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Original article

Arthroscopic Assisted-Management of Sizable Non-Fragmented Osteochondritis Dissecans Lesions

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Abstract:

Background: Osteochondritis dissecans (OCD) is a pathological condition involving subchondral bone and articular cartilage resulting in detachment of subchondral bone and overlying articular cartilage that can cause instability, with subsequent progression to osteoarthritis. This study aimed to evaluate the efficacy and the functional outcome of Arthroscopic assisted management of sizable non-fragmented Osteochondritis Dissecans lesions. **Methods:** This prospective cohort study was performed on 20 patients with unstable non-fragmented Osteochondritis (OCD) lesions larger than 0.8 cm and smaller than 3.5 cm in diameter. All studied cases were subjected to the following: detailed history taking and demographic data collection, full clinical examination, routine laboratory investigations [complete blood count, C-reactive protein (CRP), kidney and liver function tests] and radiological evaluation [Plain x-ray, computed tomography (C.T), Magnetic resonance imaging]. **Results:** VAS was significantly decreased after 3 mon. and after 6 mon. compared to preoperative and significantly decreased after 6 mon compared to after 3 mon. Lysholm knee score was significantly increased after 3 mon. and after 6 mon. compared to preoperative and significantly increased after 6 mon. compared to after 3 mon. **Conclusion:** Arthroscopic assisted management of sizable non-fragmented osteochondritis dissecans lesions- is associated with improvement in functional outcomes- as presented by Lysholm score- and improvement in pain- as shown by VAS score-.

Keywords: Arthroscopic Assisted-Management; Non-Fragmented; Osteochondritis Dissecans.

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Introduction

Arthroscopic Assisted-Management Osteochondritis dissecans (OCD)- is a pathological condition involving subchondral bone and articular cartilage, resulting in detachment of subchondral bone and overlying articular cartilage that can cause instability, with subsequent progression to osteoarthritis [(1)].

The most commonly affected joint is the knee, followed by the ankle, elbow. Knee OCD most commonly affects the medial femoral condyle (64% of knee OCDs) and is classically located on the lateral aspect of the medial femoral condyle. OCDs of the lateral femoral condyle are also fairly common (32% of knee OCDs) and are often much larger than OCDs in other locations. OCDs also occur in other locations including the patella and the trochlea [(2, 3)].

Osteochondritis dissecans affect the subchondral bone of the knee in children and adolescents with open growth plates (juvenile OCD) and young adults with closed growth plates (adult OCD) [(4)].

There are several different classification systems for OCD, including those based on plain radiographs, MRIs and arthroscopic findings. The most important aspect of any classification of OCD- is to establish whether the lesion is stable or unstable, as this will influence how the lesion is treated [(3, 5)].

Treatment of OCD attempts to maximize the healing process and minimizing damage to the overlying articular cartilage to prevent premature osteoarthritis in this young population. Treatment decisions are based on the stability of the lesion [(6)].

Surgical treatment is based on the radiographic and arthroscopic characteristics of the lesion. Surgical treatment of OCD is generally recommended for any unstable OCDs or in stable OCDs failing to improve with 3 months of conservative treatment in skeletally immature patients [(6)].

Stable OCDs are generally treated with drilling to stimulate healing. When approaching an unstable lesion at the time of surgery, the progeny fragment is determined to be salvageable as a fragment that can be saved.

Features typically associated with salvageable fragments are: the fragment contains bone on deep surface, the fragment is in one piece and the fragment contains predominantly normal articular cartilage. An unsalvageable fragment is defined as; a fragment that cannot be saved. Features typically associated with unsalvageable fragments include the following: the fragment consists of cartilage only, the fragment consists of multiple pieces, and the fragment contains damaged or absent articular cartilage [(7-9)].

A sizable non-fragmented lesion can be fixed. Different fixation techniques have been described, including metallic staples, metallic headless compression screws, bioabsorbable implants, and pins [(7-9)].

Several operative techniques have been developed to address unstable fragmented OCD lesions not amenable to repair, including: osteochondral autograft transfer (OATS), autologous chondrocyte reimplantation (ACI), osteochondral allograft, and the matrix-induced autologous chondrocyte implantation (MACI) [(10, 11)].

The purpose of this study was to evaluate the efficacy and the functional outcome of Arthroscopic assisted management of sizable non-fragmented Osteochondritis Dissecans lesions.

Patients and methods

This prospective cohort study was performed on 20 patients, in the period between April 2022 and April 2023, at Orthopedic Surgery Department at Benha University Hospitals and other private hospitals.

Informed consent from patients after approval from Faculty of Medicine, Benha University, Approval code: 2.4.2022.

Inclusion criteria were age younger than 40 years old, both sexes, all patients with unstable non-fragmented Osteochondritis

(OCD) lesions larger than 0.8 cm and smaller than 3.5 cm in diameter, and non-traumatic OCD lesions.

Exclusion criteria were patient older than 40 years old, traumatic OCD lesions, fragmented OCD lesions, lesions smaller than 0.8 cm or larger than 3.5 cm in diameter, patellar dislocations and joint ligamentous instability, advanced osteoarthritis, and septic arthritis.

All studied cases were subjected to the following: Detailed history taking and demographic data collection, including [age, sex, body mass index (BMI), Patients with JOCD commonly present with vague, activity-related knee pain, they do not have a history of acute trauma]. Full clinical examination. Routine laboratory investigations [complete blood count, C-reactive protein (CRP), kidney and liver function tests]. Radiological evaluation [Plain x-ray, computed tomography (C.T), Magnetic resonance imaging].

Surgical technique of knee OCD management:

Preoperative preparation: General or local anesthesia. Before placing the tourniquet put antibiotics. The patient was positioned supine on a standard operating room table, padding all bony prominences. A bump is placed below the buttock of the operative side to neutralize external hip rotation, and a tourniquet is placed on the thigh. A lateral post was then placed at the mid-thigh to support the operative limb during applied valgus stress.

Begin with a thorough systematic diagnostic arthroscopy using a 30° arthroscope via the antero-lateral portal.

Carefully inspect the integrity of the femoral condyle articular surface. Increase the degree of flexion (typically from 20° to 90°) to visualize the posterior extent of the lesion. Confirm the suspicion to be sure there is no break in the continuity of the articular surface overlying the subchondral bone lesion with tactile investigation via a probe placed through the antero-medial portal. If the lesion is intact, use a smooth 0.062-inch Kirschner wire (K-wire) to perforate the defect with multiple holes (thereby increasing the vascularity). Drilling options: anterograde, retrograde.

Place the K-wire perpendicular to the articular surface. Protect the surrounding soft tissues with a sleeve or cannula over the wire. Penetrate the articular surface, the subchondral lesion, and the underlying bone 1–1.5 cm.

The femoral condyle is drilled after positioning of the C-arm so that the OCD lesion can be visualized in anteroposterior and true lateral views. Under fluoroscopic guidance, a smooth Kirschner-wire (K-wire) with a diameter of 1.6 mm (0.062 inch) is inserted percutaneous through the affected femoral condyle. For lesions of the medial or lateral femoral condyle, the K-wire is inserted just anterior to the mid-condyle on the lateral view. The K-wire is directed under fluoroscopic guidance into the OCD lesion down to the bone/cartilage junction, avoiding penetration into the articular surface. In skeletally immature patients, carefully start the K-wire just distal to the femoral growth plate. Using the first K-wire as a guide, multiple retro-articular K-wires can be inserted in a parallel array about 3–8 mm away from each other using a freehand technique.

The fixation procedure was performed with the following steps: Firstly, a complete evaluation of the knee's compartments was performed to evaluate the presence of free bodies and associated lesions. The osteochondral lesion was examined. A probe was used to palpate the lesion to determine its size, stability and consistency of the cartilage surface.

Fragment fixation preparation is performed with an arthroscopic shaver and curettes. All debris and fibrotic tissue are removed. In addition, microfracture awls should be used at the base. After a temporary stabilization of the fragment with a Kirshner wire, the Herbert screw guide wire was inserted perpendicular to the fragment with the knee flexed to 90. The guide wire was over drilled.

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Then the screw was inserted until head was always buried below the articular surface to contact the bone, to gain compression and to avoid protrusion that could erode the opposite tibial surface. Second or even third screws were used when size permitted according to lesion's measurements (size and depth) on MRI films in order to have rotational stability and secure fixation of the fragment.

Mini-arthrotomy through Para patellar incision was recorded for open reduction and internal fixation with metal screws of OCD fragment after arthroscopic evaluation and preparation.

Surgical technique of ankle OCD fixation:

Preoperative preparation: as knee OCD management.

Standard ankle distraction was applied. Regional landmarks were palpated and outlined, followed by injection of 30 cc normal saline into the joint. Standard anteromedial and anterolateral portals were established. A standard diagnostic evaluation was performed to assess signs of stability or instability. Unstable OCD lesions with salvageable overlying cartilage were treated with retrograde drilling under fluoroscopic guidance using 2.0 mm K-wires or trans-articular drilling then open reduction and fixation with Herbert screws (medial malleolar osteotomy for medial and posterior lesions with longitudinal incision centered over medial malleolus and anterior arthrotomy to expose joint line.

Post-operative care: Patients with knee OCD were placed into a hinged knee brace and made non-weight bearing with range of motion limited to 0° to 90° for 6 weeks. Physical therapy started 2 weeks after surgery. At 6 weeks postoperatively, the hinged knee brace and crutches were discontinued, and full knee range of motion was allowed. After 3 months, a gradual supervised return to impact activities- was allowed if the patient remains pain free. Serial radiographs were obtained to document healing, Physiotherapeutic guidance started 6 weeks after surgery. While presenting in our outpatient clinic for 6 months postoperatively- all patients had full range of motion.

Patients with ankle OCD in which the focus of the postoperative period was to maintain range of motion while limiting shear forces on the cartilage. The ankle was placed in a short leg splint for the first week and then transitioned into a removable controlled ankle motion walking boot. For the first 6 weeks, rehabilitation consists of gentle range of motion with passive stretching. The ankle was non-weightbearing for the first 6 weeks. In the next 6-week, advancement to full weightbearing and proprioception exercises were performed. After 12 weeks, more aggressive strengthening and endurance training was permitted.

Statistical analysis

Statistical analysis was done by SPSS v26 (IBM Inc., Chicago, IL, USA). The Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD). Quantitative non-parametric data were presented as median and interquartile range (IQR). Qualitative variables were presented as frequency and percentage (%). A two-tailed P value < 0.05 was considered statistically significant.

Results

Table (1) shows age, sex, side and location of lesion of the studied patients.

Table (2) shows location of OCD knee lesion, approach of fixation and lesion size of the studied patients.

Table (3) shows number, types of screws union and AOFAS of the studied patients.

VAS was significantly decreased after 3 mon. and after 6 mon. compared to preoperative and significantly decreased after 3 mon. compared to after 6 mon., Table (4).

Lysholm knee score was significantly increased after 3 mon. and after 6 mon. compared to preoperative and significantly increased after 3 mon compared to after 6 mon., Table (5).

A 23-year-old male patient complaint of right knee pain increased with activity. On examination tenderness on medial aspect of knee, effusion and positive Wilson test, Figure (1).

Table (1): Age, sex, side and location of lesion of the studied patients (n=20)

		n = 20	
Age (years)	**Mean ± SD**	25.4 ± 7.36	
Age groups (years) Range (16-38)		**N**	**%**
	<20	5	25.0%
	20-29	9	45.0%
	≥30	6	30.0%
Sex	Male	14	70%
	Female	6	30%
Side	Right	13	65%
	Left	7	35%
Location of lesion	Knee	18	90%
	Ankle	2	10%

*: statistically significant as P value <0.05.

Table (2): Location of OCD knee lesion, approach of fixation and lesion size of the studied patients

		(n=18)
Location of OCD knee lesion	**MFC**	14 (77.78%)
	LFC	4 (22.22%)
Approach of fixation		(n=20)
Mini-arthrotomy		3 (15%)
Arthroscopic		17 (85%)
Lesion size		
Coronal lesion size (mm)	**Mean ± SD**	13.7 ± 4.71
Sagittal lesion size (mm)	**Mean ± SD**	14.3 ± 4.87

OCD: Osteochondritis dissecans, MFC: Medial femoral condyle, LFC: Lateral femoral condyle.

Table 3: Number, types of screws union and AOFAS of the studied patients (n=20)

		(n=20)
Number of screws	**2**	13 (65%)
	3	7 (35%)
Types of screws	**Herbert screw**	19 (95%)
	Cancellous screw	1 (5%)
Union		18 (90%)
AOFAS		87.5 ± 9.19

AOFSA: American Orthopaedic Foot and Ankle Society

Table 4: VAS of the studied patients (n=20)

		Preoperative	After 3 mon	After 6 mon
VAS	Mean ± SD	6.6 ± 1.19	3.3 ± 1.16	1.2 ± 1.09
P 1 #			<0.001*	<0.001*
P 2 ##				<0.001*

VAS: Visual Analogue Scale # P1: P value compared to preoperative, ## P2: P value compared to after 3 mon. *: statistically significant as P value <0.05

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Table 5: Lysholm knee score of the studied patients (n=20)

		Preoperative	After 3 mon	After 6 mon
Lysholm knee score	**Mean ± SD**	47.5 ± 12.37	78.3 ± 9.15	91.3 ± 6.25
P 1 #			<0.001*	<0.001*
P 2 ##				<0.001*

P1: P value compared to preoperative, ## P2: P value compared to after 3 mon. *: statistically significant as P value <0.05

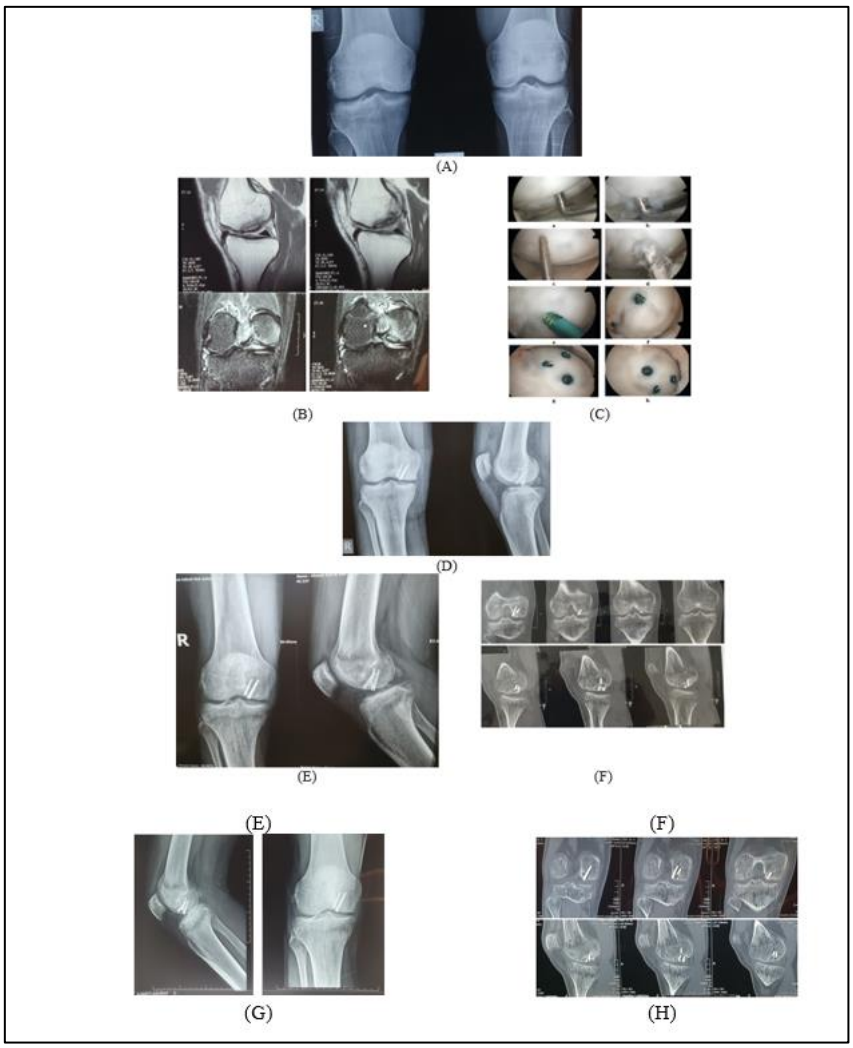

Figure (1): (A) Preoperative X- ray, (B) Pre-MRI, (C) Arthroscopic fixation steps of OCD right knee, (D) post operative X-ray, (E) X- ray follow up after 3 months, (F) Ct follow up after 3 months, (G) X-ray follow up after 9 months and (H) Ct follow up after 9 months of OCD right knee fixation

Discussion

The present study showed that the mean age of the study participants was 25.4 ± 7.36. Among the study participants, fourteen (70%) were males and six (30%) were females. The current study showed that side was right in thirteen (65%) patients and left in seven (35%) patients. Location of lesion was MFC in fourteen (77.78%) patients and LEC in four (22,22%) patients. The coronal lesion size ranged from 8 to 25 mm with a mean value (± SD) of 13.7 (±4.71) mm. The sagittal lesion size ranged from 9 to 30 mm with a mean value (± SD) of 14.3 (±4.87) mm. The number of pins was two in thirteen (65%) patients and three in seven (35%) patients. Union occurred in eighteen (90%) patients. Non-union occurred in two (10%) patients. VAS significantly decreased after

3 months and after 6 months compared to preoperative and significantly decreased after 6 months compared to after 3 months. Lysholm knee score was significantly increased after 3 months and after 6 months compared to preoperative and significantly increased after 6 months compared to after 3 months. The AOFAS ranged from 81 to 94 with a mean value (± SD) of 87.5 (±9.19).

Jungesblut et al. [12] conducted a study to analyze safety, efficiency, and limitations of magnesium-pin-based fixation of unstable OCD lesions and displaced osteochondral fragments and to report clinical and radiological outcomes at short-term follow-up. In this prospective cohort study, 19 patients (10 girls and 9 boys)-were included with mean age of 13.7 years. This study showed that six (32%) of the participants had OCD MFC, which is lower than our findings. The mean size of the osteochondral lesion was 2.3 ± 1.0 cm on sagittal and 1.3 ± 0.5 cm on coronal MRI views which is bigger than our findings. This study showed that in total 67 pins were used with a mean of 3.6 ± 1.4 pins per lesion. In most cases these pins were inserted perpendicular to the joint surface to ensure maximum stability of the fixation as in the present study. Twelve cases (63%) had complete union while 7 (37%) had timely union which is lower than our results. All patients were pain-free and had full range of motion at the 6-month follow-up except for one girl who complained about pain 11 weeks after fixation of an unstable femoral OCD lesion with 4 pins. The subsequently performed X-ray showed a broken pin with migration into the knee joint, requiring revision surgery.

Bogallo et al. [13] conducted a study to analyze the OCD patients attached with bioabsorbable nail, assisted by arthroscopy. A total of 9 patients were analyzed, of which 5 were male (55%) and 4 females (45%) with a median age of 15 years. Regarding laterality, 6 interventions were right (66%) and 4 left (34%) which is similar to our study. The location was the medial condyle in all 10 cases, 50% in the anterolateral and 50% in the posterolateral region. The median size of the major axis was 21.5 mm, and the median was 15.25 mm with respect to the minor axis, measured on pre-operative MRI on the axial-sagittal plane which is bigger than our findings. In 9 of the 10 operations, 2 implants were used, 3 implants were required in one case. No complications or reoperation were observed. Union was achieved in 80% of cases within the first year, with 2 cases of delayed union treated by restricting physical activity that achieved complete union at 15 and 18 months, respectively. There was an improvement in the KOOS questionnaire of pain which came in accordance with our findings.

Kreher et al. [14] conducted a study to report on clinical and radiographic outcomes after fixation of an osteochondral fragment with bioabsorbable pins in children with open growth plates in patients with juvenile OCD. A total of 13 knees in 12 patients (92%) with a median of 13 years were included in this study, six (50%) men and six (50%) women. A total of 12 osteochondral lesions (92%) were located at the medial femoral condyle and one lesion (8%) was located at the lateral condyle. The median Lysholm Score was 94 (69, 100), 77% had an excellent or good result (Lysholm score > 83) which is similar to our study. In one case a partial fragmental dislocation occurred, which necessitated revision surgery with arthroscopic removal of the loose body and debridement. Subsequently, the cartilage bone fragment healed properly.

Blanke et al. [15] conducted a study to evaluate the treatment results after meniscus stabilization in adults with nontraumatic OCD. Ten patients with magnetic resonance imaging (MRI)-confirmed OCD of the knee joint, meniscal instability, and closed epiphyseal plates-were enrolled in this study. The instable

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meniscus was stabilized by direct suturing of the anterior horn of the meniscus. MRI examinations were performed preoperative and 6 and 12 months postoperatively. Four women and 6 men with a mean age of 20.6 ± 1.9 years were included in this study. Blanke et al. [15] showed that 6 (60%) of the participants had OCD in the right side and 4 (40%) were in the left side which corresponds to our present findings.

In the current study, comparing results of OCD knee management to OCD Talus showing relative similarity in functional improvement but regarding few numbers of studied patients (2 patients of OCD talus), we suggest more studies in future focusing on this point.

Fixation of the osteochondral fragment has been recommended for large lesions. The thinking is that fixation of a small fragment is relatively difficult and bone-marrow stimulation alone is adequate for small lesion. Kumai et al. [15] recommended fixation for a lesion larger than 8×8 mm. Reilingh et al. [15] performed arthroscopic fixation in 14 patients with a lesion diameter > 10 mm (in three dimensions) as measured on CT scans. Most participants (91%) in the 2017 International Consensus Meeting on Cartilage Repair of the Ankle agreed that a bone diameter of at least 10 mm on the fragment side is necessary to facilitate fixation [15]. It was shown by our study that fixation of an osteochondral fragment can be performed for lesions larger than 8 mm. Because fixation of an osteochondral fragment can preserve the native hyaline cartilage when the fragment cartilage is relatively healthy, the procedure is naturally immune to lesion size. In addition to bone-marrow stimulation plus fixation of the osteochondral fragment is a good option for osteochondral lesions treatment. The advantages of internal fixation are (1) that native hyaline cartilage can be preserved, (2) that the original morphology can be preserved, and (3) that the subchondral bone congruity can be restored.

Conclusion

Arthroscopic assisted management of sizable non-fragmented osteochondritis dissecans lesions is associated with improvement in functional outcomes- as presented by Lysholm score- and improvement in pain- as shown by VAS score-.

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Author contribution

Authors contributed equally in the study.

Conflicts of interest

No conflicts of interest

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