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Case report

Management of osteonecrosis of proximal tibia using trabecular osteonecrotic rods

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ABSTRACT

Osteonecrosis of the knee is a well-described cause of acute knee pain. It can lead to significant functional impairment, rapid arthritic joint changes and subsequent collapse. Several hypotheses exist different treatment options are used ranging from conservative management to joint arthroplasty. The majority of cases involve the distal femoral condyle and to a much lesser extent the medial tibial plateau.

We are presenting a rare case of osteonecrosis of the proximal tibia affecting the lateral tibial condyle in 44 years old Caucasian male which was treated successfully using osteonecrotic tantalum rods with 26 month follow-up.

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1. Introduction

The knee is the second most common joint affected by osteonecrosis. Ten percent of patients suffering from osteonecrosis of the hip usually have knee joint involvement. Three entities are commonly referred to as “osteonecrosis”.¹ Spontaneous osteonecrosis of the knee (SPONK) which is related to an insufficiency fracture or a vascular insult, atraumatic osteonecrosis (referred to as secondary osteonecrosis), it is most commonly steroid induced or associated with other medical disorders. The exact incidence of these two disorders is not known, but atraumatic osteonecrosis appears to be more common and least but not last post-arthroscopic osteonecrosis of the knee² occurs following knee arthroscopy.

SPONK usually affects patients over 55 years of age with no predisposing cause.³ Secondary osteonecrosis on the other hand has a predisposing cause, affects patients under 55 year, can affects multiple sites in the knee and in 80% of times can

be bilateral.⁴ The post-arthroscopic osteonecrosis though occurs infrequently but is assuming more importance from medicolegal point of view.⁵

There are various classifications and staging systems available for knee osteonecrosis most commonly used are modified Ficat and Arlet classification⁶ and the one described by Kashino⁷ and modified by Aglietti.⁸ There have been several treatment options for this condition depending on the type and stage of osteonecrosis but with no uniform consensus.

2. Case report

42-year-old male white Caucasian patient was referred from Rheumatology clinic with atraumatic insidious onset of knee pain of 6 months duration. His pain was typically localized to lateral aspect of the knee. Clinical examination revealed mild

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Fig. 1 – Showing early subchondral collapse of lateral tibial plateau.

joint effusion, lateral joint line tenderness and terminal restriction of flexion by 20°, no other local clinical signs and symptoms can be seen. Patient suffers from scleroderma (rare cause for secondary osteonecrosis), with affection of small joints of the hands and mild pulmonary hypertension. He was treated by his physicians with anti-inflammatory and occasional short courses of prednisolone for his scleroderma and finger joint pains. Being high risk for secondary osteonecrosis (both due to scleroderma and steroids), patient was thoroughly investigated with various imaging modalities for his knee pain. The first set of radiographs did not show any abnormalities. The second set of radiographs obtained within

six weeks of pain onset revealed subchondral sclerosis of lateral tibial plateau with squaring of joint margin and early minor subchondral collapse of lateral tibial plateau (Fig. 1). Both T1 and T2 weighted magnetic resonance scan images showed diffuse signal changes in lateral tibial plateau with extension into the metaphysis (Fig. 2).

Based on clinical and radiological findings a diagnosis of stage III secondary osteonecrosis of lateral tibial plateau was confirmed using Aglietti classification, and early surgical intervention was suggested. Literature review highlighted three surgical options: Arthroscopic debridement and core decompression with or without bone grafting, osteotomy or arthroplasty (the later was excluded due to patients' young age, and absence of any obvious clinical deformity).

We opted for arthroscopic evaluation with debridement, core decompression and insertion of osteonecrosis interventional implant (Zimmer Inc.). This option of core decompression with insertion of osteonecrosis interventional implant has been well described and reported in treatment of femoral head osteonecrosis^{8,9} with favourable outcome but never applied or used in proximal tibial avascular necrosis. Joint arthroscopy revealed few minor fibrillations in articular cartilage in the lateral tibial articulating surface (Fig. 3). Rest of the knee joint was found to be normal. We proceeded with core decompression of the osteonecrotic lesion under the fluoroscopy guidance in the same sitting. The upper tibia was accessed through a reverse J or hockey stick skin incision and the antero-lateral approach was used for proximal lateral tibia exposure. Osteonecrotic Intervention implant (Zimmer Inc.) kit was used as advised for treating head of femur osteonecrosis. Two guide pins were inserted in the centre of osteonecrotic lesion well below the articular surface in antero-posterior direction. Cannulated reamers of 8 mm, 9 mm and 10 mm were used sequentially to core out all the necrotic material under fluoroscopy (Fig. 4). This created a large osteonecrotic defect well extending into metaphyseal area. Cannulated depth gauge was use to obtain length of the defect.

Fig. 2 – MRI showing large area of osteonecrosis on lateral tibial plateau in both T1 and T2 eighted images extending well into metaphyseal area.

Fig. 3 – Arthroscopy pictures of lateral tibial plateau showing fibrillations in the articular cartilage.

Following this decompression two Osteonecrotic trabecular metal rods (Zimmer Inc.) of appropriate length (50 mm and 55 mm) and 10 mm in diameter were inserted well below the articular cartilage and in the metaphyseal area. The small gaps in between implants and superior subcondral area was packed with autogenous cancellous bone graft from patients' ipsilateral iliac crest. A five hole peri-articular NCB proximal tibial locking plate (Zimmer Inc.) was inserted as a buttress on the lateral aspect to avoid any collapse and prevent any fracture of lateral tibial plateau (Fig. 4).

Post operatively patient was allowed only toe touch weight bearing in a Donjoy knee brace with 0°–90° of flexion for first 6 weeks.

3. Results

Patient was followed up by clinical examination and serial radiographs, first at 6 weeks and then at 3 monthly intervals. He was full weight bearing after 6 weeks and regained full range of movement with the help of physiotherapists in 3 months. Currently at 26 months he has been completely pain free, full weight bearing and maintains full range of motion. Radiologically there are no signs of progression of osteonecrosis and there has been no collapse of lateral tibial plateau (Fig. 5). The joint line is well preserved and the osteonecrosis intervention implants have well Osseo integrated. His oxford scores have improved from 21 to 44 and his knee society scores have improved from 41 to 82. Patient is still under long-term follow up.

4. Discussion

At present, treatment of osteonecrosis of the knee remains controversial and various options from conservative measures of non weight bearing, arthroscopic debridement, osteotomies, to joint arthroplasties are available. They are dependent upon multiple factors including age of patient, type of osteonecrosis, stage of disease, and the size and site of lesions.^{2,10–13} Secondary osteonecrosis frequently progresses to end-stage disease, and early surgical intervention is recommended.¹¹ As in the hip, dead bone leads to subchondral fracture and later joint collapse, which often results in debilitating arthritis needing total knee arthroplasty.

Surgical treatment is advisable in stage two and three patients with symptomatic secondary osteonecrosis as disease is progressive rapidly and can be debilitating. In younger age patients with stage two and three osteonecrosis joint arthroplasty is not recommended for fear of early loosening and failure. Arthroscopic debridement on its own may not work and core decompression is advisable. In case of large areas of osteonecrosis large amount of auto or allograft may be needed. There is no guarantee that this may incorporate and prevent further collapse. The use of trabecular metal osteonecrotic implants has shown to reduce the amount of graft needed. Tantalum or trabecular metal offers several advantages by its uniformity and structural continuity, high mechanical strength, low stiffness, high porosity and high coefficient of friction with near normal architecture and mechanical properties as of bone.¹⁴ Bobyn et al¹⁵ have shown

Fig. 4 – Core decompression under fluoroscopy and insertion of osteonecrosis Interventional implant. Supplemented by Lateral compression plate as a buttress support.

that trabecular metal act as scaffolding for normal bone to grow into and it starts as early as 4 weeks.

The buttress plating gives additional support and strength to the tibial plateau and prevents any collapse. Advantage can be taken to correct any valgus deformity if present by creating an additional open wedge osteotomy.

There have been very few reports of treating tibial plateau osteonecrosis with core decompression.^{2,13} Osteochondral grafting but as far as we know there has been no report in the

literature of using osteonecrosis intervention implant in proximal tibia.

5. Conclusion

In view of the patient's young age and activity level it was decided to offer the patient joint preservation surgery while preserving his own bone stock and avoiding massive bone grafting. This method also would give adequate strength to his subchondral bone leading to early full weight bearing mobilization and rehabilitation. In this case we describe a unique way of treating the patient to maintain the joint surface and prevent any collapse. Similar treatments have been well described for avascular necrosis of head of femur^{8,9} but as far as we know there are none described for lateral tibial plateau.

This is a novel way of treating this unusual case of Lateral tibial plateau osteonecrosis. It helps to preserve the joint in a young patient and avoid an arthroplasty procedure.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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Fig. 5 – 26 months follow-up X-ray showing well maintained joint surface with no collapse. No progression of osteonecrosis.

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