MRI STUDY OF TYPES AND INCIDENCE OF INTERNAL DERANGEMENTS OF TRAUMATIC KNEE JOINT

Bomidi Sudha Rani[1], Kaki Radha Rani[2], Bonthu Anuradha[3], B. M. Hemalatha[4], Karri Sambasiva Rao[5], Pasam Kusumalatha[6]

[1]Assistant Professor, Department of Radiodiagnosis, Rangaraya Medical College, Kakinada.
[2]Professor and HOD, Department of Radiodiagnosis, Rangaraya Medical College, Kakinada.
[3]Associate Professor, Department of Radiodiagnosis, Rangaraya Medical College, Kakinada.
[4]Final Year Postgraduate Student, Department of Radiodiagnosis, Rangaraya Medical College, Kakinada.
[5]Assistant Professor, Department of Radiodiagnosis, Rangaraya Medical College, Kakinada.
[6]Assistant Professor, Department of Radiodiagnosis, Rangaraya Medical College, Kakinada.

ABSTRACT

BACKGROUND

MRI has been accepted as the best imaging modality for noninvasive evaluation of knee injuries and it has proved reliable, safe and offers advantages over diagnostic arthroscopy, which is currently regarded as the reference standard for the diagnosis of internal derangements of the knee.[1]

METHODS AND MATERIALS

A prospective study of fifty patients who underwent MRI for the diagnosis of internal derangement of knee was conducted between the period of January 2015 to January 2016 in Government General Hospital, Kakinada. All the patients with history of knee joint pain following trauma and clinically suspected to have meniscal and ligament tears are included in the study. Patients were evaluated using GE 1.5 T MRI machine with pulsar gradient system using a sensor extremity coil.

RESULTS

Commonest lesion detected in our study was ACL tear followed by medial meniscal tear and medial collateral ligament injury. The most common sign of cruciate ligament injury was hyperintensity in the ligament. Grade 3 was the most common grade of meniscal tear.

CONCLUSION

MRI is an excellent, noninvasive, radiation free imaging modality and is unique in its ability to evaluate the internal structure as well as soft tissue delineation. Many anatomical variants can mimic a tear on MRI. MRI is an excellent noninvasive modality for imaging the knee and helps in arriving at a correct anatomical diagnosis there by guiding further management of the patient.

KEYWORDS

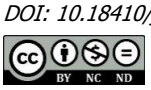
Anterior Cruciate Ligament, Posterior Cruciate Ligament, Meniscus, Internal Derangement Knee (IDK).

HOW TO CITE THIS ARTICLE: Sudharani B, Radha Rani K, Anuradha B, et al. MRI study of types and incidence of internal derangements of traumatic knee joint. J. Evid. Based Med. Healthc. 2016; 3(99), 5420-5426. DOI: 10.18410/jebmh/2016/1125

BACKGROUND

MRI has been accepted as the best imaging modality for noninvasive evaluation of knee injuries and it has proved reliable, safe and offers advantages over diagnostic arthroscopy, which is currently regarded as the reference standard for the diagnosis of internal derangements of the knee.[1] IDK is evaluated with radiography, MRI, arthrography and arthroscopy. Arthroscopy is usually considered as a gold standard for the evaluation of knee injury. However, the accuracy of arthroscopy varies from 69% to 98% depending on the experience of examiner and also intrasubstance tears cannot be evaluated in arthroscopy.[2] MRI provides excellent soft tissue contrast and is capable of evaluating the soft tissue and bony structures in multiple imaging planes, which provide significant advantages over other imaging techniques. MRI has also been demonstrated as a cost-effective technique by reducing unnecessary surgical and arthroscopic interventions. Improved diagnostic accuracy has been clearly demonstrated and MRI is shown to result in changes in patient management.[3] In this article, we are going to discuss about MRI findings of 50 patients who were diagnosed to have acute internal derangement of knee after trauma.

Financial or Other, Competing Interest: None.
Submission 07-11-2016, Peer Review 14-11-2016,
Acceptance 30-11-2016, Published 09-12-2016.
Corresponding Author:
Dr. B. Sudha Rani,
#9-8-52/T1, Sai Akshara Enclave, B-Block,
Kamaladevi Street, Gandhinagar, Kakinada.
E-mail: sudhabomidi.rani1@gmail.com
DOI: 10.18410/jebmh/2016/1125



MATERIALS AND METHODS

This is a prospective study of fifty patients of knee joint trauma who underwent MRI for internal derangement of knee. The study period was from January 2015 to January 2016. All the patients gave history of knee joint pain following trauma and clinically suspected to have meniscal and ligament tears. Patients were evaluated using GE Bravo

1.5 T with pulsar gradient system using a sensor extremity coil. The patient population consisted of only males. Ethics committee clearance was obtained and all the patients were clearly explained in their own language and informed consent was also obtained. Patients were in the age group of 20 to 50 years. The inclusion criteria were all the patients referred with clinically suspected internal derangements of knee following trauma to knee. The exclusion criteria were patients with ferromagnetic implants, pacemakers and patients with major injuries like liver/splenic rupture, flail chest and patients with unstable vital parameters especially in the setting of trauma, degenerative arthritis, infections, neoplasm and any previous surgery to the knee.

The knee joint was examined in sagittal, coronal and axial planes with T1, T2 and PD sequences. Imaging was done using an FOV of 160, 512 × 512 matrix and 3 mm slice thickness. An axial acquisition through the patellofemoral joint was used as the initial localiser for subsequent coronal and sagittal plane images. The sagittal plane is primarily used to evaluate the cruciate ligaments, menisci and synovial anatomy and the coronal plane optimally evaluates the collateral ligament and body of menisci. Patient is placed in supine position with the knee externally rotated 15°-20° and flexed 5°-10° This position increases and facilitates the evaluation of ACL and patellofemoral compartment.

RESULTS

Majority of the patients who were diagnosed as internal derangement of knee were in the age group of 21-30 years (Table 1) and most common type of injuries being anterior cruciate ligament tear and medial meniscal tear as evident from Table 2.

In our study, we found 35 cases of ACL injuries. Among these, 20 were complete tears and 15 were partial tears. Lateral meniscal injuries were not so common when compared to medial meniscal injuries. Among 24 meniscal injuries, 15 were medial meniscal tears. Among 12 collateral ligament injuries, 10 were found to be medial collateral ligament tears.

Finally, in our study, we found 31 cases of combined injuries and 19 cases of isolated injuries. Among combined injuries, the predominant pattern is ACL tear and MM tears followed by ACL tear and LM tear. Lateral discoid meniscus found in 1 patient. Cystic lesions encountered were meniscal cyst. Parameniscal cyst and popliteal cyst were found to be associated with LM tears in 6 and MM tears in 3. These findings were correlated with findings described by Thomas H. Berquist.[4] In our study, osseous and osteochondral lesions were seen in 28 patients (52%). Most of these were bone contusions involving femoral and tibial condyles. In our study, we also saw a case of spontaneous osteonecrosis of medial femoral condyle. The finding of haemarthrosis and lipohaemarthrosis was associated in 2 cases with presence of intercondylar fracture. The finding of partial tear of proximal fibers of medial head of gastrocnemius muscle was seen in 2 patients in our study. All these findings were correlated with findings described by Thomas H. Berquist.[4]

Age in Years	Number	%
Up to 20	6	12
21-30	22	44
31-40	14	28
41-50	5	10
>50	3	6
Total	**50**	**100**

Table 1. Distribution of Patients by Age

MRI Findings	Positive Findings	%
Joint effusion	40	80
ACL Tear	35	70
PCL Tear	2	4
MCL Tear	10	20
LCL Tear	2	4
MM Tear	15	30
LM Tear	9	18
Osseous/osteochondral Lesions	26	52

Table 2. MRI Findings

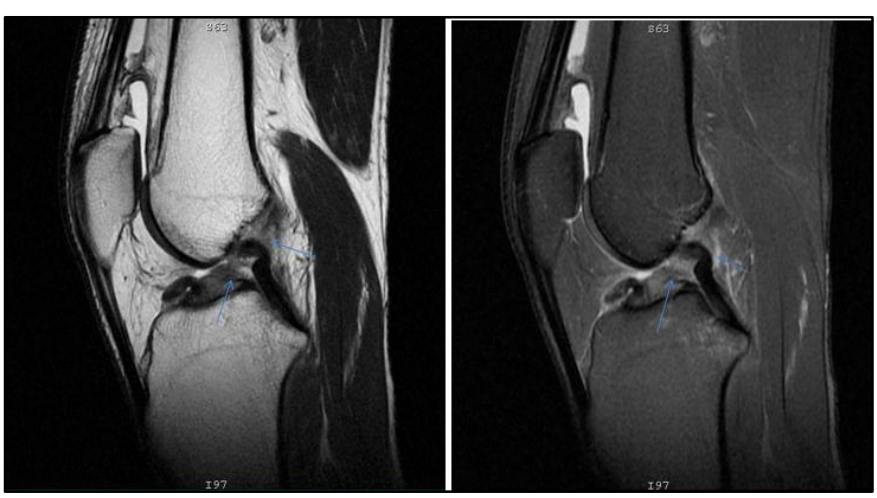


Figure 1. Sagittal T2W, STIR Images Showing Complete ACL Tear with Lax Tibial Attachment Anteriorly with Buckling of PCL

Figure 2. Sagittal T2W, STIR Images Showing Partial Tear of ACL with Oblique Fracture of Tibial Plateau

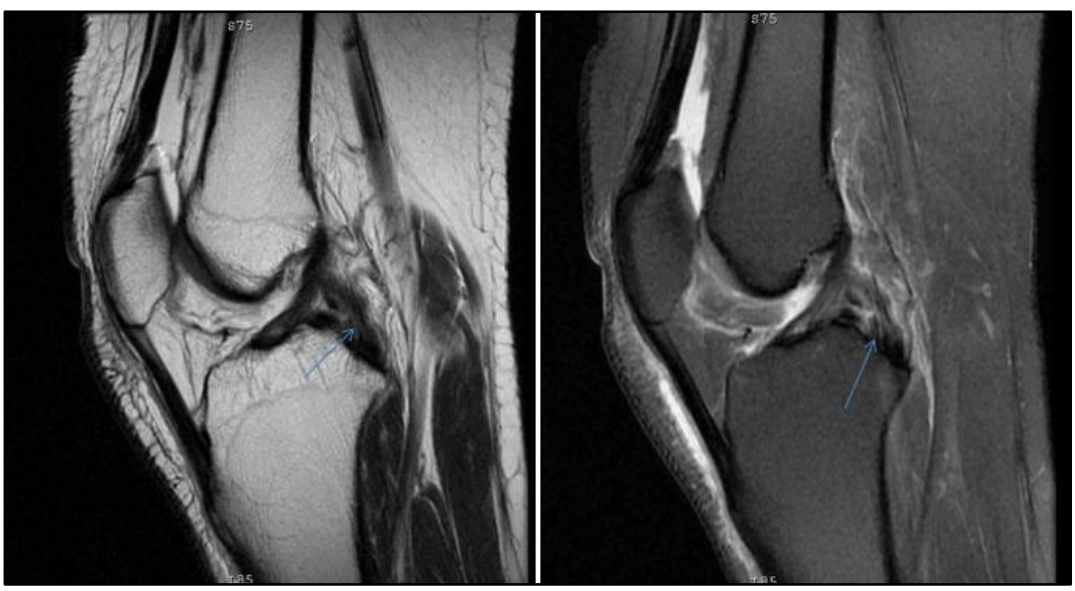


Figure 3. Sagittal T2W, STIR Images Showing Complete Tear of PCL

Figure 4. Coronal T1W, STIR Images Showing Complete ACL Tear with Radial Tear of the Lateral Meniscus with Lateral and Inferior Subluxation

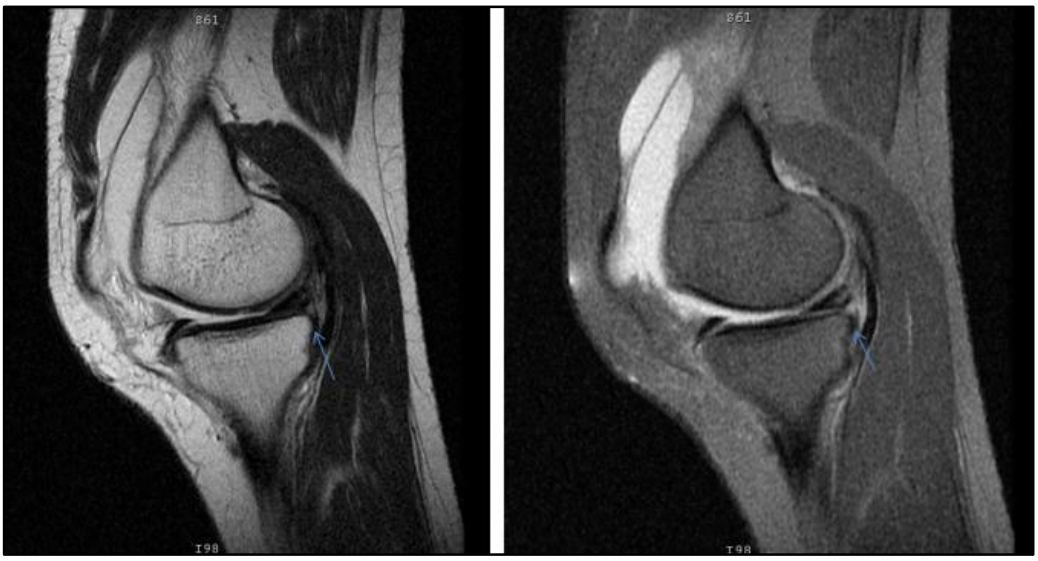


Figure 5. Sagittal T2W, STIR Images Showing Horizontal Tear of Posterior Horn of Medial Meniscus

Figure 6. Coronal T2W, STIR Images Showing Complete Medial Collateral Ligament Tear

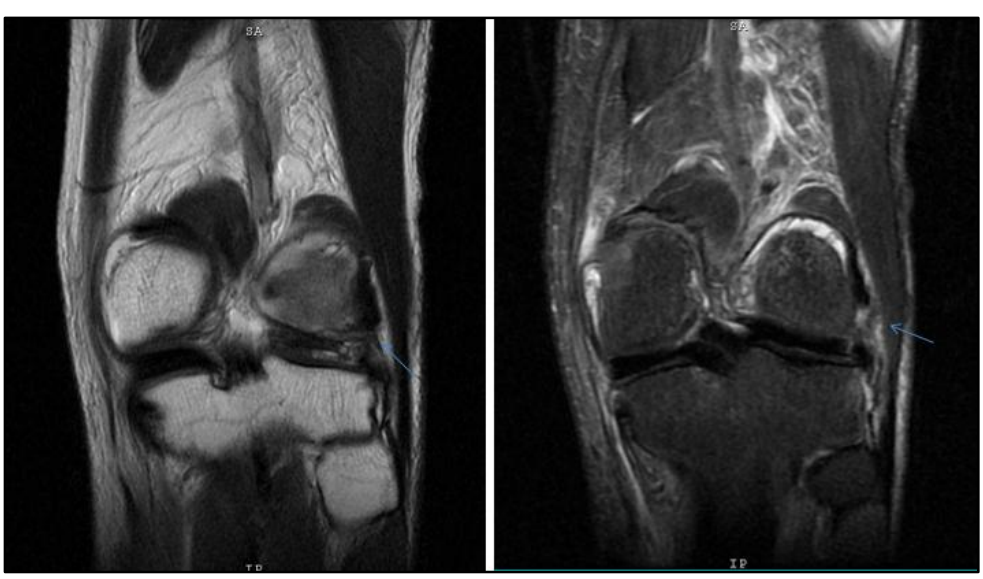


Figure 7. Coronal T1W, STIR Images Showing Grade II Sprain of Lateral Collateral Ligament

Figure 8. Sagittal T2W, STIR Images Showing Complete ACL Tear

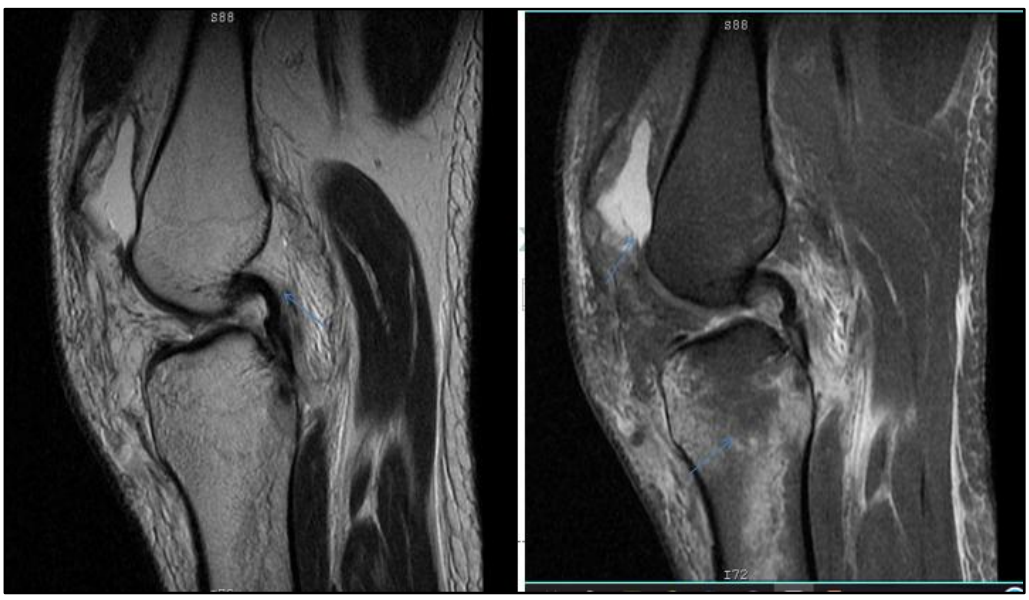


Figure 9. Sagittal T2W, STIR Images showing Buckling of PCL Along with Bony Contusions and Joint Effusion

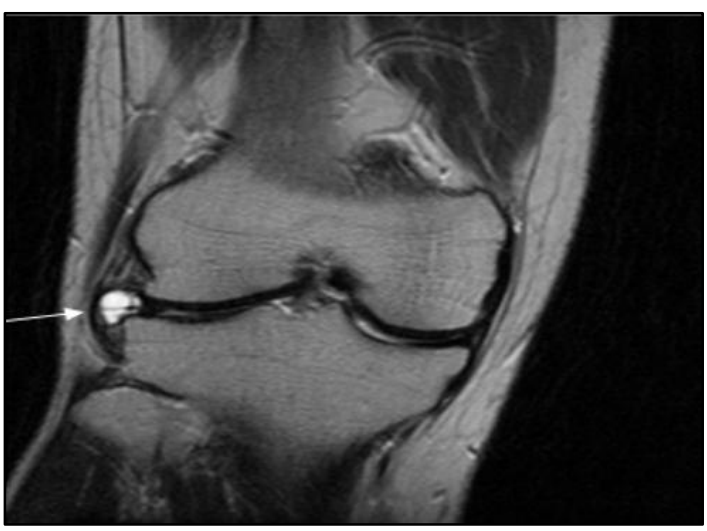


Figure 10. T2W Coronal Image Shows a Bilobed Parameniscal Cyst along Lateral Joint Line (Arrow)

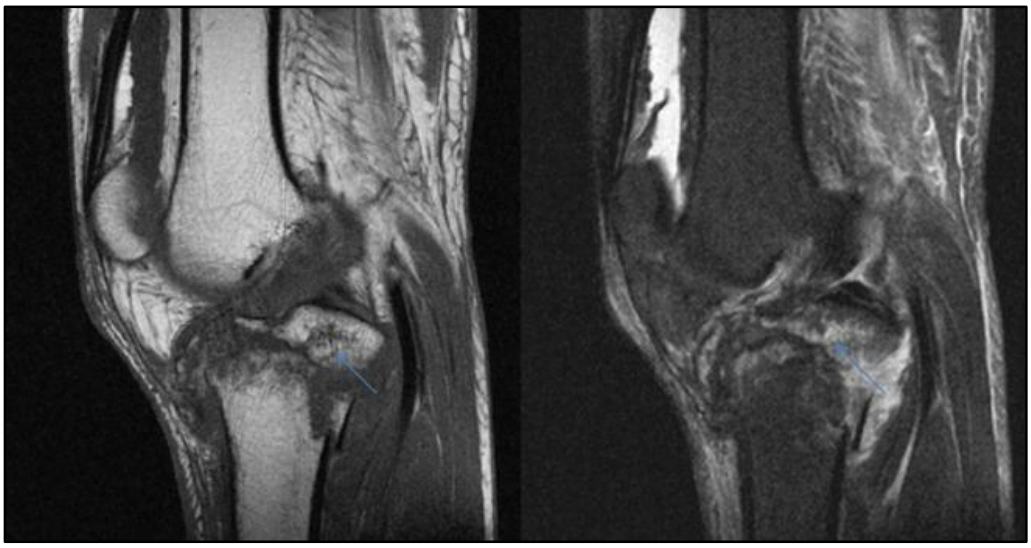


Figure 11. T1 and T2W Sag Image Showing Lateral Tibial Condylar Fracture, Lipohaemarthrosis and Partial ACL Tear

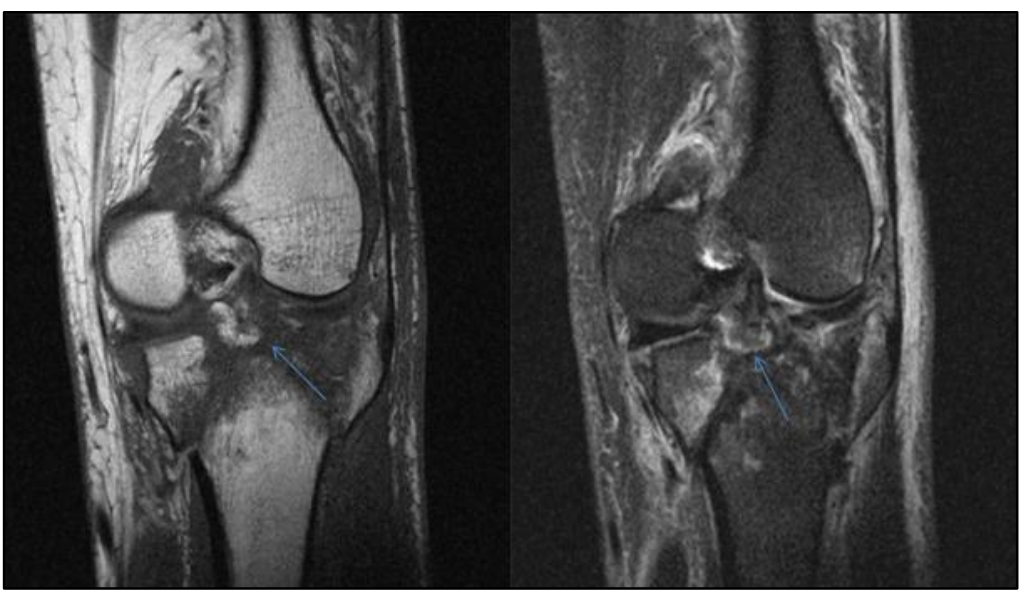


Figure 12. T1 and T2W Coronal Fat Sat Image Showing Comminuted Bicondylar Fracture of Proximal End of Tibia with Intraarticular and Intercondylar Extension

DISCUSSION

The major advantage of MRI is being noninvasive and radiation-free modality. All the patients in our study were male patients and majority were in the age group of 21-30 years. Multiplanar MR images provide significant improvement in assessing these structures.

Magnetic Resonance (MR) imaging is sensitive and specific in the diagnosis of internal derangements of the knee.[4] In our study, joint effusions were the most common finding affecting 40 patients (80%). Among the ligamentous and meniscal injuries, ACL tear is most common seen in 35 patients (70%). Among these, 15 (42.8%) were partial and 20 (57.1%) were complete to be followed by the medial meniscal injuries seen in 15 patients (30%) with grade 3 type injury being the commonest (86.6%).

ACL was the most common ligament injury in our study. This was comparable to the study by Singh JP et al in their series of 173 patients. 78 patients showed ACL tears. Among these, 52 are partial, 16 are complete and 10 cases showed nonvisualisation of ACL. The authors concluded that ACL tears (partial) are more common than ligament injuries.[5] PCL injuries were found to be relatively uncommon in our study found in only 2 patients and all tears were demonstrated as thickening of the ligament with abnormal signal intensity (partial tear). Sonnin et al found the incidence of PCL tear to be 3% in a study of 350 cases of knee injury, only 10 had PCL tears.[6]

In our study, MCL tears (20%) were found to be more common than LCL (4%). All these cases had H/o trauma and associated with multiple injuries. This suggests presence of single injury should prompt the examiner to look for other subtle associated injuries, which were confirmed by Mink JH et al.[7] They observed on MRI and arthroscopy of 11 patients who had tear of ACL, 7 patients had tear of MCL. 4 patients had tear of lateral meniscus and 1 patient had tear of medial meniscus. In our study, grade-3 injuries of MCL were more common.

In our study, the incidence of medial meniscus tears was more than lateral meniscus tears (Figure 2), which is well correlated with the study by Singh JP et al in a series of 173 cases of which they found 57 (38.23%) patients showed MM tear and 28 (29.4%) patients showed LM tear. Out of 173 grade 3 tear of MM was seen in 57 patients, grade 2 in 16 patients and grade 1 in 20 patients. In LM, G3 tears were seen in 28, G2 in 12 and G1 in 14 patients. In our study, MM tears were found in 15 (30%) with G1 tear in none, G2 tear in 2 (13%) and G3 in 13 (86.6%) and LM tear in 9 (18%) with G1 tear in 3 (15.8%) G2 tear in 1 (26.3%) and G3 in 5 (57.9%). Grade 3 tears were the most common in both menisci.

In our study, we found 31 cases of combined injuries and 19 cases of isolated injuries. Among combined injuries, the predominant pattern is ACL tear and MM tears followed by ACL tear and LM tear, which is well correlated with study by Ali Akbar Esmail Jah et al in a series of 17 cases of concomitant injuries at MRI and arthroscopy. Predominant pattern was ACL tear and MM tear (5 patients) followed by ACL and LM (4 patients) or ACL+MM+LCL (4 patients).[8]

CONCLUSION

The present study attempts to determine the role of MRI in the evaluation of internal derangements of traumatic knee joint. In our study, patients in the age group of 21-30 years accounted for a maximum number of cases. Commonest lesion detected in our study was ACL tear followed by medial meniscal tear and medial collateral ligament injury. In combined injuries, predominant pattern was ACL rupture and MM tear. Complete tears were more common in ACL injuries. Grade 3 was the most common grade of meniscal tear. Among medial collateral injuries, grade 3 tears were more common. Among osseous/osteochondral lesions bony contusions involving femoral and tibial condyles were common. Other findings like the discoid meniscus, haemarthrosis, joint effusions and other myotendinous tears were accurately detected and characterised with the help of MRI. The present study revealed the ability of MRI in evaluation of the various internal derangements including their detection, localisation, characterisation and assessment of extent of damage in cases of trauma.

REFERENCES

1. Oei EHG, Nikken JJ, Verstijnen ACM, et al. MR imaging of menisci and cruciate ligament: a systemic review radiology 2003;226(3):837-848.
2. Bredella MA, Tirman PFJ, Peterfy CG. Accuracy of T2 weighted fast spin echo MR imaging with fat saturation in detecting cartilage defects in the knee: comparison with arthroscopy in 130 patients. AJR Am J Roentgenol 1999;172(4):1073-1080.
3. Maurer EJ, Kaplan PA, Dussault RG, et al. Acutely injured knee: effect of MR imaging on diagnostic and therapeutic decision. Radiology 1997;204(3):799-805.
4. Berquist TH. Osseous and myotendinous injuries about the knee. Magn Reson Imaging Clin N Am 2007;15(1):25-38.
5. Sing JP, Garg L, Shrimali R, et al. MR imaging of knee with arthroscopic correlation in twisting injuries. Indian J Radiol Imaging 2004;14(1):33-40.
6. Sonin AH, Fitzgerald SW, Hoff FL, et al. MR imaging of the posterior cruciate ligament: normal, abnormal and associated injury pattern. Radiographics 1995:15(3):551-561.
7. Mink JH. The cruciate and collateral ligament. In: Mink JH, Reicher MA, Crues JV, eds. MRI of the knee. 2nd edn. Newyork, NY: Raven 1993:141-188.
8. Rosner B. Fundamentals of biostatistics. 5th edn. Duxbury: Blackwell 2000:80-240.