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# MRI Study of Types And Incidence of Injuries In Traumatic Knee Joint At Rajendra Institute of Medical Sciences (RIMS), Tertiary Care Hospital of Ranchi, Jharkhand.

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***Abstract***
***Background :****–Magnetic resonance imaging (MRI) has now been accepted as the best imaging modality for non-invasive evaluation of knee injuries and most widely used diagnostic modalities to assess the joint injury. Complete evaluation of all the internal structures of the knee was not possible with other modalities like conventional radiography, arthrography, ultrasonography and computed tomography.* ***Objectives:-1).*** *Study of the spectrum of MRI findings in all consecutive cases of knee trauma referred from orthopedic OPD and INDOOR of RIMS.* ***2).*** *Grading of the various ligamentous and meniscal injuries on the basis of laid down criteria.* ***3).*** *Comparison of findings of magnetic resonance imaging with surgical findings in selected cases.* ***Material and Methods:-*** *All cases referred from Orthopedic/Surgury department of Rajendra institute of medical sciences(RIMS) Ranchi for evaluation of traumatic knee. Duration of study is one year from November 2016- November 2017 having sample size of one hundred eleven(111) cases.* ***Results:-****In our study joint effusions were the most common finding affecting 89 patients (80.5%). Among the ligamentous and meniscal injuries, ACL tear is most common, in 89 patients (68.5%), to be followed by the Medial Meniscal injuries seen in 33 patients (29.7%) with grade 3 type injury being commonest.* ***Conclusion:-****MRI is an excellent, noninvasive, radiation free imaging modality with multiplane capabilities and excellent soft tissue delineation. It can accurately detect, localize and characterize various internal derangements of the knee joint and help in arriving at a correct anatomical diagnosis thereby guiding further management of the patient.*

***Key words:-MRI, USG, Computed tomography, ACL, PCL, Menisci, collateral ligaments.***

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## I. Introduction

Trauma to knee joint is a significant cause of morbidity in the young, active individuals especially amongst accidental case, military recruits, trained soldiers and athletes. An accurate diagnosis regarding the type and extent of injuries is essential for early operative as well as non-operative treatment. This requires an accurate clinical history, a thorough physical examination and complementary diagnostic tools. With the availability of improved surgical options, accurate imaging of the knee becomes all the more imperative.

The most widely used diagnostic modalities to assess the joint injury are arthroscopy and MRI. Arthroscopy, though accurate, is invasive and can cause complications **[1, 2].** Magnetic resonance imaging (MRI) has now been accepted as the best imaging modality for non-invasive evaluation of knee injuries. It has been reported to have a high diagnostic accuracy and does not involve the use of ionizing radiation **[3].**Since its introduction for clinical use in the mid-1980s, the role of MRI in the diagnosis of knee lesions has been well established. MRI 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 **[4].**In the context of trauma, post-traumatic limited range of motion and mechanical knee symptoms MRI is generally considered a valuable diagnostic tool **[5].**

MRI has made it possible to look into the injured knee non-invasively, thereby avoiding invasive procedures and further morbidity **[6].**

The knee joint is a compound type of synovial joint and due to the lack of bony support, stability of the joint is highly dependent on its supporting ligamentous structures, therefore injuries of ligaments and menisci are extremely common **[7].**

This study was undertaken to evaluate the types and incidence of injuries in traumatic knee joint by MRI and to compare with surgical findings in selected cases.

## II. Aims And Objectives

1). Study of the spectrum of MRI findings in all consecutive cases of knee trauma referred from orthopedic OPD and INDOOR of RIMS.
2). Grading of the various ligamentous and meniscal injuries on the basis of laid down Criteria.
3). Comparison of findings of magnetic resonance imaging with surgical findings in selected cases.

## III. Material & Methods

Inclusion Criteria : All the patients referred with clinically suspected internal derangement of knee following trauma to knee
Exclusion Criteria
i). Patients with ferromagnetic implants, pacemakers, and Aneurysm clips.
ii). Patients with major injuries like liver / splenic rupture and flail chest and patients with unstable vital parameters especially in the setting of trauma.

All patients will be subjected to MR imaging and followed by surgical findings in selected cases wherever indicated.

## IV. Results

A descriptive statistical analysis and correlation evaluation study consisting of 111 patients with Traumatic knee joint is undertaken to study the spectrum of MRI findings in all consecutive cases of knee trauma referred from Orthopedic/Surgury outdoor patients and indoor patients of Rajendra institute of medical sciences(RIMS) Ranchi, and Comparison of findings of magnetic resonance imaging with surgical findings in selected cases. Rajendra institute of medical sciences(RIMS) is tertiary care hospital of Jharkhand.Duration of study is one year from Nov 2016- Nov 2017.

**Table 1: Age distribution of patients studied.**

| Age in years | Number | % |
|---|---|---|
| Up to 20 | 14 | 12.6 |
| 21-30 | 51 | 45.9 |
| 31-40 | 30 | 27.1 |
| 41-50 | 10 | 9.1 |
| >50 | 6 | 5.4 |
| Total | 111 | 100.0 |
| Mean ± SD | 30.66±10.58 | |

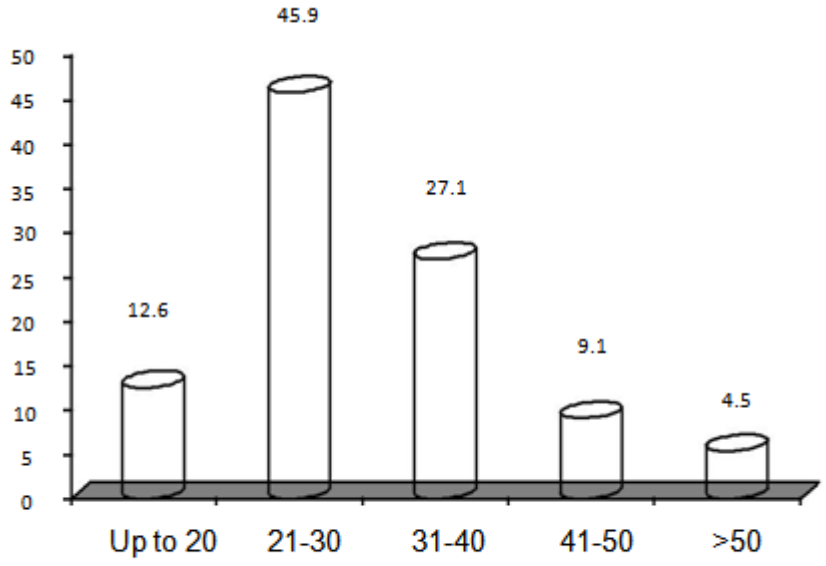
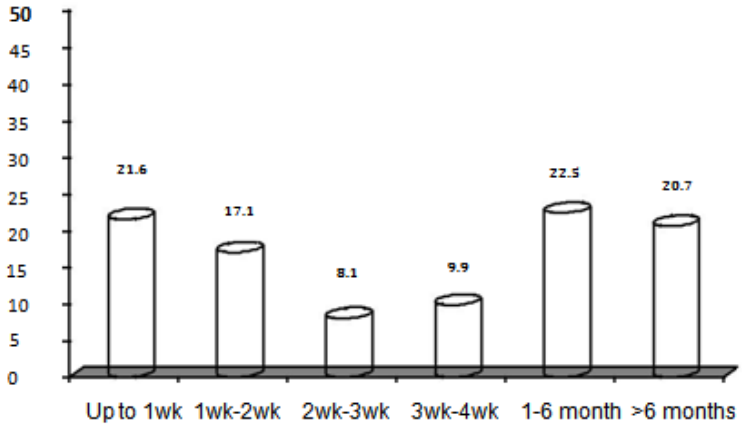



**Fig -1**

**Table 2: Duration of Injury of patients studied.**

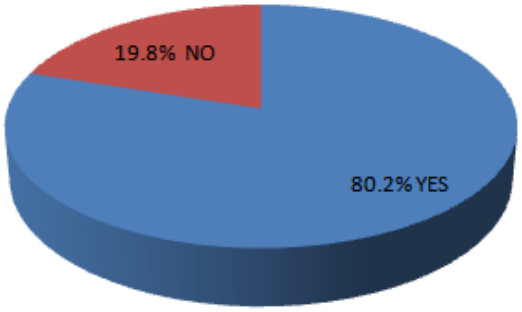
| Duration of injury | Number | % |
|---|---|---|
| | | |
| Up to 1 week | 24 | 21.6 |
| 1week-2 week | 19 | 17.1 |
| 2week-3 week | 9 | 8.1 |
| 3 week-4 week | 11 | 9.9 |
| 1 month-6 month | 25 | 22.5 |
| >6 months | 23 | 20.7 |
| Total | 111 | 100.0 |
| | | |




**Injury duration**
**Fig 2**

**Table 3: Joint effusion**

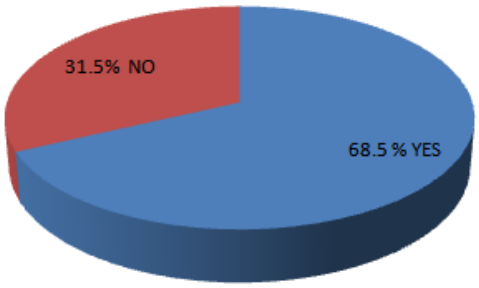
| Joint effusion | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 22 | 19.8 | 13.5-28.2 |
| Yes | 89 | 80.2 | 71.8-86.5 |




**Joint effusion**
**Fig 3**

**Table 4: ACL tear**

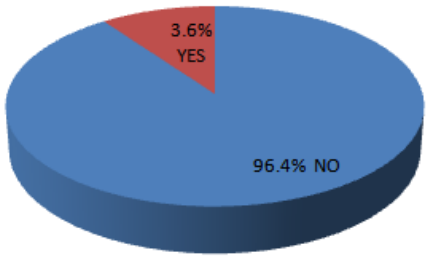
| ACL tear | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 35 | 31.5 | 23.6-40.7 |
| Yes | 76 | 68.5 | 59.3-73.4 |
| Partial | 36 | 47.4 | 36.5-58.5 |
| Complete | 40 | 52.6 | 41.6-63.5 |




**ACL tear**
**Fig-4**

**Table 5: PCL tear**

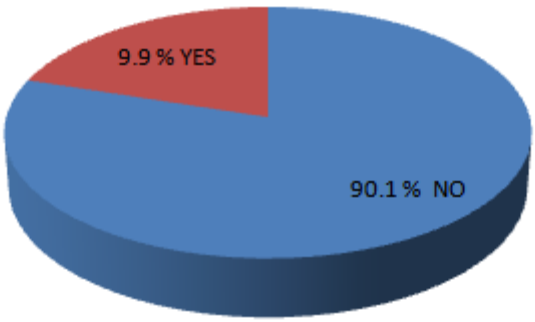
| PCL tear | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 107 | 96.4 | 91.1-98.6 |
| Yes | 4 | 3.6 | 1.4-8.9 |




**PCL tear**
**Fig-5**

**Table 6: MCL tear**

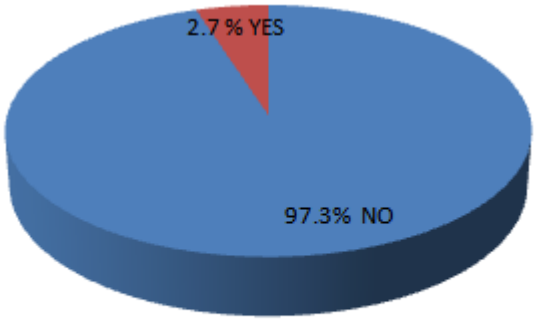
| MCL tear | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 100 | 90.1 | 81.9-93.6 |
| Yes | 11 | 9.9 | 6.13-17.8 |
| Grade I | 4 | 36.4 | 13.3-61.9 |
| Grade II | 2 | 18.2 | 4.3-44.9 |
| Grade III | 5 | 45.5 | 19.1-68.8 |




**MCL tear**
**Fig-6**

**Table 7: LCL tear.**

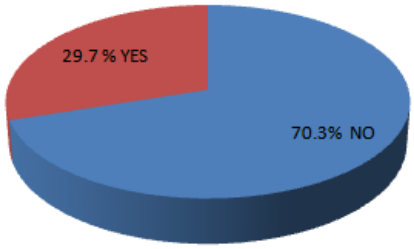
| LCL tear | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 108 | 97.3 | 92.4-99.1 |
| Yes | 3 | 2.7 | 0.9-7.7 |
| Grade I | 1 | 33.3 | 6.2-79.3 |
| Grade II | 1 | 33.3 | 6.2-79.3 |
| Grade III | 1 | 33.3 | 6.2-79.3 |




**LCL tear**
**Fig-7**

**Table 8: Medial meniscus tear**

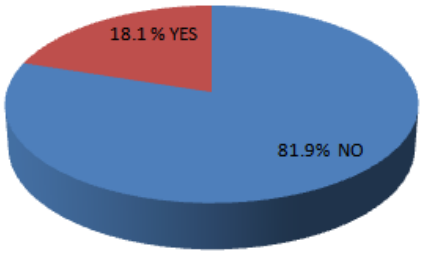
| MM tear | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 78 | 70.3 | 61.2-77.9 |
| Yes | 33 | 29.7 | 22.0-38.9 |
| Grade I | - | - | - |
| Grade II | 4 | 12.1 | 4.8-27.3 |
| Grade III | 29 | 87.8 | 72.6-95.2 |




**Medial Meniscus tear**
**Fig-8**

**Table 9: Lateral meniscus tear**

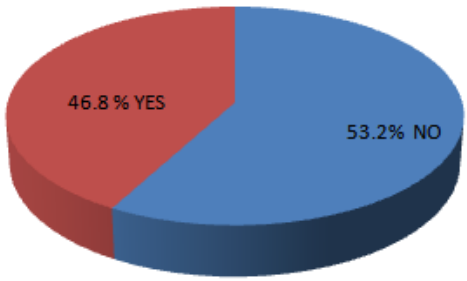
| LM tear | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 91 | 81.9 | 73.8-88.1 |
| Yes | 20 | 18.1 | 11.9-26.2 |
| Grade I | 3 | 15.0 | 5.2-36.1 |
| Grade II | 5 | 25.0 | 11.2-46.9 |
| Grade III | 12 | 60.0 | 38.7-78.1 |




**Lateral meniscus tear**
**Fig-9**

**Table 10: Osseous/Osteochondral lesions.**

| Osseous/Osteochondral lesions | Number (n=111) | % | 95%CI |
|---|---|---|---|
| No | 59 | 53.2 | 43.9-62.3 |
| Yes | 52 | 46.8 | 37.8-56.1 |




**Osseous/Osteochondral lesions**
**Fig-9**

**Table 11: Spectrum of MRI findings.**

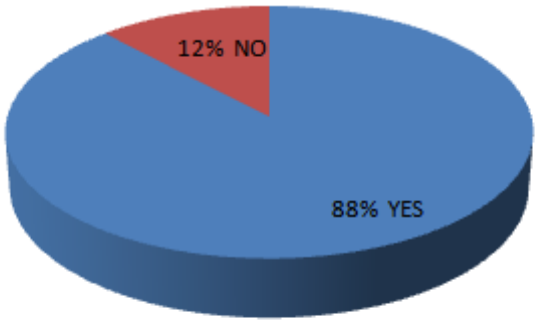
| MRI findings | Positive findings(n=111) | % |
|---|---|---|
| Joint effusion | 89 | 80.2 |
| ACL tear | 76 | 68.5 |
| PCL tear | 4 | 3.6 |
| MCL tear | 11 | 9.9 |
| LCL tear | 3 | 2.7 |
| MM tear | 33 | 29.7 |
| LM tear | 20 | 18.1 |
| Osseous/Osteochondral lesions | 52 | 46.8 |

**Table 12: Surgical findings**

| Surgical findings | Number (n=111) | % | 95%CI |
|---|---|---|---|
| Not available | 86 | 77.5 | 68.7-84.3 |
| Available | 25 | 22.5 | 15.7-31.1 |

**Table 13 Correlation of MRI diagnosis with Surgical findings.**

| Correlation | Number (n=25) | % | 95%CI |
|---|---|---|---|
| Yes | 22 | 88.0 | 70.04-95.83 |
| No | 3 | 12.0 | 4.17-29.96 |



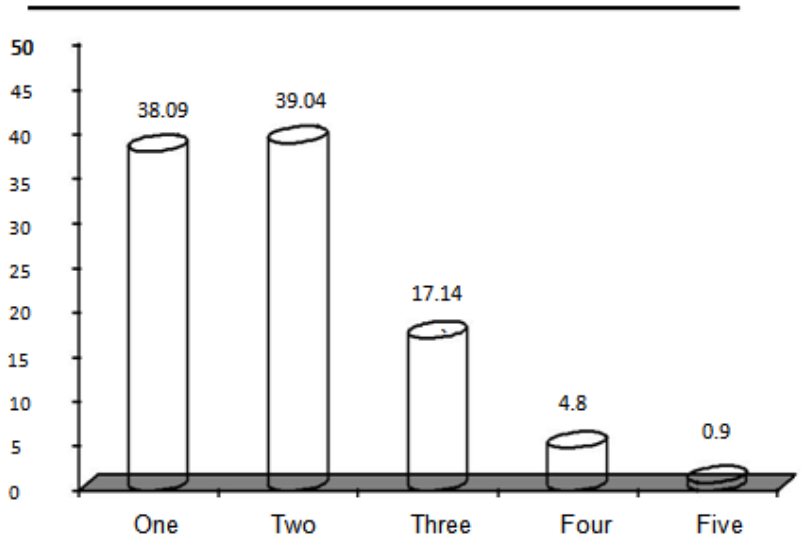

**Correlation of MRI diagnosis with surgicalfindings**
**Fig-9**

Correlation b/w MRI and surgical findings are statistically significant with 95%
CI (70.04-95.83%)

Sensitivity, specificity, PPV, NPV and Accuracy could not be found as the Surgical intervention required only after the positive indication of MRI diagnosis. Therefore, the both the variables are not statistically independent hence the diagnostic statistics cannot be performed [8.9]

**Table 14: Combined / multiple injuries.**

| Combined/Multiple injuries | Number (n=105) | % |
|---|---|---|
| Isolated | 40 | 38.09 |
| Two injuries | 41 | 39.04 |
| Three injuries | 18 | 17.14 |
| Four injuries | 5 | 4.8 |
| Five injuries | 1 | 0.9 |




**Number of combined injuries**
**Fig-12**

Descriptive statistical analysis and correlation evaluation has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD
(Min-Max) and results on categorical measurements are presented in Number (%).95%Confidence interval has been used to find the significance in the present study [8,9]

## V. Discussion

The role of magnetic resonance imaging has steadily increased and now it has become the first line investigation for most of the lesions of knee. It is also being used for pre and post-operative evaluation. Complete evaluation of all the internal structures of the knee was not possible with other modalities like conventional radiography, arthrography, ultrasonography and computed tomography. Even with arthroscopy/Surgery, lesions such as peripheral meniscal tears, inferior surface tears and osteochondritisdessicans without articular cartilage damage are most often not detected. Multiplanar MR images provide significant improvement in assessing these structures

In our study joint effusions were the most common finding affecting 89 patients (80.5%). Among the ligamentous and meniscal injuries, ACL tear is most common, seen in 89 patients (68.5%), to be followed by the Medial Meniscal injuries seen in 33 patients (29.7%) with grade 3 type injury being commonest.

**Cruciate ligaments:**

Singh JP et al in their series of 173 patients, 78 patients (45.08%) showed ACL tears, among these 52 (66.67%), are partial, 16(20.51%) are complete and 10 (12.82%) cases showed non visualization of ACL. The authors concluded that ACL tears are more common than other ligamentous injuries with partial tears being commoner [6].

However, in our study ACL tear was found in 76 patients (68.5 %) among these 36(47.4%) were partial tears and 40(52.6%) were complete, which can attributable to the severity of training involved in military personnel.

Posterior cruciate ligament injuries were found to be relatively uncommon, in our study found in only 4 patients (3.6%) and all the 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 percent; in a series of study analyzing 350 case of knee injury only 10 patients had PCL tear [10]

In a study by Grover et al where they analyzed findings of 510 consecutive MRI of knee joints with an emphasis on PCL tear; 11 (2%) patients had different grades of tear on MRI which was confirmed correctly by arthroscopy. Of the other 202 patients who had undergone MRI as well as arthroscopy for internal derangement of knee none of the patients had any PCL injury as predicted correctly by MRI [11].

**Collateral ligaments:**

In our study, MCL tears (9.9 %) were found to be more common than the LCL tear (2.7 %). All these cases had history of trauma and were associated with multiple injuries. This suggests presence of a single injury should prompt the examiner to look for other subtle associated injuries, which was further confirmed by Mink JH et al [41]. 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 (tear 45.5%) of MCL ware more common which is attributable to the severity of training involved in military personnel.

**Menisci lesions:**

There is preponderance of MM tears over LM tears in our study which is well correlated with the study done by Singh JP et al, in a series of 173 cases of which they found 57 (38.23%) patients showed MM tear and 28(29.41%) patients showed LM tear. Out of 173 patients, Grade 3 tear ofwas seen in 57(32.95%) patients, Grade 2 in 16(9.25%) patients & Grade 1 in 20(11.56%). In LM, Grade 3 tears were seen in 28(16.18%) patients, Gr 2 in 12 (6.94%) patients & Gr I in 14(8.1%) patients [6].

In our study, MM tears ware found in 33 (29.7) with Grade I tear in none, Grade 2 tear in 4 (12.1%) and Grade 3 in 29 (87.8%) and LM tear in 20 (18.1%) with Grade I tear in 3 (15%) Grade 2 tear in 5 (25.0%) and Grade 3 in 12 (60.0%).

Grade III tears were the more common in both the menisci; MM 29(87.9%) and LM 12(60.0%), which can attributable to the severity of training involved in military personnel.

Lateral Discoid meniscus with appearance of bow tie configuration in more than two contiguous slices on sagittal images was found in one patient.

The cystic lesions encountered were meniscal cyst, parameniscal cyst and popliteal cyst (Baker's cyst). The meniscal cysts and parameniscal cysts were found to be associated with tear of the lateral meniscus in 6 and medial meniscus in 3. In the 2 cases of the popliteal cysts, its location, relation to the joint space and its communication with joint space ware clearly demonstrated on sagittal T2 weighted images. These findings were correlated with findings described by Thomas H. Berquist[12]

**Osseous and Osteochondral injuries**

In our study Osseous/Osteochondral lesions were seen in 52 patients (46.8%). Most of these were bony contusions involving the femoral and tibial condyles. Osteochondral lesions are seen in nine patients. In our study we found a case of Comminuted bicondylar fracture of proximal end of Tibia with intra-articular and intracondylar extension. There is also fracture of medial tibial condyle inpostero-lateral aspect which is displaced antero-medially. A case of Segond fracture of the lateral tibial rim with bony contusion of the lateral femoral condyle was also seen. These findings were correlated with findings described by Thomas H. Berquist[12]

In our study we also saw a case spontaneous osteonecrosis of medial femoral condyle, which is well depicted on magnetic resonance imaging earlier than radiographic appearance. It appeared as a focus of altered signal in the antero-medial aspect of medial femoral condyle with a thin rim of sclerosis and associated marrow edema involving entire medial femoral condyle and flattening of the articular surface with evidence of subchondral collapse. These findings were correlated with findings described by Thomas H. Berquist[12].

The finding of hemarthrosis and lipohemoarthrosis was associated in two cases with presence of intercondylar fractures. These findings were correlated with findings described by Thomas H. Berquist[12].

The findings of a partial tear of proximal fibers of medial head of Gastronemius muscle were seen in two patients in our study. These findings were correlated with findings described by Thomas H. Berquist[12]

In our study, a correlation of MRI findings with Surgical findings was performed in 25 patients (22.5 %). Among which in 21 patients (84%) MRI findings are well correlated with surgical findings with 95% Confidence interval. Correlation between MRI and surgical findings are statistically significant with 95% CI (70.04-95.83%) [8,9].

**Combined injuries:**

In our study, we found 65 cases of combined injuries and 40 cases of isolated injuries. The predominant pattern is ACL tear and MM tears (n-23); followed by ACL tear and LM tear (n-12), which is well correlated with a study by Ali Akbar Esmaili Jah et al, in a series of 17 cases of concomitant injuries at MRI and arthroscopy. The predominant pattern was anterior cruciate ligament rupture and medial meniscus tear (5 patients), followed by anterior cruciate ligament and lateral meniscus (4 patients), or anterior cruciate ligament + medial meniscus + lateral ligament (4 patients) [13].

In our study we found a case of Comminuted bicondylar fracture of proximal end of Tibia with intra-articular and intracondylar extension and multiple ligamentous and Meniscal injuries.

The present study revealed the ability of magnetic resonance imaging in evaluation of the various internal derangements, including their detection, localization, characterization and assessment of extent of damage and the strength of correlation between MRI and arthroscopic findings confirms the value of MRI in assessing internal knee structures.

## VI. Conclusion

MRI is an excellent, noninvasive, radiation free imaging modality with multiplane capabilities and excellent soft tissue delineation. It can accurately detect, localize and characterize various internal derangements of the knee joint and help in arriving at a correct anatomical diagnosis thereby guiding further management of the patient.

The ligamentous & meniscal and associated injuries are of increased severity compared to the available literature that can be attributable to the severity of training and injuries involved in military personnel and sportsmen.

## References


[1]. DW Polly, JJ Callaghan, RA Sikes, JM McCabe, K McMahon and CG Savory. The Accuracy of Selective Magnetic Resonance Imaging Compared with the Findings of Arthroscopy of the Knee. Am J Bone Joint Surg1988;70:192-198.

[2]. Vaz CES, Camargo OP de, Santana PJ de, Valezi AC. Accuracy of magnetic resonance in identifying traumatic intraarticular knee lesions. Clinics 2005;60(6):445-50.

[3]. Keith Winters, Russell Tregonning. Reliability of magnetic resonance imaging for traumatic injury of the knee. NZMJ [serial online] 2004 Feb [cited 2005 Feb 11]; 118 (1).

[4]. Edwin H G Oei, Jeroen J Nikken, Antonia C M Verstijnen, Abida Z Ginai, M G MyriamHunink. MR Imaging of the Menisci and Cruciate Ligaments: A Systematic Review. Radiology 2003;226:837–848.

[5]. Edwin H G Oei, Abida Z Ginai, M G MyriamHunink. MRI for Traumatic Knee Injury: A Review. Semin Ultrasound CT MRI 2007;28:141-157.

[6]. Singh JP, Garg L, Shrimali R, Setia V, Gupta V. MR Imaging of knee with arthroscopic correlation in twisting injuries. Indian J Radiol Imaging 2004;14: 33-40.

[7]. David K B Li, Mark E Adams, J Pat McConkey. Magnetic Resonance Imaging of Ligaments and Menisci of the Knee. RadiolClin North Am 1986;24(2):209-227.

[8]. Bernard Rosner, Fundamentals of Biostatistics. In: Bernard Rosner, editor. Fundamentals of Biostatistics. 5th ed. Duxbury: Blackwell, 2000; 80-240.

[9]. M. Venkataswamy Reddy, Statistics for Mental Health Care Research. In: Subba Rao, S Jingar editors, NIMHANS, INDIA 2002.

[10]. Sonin AH, Fitzgerald SW, Friedman H: MR imaging of Posterior cruciate ligament;normal, abnormal and associated injury pattern. Radiographics 1995; 15: 551-56.

[11]. Grover JS, Bassett LW, Gross ML. Posterior cruciate ligament: MR imaging. Radiology 1990; 174:527-530.

[12]. Thomas H. Berquist. Osseous and Myotendinous Injuries About the Knee. Radiolclin N Am 2007;45: 955-968.

[13]. Ali Akbar Esmaili Jah, SohrabKeyhani, Reza Zarei, Ali KalhorMoghaddam. Accuracy of MRI in comparison with clinical and arthroscopic findings in ligamentous and meniscal injuries of the knee: ActaOrthop. Belg., 2005; 71:189-196.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