

# Clinical, MRI, and arthroscopic correlation in meniscal and anterior cruciate ligament injuries

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**Abstract** The aim of this prospective study was to compare and correlate clinical, magnetic resonance imaging (MRI), and arthroscopic findings in cases of meniscal tear and anterior cruciate ligament (ACL) injuries. MRI scan results and clinical diagnosis are compared against the arthroscopic confirmation of the diagnosis. One hundred and thirty-one patients had suspected traumatic meniscal or anterior cruciate ligament (ACL) injury. Clinical examination had better sensitivity (0.86 vs. 0.76), specificity (0.73 vs. 0.52), predictive values, and diagnostic accuracy in comparison to MRI scan in diagnosis for medial meniscal tears. These parameters showed only marginal difference in lateral meniscal and anterior cruciate ligament injuries. We conclude that carefully performed clinical examination can give equal or better diagnosis of meniscal and ACL injuries in comparison to MRI scan. MRI may be used to rule out such injuries rather than to diagnose them.

**Résumé** Le but de cette étude prospective est d'établir une corrélation clinique entre l'IRM et les constatations arthroscopiques lors de lésions méniscales associées à des lésions du ligament croisé antérieur. Matériel et méthode:

les résultats du scanner ont été comparés aux résultats arthroscopiques, 131 patients suspects de lésions méniscales post-traumatiques ou de lésions du ligament croisé antérieur ont été inclus. Résultats : l'examen clinique a une sensibilité de (0,86 v/s 0,76) et une spécificité de (0,73 v/s 0,52) si l'on compare les constatations pré-opératoires avec le diagnostic. Ces paramètres montrent une différence marginale lors de lésion du ménisque latéral et des lésions du ligament croisé antérieur. Conclusion : nous pouvons conclure que l'examen clinique permet de faire un diagnostic équivalent, sinon meilleur, des lésions méniscales et des lésions du ligament croisé antérieur comparé aux examens complémentaires IRM, scanner. L'IRM peut être utilisé pour exclure ces lésions traumatiques plutôt que pour leur diagnostic.

## Introduction

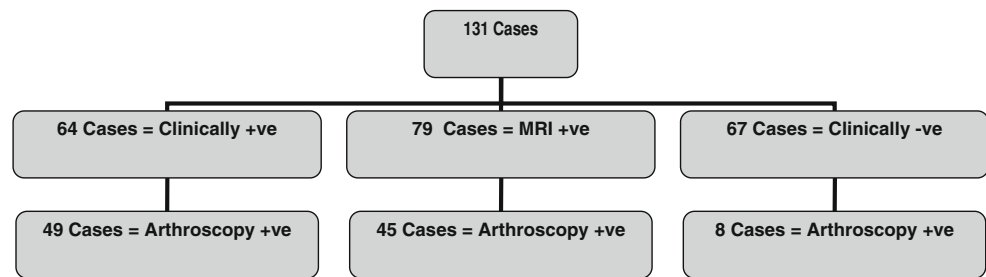
MRI scanning of the knee joint has often been regarded as the noninvasive alternative to diagnostic arthroscopy. In day to day clinical practice, MRI scan is routinely used to support the diagnosis for meniscal or ACL injuries prior to recommending arthroscopic examination and surgery. Identification of meniscal tears can be difficult to interpret and can be observer dependent as well as dependent upon the sensitivity of the scanner. Similar difficulties may exist in clinical examination as well. Our objective was to compare and correlate clinical, MRI, and arthroscopic findings in the diagnosis of meniscal and anterior cruciate ligament (ACL) injuries. Review of the available literature suggests that there are a number of studies looking at two out of the three diagnostic tools (clinical examination, MRI scan, and arthroscopy), so our study was designed to identify correlation of all three methods for all cases in this study.

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**Fig. 1** Medial meniscal tears

## Material and methods

One hundred and eighty-five cases of traumatic meniscal or ACL injuries were identified and prospectively reviewed clinically, with MRI scan followed by arthroscopic surgery. Out of 185 cases, 54 cases were excluded from the study where clinical findings were equivocal and/or MRI scan was inconclusive. One hundred thirty-one patients over 36 months at Kettering general hospital were clinically assessed and operated upon by consultants in this prospective study. All of the 131 patients had suspected traumatic meniscal injury or anterior cruciate ligament injury. Inclusion criteria were all patients with history of injury who underwent both MRI and arthroscopy, patients who failed to show clinical improvement after 3 months, and those who had no additional injury to the knee between the time of MRI/clinical diagnosis and surgery. Patients with degenerative changes or evidence of loose bodies in plain radiographs, any prior surgery for the index diagnosis, and patients treated nonoperatively were excluded from the study.

Clinical criteria used were history, tender joint line, and positive McMurray's test for meniscal injury. Lachman test and anterior drawer test were considered to be essential for clinical diagnosis of anterior cruciate ligament injury. Arthroscopic examinations were carried out as day case procedures under general anaesthesia. Examination under anaesthesia was carried out once again to check for any signs of instability. Record of clinical, MRI, and arthroscopic findings were kept and compared. Arthroscopic findings were regarded as the gold standard.

**Table 1** Diagnostic values of MRI

	Medial meniscal tear	Lateral meniscal tear	ACL tear
Sensitivity	76	61	81
Specificity	52	92	96
Accuracy	63	85	93
+ve Predictive value	57	74	81
-ve Predictive value	73	88	95

## Results

### Medial meniscal injuries

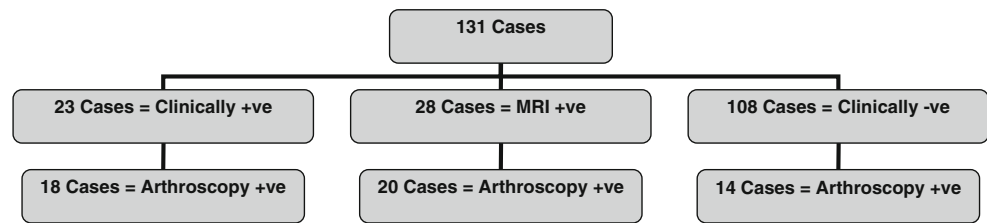
There were 64 cases where clinical diagnosis of medial meniscal tear was suspected (Fig. 1). Out of these 64 cases there were 45 cases where both MRI and arthroscopy were positive in confirming the diagnosis (70.3%). Arthroscopy was positive in 49 cases (76.5%). From a total of 79 cases where MRI scan showed torn medial meniscus, 45 cases confirmed with positive arthroscopic evidence (56.9%). Clinical examination had better sensitivity (0.86 vs. 0.76) and specificity (0.73 vs. 0.52) in comparison to MRI scan in diagnosis for medial meniscal tears. Similarly +ve predictive values (0.76 vs. 0.57) and -ve predictive values (0.83 vs. 0.73) were found to be higher in clinical diagnosis than MRI scan diagnosis for these injuries. Diagnostic accuracy of clinical examination was considerably higher in comparison to MRI (0.79 vs. 0.63) as depicted in Tables 1 and 2.

### Lateral meniscal injuries

There were 23 cases where clinical diagnosis of lateral meniscal tear was suspected (Fig. 2). Out of these 23 cases there were 20 cases where both MRI and arthroscopy were positive in confirming the diagnosis (86.9%). Arthroscopy was positive in 18 cases (78.2%). Of a total of 28 cases where MRI scan showed torn lateral meniscus, 20 cases had positive arthroscopic evidence of it (71.4%). Between clinical examination diagnosis and MRI scan diagnosis for lateral meniscal injuries (Tables 1 and 2), there was

**Table 2** Diagnostic values of clinical examination

	Medial meniscal tear	Lateral meniscal tear	ACL tear
Sensitivity	86	56	77
Specificity	73	95	100
Accuracy	79	85	96
+ve Predictive value	76	78	100
-ve Predictive value	83	87	95

**Fig. 2** Lateral meniscal tears

minimal difference in sensitivity (0.56 vs. 0.61, respectively), specificity (0.95 vs. 0.92), +ve predictive value (0.78 vs. 0.74) and -ve predictive value (0.87 vs. 0.88). Diagnostic accuracy was the same for both the modalities (0.85 vs. 0.85).

### Anterior cruciate ligament injuries

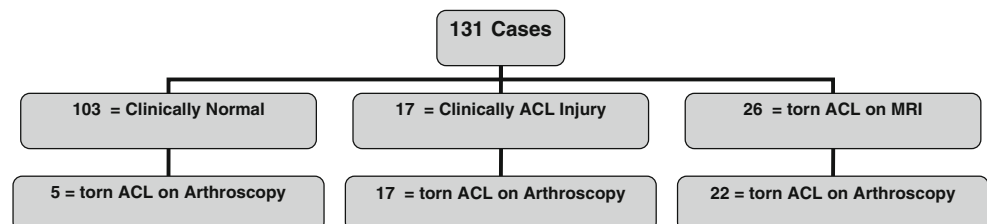
There were 17 cases where ACL injury was suspected clinically (Fig. 3), whereby all of them had ACL injury evident on arthroscopy as well (100%). Out of 26 cases where ACL was found damaged on MRI scan, 22 cases had arthroscopic evidence of ACL injury (84.6%). Five cases out of 103 where clinical ACL was found normal had evidence of injury on arthroscopy. Similar to the lateral meniscal tears, ACL injury diagnosis using clinical examination and MRI scan (Tables 1 and 2), there was marginal difference in sensitivity (0.77 vs. 0.81, respectively), specificity (1.0 vs. 0.96), +ve predictive value (1.0 vs. 0.81), -ve predictive value (0.95 vs. 0.95), and diagnostic accuracy (0.93 vs. 0.96).

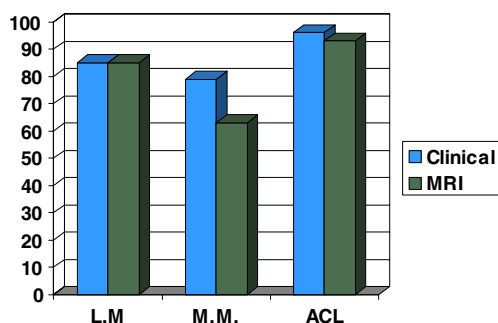
### Discussion

We studied 131 patients who initially had an MRI and then, based on the findings and clinical indications, arthroscopy was conducted. We also analysed several papers comparing MRI scans with arthroscopy for the knee joint. Chang et al. studied findings of 148 patients with figures of 92% for sensitivity and 87% for specificity for meniscal tears [4]. The conclusion was that MRI is a reliable diagnostic tool for displaced meniscal tears. Aydingoz et al. found sensitivity and positive predictive values of 90% in a series of 45 meniscal injuries [2].

De Smet and Graf analysed 400 records and concluded that sensitivity of MRI scans was reduced for meniscal tears in the presence of ACL injury [6]. Reduction of sensitivity was shown to be from 94% to 69% for medial meniscal tears. Munshi et al. studied 23 patients of haemarthrosis who had MRI scans followed by arthroscopy [12]. Higher sensitivity was found and the conclusion was made that prospective use of MRI could have prevented 22% of diagnostic arthroscopic procedures. Jee et al. concluded that MRI in the presence of ACL tears has lower sensitivity for detecting meniscal tears due to missed lateral meniscal tear [7]. Lundberg et al. found sensitivity and specificity of 74% and 66%, respectively, for medial and 50% and 84% for lateral meniscus [10]. They found that MRI could not replace arthroscopy in diagnosis of acute knee injuries. Barronian et al. found 100% sensitivity for medial meniscal tears and 73% for lateral thus finding MRI to be a reliable tool [3].

For Mohan et al., in their retrospective series of 130 patients, diagnostic accuracy of clinical examination was 88% for medial meniscal tears and 92% for lateral meniscal tears; they concluded that clinical diagnosis of meniscal tears is as reliable as the magnetic resonance imaging (MRI) scan [11]. Rose et al. found better diagnostic accuracy clinically than with MRI scans in a series of 100 patients [14]. On the contrary, in a prospective series by Abdon et al., clinical examination had only 61% accuracy for meniscal tears [1]. Cheung et al. interpreted a series of 293 patients finding 89% sensitivity and 84% specificity for medial meniscus injuries [5]. For lateral meniscus, the sensitivity was 72% and specificity 93%. Kelly et al. found high negative predictive value in a series of 60 patients [8]. Rangger et al. studied 121 patients and concluded that MRI should be an essential diagnostic tool before arthroscopy [13]. Barronian et al. found 88% sensitivity and 72%

**Fig. 3** Anterior cruciate ligament injuries



**Fig. 4** Diagnostic accuracy of clinical vs. MRI evaluation in injuries to lateral meniscus (LM), medial meniscus (MM), and anterior cruciate ligament (ACL)

specificity for meniscal injuries concluding that a selective role exists for MRI [3]. Kreitner et al. reevaluated discrepancies in MRI reports and arthroscopic findings. Insufficient arthroscopic evaluation was identified as a further cause for discrepancy [9].

## Conclusion

By obtaining correlation between clinical examination, MRI scan, and arthroscopy for meniscal and ACL injuries, we conclude that carefully performed clinically examination can give equal or better diagnosis of meniscal and ACL injuries in comparison to MRI scan (Fig. 4). MRI scan may be used to rule out such injuries rather than to diagnose them. MRI scan has much better negative predictive value than positive predictive value in both meniscal and ACL injury diagnosis. When clinical signs and symptoms are inconclusive, performing an MRI scan is likely to be more beneficial in avoiding unnecessary arthroscopic surgery. When clinical diagnosis is in favour of either meniscal or ACL injuries, performing an MRI scan prior to arthroscopic examination is unlikely to be of significance. MRI scanning should not be used as a primary diagnostic tool in meniscal and ACL injuries. Bypassing MRI scans and performing arthroscopic examination in suspected cases will be helpful providing earlier treatment of the condition.

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