A COMPARISON OF MRI AND ARTHROSCOPIC FINDINGS OF INTRA-ARTICULAR SOFT TISSUE INJURY OF THE KNEE AT KENYATTA NATIONAL HOSPITAL, KENYA

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ABSTRACT

Background: Musculoskeletal system disorders rank as the second most common cause of disability universally contributing to 169,264,000 Disability-Adjusted Life Years (DALYs). The knee joint is particularly susceptible to injury especially of the ligaments and menisci. A comparison between MRI and arthroscopic findings will help determine the reliability of MRI reports in knee injury patients and guide their management in our setting.

Objective: To compare the MRI and arthroscopic findings of patients with intra-articular soft tissue injury of the knee at Kenyatta National Hospital, Kenya.

Methodology: This was a retrospective cross-sectional study from January 1st 2018 to December 31st 2022. Seventy two participants were recruited for the study and the nature of injuries on MRI and at arthroscopy were analyzed.

Results: MRI had a sensitivity of 83.8%, 87.5%, 100% and 50% for medial meniscal, lateral meniscal, ACL and PCL tears respectively. It had a specificity of 77.1%, 85%, 96.6% and 98.5% for the same. Accuracy was highest for ACL injury detection by MRI (97.2%), followed by PCL injury detection (95.8%), and lateral meniscal tear detection (86.1%). The accuracy of MRI was lowest for medial meniscal injury detection (80.5%).

Conclusion: Overall, MRI and arthroscopy have comparable diagnostic effectiveness for detecting intra-articular soft tissue injuries of the cruciate ligaments as well as high sensitivity, specificity, and accuracy for detecting medial and lateral meniscal tears. These findings suggest that MRI is a useful diagnostic tool in the evaluation of knee injuries and should be carried out in patients presenting with intra-articular soft tissue injuries of the knee.

Key words: MRI, Arthroscopy, Intra-articular, Soft tissue, Injury

INTRODUCTION

Musculoskeletal system disorders rank as the second most common cause of disability universally contributing to 169,264,000 Disability-Adjusted Life Years (DALYs) (1). The knee is prone to a myriad of injuries such as fractures, dislocations and tears due to its complex structure, thin anterior as a result of inadequate muscular coverage in addition to holding up much of the body's weight (2). It is thus important to have confidence in clinical diagnosis of knee injuries in the least invasive, least time-consuming manner with less negative health impacts like radiation.

Since its advent, MRI has become one of the most widely used imaging diagnostic techniques and has cemented itself as being a staple in knee injury diagnostics, with one of its uses being to exclude arthroscopically treatable injuries amongst patients to be subjected to diagnostic arthroscopy reducing the number of unnecessary arthroscopic surgeries. However, several queries still linger as to its accuracy in diagnosing certain soft tissue knee pathologies. Some studies even suggest that MRI does not make a difference in reducing the number of negative arthroscopies and some even report of athletes going back to play with undiagnosed

meniscal injuries on the basis of normal MRI (3–5). There have been many studies that have aimed to show the sensitivity, specificity and accuracy of MRI as a diagnostic tool, many using arthroscopy (a modality used for both diagnostic and treatment purposes of intra-articular soft tissue injuries and widely accepted as the gold standard) as the standard, this study included. There has been varying results across these studies (4,6–8). Most showing comparable sensitivity and specificity between the two diagnostic modalities.

In our study we aim to determine the accuracy of MRI using arthroscopy as the standard in the Kenyan population; where there is a paucity of these data.

MATERIALS AND METHODS

This study was a retrospective cross-sectional study using records for patients who underwent arthroscopy at Kenyatta National Hospital (KNH) from January 1st 2018 to December 31st 2022. In particular, this study was carried out in the records department using files for patients who visited the orthopaedics clinic and subsequently underwent arthroscopy at the hospital.

Study population, eligibility and selection of participants

The study population were patients who had knee MRI showing intra-articular soft tissue injuries and underwent arthroscopy at KNH. To be eligible, the patient had to have an intra-articular soft tissue injury of the knee confirmed using MRI, their file must have the reports present and they underwent arthroscopy of the knee. Moreover, those patients for whom reports of the MRI were not present in the files, who did not undergo arthroscopy and those who had intra-articular knee fractures were excluded from the study. All participants who fit the inclusion criteria were included in the study. Seventy-two participants were recruited for the study with their records were identified, examined and data extracted from their patient records. Data was copied into a database, from which analysis was done.

Statistical analysis of data

The data was crosschecked for inconsistencies before analysis was done using SPSS version 26. Frequency tables were used to describe the categorical variables for the study population. Measures of central dispersion were used to characterize continuous variables. Chi-square test was used to test the associations of categorical data between different variables. The significance level was fixed at 95%, with a p-value less than 0.05 considered significant.

RESULTS

A total of 72 participants were included in this study, with 43 (60%) being male and 29 (40%) being female. The mean age of the participants was 38 years (SD = 13.6), with a median age of 38 years (IQR: 29–47) (Table 1).

Table 1

Demographic characteristics of participants

	Frequency (%)
Gender	
Male	43 (60%)
Female	29 (40%)
Age (years)	
Mean (SD)	38 (13.6)
Median (IQR)	38 (29-47)
Knee injured	
Right knee	41(57%)
Left knee	31(43%)

Of the 72 participants, 39 (54%) had a medial meniscal tear on MRI, while 37 (51%) had a medial meniscal tear on arthroscopy. Similarly, 34 (47%) participants had a lateral meniscal tear on MRI, while 32 (44%) had a lateral meniscal tear on arthroscopy. There was no significant difference in the prevalence of medial or lateral meniscal tears between MRI and arthroscopy (p=0.738).

In terms of cruciate ligament injuries, 28 (39%) participants had an Anterior Cruciate Ligament (ACL) injury on MRI, while 26 (36%) had an ACL injury on arthroscopy. Three (4%) participants had a Posterior Cruciate Ligament (PCL) injury on MRI, while four (6%) had a PCL injury on arthroscopy. There was no significant difference in the prevalence of ACL or PCL injuries between MRI and arthroscopy (p = 0.731 and p = 0.698, respectively). No participant had articular cartilage damage detected on either an MRI or an arthroscopy. There was no significant association between gender and age with the type of intra-articular soft tissue injury detected on either MRI or arthroscopy (Table 2).

Table 2

Chi-square test for association between demographic characteristics and injury type for MRI and arthroscopy

	Medial meniscal tear	Lateral meniscal tear	ACL injury	PCL injury
Gender				
MRI	0.269	0.075	0.396	0.341
Arthroscopy	0.963	0.162	0.445	0.296
Age (years)				
MRI	0.966	0.842	0.816	0.241
Arthroscopy	0.504	0.909	0.574	0.306
Cause of injury				
MRI	0.443	0.450	0.352	0.670
Arthroscopy	0.318	0.362	0.312	0.999

The sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), and accuracy of MRI for detecting different types of intra-articular soft tissue injuries with arthroscopy as the gold standard are presented in Table 3.

Table 3

Comparison of diagnostic effectiveness of MRI for different types of intra-articular soft tissue injuries with arthroscopy as the gold standard

	MRI				
	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Medial meniscus	83.8%	77.1%	79.5%	81.8%	80.5%
Lateral meniscus	87.5%	85.0%	82.3%	89.5%	86.1%
ACL	100%	96.6%	92.9%	100%	97.2%
PCL	50.0%	98.5%	66.7%	97.1%	95.8%

Table 4

Patients with injuries identified on MRI, arthroscopy or both

Patients who had injuries (N=72)	Identified on MRI and confirmed at arthroscopy	Identified on MRI but none at arthroscopy	Not identified on MRI but found at arthroscopy
Medial meniscus	58	8	6
Lateral meniscus	62	6	4
Anterior cruciate ligament	70	2	0
Posterior cruciate ligament	69	1	2

MRI had a sensitivity of 83.8% and specificity of 77.1% for detecting medial meniscal tears. For lateral meniscal tears, MRI had a sensitivity of 87.5% and a specificity of 85.0%. For ACL injuries, MRI had a sensitivity of 100% and a specificity of 96.6%. For PCL injuries, MRI had a sensitivity of 50.0% and specificity of 98.5%.

Accuracy was highest for ACL injury detection by MRI (97.2%), followed by PCL injury detection (80.5%), and lateral meniscal tear detection (86.1%). The accuracy of MRI was lowest for medial meniscal injury detection (80.5%).

Overall, MRI and arthroscopy have comparable diagnostic effectiveness for detecting intra-articular soft tissue injuries of the collateral ligaments. MRI had high sensitivity, specificity, and accuracy for detecting medial and lateral meniscal tear.

DISCUSSION

This study sought to compare the findings of MRI against arthroscopy in detecting intra-articular soft tissue injuries of the knee. This study had a higher percentage of male participants (60%) than female participants (40%). This gender distribution is in line with those reported by Nickinson *et al.* (9), and Ankit *et al.* (10), where a higher percentage of men were detected with these injuries. The right knee was injured more commonly (56%) than the left knee (43%), with only 1% of the participants having injured both knees. This is comparable with the findings from Nickinson *et al*. (9), who also found that the right knee was more commonly injured than the left (9). The mean age of the participants in this study was 38 years old. This reported number is just comparably higher than that of a similar study conducted in Kenya by Ankit *et al*. (10), which reported a mean participant age of 30 years.

The medial meniscus was the most commonly injured structure with 51% of participants having tears to the medial meniscus as evidenced on arthroscopy. The lateral meniscus was torn in 44% of the participants while 36% had an ACL tear. The PCL was least commonly injured intraarticular soft tissue structure within the knee with only 6% of participants having positive arthroscopy indicating a tear. This is in keeping with several studies such as those by Yaqoob *et al.* (11) and Bollen *et al.* (12) that also found that the medial meniscus was most commonly injured.

The study further found that MRI of the knee had a sensitivity of 83.8% for detecting tears of the medial meniscus. This falls within the ranges of similar studies which found sensitivities ranging from 79.4% to 88% (10). Interestingly, Yaqoob *et al*. (11) found 100% sensitivity for medial meniscal tears on MRI in their setup. This is likely due to the relatively low number of participants who had such injuries in their study (11). Similarly, the sensitivity of MRI for detecting lateral meniscus injuries was 87.5% and fell within the reported ranges found in other studies (13,14).

Interestingly, the sensitivity of MRI for diagnosing ACL injuries was 100% in this study. This is higher than most studies (10,15). Šimeček *et al.* (13) demonstrated similarly high sensitivity (93%) for detection of ACL injuries by MRI if both partial and complete ACL tears were combined (13. This similarity is likely due to similar methodology employed in both studies, i.e. both studies employed a retrospective cross-sectional design approach. Possible reasons that the sensitivity was higher in the current study could be that participants were more likely to present to hospital for diagnosis and correction of ACL injuries as opposed to other forms of intra-articular knee soft tissue injuries due to the degree of interference with activities of daily living that ACL injuries pose.

The accuracy of MRI in this study was similar to that found in a systematic review done by Crawford *et al.* (7) in 2007. This study found that MRI had an accuracy of 80.5%, 86.1%, 97.2% and 98.5% for medial meniscus, lateral meniscus, ACL and PCL injuries respectively. This is compared to the accuracy of 86.3%, 88.8% and 93.4% for medial meniscus, lateral meniscus and ACL injuries in the study by Crawford *et al.* (7). In the study by Ankit *et al*. (10) which was also carried out in Kenya, the accuracy of MRI was found to be very low with the reported accuracy for detecting medial meniscus injuries being 47% and those of the lateral meniscus being just 41%. The accuracy of detection of ACL tears was also found to be 23% (10). This difference may be attributed to the improvement of MRI reporting over time between the two studies.

CONCLUSION

In conclusion, our study compared the diagnostic accuracy of MRI and arthroscopy in detecting intra-articular soft tissue injuries of the knee at Kenyatta National Hospital. Our results showed that overall, MRI and arthroscopy have comparable diagnostic effectiveness for detecting intra-articular soft

tissue injuries of the cruciate ligaments as well as high sensitivity, specificity, and accuracy for detecting medial meniscal tears and lateral meniscal tears. These findings suggest that MRI is a useful diagnostic tool in the evaluation of knee injuries. Arthroscopy remains the gold standard for definitive diagnosis and treatment planning. The use of MRI as a primary diagnostic modality can help in early and accurate diagnosis and management of knee injuries, leading to improved patient outcomes.

RECOMMENDATIONS

MRI should be carried out in patients presenting with intra-articular soft tissue injuries of the knee to help establish a diagnosis.

LIMITATIONS

(i) Incomplete and missing records greatly reduced the number of participants that were able to be enrolled in the study.

(ii) MRI report interpretation may vary due to the fact that MRIs were carried out in different centers.

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