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Management of loose osteochondritis dissecans in an adolescent

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ABSTRACT

Osteochondritis dissecans (OCD) of the knee joint affects subchondral bone first, and then it involves the articular cartilage. It can cause pain, effusion and loose body formation. Nonoperative treatment is for the stable lesion, but if the lesion is unstable and symptomatic, then operative management is needed. Short term goal of the treatment is pain relief, and the long-term goal is the prevention of early arthritis. Surgical treatment includes removal of loose body, microfractures, osteochondral autograft and allograft transplantation, autologous chondrocyte implantation (ACI), arthroscopic removal of the loose body and internal fixation of the fragment using k wire or screw. We successfully managed an adolescent with a loose OCD fragment with an arthroscopic evaluation, removal of the loose body and refixation of the loose fragment to the parent location, using three bio screws.

1. Introduction

Osteochondritis dissecans is a disease of articular cartilage and subchondral bone. The subchondral bone is affected first and ultimately involves the articular cartilage leading to a painful joint.[1] The most common site of involvement by OCD is the knee joint, but it also occurs in elbow, wrist, and ankle.[2] In the knee joint, medial femoral condyle (70–80%) is affected most commonly followed by lateral femoral condyle (15–20%) and the patella (5–10%).[3] OCD is more common in male.[1,2] It is thought to occur due to the repetitive microtrauma, but there are other factors which have been implicated, and these include vascular insufficiency, genetic factors, endocrinal disorders and abnormalities in ossification center.[1]

OCD is classified into two forms: Juvenile osteochondritis dissecans (JOCD) if it occurs in a patient with open physis and Adult osteochondritis dissecans (AOCD) if it happens in a patient with closed physis.[4] The difference between the two forms is essential for treatment and prognosis. There are variety of treatment modalities available for the management of OCD ranging from nonoperative treatment, fixation of the fragment, microfracture, autologous chondrocytes implantation, and mosaicplasty (see Table 1). The decision to use a particular modality depends on multiple factors like age, status of closure of the physis and the stability of the lesion.

We report the case of a 16 years old girl with a large unstable and detached osteochondral fragment of an OCD, which was managed with re-fixation of the fragment to the parent site.

1.1. Case presentation

A 16-year-old girl presented with history of intermittent locking of the left knee of one month duration and mild pain since six months. There was no history of injury, fever or other joint involvement. Local examination revealed lateral joint line tenderness and a floating palpable mass in the lateral suprapatellar pouch with mild quadriceps muscle wasting.

Plain radiographs (Fig. 1) revealed a loose body in the suprapatellar region, which was confirmed by magnetic resonance imaging (MRI). MRI also showed an osteochondral defect in the weight-bearing area of the lateral femoral condyle, suggestive of an OCD (Fig. 2). After taking informed and written consent, the patient was planned for in situ fixation of the lesion.

The arthroscopic evaluation revealed a significant, full thickness defect over the weight bearing area of the lateral femoral condyle

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Table 1
Table depicting the advantages and disadvantages of various modalities for treatment of OCD.

Treatment modality	Advantages	Disadvantages
Removal of fragment	• Less expertise required • No additional instruments/set up needed	• Poor results • Persistent symptoms • Early arthritis
Microfracture	• Easy to perform • Smaller learning curve • No additional set up needed	• Fibrocartilage formed is not as strong as native cartilage • Can not be done for large lesions (>2.5cm^2) • Comparatively poor long term prognosis
Reduction and fixation (Open/Arthroscopic) with K wires	• Suitable for large fragments with attached subchondral bone • Cheaper implant	• Chances of pin tract infection • Chances of septic arthritis • Needs k wire removal • Non MRI compatible • Inability to provide compression
Reduction and fixation (Open/Arthroscopic) with headless metallic screws	• Can achieve compression of the fragment to native bone • May not need removal	• Not compatible with MRI (except titanium) • Risk of fracture of fragment when over tightened • Difficulty in placing the screw perpendicular to the plane of the fragment
Reduction and fixation (Open/Arthroscopic) with biodegradable screws	• Similar to metallic screws	• Compatible with MRI
Osteochondral autograft transfer system (OATS)	• Suitable for lesions where fixation not possible but size is less than 2.5 cm^2	• Learning curve involved • Special instruments needed • Donor site morbidity
Osteochondral allograft implantation	• Suitable for >2.5 cm^2 lesions	• Difficult availability of cadaveric donor • Needs large institutional set up
Autolgous chondrocyte Implantation (ACI)	• Suitable for >2.5 cm^2 lesions	• Costly • Two stage procedure • Waiting period between harvesting and implantation • Expertise needed

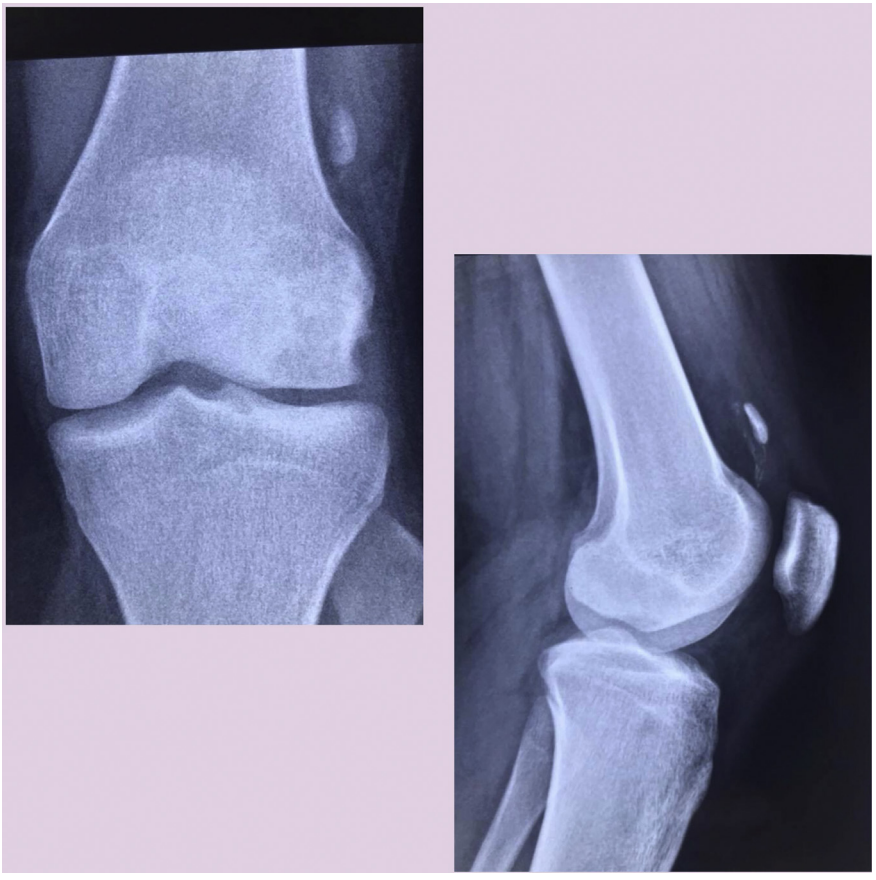

Fig. 1. Preoperative plain radiographs of the knee showing a loose body in the suprapatellar region.

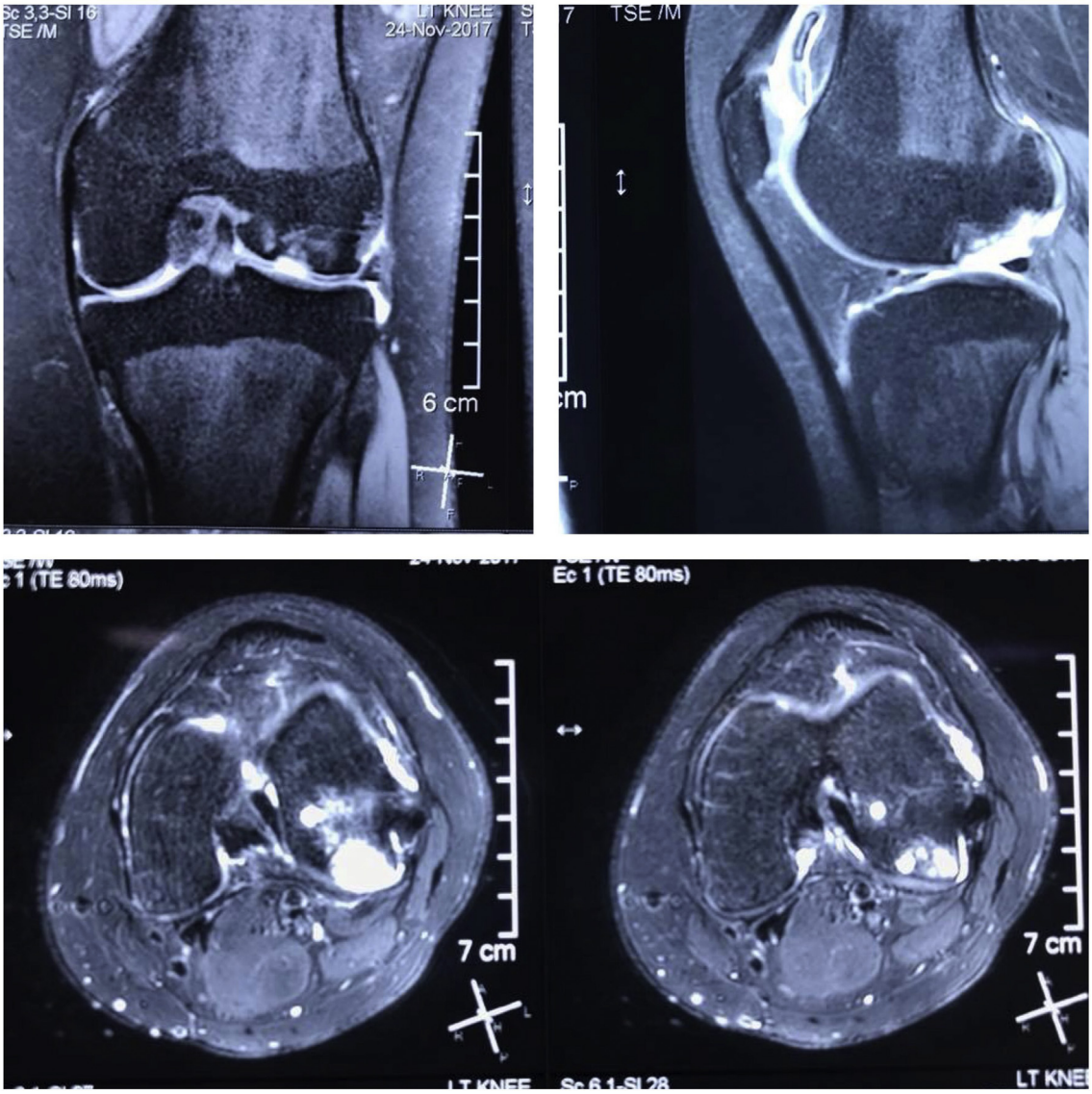

Fig. 2. MRI images are showing a large Osteochondral lesion involving the lateral femoral condyle with a loose boy in the suprapatellar pouch.

(almost covering 2/3rd of it). A sizeable osteochondral fragment (loose body) was also found in the supra-patellar pouch (3 × 2 cm), with an underlying thin layer of subchondral bone (Fig. 3). After the arthroscopic removal of loose body, it was cleaned and a mini anterolateral arthrotomy was made. Micro-drilling was done in the lesion to increase the chances of incorporation of the fragment. The fragment was refixed to its parent location, using three headless compression bio screws (2mm x 26mm, Arthrex). Since the lesion was extending posteriorly and involved a large segment of posterior femoral weight bearing surface, flexion of 120° was needed to fix the fragment adequately. Special care was taken while fixing the fragment to avoid over-tightening of the screws as this might have lead to fragment fracture. After the fixation of the fragment, the knee was taken through full range of motion to make sure that the heads of the screws were buried under the cartilage and there was no mechanical block due to the screws. Stable and congruent articular surface was achieved (Fig. 3).

The knee was kept in a range of motion knee brace which was locked in extension for one week. The range of motion (ROM) exercises were started at the end of one week with a 10-degree increase every day with the ROM knee brace. The patient was kept non-weight bearing for two months. The weight bearing was gradually increased to full weight bearing at three months. At 12 months follow up, she was asymptomatic with a full ROM, at the knee. She was relieved of the episodes of locking and there no feeling of instability at the knee. The plain radiographs, at the final follow-up, revealed that the OCD fragment was in position with no fragmentation of the lesion (Fig. 4).

At one year follow up MRI of the patient was also obtained to assess the healing of the fragment. The MRI showed optimal placement of the fragment to its parent bed with good healing to the native subchondral bone with no further fragmentation of the fixed osteochondral fragment (Fig. 5).

2. Discussion

The goal of treatment of an OCD is to maintain the normal function of the knee and delay the onset of secondary degenerative

Fig. 3. Operative pictures, showing a large osteochondral lesion involving the lateral femoral condyle, loose body removal and refixation of the osteochondral loose body with three biodegradable headless compression screws.

arthritis. Various factors including loose body formation, the stability of fragment, the status of the physis, size and thickness of the fragment, presence of subchondral bone, stage of the disease and activity levels of the patient determine whether operative management is indicated or not. JOCD, without loose body formation, may be treated with conservative management as these fragments heal well.[2] In AOCD, the possibility of spontaneous healing is much less, and these lesions usually require intervention for optimal results. As long as the lesion is stable, a fair trial of conservative treatment including activity curtailment, weight-bearing restriction, and physiotherapy can be given. It is essential to know that the chances of healing of the lesion are more in the juvenile variant as compared to the adult variant.[4] Hence, it is vital to keep a low threshold of surgical intervention in the adult variant as soon as there is a failure of conservative treatment. The lesions which have already detached or are deemed unstable on MRI, usually require early intervention, irrespective of the physeal status.[4]

There is a dilemma in the management of a loose OCD, due to the multiple treatment options available. The management of the fragments depends on multiple factors (Fig. 6). Removal of loose fragment gives symptomatic relief to the patient. Lim et al. reported a case series of 28 knees showing that removal of loose fragment gives significant improvement in Lysholm score, but degenerative changes are more in the third and fourth decades of life.[5] The removal of the loose fragment may be combined with microfracture. The microfractures done in the subchondral bone lead to extrusion of marrow elements which, in turn,stimulate fibrocartilage fill. This fibrocartilage is deemed to impair good prognosis and optimal results are obtained, only, if the size of the lesion is less than 2.5 cm^2.[6] Osteochondral autograft transfer system (OATS) is most useful if the size of the lesion is less than 2.5 cm^2. In this process, the articular cartilage with subchondral bone from the nonweight bearing area of the knee joint is transferred to the affected part of the knee joint. In this technique, lugs or dowels of healthy cartilage along with the subchondral bone are harvested from non-articulating superolateral or medial and lateral trochlea. These dowels are then inserted in predrilled holes in the defect. If more than one plug is used to fill the defect, then this technique is

Fig. 4. Plain radiographs at 12 months follow-up, showing healing of the OCD lesion and absence of a loose body.

Fig. 5. a: Follow up coronal T2 weighted MRI, done at one year follow up, shows healed fragment with optimal position (arrow). Fig. 5b: The sagittal image of the knee at follow up shows the posterior extent of the lesion and healing of the fragment in the bed (arrow).Fig. 5c: T2 weighted axial cut of the one year follow up MRI showing the tracks of biodegradable screws used for the fixation of the fragment (circle).

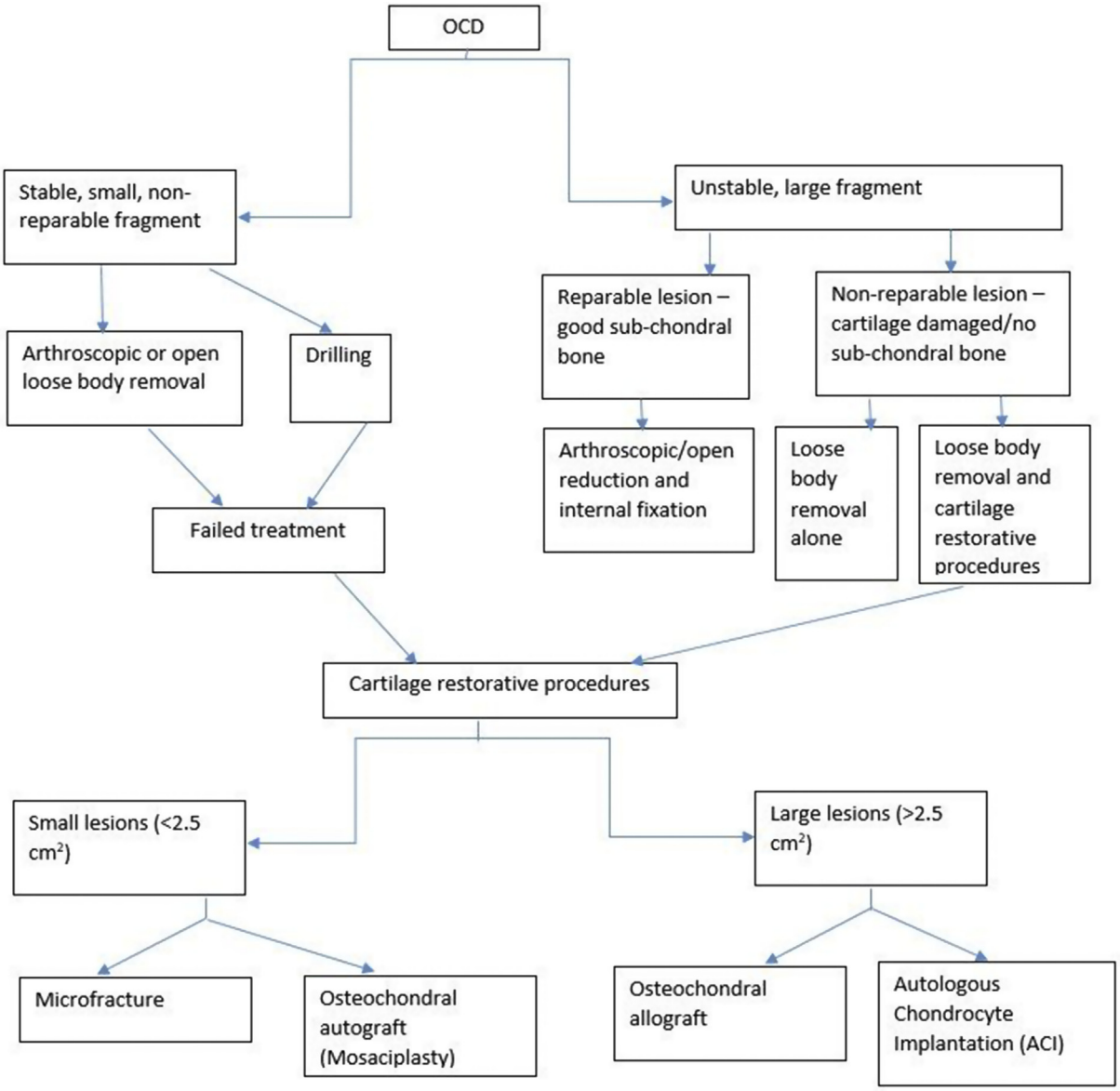

Fig. 6. An algorithm depicting the management of osteochondritis dissecans (OCD).

known as mosaicplasty. If the size of the lesion is large, it is recommended to use allograft as the chances of donor site morbidity are more with an autograft. Ollat et al. found the good result of OATS in 72.5%.[7] It has also been recommended that the medial femoral condyle OCD lesions give a better result with OATS as compared to the lateral femoral condyle. Autologous chondrocyte implantation (ACI) is most effective in lesion more than 2.5 cm^2, which is a two-stage procedure.[8,9] In the 1st stage, arthroscopic biopsy from healthy cartilage is taken from a non-weight bearing area (intercondylar notch or from the periphery of femoral condyles) and in the 2nd stage, these cultured cells are injected into the cartilage defect under a scaffold or mixed with fibrin glue. If the defect is large and deep, then it is advisable to use bone graft along with cultured cell (sandwich technique). Peterson et al. reported 91% good results after ACI at 2–10 years follow up.[10] There are certain drawbacks of ACI as the technique is expensive, involvestwo-stage procedure and the facility of cell culture is not universally available.

In our case, the arthroscopic evaluation done showed large defect more than 2.5 cm^2 over the weight-bearing area of the lateral femoral condyle, which extended posteriorly. The size of an osteochondral fragment (loose body) was 3 cm x 2 cm and had a sliver of attached subchondral bone. These factors prompted us for re-fixation of the fragment. There are multiple ways in which fixation of such a sizeable osteochondral fragment can be achieved. These fragments can be fixed using Kirschner wires, but these wires require an additional procedure of removal at the end of six weeks, and there is a possibility of pin tract infection through the protruding joint and can lead to secondary septic arthritis. Hence, the use of K-wires is usually avoided. There are other fixation modalities, such as headless compression screws (HCS), metallic and biodegradable. The advantage with the HCS is that they do not require a second procedure of implant removal. Patients with cartilage lesions may need to undergo MRI for follow up, and hence the use of metallic screws may interfere with MRI and produce a significant artfact around the lesion, thus preventing adequate imaging.[11] The biodegradable screws have a distinct advantage over metallic screws in the fixation of OCD lesions as these do not

interfere with MRI and therefore was preferred in our case. Weckstrom et al. compared bioabsorbable pin and nail fixation in AOCD and reported good or excellent result in the nail group (73%) than in the pin group (35%).[13] Camathias et al. found good results with the use of the partial threaded bioabsorbable screws in children.[14] Millington et al. however, shows radiographic healing rate of only 67% with closed physis fixed with bioabsorbable implants.[12] We used the biodegradable screws and obtained good functional outcome at one-year follow-up. The presence of biodegradable screws also helped us in ease of visualization of the healing pattern of the OCD.

3. Conclusion

Stable, JOCD lesions can be managed with conservative treatment. However, failure of conservative treatment, may lead to a sizeable detached fragment with mechanical symptoms. In these cases, the use of micro drilling, fixation of the fragment or restorative procedures are indicated. The restorative procedures include OATS or using cultured cells. Allografts may be used in extensive lesions to avoid donor site morbidity. Internal fixation is a good option for acute OCD with dislodged fragment which has some amount of attached subchondral bone. The use of bio screw gives a good result with the additional benefit of not requiring a second surgery, for implant removal.

COI

There are no conflicts of interest to declare.

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