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Prevalence and severity of chondromalacia patella on MRI Knee: A retrospective analysis

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Abstract
Background: Chondromalacia patella (CMP) is a frequent cause of anterior knee pain and may progress to patellofemoral osteoarthritis if undetected. MRI is the imaging modality of choice for non-invasive assessment of patellar cartilage, providing detailed grading and evaluation of associated anatomical risk factors.
Objective: To determine the prevalence and severity of CMP on knee MRI and assess the relationship between cartilage damage and patellofemoral anatomical parameters.
Materials and Methods: A retrospective review was conducted on knee MRI studies performed at a tertiary care center in last 18 months. Patients aged 15 – 75 years with adequate image quality were included; cases with prior patellar surgery or fracture were excluded. Patellar cartilage was graded using the MRI-adapted Outerbridge classification (Grades 0–4). Trochlear dysplasia (Dejour classification), patellar tilt, TT–TG distance, and presence of joint effusion were recorded. Statistical analysis included descriptive statistics, χ^2 tests for categorical variables, and logistic regression to identify predictors of high-grade CMP (Grade ≥3).
Conclusion: CMP is highly prevalent on knee MRI, with a notable proportion demonstrating severe cartilage damage. MRI assessment of patellar cartilage and associated anatomical risk factors can guide early diagnosis, clinical management, and preventive strategies for anterior knee pain.

Keywords: Chondromalacia patella, Anterior knee pain, Knee MRI, Patellofemoral joint, Cartilage degeneration

Introduction

Chondromalacia patella (CMP) refers to softening and degeneration of the articular cartilage of the patella and represents one of the earliest manifestations of patellofemoral cartilage disease [1, 2]. It is a common cause of anterior knee pain, particularly among adolescents, young adults, and physically active individuals [3, 4]. If left undetected and untreated, progressive cartilage degeneration may lead to patellofemoral osteoarthritis and long-term functional impairment [5].

Magnetic resonance imaging (MRI) is the imaging modality of choice for non-invasive assessment of patellar cartilage because of its excellent soft tissue contrast and ability to evaluate cartilage morphology, subchondral bone, and associated patellofemoral alignment abnormalities [6, 7]. MRI also enables accurate grading of cartilage lesions and identification of anatomic risk factors such as trochlear dysplasia, patellar tilt, and increased tibial tubercle–trochlear groove (TT–TG) distance [8, 9],

The clinical diagnosis of CMP is frequently delayed because patients often present with non-specific symptoms of anterior knee pain and physical examination findings may be inconclusive [10]. MRI therefore plays an important role in early diagnosis, characterization of cartilage damage, and treatment planning. Despite the increasing use of MRI, there is limited published data from India regarding the prevalence, severity, and associated anatomical risk factors of CMP on knee MRI. The present study was undertaken to determine the prevalence and severity of CMP and to evaluate the relationship between cartilage damage and patellofemoral anatomical parameters.

Description - Materials & Methods

- **Design:** Retrospective descriptive study.
- **Duration:** From August 2024 to October 2025.
- **Sample:** 119 MRI knee studies (15 – 75 yrs).
- **Exclusion:** Prior patellar surgery/fracture.
- **Imaging:** 1.5 T MRI – axial, sagittal, coronal PD FS sequences, stored in the MEDSYNAPSE system of the Department of Radiodiagnosis, SIMS & RC, Bangalore were reviewed.
- **Analysis:** Outerbridge grading; statistical tests – descriptive, χ^2, logistic regression.

Mri Evaluation Parameters

- Patellar cartilage thickness & signal.
- Patellar tilt angle and TT–TG distance.
- Trochlear depth / dysplasia (Dejour).
- Patella alta (Insall–Salvati index > 1.2).
- Presence of effusion or bone marrow edema.

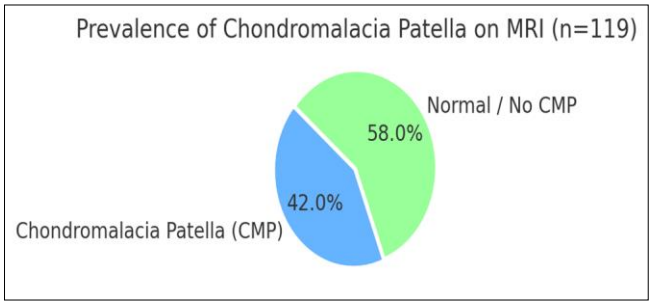
Outerbridge MRI Grading

Grade	MRI Appearance	Interpretation
I	Focal signal increase, intact surface	Softening
II	Fissures < 50% thickness	Mild defect
III	Fissures > 50% thickness	Deep fissure
IV	Full-thickness defect ± bone edema	Severe loss

Discussion

Results - Prevalance

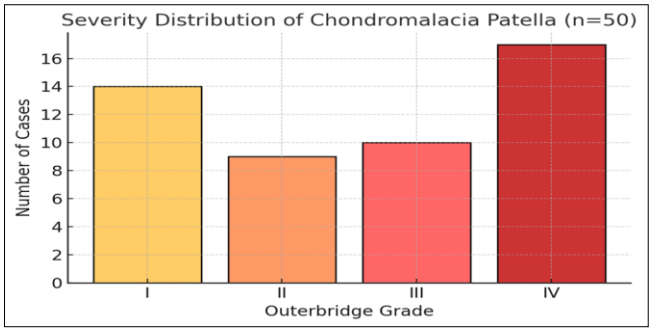
- **Total MRI studies:** 119
- **Positive for CMP:** 50 (42%)
- **Normal / No CMP:** 69 (58%)



Severity Distribution

Grade	Cases (n=50)	% of Positive
I	14	28 %
II	9	18 %
III	10	20 %
IV	17	34 %

High-grade (III–IV): 54 % of positives (23 % overall)

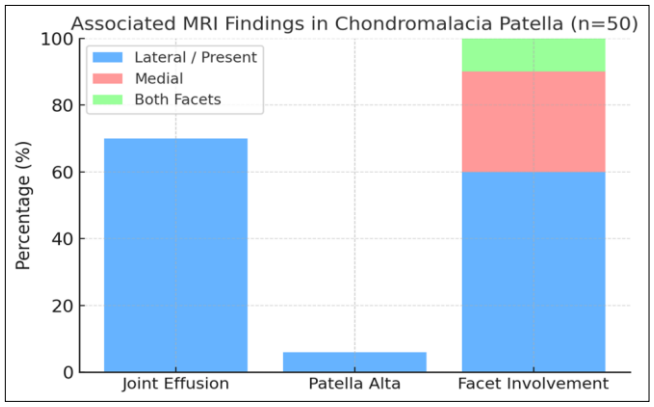


Associated Findings

- **Joint effusion:** 70 %
- **Patella alta:** 6 %

Facet involvement

- Lateral – 60 %
- Medial – 30 %
- Both – 10 %



- CMP prevalence (42%) higher than some international reports (~25–35%).[1]
- Lateral facet predominance consistent with patellofemoral mal tracking.[2]
- MRI enables early identification of high-grade lesions before OA develops. [3]
- Effusion and patella alta are strong indicators of cartilage injury severity. [4]

Clinical Implications

- MRI grading guides management and rehabilitation strategies.
- Early intervention can halt progression to patellofemoral osteoarthritis.
- Imaging parameters help stratify risk and optimize therapy.

Conclusion

- Chondromalacia patella (CMP) detected in 42% of knee studies on MRI.
- High-grade lesions in > 50% of positives.
- Lateral facet and joint effusion are most common associations.
- MRI is a valuable tool for early diagnosis and prevention of anterior knee pain progression.

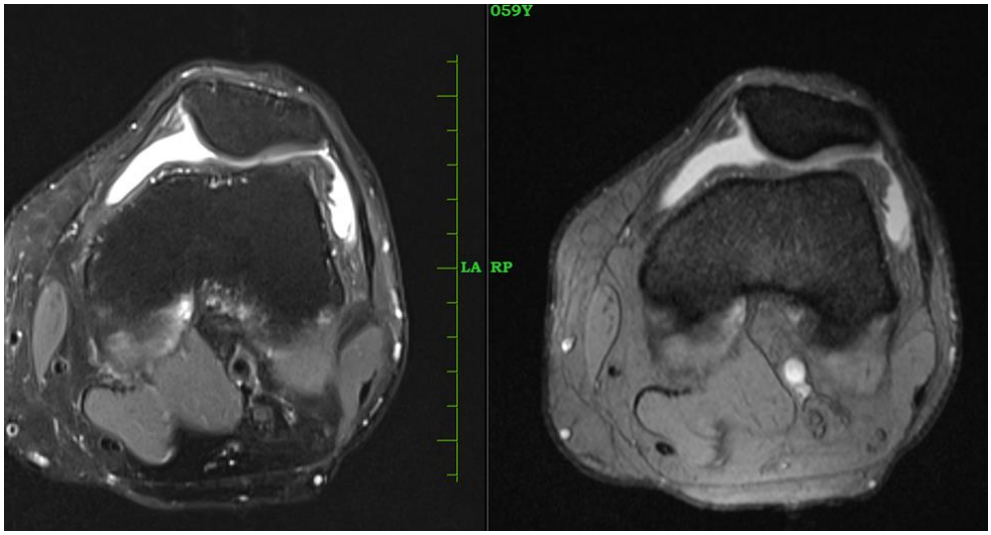


Fig 1: Grade I PDFS, T2 GRE

A 59 year male with Grade 1 chondromalacia patella involving the lateral patellar facet. Mild to moderate prepatellar and infrapatellar bursitis.Mild-to-moderate joint effusion present. Lateral patellar facet is mildly thickened and shows increased signal intensity.

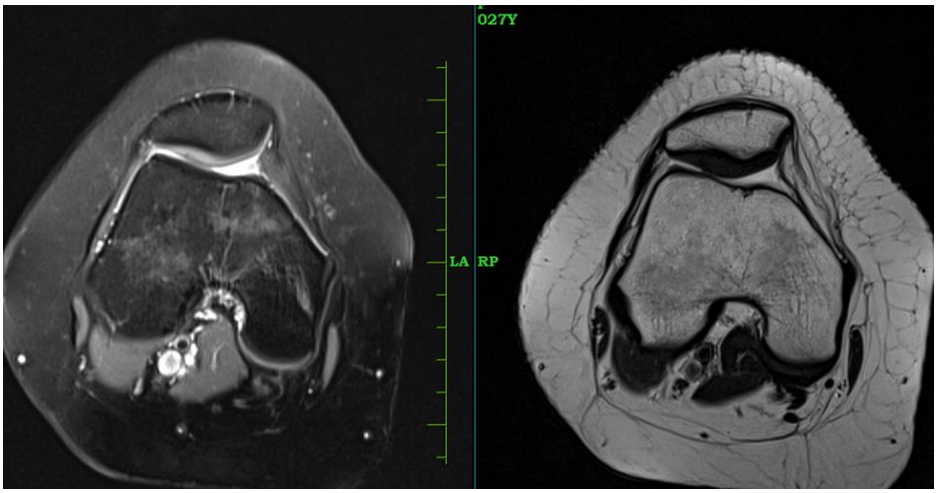
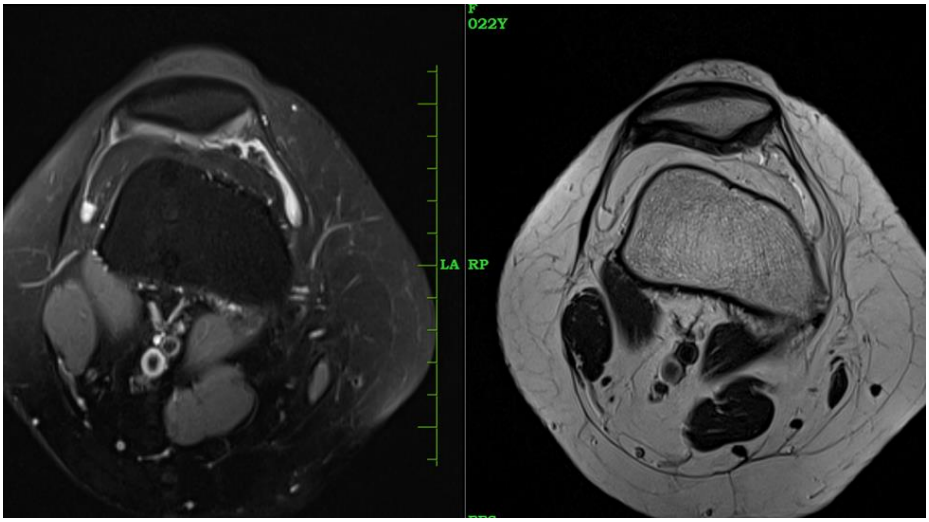


Fig 2: Grade II

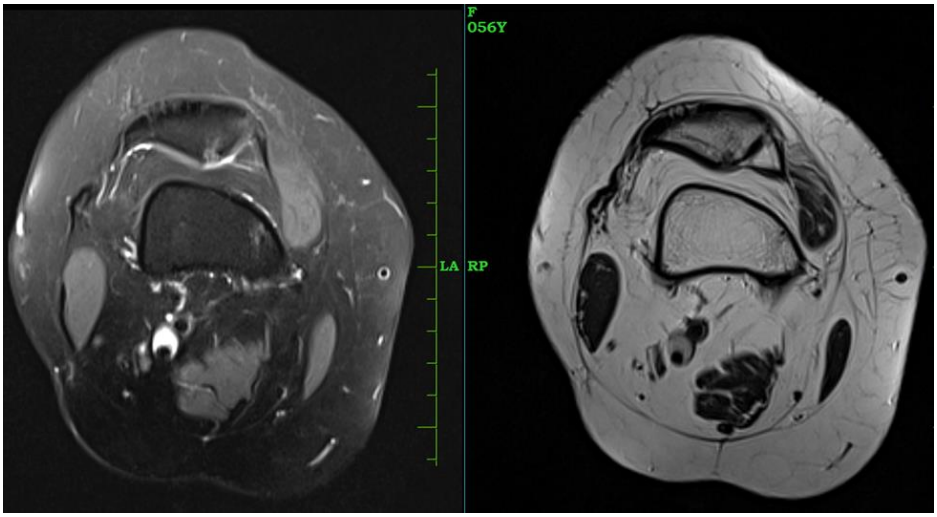
A 29 year female with Chondromalacia patella (Modified Outerbridge grade II) along with minimal joint effusion.



PDFS T2 grade III

Fig 3: Grade III

A 27 year female Grade 3 chondromalacia patellae (Modified Outerbridge grading of chondromalacia) with low grade fissure and scarring in the mid third of the articular cartilage close to the apex along with minimal knee joint effusion.



PDFS T2W

Fig 4: Grade IV

A 56 year old female with full-thickness cartilage defect in posteromedial patellar cartilage with associated bone marrow edema – Grade IV chondromalacia patella.

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