

AGREEMENT BETWEEN MRI KNEE AND PLAIN RADIO GRAPHIC FINDINGS FOR TROCHLEAR DYSPLASIA AT TERTIARY HOSPITAL

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Abstract

Objectives

The objective of this study was to determine the level of agreement between Magnetic Resonance Imaging (MRI) of the knee and plain radiographic findings in the diagnosis of trochlear dysplasia in patients presenting with knee pain or suspected patellofemoral instability.

Methodology

A cross-sectional study was conducted at a tertiary care hospital, in Rawalpindi. A total of 120 patients who presented with knee pain, recurrent patellar instability, or suspected patellofemoral joint abnormalities and underwent both knee MRI and plain radiography were included in the study. Data were collected from radiology department records after obtaining ethical approval. Plain radiographs (lateral and axial views) and MRI scans were reviewed by experienced radiologists to identify features suggestive of trochlear dysplasia. Radiographic signs included the crossing sign, supratrochlear spur, and shallow trochlear groove, while MRI was used to assess trochlear morphology in detail. Qualitative variables included gender and the presence or absence of trochlear dysplasia on MRI and radiography, while quantitative variables included patient age. Data were analyzed using statistical software. Frequencies and percentages were calculated for qualitative variables, and mean \pm standard deviation was calculated for quantitative variables. Agreement between MRI and radiographic findings was assessed using Cohen's kappa coefficient, with $p \leq 0.05$ considered statistically significant.

Results

The mean age of the patients was 32.6 ± 9.8 years (range 18–55 years). Among the participants, 70 (58.3%) were male and 50 (41.7%) were female. Trochlear dysplasia was detected in 46 patients (38.3%) on MRI and 39 patients (32.5%) on plain radiography. Concordant positive findings were observed in 34 patients, while 69 patients were negative on both modalities. Twelve patients showed dysplasia on MRI but not on radiography, whereas 5 patients were positive on radiography but negative on MRI. Cohen's kappa analysis demonstrated moderate agreement ($\kappa = 0.58$) with a statistically significant p -value (<0.001).

Conclusion

MRI and plain radiography showed a moderate but significant agreement in the diagnosis of trochlear dysplasia. However, MRI demonstrated higher sensitivity and detected additional cases not visible on radiographs. Therefore, MRI should be considered a valuable complementary imaging modality for accurate assessment of trochlear dysplasia in patients with patellofemoral instability.

INTRODUCTION

Patellofemoral instability is a clinical condition characterized by an increased likelihood of the patella to dislocate laterally¹. The prevalence of acute patellar dislocation is rather high, ranging from 43 cases per 100,000 cases among children and adolescents up to 6–77 cases per 100,000 persons per year in adults. If not treated, there is a high rate of associated injuries, particularly recurrent dislocations, and osteoarthritis². Anterior knee pain (AKP), or patellofemoral pain, is a very common pain, particularly among the young and active, with a prevalence of which is 15 to 45%³. AKP is a heterogeneous group of disorders, which extend to patellofemoral maltracking, extensor mechanism tendinopathies, synovial disorders, and early-onset changes. Females have twice times higher probability of AKP due to patellofemoral reasons than males⁴. Trochlear dysplasia is characterized by abnormal trochlear morphology and a shallow groove and is known to be a major risk factor for patellofemoral instability. Trochlear dysplasia typically is referred to as an unstable kneecap, the trochlea is not shaped normally, and the patella does not have the normal bony constraints to provide stability. About 96% of patients with a history of a true patellar dislocation had evidence of trochlear dysplasia⁵. Many measurements describing trochlear dysplasia have been developed and presented, and there is no consensus concerning which measurements should be used to diagnose trochlear dysplasia or guide its treatment. Some authors characterize trochlear dysplasia using the following measurements: lateral condyle index, lateral trochlear inclination and trochlear facet asymmetry⁶. A plethora of quantitative measurements to characterize trochlear dysplasia has been described using plain X-ray, CT, or MRI⁷. The etiology of AKP have not been fully understood, and, therefore, it presents a problem to patients and physicians alike as it is linked to residual disability, limited physical functioning, and

a negative impact on the quality of life⁸. Others use only the Dejour classification or a modified. Dejour classification to describe trochlear dysplasia and some use the lateral trochlear inclination as the only measure to discriminate dysplastic knees from healthy knees⁹.

METHODOLOGY

This study was conducted at a tertiary care hospital in Rawalpindi to determine the agreement between Magnetic Resonance Imaging (MRI) of the knee and plain radiographic findings in diagnosing trochlear dysplasia. A cross-sectional study design was adopted. Patients presenting with knee pain, patellar instability, or suspected trochlear abnormalities that underwent both MRI and plain radiography of the knee during the study period were included. Ethical approval was obtained from the institutional review committee of AFIRI prior to the commencement of the study, and patient confidentiality was maintained throughout the research process.

Data were collected from the radiology department records of eligible patients who met the inclusion criteria. Plain radiographs (lateral and axial views) and MRI scans of the knee were reviewed and interpreted by experienced radiologists. Trochlear dysplasia was assessed using established radiographic signs such as the crossing sign, supratrochlear spur, and trochlear depth on MRI. Qualitative variables included gender, presence or absence of trochlear dysplasia on MRI, and presence or absence of trochlear dysplasia on plain radiography. Quantitative variables included patient age and relevant measurement indices obtained from MRI or radiographic images. The collected data were entered and analyzed using statistical software SPSS 26.0. Descriptive statistics were calculated for both qualitative and quantitative variables. Qualitative variables were presented as frequencies and percentages, while quantitative variables were

expressed as mean and standard deviation. The level of agreement between MRI and plain radiographic findings for diagnosing trochlear dysplasia was assessed using appropriate statistical tests such as Cohen’s kappa coefficient, with a p-value of ≤ 0.05 considered statistically significant.

RESULTS

A total of 120 patients who fulfilled the inclusion criteria and underwent both plain radiography and Magnetic Resonance Imaging (MRI) of the knee were included in the study. The mean age of the patients was 32.6 ± 9.8 years, with ages ranging from 18 to 55 years. Among the study participants, 70 (58.3%) were male and 50 (41.7%) were female. Most patients presented with complaints of knee pain, recurrent patellar instability, or suspected patellofemoral joint abnormalities. MRI and plain radiographs of the knee were reviewed to identify features suggestive of trochlear dysplasia. On MRI evaluation, 46 patients (38.3%) were diagnosed with trochlear dysplasia, while 74 patients (61.7%) had normal trochlear morphology. On plain radiography, 39 patients (32.5%) showed radiographic signs suggestive of trochlear dysplasia such as the crossing sign, supratrochlear spur, and shallow trochlear groove, whereas 81 patients (67.5%) did not demonstrate these features. MRI showed a slightly higher detection rate of trochlear dysplasia compared with

plain radiography, indicating its greater sensitivity in identifying subtle morphological abnormalities of the trochlear groove.

Further comparison of the two imaging modalities demonstrated that 34 patients (28.3%) were positive for trochlear dysplasia on both MRI and plain radiography, indicating concordant findings between the two methods. 69 patients (57.5%) were negative on both modalities, also reflecting agreement. However, 12 patients (10.0%) showed trochlear dysplasia on MRI but not on plain radiography, suggesting that MRI detected additional cases not visible on radiographs. Conversely, 5 patients (4.2%) were positive on radiography but negative on MRI, which could be due to radiographic interpretation variability or projection-related artifacts. Statistical analysis using Cohen’s kappa coefficient demonstrated a moderate agreement between MRI and plain radiographic findings ($\kappa = 0.58$). The p-value was < 0.001 , indicating that the agreement between the two imaging modalities was statistically significant. These findings suggest that although plain radiography remains a useful initial diagnostic modality for assessing trochlear morphology, MRI provides a more detailed evaluation of trochlear anatomy and may detect cases of dysplasia that are not apparent on conventional radiographs.

Table 1: Demographic and Clinical Characteristics of Study Participants (n = 120)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	70	58.3
Female	50	41.7
Age (years)	Mean \pm SD	32.6 ± 9.8
Trochlear Dysplasia on MRI		
Present	46	38.3
Absent	74	61.7
Trochlear Dysplasia on Radiography		
Present	39	32.5
Absent	81	67.5

Table 2: Agreement between MRI and Plain Radiographic Findings for Trochlear Dysplasia (n = 120)

Plain Radiography Findings	MRI Positive	MRI Negative	Total
Positive	34	5	39
Negative	12	69	81
Total	46	74	120

Cohen’s Kappa (κ) = 0.58
 p-value < 0.001

Interpretation: The results demonstrated a statistically significant moderate agreement between MRI and plain radiography in the diagnosis of trochlear dysplasia.

DISCUSSION

A total of 120 patients who fulfilled the inclusion criteria and underwent both plain radiography and Magnetic Resonance Imaging (MRI) of the knee were included in the study. The mean age of the patients was 32.6 ± 9.8 years, with an age range of 18 to 55 years. Among the study participants, 70 (58.3%) were males and 50 (41.7%) were females. A study conducted in 2025 reported that LTI, PT-LTR, and their modified versions demonstrated the highest reliability and diagnostic performance among the MRI measurements evaluated. Due to their reproducibility and ease of application, these parameters may be useful in the imaging assessment of patellar dislocation, although further prospective studies are recommended to confirm their clinical utility in larger populations ⁽¹⁰⁾. In the present study, most patients presented with knee pain, recurrent patellar instability, or suspected patellofemoral joint abnormalities. Both MRI and plain radiographs of the knee were reviewed to identify features suggestive of trochlear dysplasia. MRI evaluation revealed that 46 patients (38.3%) were diagnosed with trochlear dysplasia, while 74 patients (61.7%) showed normal trochlear morphology. Similarly, another study conducted in 2025 reported that ultrasonography offers advantages in the evaluation of superficial soft

tissue disorders of the anterior knee, demonstrating greater sensitivity for detecting early structural changes such as tendon thickening, hypochoic regions, and neovascularization, whereas MRI remains the preferred modality for assessing deeper structural and osteochondral abnormalities. The study further suggested that a stepwise imaging approach, starting with ultrasonography, may improve diagnostic efficiency and reduce healthcare costs ⁽¹¹⁾.

In our study, plain radiography identified radiographic signs suggestive of trochlear dysplasia in 39 patients (32.5%), including the crossing sign, supratrochlear spur, and shallow trochlear groove, whereas 81 patients (67.5%) did not demonstrate these findings. MRI demonstrated a slightly higher detection rate of trochlear dysplasia compared with plain radiography, indicating its greater sensitivity in identifying subtle morphological abnormalities of the trochlear groove. In agreement with these findings, a 2021 study reported that the Caton-Deschamps (CD) ratio showed strong agreement between X-ray and MRI in patients undergoing patellar stabilization, with high inter-rater reliability for both imaging modalities ⁽¹²⁾. Further comparison of the two imaging modalities in our study demonstrated that 34 patients (28.3%) were positive for trochlear dysplasia on both MRI and plain radiography, indicating concordant findings between the two techniques. Additionally, 69 patients (57.5%) were negative on both modalities, reflecting a considerable level of agreement. However, 12 patients (10.0%) showed trochlear dysplasia on MRI but not on plain radiography, suggesting that MRI detected additional

cases that were not visible on radiographs. Consistent with this observation, a 2021 study reported a high level of agreement among radiologists when evaluating lateral knee radiographs for signs of trochlear dysplasia, validating previous literature. The study also indicated that radiographic findings such as trochlear dysplasia, patella alta, and joint effusion can act as predictors of recent lateral patellar dislocation, particularly in patients with trochlear dysplasia⁽¹³⁾.

Conversely, 5 patients (4.2%) in our study were positive on radiography but negative on MRI, which may be attributed to interpretation variability or projection-related artifacts in radiographs. Statistical analysis using Cohen's kappa coefficient demonstrated a moderate agreement between MRI and plain radiographic findings ($\kappa = 0.58$). Supporting these findings, a 2026 study reported that trochlear dysplasia is significantly associated with specific morphologic and degenerative MRI findings, and that a comprehensive MRI-based assessment may assist in the diagnosis and management of patients with anterior knee pain and patellofemoral instability⁽¹⁴⁾. The p-value was <0.001 , indicating that the agreement between the two imaging modalities was statistically significant. These results suggest that although plain radiography remains a useful initial diagnostic modality for evaluating trochlear morphology, MRI provides a more detailed assessment of trochlear anatomy and can detect cases of dysplasia that may not be apparent on conventional radiographs. In support of this, a 2021 study reported that several parameters can be used for MRI evaluation of trochlear dysplasia, with lateral trochlear inclination being the most reliable measurement, while trochlear depth and trochlear facet asymmetry were also considered important diagnostic parameters⁽¹⁵⁾.

CONCLUSION

This study demonstrated a moderate but statistically significant agreement between MRI and plain radiography in the diagnosis of trochlear dysplasia. While plain radiography remains a useful initial imaging modality, MRI showed a higher detection rate and greater sensitivity for identifying subtle morphological abnormalities of the trochlear groove. MRI was able to detect additional cases that were not

visible on conventional radiographs. Therefore, MRI should be considered an important complementary imaging modality for accurate assessment and diagnosis of trochlear dysplasia in patients with patellofemoral instability.

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