48	Conservative
4	F, 68	No	L	72 weeks	Positive	Tear m.m.	No	MFC	12	Conservative
5	F, 72	No	L	3 days	Negative	Tear m.m.	Yes	MFC	6	TKR
6	M, 69	No	R	8 weeks	Negative	Tear post. horn, m.m.	No	No	16	Conservative
7	F, 82	No	R	48 weeks	Negative	Tear lat.m.	No	LFC	20	TKR
8	F, 65	Yes	L	36 weeks	Positive	Tear post. horn, m.m.	No	All	28	Conservative
9	M, 72	No	L	24 weeks	Positive	Tear ost. + lat. horn, m.m.	No	No	25	Conservative

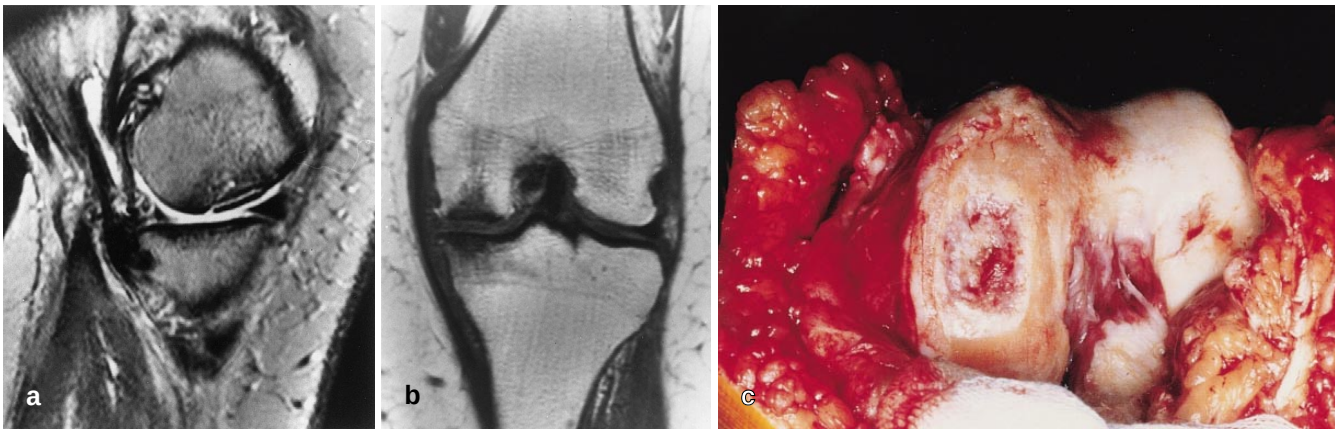

Fig. 1a–c Case 5. **a, b** Magnetic resonance imaging (MRI) 6 weeks after arthroscopy. Sagittal and coronal image of left medial femoral condyle (MFC) showing subchondral area of low signal intensity with disruption of the subchondral plate. **c** Perioperative view of MFC. Large zone of necrosis in the weight-bearing area (3×5 cm) and extensive synovitis in the medial compartment

tients complained of persistent pain and effusion following arthroscopic meniscectomy. Osteonecrosis was diagnosed 6–48 weeks (mean 25 weeks) after arthroscopy by MRI scan.

Case 1

A 64-year-old man strained his right knee. He presented with persistent medial compartment pain without effusion or instability. A MRI scan was performed 4 weeks later showing a tear of the posterior horn of the medial meniscus. Arthroscopy was performed a further 4 weeks later under epidural anaesthesia,. Ten weeks after the procedure the patient still had medial compartment pain which did not improve by needle aspiration and corticoid infiltration.

A second arthroscopy 12 weeks after the first procedure showed a large erosion of the medial femoral condyle (2 cm^2) and massive synovitis of the medial compartment. Osteonecrosis was confirmed 48 weeks after the first arthroscopy by MRI scan. The patient underwent medial unicompartmental knee replacement 14 months after the injury.

Case 2

A 75-year-old man presented with pain of the medial compartment and effusion of the right knee after a strain. A MRI scan performed 10 days after the injury confirmed a medial meniscus tear. The medial meniscus was partially resected by arthroscopy under general anaesthesia.

The patient remained symptomatic, and osteonecrosis of the right femoral condyle was ascertained 16 weeks after meniscectomy by MRI scan. Thirty-two months after arthroscopy the patient still has pain and needs a walking stick. He refused all further procedures.

Case 3

A 58-year-old woman presented with a 4-week history of right knee pain without trauma. On examination she was overweight, and the right knee was stable without effusion. Palpation of the femorotibial joint was painful. Meniscal tests were negative. MRI demonstrated a large tear of the medial meniscus. The patient was treated conservatively with partial weight-bearing, non-steroidal anti-inflammatory drugs (NSAIDs) and rest without any improvement. Arthroscopy was performed 8 weeks later under general anaesthesia, and the posterior horn of the medial meniscus resected. Chondromalacia grade II of the medial femoral condyle was present.

Because of persistent symptoms a MRI scan was performed 48 weeks after the arthroscopy, which revealed osteonecrosis of the

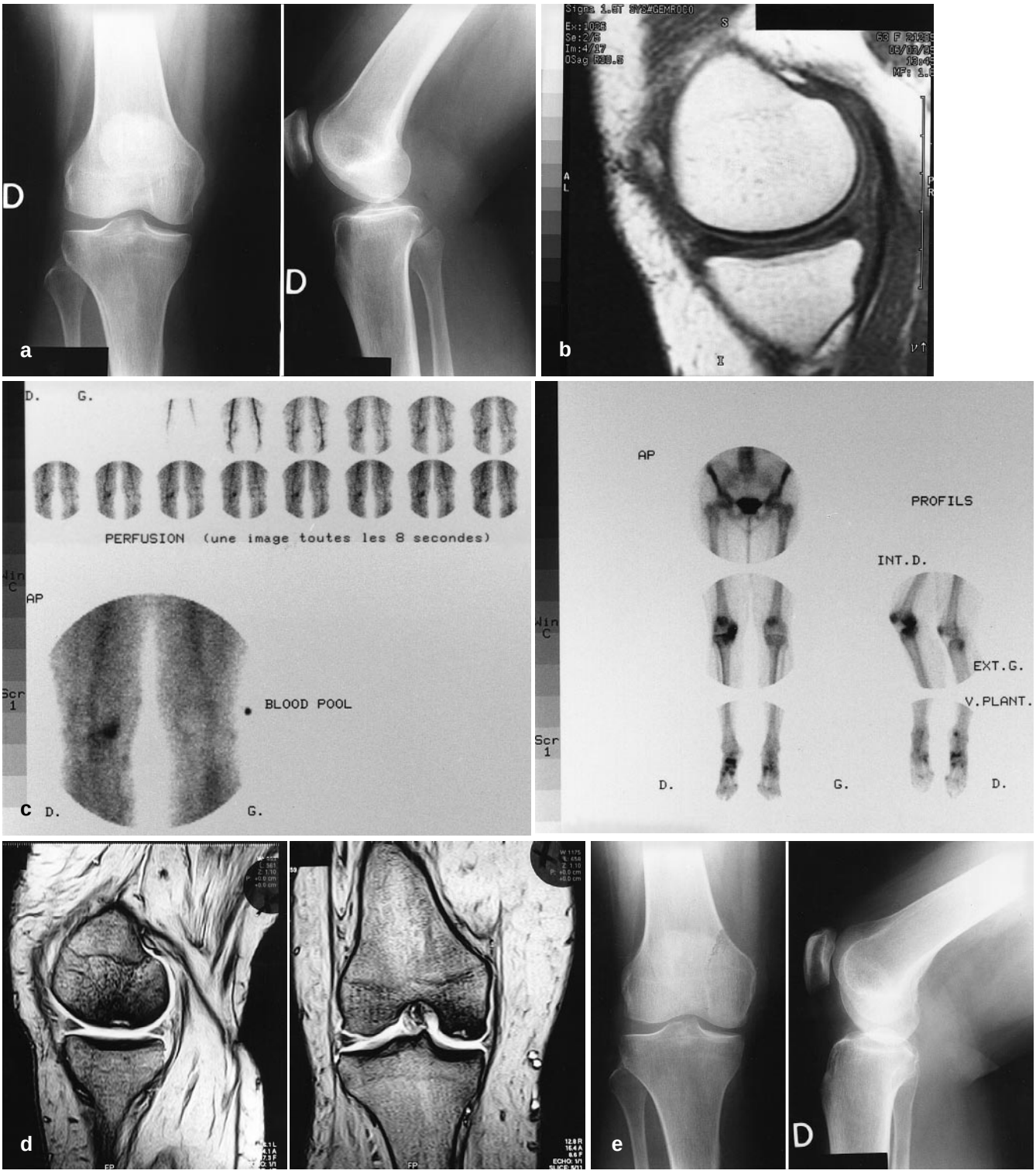

Fig. 2a–e Case 8. **a** X-ray of the left knee 34 weeks after injury. **b** MRI 36 weeks after injury. Grade III tear of the posterior horn of the medial meniscus. **c** Bone scan 26 weeks after arthroscopic meniscectomy, showing focal increased uptake of the MFC. **d** MRI 28 weeks after arthroscopic meniscectomy. Lesion of the MFC. **e** X-ray after second MRI showing MFC radiolucency

Fig. 3a–d Case 9. **a** T1-weighted sagittal image shows a large subchondral cavity surrounded by low and high signal intensity. Oedema of the surrounding cancellous bone. **b** MRI 25 weeks after arthroscopy. High signal intensity in a large area of the MFC with collapse of the subchondral plate in T2-weighted coronal image. Effusion is present. **c, d** X-rays of the left knee after MRI demonstrating osteonecrosis of MFC

right medial femoral condyle. At present, the patient still has pain but no effusion. She refuse all further procedures.

Case 4

A 68-years-old woman presented with a 18-month history of left knee pain without any trauma. On examination she was overweight, the range of motion of the left knee was preserved, and medial meniscal tests were positive. A MRI scan showed a medial meniscal tear. Arthroscopy under general anaesthesia revealed chondromalacia grade III of the medial femoral condyle. Partial meniscectomy of the medial meniscus was performed. MRI done 12 weeks after the arthroscopy showed osteonecrosis of the medial femoral condyle.

Case 5

A 72-year-old woman presented with medial compartment pain after straining her left knee. Three days after injury a MRI scan was performed showing a tear of the medial meniscus. One week later the patient underwent holmium:Yag laser-assisted arthroscopy with partial medial meniscectomy. Chondromalacia grade III of the medial femoral condyle was seen. Cartilage shaving was performed.

Five weeks after meniscectomy she was admitted to hospital for severe pain and effusion in her left knee. MRI showed osteonecrosis of the medial femoral condyle and oedema of the medial tibial plateau (Fig. 1). Five months after meniscectomy total knee replacement was performed with excellent clinical results.

Case 6

A 69-year-old man presented with a 2-month history of right knee pain without trauma. Pain was localised in the medial compartment, and a MRI scan confirmed a grade IV medial meniscus tear. An arthroscopy was performed with partial resection of the medial meniscus.

Following arthroscopy he presented with persistent right knee effusion. Joint aspiration was performed twice. Twenty weeks later osteonecrosis of the medial femoral condyle was diagnosed by MRI. At this stage the patient was treated conservatively.

Case 7

A 82-year-old woman complained about right knee pain in the absence of trauma for 12 months. She denied other symptoms such as locking or giving way of the knee joint. On examination she was overweight, the lateral compartment was tender on palpation, and

meniscal tests were negative. MRI scan showed a lateral meniscal tear, degenerative changes of the medial meniscus but no osteonecrosis. Arthroscopy 8 weeks later confirmed the lateral meniscal tear which was resected. Chondromalacia grade II was noted in all compartments. Twenty weeks after arthroscopy a MRI scan was performed for persistent pain in the lateral compartment and showed osteonecrosis of the lateral femoral condyle requiring right total knee replacement.

Case 8

A 65-year-old woman was referred for left knee pain after a fall. The medial compartment was painful on examination, and meniscal tests were positive. Instability was not noted. MRI scan performed 36 weeks after the initial injury showed a tear of the posterior horn of the medial meniscus but no osteonecrosis (Fig. 2a,b). The patient underwent arthroscopy, and the posterior horn of the medial meniscus was removed.

Recovery was very slow and incomplete despite physical therapy and balneotherapy. Twenty-five weeks after arthroscopy MRI showed osteonecrosis of the medial femoral condyle (Fig. 2d). The patient declined further surgery.

Case 9

A 72-year-old man presented with a 6-month history of left knee pain without trauma. No improvement was noted after conservative treatment with NSAIDs and rest. MRI scan demonstrated a grade III tear of the posterior horn and lateral part of the medial meniscus. Partial arthroscopic meniscectomy was performed, but the pain persisted. Twenty-four weeks after the procedure MRI confirmed the diagnosis of osteonecrosis of the medial femoral condyle (Fig. 3a,b). Unicompartmental knee replacement was refused.

Discussion

MRI has been described as the most sensitive method for the early detection of osteonecrosis [4–6, 29, 30]. One study reports that MRI allows diagnosing osteonecrosis even earlier than radionuclide bone scintigraphy [13]. However, others express doubt about the validity of MRI if performed soon after the onset of symptoms [3, 20, 25]. The concept of a window of time has also been postulated in which MRI cannot detect osteonecrosis [20].

Seven of the nine patients of this series had MRI performed at least 4 weeks after the onset of symptoms. MRI showed no signs of osteonecrosis in any of these seven patients. If early signs of osteonecrosis had been present, it is unlikely that MRI would have missed them. It is not possible to rule out osteonecrosis as the primary pathology for patients 2 and 5 in whom MRI was performed after 10 and 3 days, respectively. One could argue that even MRI should have detected bone marrow oedema in patient 2 and alerted the surgeon to the presence of some bone pathology.

The causes for idiopathic osteonecrosis in the elderly are not known. Trauma and systemic administration of corticosteroids are frequently listed as causing osteochondritis dissecans in the elderly. They may also be risk factors for osteonecrosis in this age group.

Osteonecrosis after local intra-articular injection of long-acting corticosteroids (triamcinolone) has been reported [17, 22]. Cortisol excess with systemic effects was demonstrated after injections in these cases. Patients 1, 5 and 6 received one intra-articular injection of betamethasone postoperatively without systemic effect.

Meniscal tears have been associated with idiopathic osteonecrosis of the knee [24]. Many reports have emphasised the major role of menisci in transmitting loads and absorbing energy in the knee joint [16, 18, 26, 31]. Total meniscectomy leads to greater stress in the weight-bearing areas of the femoral condyle and the tibial plateau [26]. Retention of a torn meniscus does not appear to have a deleterious effect on the magnitude or distribution of stress in the same model.

We recently reported that arthroscopic meniscectomy in patients over 50 years old led to disappointing results when performed for degenerative lesions. Recent trauma and positive meniscal tests were the only significant criteria determining the success of arthroscopic treatment [21]. Only three of our nine patients had positive meniscal tests, and only one gave a true traumatic history. In all other cases pain, swelling, limitation of motion and difficulties in weight-bearing were the main symptoms, with meniscal tests being negative.

Partial meniscectomy may lead to changes in load distribution and could be the additional insult to the knee joint that may provoke osteonecrosis by microtrauma and fractures in the subchondral bone. Moreover, arthroscopy by itself could be a risk factor for osteonecrosis by constituting an additional trauma to the knee joint. Arthroscopy was performed without tourniquet and was uneventful in all our cases. No excessive manipulation of the knee joint was undertaken under anaesthesia. Pathological cartilage of the femoral condyle was found in five knees. The increased permeability of pathological cartilage may lead to subchondral oedema, and increased fluid pressure during the procedure could impair vascularisation further.

One patient underwent laser-assisted meniscal resection and cartilage shaving with a Ho:YAG laser. Studies have reported osteonecrosis after laser-assisted arthroscopic surgery even in younger patients [10, 12, 27]. In our case osteonecrosis could have been secondary to thermal injury or photo-acoustic shock [12].

Between 1992 and 1996, 585 knee arthroscopic procedures were undertaken in patients over 50 years old in our institution. We reported osteonecrosis of the femoral condyle in 9 patients who underwent arthroscopic partial meniscectomy. The clinical course was favourable in 2 cases, whereas 3 patients eventually required knee replacement. The remaining patients still suffer severe pain and effusions but have declined further surgery.

Our report supports the results of recent studies which have related osteonecrosis to arthroscopic meniscectomy. Further studies need to be undertaken to determine the aetiology of osteonecrosis related to this procedure in the elderly. Until the results of these studies are available, we recommend considering carefully before performing arthroscopic procedures in the elderly.

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