

MRI Evaluation of Acute Internal Derangement of Knee

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Received 19 April 2015; accepted 30 May 2015; published 2 June 2015

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Abstract

Introduction: Internal derangement of the knee is a blanket term used to cover a group of disorders involving destruction of the normal functioning of the ligaments or cartilages. MRI provides excellent soft tissue contrast and is capable of evaluating the soft tissue and bony structures in multiple imaging planes which provide significant advantage in IDK. **Methods and Materials:** A prospective study of hundred twenty patients who underwent MRI for the diagnosis of internal derangement of knee between the period January 2013 and January 2015 was conducted. All the patients gave a history of knee joint pain following trauma and clinically suspected to have meniscal and ligament tears. Patients were evaluated using Philips intera R 11 1.5 T with pulsar gradient system using a sensor extremity coil. **Results:** Commonest lesion detected in our study was ACL tear followed by meniscal tear and medial collateral ligament injury. The most common sign of cruciate ligament injury was hyper intensity in the ligament. Grade 3 was the most common grade of meniscal tear. **Conclusion:** MRI is unique in its ability to evaluate the internal structure as well as the surface of the meniscus. Many anatomical variants can mimic a tear on MRI. MRI is an excellent non invasive modality for imaging the knee.

Keywords

Anterior Cruciate, Posterior Cruciate, Meniscus, Internal Derangement Knee

1. Introduction

Internal derangement of the knee is a blanket term used to cover a group of disorders involving destruction of the normal functioning of the ligaments or cartilages. 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 [1]. Also, intra-substance tears cannot be evaluated in arthroscopy. 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 in 41% of patients [2]. In this article, we were going to discuss about MRI findings of 120 patients who were diagnosed to have acute internal derangement of knee.

2. Method

This is a prospective study of hundred and twenty patients who underwent MRI for internal derangement of knee. The study period was January 2013 to January 2015. All the patients gave history of knee joint pain following trauma and clinically suspected to have meniscal and ligament tears. Patients were evaluated using Philips intera R 11 1.5 T with pulsar gradient system using a sensor extremity coil. The patient population consisted of 111 males and 9 females. 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 history of twisting injuries with or without contact mechanism with knee joint pain. The exclusion criteria were 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 3mm slice thickness. An axial acquisition through the patella femoral joint was used as the initial localizer for subsequent coronal and sagittal plane images. The sagittal plane is primarily used to evaluate the cruciate ligaments, menisci and synovial anatomy as 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 patella femoral compartment.

3. Result

Majority of the patients who were diagnosed as internal derangement of knee were having anterior cruciate ligament tear and medial meniscal tear when evaluated using Mri as evident from **Table 1**. Lateral meniscal injury were not so common than the medial meniscal tear. We found 15 cases of ACL injuries to coexist with medial meniscus injuries (27%). Other associated injuries were seen in medial collateral ligament (22%) and lateral meniscus (16%). There was a increased frequency of occurrence of MCL injury in patients with coexisting ACL injuries (**Table 2**).

4. Discussion

The major advantage of MRI is its non-invasive and non-ionizing nature. Although arthroscopy is considered the gold standard, improved diagnostic accuracy with MRI has been clearly demonstrated [3]. The study done by Ruwe *et al.* demonstrated that MRI reduced unnecessary arthroscopic interventions in 53 of 103 patients [4]. Another study by Vincent *et al.* reported that MRI reduces the need for arthroscopy in 42 patients. Majority of the patients in our study were male 111 patients and their common cause of injury was contact sports followed by road traffic accidents. Patients in the age group 20 - 30 years accounted for maximum number of cases (**Table 1**).

Singh *et al.* showed MRI to be superior to arthroscopy for diagnosing meniscal and cruciate ligament tears. The internal structure of menisci which could not be demonstrated by arthroscopy can be visualized by MRI. Also MRI can visualize peripheral meniscal tears and inferior surface tears which is the Achilles heel of arthroscopy. Another conclusion drawn from the study was the superior sensitivity of MRI in the detection of multiple meniscal tears [5]. The study by Reicher *et al.* reported better patient compliance and preference for MRI over arthroscopy [6]. The major pitfalls in MR imaging of knee are due to anatomic variants and artefacts, especially partial volume effects. The study by Rubin *et al.* reported a fall in diagnostic specificity for ligament tears with multiple ligament injuries [7].

Table 1. Distribution of patients by age.

Age	Number	Percentage %
20 - 30	66	55%
31 - 40	39	33%
41 - 50	15	12%

Table 2. MRI findings.

Cases	Number	Percentage %
ACL tears	54	45%
PCL tears	15	12.5%
Medial meniscus tear	39	32%
Lateral meniscus tear	27	22%
Discoid meniscus	6	5%
Medial collateral sprain/tear	27	22.5%
Lateral collateral sprain/tear	12	10%

Magnetic resonance (MR) imaging is sensitive and specific in the diagnosis of internal derangements of the knee [8] [9]. In our study of Internal Derangement of Knee, we studied 120 patients of which 48 were left knee joint and 72 were right knee joint. Forty five percentages of our cases showed ACL tears (**Table 2** and **Figure 1**). This was the most common ligament injury in our study. This was comparable to the study by Shetty *et al.* who reported 37% of knee injuries to the ACL [10]. Hyper intensity of the ligament was the most common sign (55%). 25% showed discontinuity and 16% of ligaments was not visualized which corresponded with Gentali *et al.* study [11]. This was also comparable to study by Shetty *et al.* who reported hyper intensity as the most common sign observed followed by discontinuity and lastly non visualization.

We had thirteen percentages of cases having posterior cruciate ligament tear which was more than that which was reported by Shetty and colleagues, who reported 4.5% PCL tears. Berquist reported between 2% - 23% of tears to be PCL tears [3]. Berquist found the primary findings in PCL tears to be similar to the ACL tears except that the cause of ligament tear is not as useful. Hyper intensity was seen in 3 cases and discontinuity of ligaments in 2 cases.

The main findings in collateral ligament injuries were adjacent fascial oedema and increased signal intensity. Schweitzer *et al.* reported a higher frequency of MCL injury than ACL injury [12] which we could not corroborate in our study. This could be because certain sports activities (skiing) have a very high incidence of MCL injuries which are not a part of our sports culture. The incidence of medial meniscus tear is more common than lateral meniscus tears (**Figure 2**) which correlated with the study by Berg *et al.* [13]. Grade 3 lesions were the most common (45%) subset of meniscal tears. We found 6 cases (5%) of discoid meniscus in the lateral meniscus. This corresponds to the report by Berquist *et al.* who found discoid meniscus to be more common in the lateral meniscus compared to medial meniscus. Our findings also correspond to the report by Shetty *et al.* who found 5% incidence for discoid meniscus.

Bone contusions (**Figure 3**) showed a high association with ACL tears (50%), and PCL tears (60%). This corresponds to the study by Remer *et al.* who found upto 68% bone injury associated with ACL injury [14]. Mc Cauley *et al.* also reported a high incidence of bone bruise with ACL tears [15]. We found 15 cases of ACL injuries to coexist with medial meniscus injuries (**Table 3** and **Figure 4**). Other associated injuries were seen in medial collateral ligament (22%) and lateral meniscus (16%). This corresponds to the report by Remer *et al.* who observed 68% of meniscal tears to be associated with ACL injuries. He also reported an increased frequency of occurrence of MCL injury in patients with coexisting ACL injuries (18%).



Figure 1. T1 weighted image shows joint effusion and nonvisualisation of ACL.



Figure 2. Stir sequence shows associated bone bruise of tibia.



Figure 3. Grade 2 linear signal intensity in posterior horn of lateral meniscus.



Figure 4. T2 weighted sequences showing discontinuity and hyperintensity of ACL with grade 3 meniscal tear of the posterior horn of medial meniscus.

Table 3. Multiple Ligament injuries.

	ACL	PCL	MM	LM	MCL	LCL
ACL	--	9	15	9	18	3
PCL	9	--	9	--	9	--
MM	15	9	--	3	12	3
LM	9	--	3	--	3	6
MCL	18	9	12	3	--	3
LCL	3	--	3	6	3	--

Note: ACL—Anterior cruciate ligament; PCL—Posterior cruciate ligament; MM—Medial meniscus; LM—Lateral meniscus; MCL—Medial collateral ligament; LCL—Lateral collateral ligament.

5. Conclusion

Patients in the age group 20 - 30 years accounted for a maximum number of cases. Commonest lesion detected in our study was ACL tear followed by meniscal tear and medial collateral ligament injury. We found increased incidence of medial meniscal and collateral ligament tears associated with ACL tears. Majority of posterior cruciate ligament tears were associated with anterior cruciate, medial collateral and medial meniscus injuries. The most common sign of cruciate ligament injury was hyper intensity in the ligament. Grade 3 was the most common grade of meniscal tear. Bone bruise and anterior tibial subluxation showed a higher frequency with ACL injury. MRI is unique in its ability to evaluate the internal structure as well as the surface of the meniscus. Many anatomical variants can mimic a tear on MRI. MRI is an excellent non invasive modality for imaging the knee.

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