BENHA MEDICAL JOURNAL bmj
Print ISSN 1110-208X
Online ISSN 2357-0016

Original article

Role of MRI in Evaluation of Osteochondral Lesions around the Knee Joint

Medhat M. Refaat [a], Muhammad M. Seleem [a], Yara M. Aly Ziada [b]

[a] Department of radiology, Benha faculty of medicine, Benha University, Egypt.
[b] Department of radiology, Fellow Consultant General organization for Teaching Hospitals and Institutes.

Correspondence to: Muhammad M. Seleem, Department of radiology, Benha faculty of medicine, Benha University, Egypt.

Email:

muhammedbenha@gmail.com

Received:

Accepted:

Abstract

Background: Osteochondral lesions of the knee- a lesion of the subchondral bone that may involve partial or total separation of a fragment of the articular cartilage and the subchondral bone from the articular surface - is an increasingly recognized cause of knee pain and joint dysfunction. The aim of this study is to discuss the high-resolution MRI with its new evolving sequences, highlighting its pivotal role in evaluation and characterization of different morphological patterns, and pathological types of osteochondral lesions around the knee joint. **Methods:** This study included 50 patients, all were subjected to full history taking, complete clinical assessment and MRI assessment. **Results**: This study included 32 (64%) males and 18 (36%) females. According to age there were 13 (26%) with age less than 30, 7 (14%) with age ranged from 30 to 40, 12 (24%) from 40 to 50 and 18 (36%) with age more than 50 years with mean age 42.96 (±17.29) and range (11-78). The sensitivity of MRI in diagnosis of Osteochondral Lesions around the Knee was 95%, specificity was 76.7%, PPV was 86.3%, NPV was 96.4% and accuracy was 92%, **Conclusion**: MRI has the advantage of not utilizing ionizing radiation and gives a superior detail state of cartilage, the underlying bone plates, associated edema, signs of instability. This could be guide for treatment as well as the diagnosis, and could be used as prognostic indicator for the disease process. In our opinion, MRI is golden tool for diagnosis, classification and follow up of osteochondral lesion.

Keywords: MRI; Osteochondral Lesions; Knee Joint.

Introduction

Several pathologic conditions may manifest as an osteochondral lesions of the knee, which are; a localized abnormalities of the subchondral marrow, subchondral bones, and articular cartilage (1). Osteochondral lesions of the knee- a lesion of the subchondral bone that may involve partial or total separation of a fragment of the articular

cartilage and the subchondral bone from the articular surface- is an increasingly recognized cause of knee pain and joint dysfunction. Individuals with unresolved osteochondritis dissecans lesions often progress to osteoarthritis and often have poor long-term outcomes (2).

There is a great need for noninvasive clinical tools that can diagnose and grade the severity of osteochondral lesions of the knee, monitor disease progression, and assess clinical outcomes of treatments (3). Although both radiography and magnetic resonance imaging (MRI) are routinely used to identify and evaluate these lesions of the knee, MRI is often the imaging modality of choice and has been recommended as a technique to follow the healing response and degree of revascularization of the lesion (4).

The aim of this study is to discuss the high-resolution MRI with its new evolving sequences, highlighting its pivotal role in evaluation and characterization of different morphological patterns, and pathological types of osteochondral lesions around the knee joint.

Patients and methods

This study is a prospective study that included 50 patient referred from orthopedic clinic Suspected to have any pathologic entity of osteochondral lesions. The research was carried on MRI unit–Radiology department–Al Ahrar teaching hospital, Zagazig, Sharkia governorate – Ministry of health, during the period from September 2019 to September 2020.

The study was approved by the ethical committee of Benha faculty of medicine, and an informed consent obtained from each patient before participating in the study.

Before MRI examinations, all patients were subjected to Precise medical History taking including: Patient's age and complaints of painful knee joint, their intensity and complain of painful knee joint, their intensity and duration. Clinical examination was carried out by the referring clinician.

Exclusion criteria:

- Absolute contraindications for MR imaging (e.g. cardiac pace maker, prosthetic heart valves, cochlear implants or any metallic implants).

MRI Imaging

A. All MRI examinations were performed with a 1.5-T MRI System, with the following MRI sequences :

- Sagittal T1, T2, and PD.
- Axial, coronal, sagittal and fat suppressed PD-weighted imaging.
- Sagittal gradient.

B. Images were acquired with the patient is in supine position with feet First;

- Knee position at knee coil and immobilize with cushions
- Centre the laser beam localizer over the lower border of the patella.

Possible risk:

MRI contains no radiation. No side effects from the magnetic field or radio waves have been reported.

Time of plan:

It started after registration aiming to finish within 6 months period of time.

Ethical considerations:
An informed consent was taken from all the participants and parents of the young patients (less than 18 years old) before taking any data or doing any imaging techniques.

Statistical analysis:
We measured sensitivity, specificity, positive and negative predictive values of the analyzed data, using commercially available PC-based software package (SPSS). Our gold standard was the final clinical diagnosis, orthoscopic and /or post-operative data. The analyzed included: Different morphological aspects for each case, such as: Location and extent of edema, Presence of fracture lines, Periarticular hypo-intensity, Deformities of subchondral bone plate, Double line sign , Patient age and Traumatic history.

Results

This study included 32 (64%) males and 18 (36%) females. According to age there were 13 (26%) with age less than 30, 7 (14%) with age ranged from 30 to 40, 12 (24%) from 40 to 50 and 18 (36%) with age more than 50 years with mean age 42.96 (±17.29) and range (11-78).

Among the studied cases, there were 30 (60%) with Lesion in medial femoral condyle, 16 (32%) in Lateral femoral condyle, 3 (6%) in Lateral tibial plateau and 1 (2%) in both femoral condyles, Figure 1.

There were 36 (72%) with no Traumatic history, 8 (16%) with Repetitive minor trauma and 6 (12%) with major trauma history, Figure 2.

There were 30 (60%) without any history of chronic disease, 2 (4%) with Long use of corticosteroids, 6 (12%) with Unhealed juvenile OCD, 4 (8%) with Rheumatoid arthritis, 5 (10%) with Osteoporosis, 2 (4%) with Gaucher disease and 1 (2%) with SLE, Figure 3.

There were 6 (12%) of patients with fracture Lines, 28 patients (56%) without signs of instability, 1 (2%) with signs of instability, 2 (4%) with Positive Rim sign and 19 (38%) with loss of underla. All the studied cases had edema; there were 41 (82%) with localized edema and 9 (18%) with extensive edema. There were 45 (90%) of studied cases with T1 Prearticular hypo-intenisty, 33 (66%) with Deformities of subchondral bone plate and 5 (10%) with Double line sign. Among the studied cases there were 20 (40%) with OCD, 10(20%) with OA, 9 (18%) with SIF, 6(12%) with acute osteochondral fracture and 5(10%) with AVN. The sensitivity of MRI in diagnosis of Osteochondral Lesions around the Knee was 95%, specificity was 76.7%, PPV was 86.3%, NPV was 96.4% and accuracy was 92%, Table 1.

Case 1, Figure 4:

Clinical history: 36 years old male with long period of corticosteroids therapy complaining of right knee pain for 2 months. Radiological findings: Conventional MRI (A. sagittal T1WI, B. sagittal T2WI, C.coronal PD fat sat and D.sagittal PD fat sat) showing medial femoral condyle posterior peripherally located area of marrow signal alteration, being of low T1, high T2and STIR signals surrounded by

linear hypo-intense sclerotic line giving a double line sign, surrounded by patch marrow edema signal, no subchondral collapse nor instability sign. Diagnosis: AVN.

Case 2, Figure 5:

Clinical history: 26 years old male with history of acute major trauma complaining of right knee pain. Radiological findings: Conventional MRI (A.sagittal T1WI, Bsagittal T2WI, C.sagittal PD fat sat, D.coronal STIR) showing medial tibial plateua irregular hypointense fracture line reaching the articular surface and surrounded by extensive bone marrow edema, manifested by patchy fat sat hypo-intense signal m the fracture shows signs of instability in the form of linear rim of high PD fat sat signal at its base. Diagnosis: Unstable acute osteo-chondoral fracture confirmed by arthroscope.

Case 3, Figure 6:

Clinical history: 43 years old female with history of major trauma complaining from acute onset LT knee pain. Radiological finding: Conventional MRI (A.Sagittal T1WI, B.sagittal T2WI, Csagittal PD fat sat, D.coronal PD fat sat) showing abnormal signal intensity lesion seen at the medial femoral condyle displayed iso-to-hypo-intense signal at T1w and intermediate signal at T2w. Bone marrow contusion displayed high signal at STIR at medial femoral condyle, diffuse red marrow reconversion and minimal knee effusion were noted).

Diagnosis: Medial femoral condyle subchondral fracture associated with bone marrow contusion, no MRI signs of instability.

Table (1): Validity of MRI in diagnosis of unstable Osteochondral Lesions around the Knee (n=50)

MRI	**Arthroscopic findings**		
	+ve	**-ve**	**Total**
+ve	**19**	**3**	**22**
-ve	**1**	**27**	**28**
	20	**30**	**22**

Validity	**%**
Sensitivity	95.0
Specificity	76.7
PPV	86.3
NPV	96.4
Accuracy	92.0

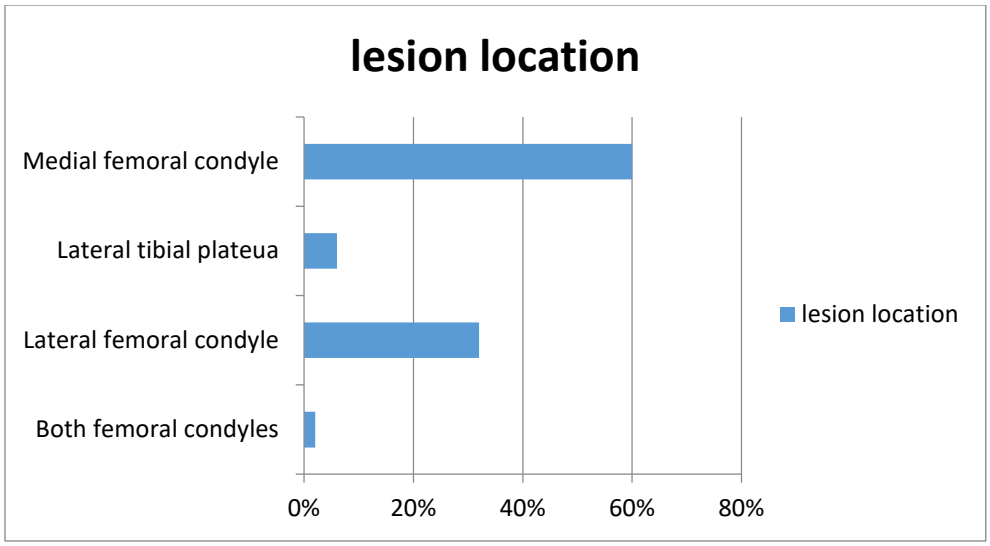


Figure (1): Distribution of the studied cases according to lesion location.

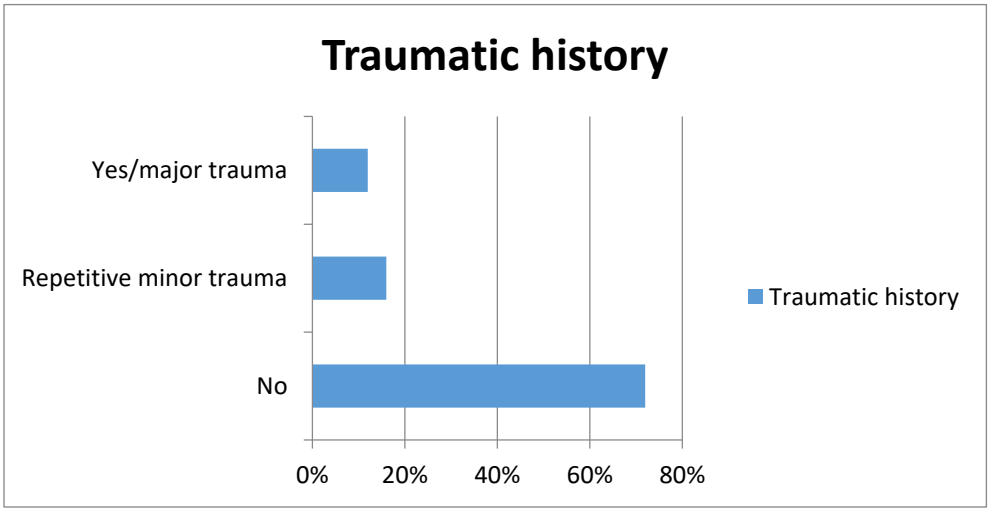


Figure (2): Distribution of the studied cases according to traumatic history.

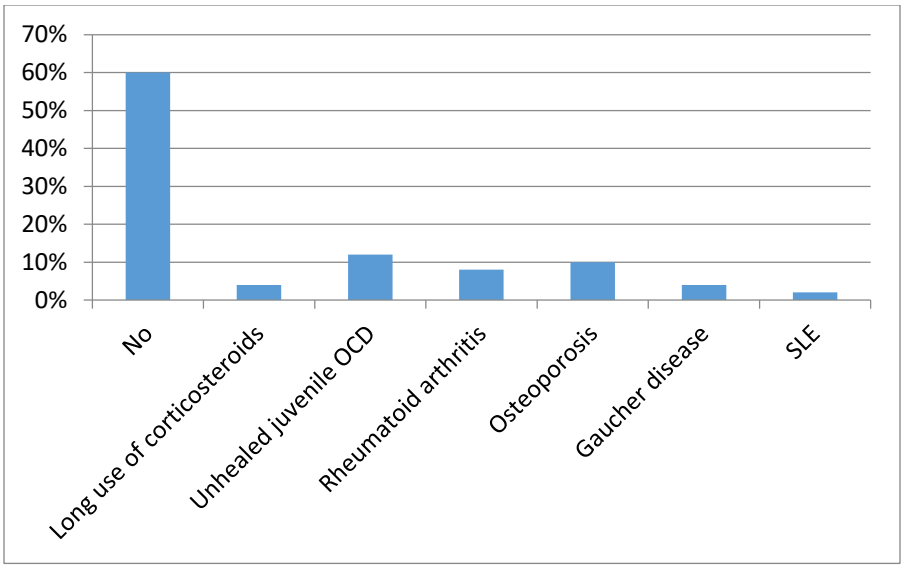


Figure (3): Distribution of the studied cases according to history of chronic disease.

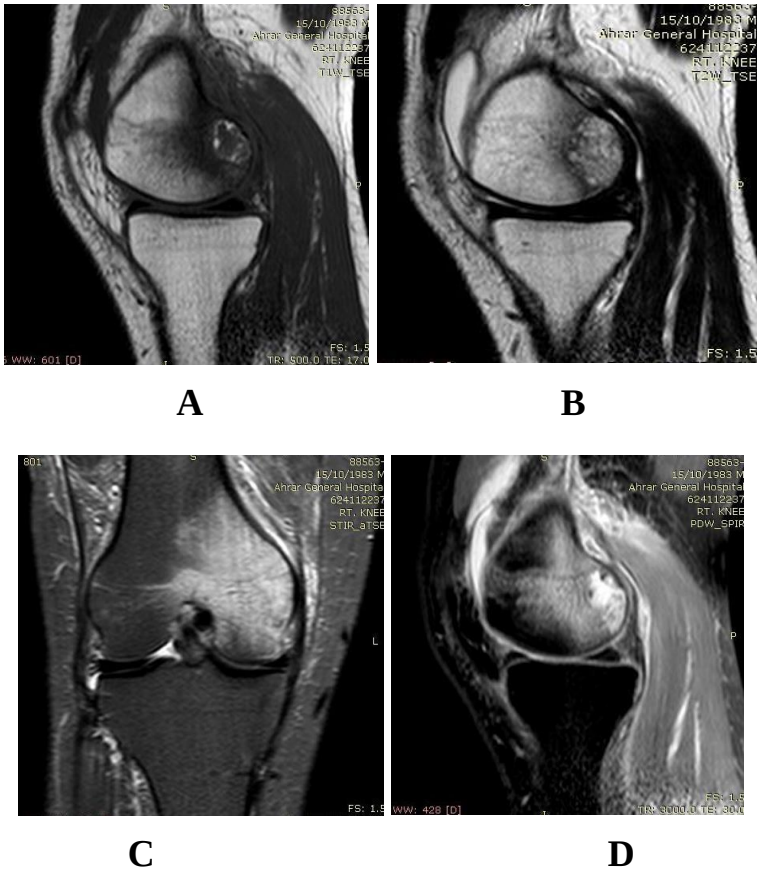
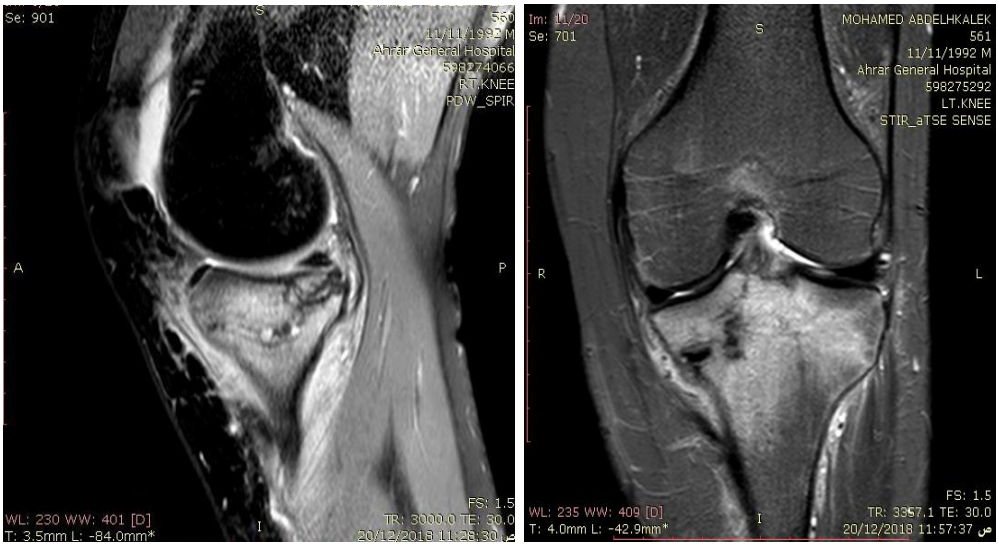


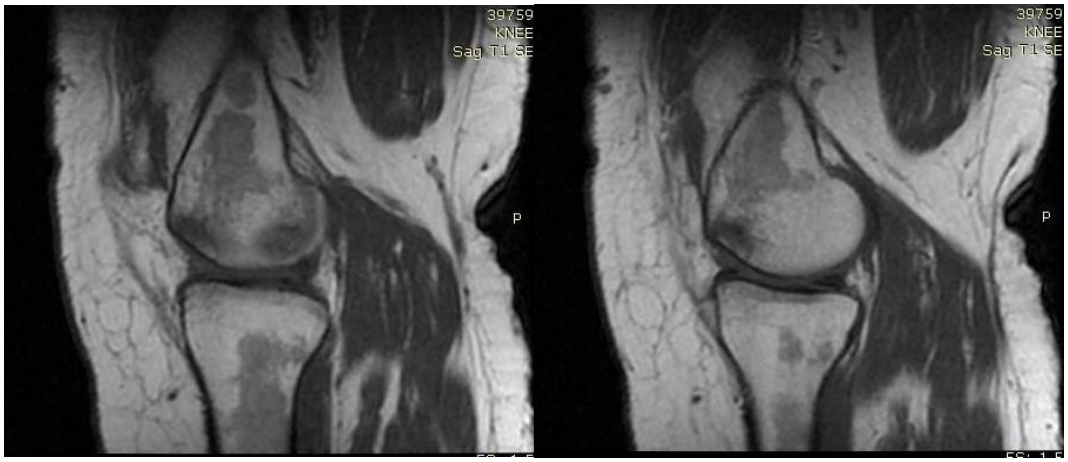
Figure 4

A **B**



C **D**

Figure 5



A

B **C**

D

Figure 6

Discussion

In our study, among the studied cases there were 32 (64%) males and 18 (36%) females. According to age there were 13 (26%) were less than 30, 7 (14%) ranged from 30 to 40, 12 (24%) from 40 to 50 and 18 (36%) with age more than 50 years with mean age 42.96 (±17.29) and range (11-78).

In *Pareek et al.* (5) study, males (8.82 per 100,000) had a significantly higher incidence of OCD compared to females (3.32 per 100,000). The highest incidence of knee OCD lesions is in the 11 to 15 years age group where males have 2.4-fold higher risk compared to females (males, 39.06 per 100,000, females, 16.15 per 100,000) which are comparable to our study results.

Another study (6), reported a slightly higher estimated incidence of 9.5 per 100,000, with corresponding incidences of 15.4 and 3.3 per 100,000 for males and females, respectively. This study also reported a higher risk of OCD in male patients compared to female patients with similar lesion location characteristics (96% of the lesions were on the femoral condyles compared to 95% in the current study). This difference may be due to differences in the sample size of both studies).

In our study, among the studied cases there were 30 (60%) without any history of chronic disease, 2 (4%) with Long use of corticosteroids, 6 (12%) with Unhealed juvenile OCD, 4 (8%) with Rheumatoid arthritis, 5 (10%) with Osteoporosis, 2 (4%) with Gaucher disease and 1 (2%) with SLE.

Martel et al. (7) showed the difference in vascular pattern that has been seen at the OCD-positioned sites. Such a joint morphology combined with focal repeated trauma on this site with a unique vascular architecture may trigger ischemic events and subsequent OCD.

For the most common location, our study showed- among the studied cases- there were 30 (60%) with Lesion in medial femoral condyle, 16 (32%) in Lateral femoral condyle, 3 (6%) in Lateral tibial plateau and 1 (2%) in both femoral condyles. These counter act the results by *Kessler et al.* (6) in showing that the lateral aspect of the medial femoral condyle (64%) is the most common location for osteochondritis lesions in the knee, followed by the lateral femoral condyle (32%).

Numerous hypotheses exist for the precise etiology of osteochondritis, including inflammatory, vascular/ischemic, trauma/ micro trauma, and hereditary/genetic causes, although none have been proven definitive (8). Although there is no universal agreement regarding etiology of osteochondritis of the knee, repetitive trauma has been recognized as the most commonly accepted cause (9).

Our study revealed that the sensitivity of MRI in diagnosis of Osteochondral Lesions around the Knee was 95%, specificity was 76.7%, PPV was 86.3%, NPV was 96.4% and accuracy was 92%

A high accuracy of diagnosing Osteochondral Lesions around the Knee with MRI has been reported in *Van et al* (10) that comes online with our study results. *Verhagen et al.* (11) reported a sensitivity and specificity of 96%. *Mintz et al.* (12) analyzed patients who had an MRI and in whom arthroscopy was performed. They reported 100% specificity and 95% sensitivity of the MRI to identify OCDs.

Conclusion

MRI has the advantage of not utilizing ionizing radiation and gives a superior detail state of cartilage, the underlying bone plates, associated edema, signs of instability. This could be guide for treatment as well as the diagnosis, in addition, it could be used as prognostic indicator for the disease process. In our opinion MRI is golden tool for diagnosis, classification and follow up of osteochondral lesion.

References

1. Gorbachova T, Melenevsky Y, Cohen M, Cerniglia BW. Osteochondral lesions of the knee: differentiating the most common entities at MRI. Radiographics. 2018;38(5):1478–95.

2. Accadbled F, Vial J, de Gauzy JS. Osteochondritis dissecans of the knee. Orthop Traumatol Surg Res. 2018;104(1):S97–105.

3. Prado MP, Kennedy JG, Raduan F, Nery C. Diagnosis and treatment of osteochondral lesions of the ankle: current concepts. Rev Bras Ortop (English Ed. 2016;51(5):489–500.

4. Quatman CE, Quatman-Yates CC, Schmitt LC, Paterno M V. The clinical utility and diagnostic performance of MRI for identification and classification of knee osteochondritis dissecans. J Bone Jt Surgery Am Vol. 2012;94(11):1036.

5. Pareek A, Sanders TL, Wu IT, Larson DR, Saris DBF, Krych AJ. Incidence of symptomatic osteochondritis dissecans lesions of the knee: a population-based study in Olmsted County. Osteoarthr Cartil. 2017;25(10):1663–71.

6. Kessler JI, Nikizad H, Shea KG, Jacobs Jr JC, Bebchuk JD, Weiss JM. The demographics and epidemiology of osteochondritis dissecans of the knee in children and adolescents. Am J Sports Med. 2014;42(2):320–6.

7. Martel G, Kiss S, Gilbert G, Anne-Archard N, Richard H, Moser T, et al. Differences in the vascular tree of the femoral trochlear growth cartilage at osteochondrosis-susceptible sites in foals revealed by SWI 3T MRI. J Orthop Res. 2016;34(9):1539–46.

8. Grimm NL, Weiss JM, Kessler JI, Aoki SK. Osteochondritis dissecans of the knee: pathoanatomy, epidemiology, and diagnosis. Clin Sports Med. 2014;33(2):181–8.

9. Edmonds EW, Polousky J. A review of knowledge in osteochondritis dissecans: 123 years of minimal evolution from König to the ROCK study group. Clin Orthop Relat Res. 2013;471(4):1118–26.

10. Van Bergen CJ, Gerards RM, Opdam KTM, Terra MP, Kerkhoffs GMMJ. Diagnosing, planning and evaluating osteochondral ankle defects with imaging modalities. World J Orthop. 2015;6(11):944.

11. Verhagen RAW, Maas M, Dijkgraaf MGW, Tol JL, Krips R, van Dijk CN. Prospective study on diagnostic strategies in osteochondral lesions of the talus: is MRI superior to helical CT? J Bone Joint Surg Br. 2005;87(1):41–6.

12. Mintz DN, Tashjian GS, Connell DA, Deland JT, O'Malley M, Potter HG. Osteochondral lesions of the talus: a new magnetic resonance grading system with arthroscopic correlation. Arthrosc J Arthrosc Relat Surg. 2003;19(4):353–9.

To cite this article: Medhat M. Refaat, Muhammad M. Seleem, Yara M. Aly Ziada. Role of MRI in Evaluation of Osteochondral Lesions around the Knee Joint. BMFJ 2023;40 (Radiology):1-10.