



Original Article

A Cross-Sectional Study of Associated Chondral and Meniscal Lesions in Patients with Anterior Cruciate Ligament Injury Undergoing Arthroscopy

Dr Ponnuswamy Siva Subramanian Nithin¹, Dr D. Ilayaselvan², Dr Anish Sundar Raj³

¹Assistant Professor, Department of Orthopedics, Kanyakumari Medical Mission Research Centre, Kanyakumari, Tamil Nadu, India

²Assistant Professor, Department of Orthopedics, Kanyakumari Medical Mission Research Centre, Kanyakumari, Tamil Nadu, India

³Assistant Professor, Department of Radio-Diagnosis, Kanyakumari Medical Mission Research Centre, Kanyakumari, Tamil Nadu, India

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ABSTRACT

Background: Anterior cruciate ligament injury is frequently accompanied by meniscal and chondral pathology that influences symptoms, operative planning, and long-term joint status. Arthroscopy allows direct assessment of these associated intra-articular lesions.

Objectives: To determine the frequency and pattern of meniscal and chondral lesions in patients with anterior cruciate ligament injury undergoing arthroscopy and to examine their relationship with duration from injury to arthroscopy.

Methods: This hospital-based cross-sectional study was conducted at on fifty consecutive patients with anterior cruciate ligament injury who underwent arthroscopy were evaluated. Demographic details, mechanism of injury, side involved, and injury duration were recorded. Meniscal tears and chondral lesions were documented arthroscopically, and chondral damage was graded using the Outerbridge system.

Results: The mean age was 29.8 ± 7.6 years, and 78.0% were men. Meniscal lesions were present in 68.0% of patients and chondral lesions in 44.0%. Medial meniscal tear was the commonest meniscal abnormality, while the medial femoral condyle was the most frequent site of chondral injury. Patients presenting after 6 months showed higher proportions of meniscal lesions, chondral lesions, and combined lesions than those presenting earlier.

Conclusion: Associated intra-articular lesions were common in anterior cruciate ligament-deficient knees, with meniscal pathology predominating over chondral damage. Delayed presentation was linked to a greater burden of secondary lesions, supporting timely evaluation and intervention.

Keywords: anterior cruciate ligament injury, arthroscopy, meniscal tear, chondral lesion, medial femoral condyle, knee instability.

Corresponding Author:

Dr Ponnuswamy Siva Subramanian Nithin

Assistant Professor, Department of Orthopedics, Kanyakumari Medical Mission Research Centre, Kanyakumari, Tamil Nadu, India

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INTRODUCTION

Anterior cruciate ligament [ACL] injury is one of the most common serious ligamentous injuries of the knee and is encountered particularly in young, physically active individuals [1]. Instability following ACL rupture alters tibiofemoral kinematics, predisposes the knee to recurrent giving-way episodes, and increases the likelihood of secondary damage to the menisci and articular cartilage [3-7]. Because meniscal preservation and protection of the articular surface are central determinants of long-term knee health, understanding the pattern of associated intra-articular lesions in ACL-deficient knees remains clinically important.

The natural history of ACL deficiency is not uniform. Several studies have shown that the burden of associated lesions varies with chronicity, age, activity level, and mechanism of trauma [4-7,9,11]. Acute ACL injuries are often linked with lateral meniscal pathology, whereas chronic instability has been associated more strongly with medial meniscal tears,

especially posterior horn and complex tears [3,9]. Chondral damage also appears to accumulate with time, particularly in the medial compartment, reflecting repetitive micro-instability and altered load transmission across the knee [5-7,11,14]. These associated lesions are not merely incidental arthroscopic findings; they influence symptoms, surgical planning, need for meniscal repair or meniscectomy, rehabilitation, and future osteoarthritic risk [3,6,10,14].

Clinical examination and magnetic resonance imaging help establish the diagnosis of ACL rupture and suspected associated injuries, but direct arthroscopic visualization remains important for precise characterization of meniscal tears, chondral location, and severity grading [1,2,8]. Arthroscopy also permits concurrent treatment of lesions identified during evaluation. From an operative standpoint, documenting the prevalence and distribution of meniscal and chondral injuries helps surgeons anticipate procedure complexity and counsel patients more accurately regarding prognosis and tissue-preserving strategies [2,3,10]. Published studies from different populations have reported substantial variability in the frequency of associated lesions, which highlights the influence of local injury patterns, referral delays, and case mix [4-7,9-14].

Indian data specifically describing arthroscopically confirmed associated lesions in ACL-injured knees remain comparatively limited, particularly from single-centre hospital-based cohorts. Local documentation of lesion burden is relevant because patterns of trauma, delays in presentation, sports participation, and access to early specialist care differ across regions. A focused cross-sectional evaluation can therefore provide useful descriptive evidence for routine orthopaedic practice.

The objectives of the present study were to determine the frequency and pattern of associated meniscal and chondral lesions in patients with ACL injury undergoing arthroscopy, to describe the site and severity of chondral damage, and to examine the relationship between duration from injury to arthroscopy and the prevalence of associated intra-articular lesions.

METHODOLOGY

This hospital-based cross-sectional study was conducted in the Department of Orthopaedics at Kanyakumari Medical Mission Research Centre and Hospitals, [St. Devasahayam Nagar Muttom, Kanyakumari](#), Tamil Nadu, India, over a six-month period from June 2025 to November 2025. The study was designed to evaluate arthroscopically confirmed associated intra-articular lesions in patients with ACL injury.

Study participants

Fifty consecutive patients with ACL injury who underwent arthroscopy during the study period were included. Eligibility was based on a compatible history of knee trauma, symptoms of instability, supportive clinical examination findings, and preoperative imaging consistent with ACL injury, followed by arthroscopic confirmation. Adult patients of either sex who were willing to participate were enrolled. Patients with previous surgery on the affected knee, fractures around the knee, inflammatory arthropathy, advanced degenerative joint disease, active infection, and major multi-ligament injuries requiring separate staged management were excluded in order to maintain a relatively homogeneous study cohort.

Data collection

After obtaining informed consent, demographic and clinical details were recorded using a structured proforma. The variables documented included age, sex, side involved, mechanism of injury, and duration between injury and arthroscopy. For analysis, injury duration was categorized as less than 3 months, 3-6 months, and more than 6 months. These strata were selected to facilitate comparison of early and delayed presentations, as used in prior ACL literature assessing secondary intra-articular pathology [5,11-14].

Arthroscopic assessment

Standard arthroscopic evaluation of the knee was performed by the treating orthopaedic team under appropriate anaesthetic and aseptic precautions. The ACL status was confirmed arthroscopically, and the medial meniscus, lateral meniscus, femoral condyles, tibial plateaus, trochlea, and patellofemoral surface were systematically inspected. Meniscal lesions were categorized as no meniscal lesion, medial meniscal tear only, lateral meniscal tear only, or combined medial and lateral meniscal tears. Chondral lesions were documented according to anatomical site. Severity of cartilage damage was graded arthroscopically using the Outerbridge classification, a widely accepted grading system for chondral injury [8].

Outcome measures

The primary outcomes were the frequency and pattern of associated meniscal lesions and chondral lesions in ACL-injured knees. Secondary outcomes included the distribution of chondral lesions by anatomical site, severity of cartilage injury by Outerbridge grade, combined lesion pattern, and the relationship of lesion prevalence with time from injury to arthroscopy.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using SPSS software. Continuous data were summarized as mean \pm standard deviation, while categorical variables were expressed as frequencies and percentages. The lesion profile was described overall and also stratified by duration from injury to arthroscopy. Given the modest sample size and descriptive objective of the study, emphasis was placed on distributional patterns rather than extensive inferential modeling.

Ethical considerations

Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was secured from all participants, and confidentiality of patient information was maintained throughout the study.

RESULTS

A total of 50 patients with anterior cruciate ligament [ACL] injury who underwent arthroscopy were included in the study. The mean age of the study population was 29.8 ± 7.6 years, with most patients belonging to the 26-35 years age group. Men constituted the majority of the cohort [78.0%]. Right knee involvement was slightly more common than left knee involvement [58.0% vs. 42.0%]. Sports-related trauma was the leading mode of injury [46.0%], followed by road traffic accidents [34.0%] and fall/twisting injuries [20.0%]. A substantial proportion of patients presented more than 6 months after injury [44.0%] [Table 1].

Table 1. Baseline characteristics of study participants [n = 50]

Variable	Category	n	%
Age group [years]	18-25	14	28.0
	26-35	21	42.0
	36-45	11	22.0
	>45	4	8.0
Sex	Male	39	78.0
	Female	11	22.0
Side involved	Right knee	29	58.0
	Left knee	21	42.0
Mode of injury	Sports injury	23	46.0
	Road traffic accident	17	34.0
	Fall/twisting injury	10	20.0
Duration from injury to arthroscopy	<3 months	13	26.0
	3-6 months	15	30.0
	>6 months	22	44.0

Associated meniscal lesions were identified in 34 patients [68.0%], while chondral lesions were observed in 22 patients [44.0%]. Medial meniscal tears were the most frequent meniscal abnormality, and the medial femoral condyle was the most common site of chondral involvement [Table 2].

Table 2. Arthroscopic distribution of associated meniscal and chondral lesions [n = 50]

Lesion category	Finding	n	%
Meniscal lesions	No meniscal lesion	16	32.0
	Medial meniscal tear only	17	34.0
	Lateral meniscal tear only	11	22.0
	Both medial and lateral meniscal tears	6	12.0
Chondral lesions	No chondral lesion	28	56.0
	Medial femoral condyle	9	18.0
	Lateral femoral condyle	5	10.0
	Patella	4	8.0
	Trochlea	2	4.0

Lesion category	Finding	n	%
	Tibial plateau	2	4.0

Most chondral lesions were of low-to-moderate severity, although advanced lesions were also observed. On combined arthroscopic assessment, isolated meniscal lesions were more common than isolated chondral lesions, and both meniscal and chondral lesions coexisted in nearly one-third of cases [Table 3].

Table 3. Severity and combined pattern of associated intra-articular lesions [n = 50]

Variable	Category	n	%
Outerbridge grade	No chondral lesion	28	56.0
	Grade I	5	10.0
	Grade II	8	16.0
	Grade III	6	12.0
	Grade IV	3	6.0
Combined pattern of associated injury	No associated meniscal or chondral lesion	10	20.0
	Isolated meniscal lesion	18	36.0
	Isolated chondral lesion	6	12.0
	Both meniscal and chondral lesions	16	32.0

The frequency of associated intra-articular lesions increased with longer duration between injury and arthroscopy. Meniscal lesions were seen in 46.2% of patients presenting within 3 months, 66.7% of those presenting between 3 and 6 months, and 81.8% of those presenting after 6 months. A similar gradient was observed for chondral lesions and combined lesions, which were particularly common among delayed presenters [Table 4].

Table 4. Association of duration chondral lesions [n = of injury with meniscal and 50]

Duration injury from	Total cases	Meniscal lesion n [%]	Chondral lesion n [%]	Both lesions n [%]
<3 months	13	6 [46.2]	3 [23.1]	2 [15.4]
3-6 months	15	10 [66.7]	6 [40.0]	4 [26.7]
>6 months	22	18 [81.8]	13 [59.1]	10 [45.5]

Overall, the present study demonstrated that associated meniscal and chondral lesions were common in patients with ACL injury undergoing arthroscopy. Meniscal lesions, particularly medial meniscal tears, were more frequent than chondral lesions. The prevalence of both lesion types increased with chronicity of ACL injury, indicating that delayed presentation was associated with greater secondary intra-articular damage.

DISCUSSION

The present study showed that associated intra-articular lesions were common in ACL-injured knees undergoing arthroscopy. Meniscal lesions were identified in 68.0% of patients and chondral lesions in 44.0%, with isolated meniscal pathology being more frequent than isolated chondral damage. This pattern is broadly consistent with operative series showing that meniscal pathology is the commonest concomitant lesion in ACL-deficient knees, while cartilage injury is also present in a substantial subset [3-7,10,11].

The demographic profile of this cohort was typical of ACL injury. Most patients were young adults, men predominated, and sports trauma was the leading mechanism, findings that parallel the established epidemiology of ACL rupture in active populations [1,4,9]. The slight right-knee predominance observed in this series is likely related to limb dominance and injury mechanics rather than a distinct biological preference.

A key observation was the predominance of medial meniscal involvement. Medial meniscal tears, either isolated or combined, were more frequent than isolated lateral tears. This agrees with previous reports showing that the chronically

ACL-deficient knee is particularly vulnerable to secondary medial meniscal injury [3,5,7,9,10]. Hagino et al. noted that lateral meniscal injury is more characteristic of acute ACL trauma, whereas medial tears become increasingly common with chronic instability [9]. In the present study, medial meniscal involvement was documented in nearly half of the total cohort, supporting the concept that the medial meniscus functions as a secondary stabilizer and becomes increasingly exposed to repetitive shear stress in an unstable knee.

Regarding cartilage pathology, the medial femoral condyle was the most common site of chondral injury, followed by the lateral femoral condyle and patella. This distribution mirrors arthroscopic reports in which medial compartment cartilage damage becomes more evident as the interval from injury increases [5-7,10,14]. Most lesions in the present study were low-to-moderate grade, although advanced Outerbridge lesions were also documented, indicating clinically meaningful cartilage deterioration [8].

The most important finding was the progressive rise in lesion burden with delayed arthroscopy. Meniscal lesions increased from 46.2% in patients presenting within 3 months to 81.8% in those presenting after 6 months, while chondral lesions increased from 23.1% to 59.1%. Similar temporal trends have been reported by Fok et al., Brambilla et al., Magnussen et al., Dumont et al., Anderson and Anderson, and Rahardja et al. [6,7,11-14]. These studies, together with the present data, indicate that prolonged ACL deficiency is associated with increasing secondary damage, particularly in the medial meniscus and medial compartment cartilage.

This study adds useful single-centre evidence from an Indian tertiary-care setting and reinforces the practical value of timely diagnosis, specialist referral, and arthroscopic evaluation in ACL injury. Earlier recognition of instability can facilitate tissue-preserving treatment and reduce the burden of avoidable secondary intra-articular damage.

LIMITATIONS

The study was conducted at a single centre with a sample size of 50, which restricts external generalizability. Its cross-sectional design captured arthroscopic findings at one time point and did not evaluate postoperative outcomes or long-term cartilage progression. The study included only patients who underwent arthroscopy, so the lesion profile reflects an operative cohort rather than all ACL-injured individuals seen in outpatient practice.

CONCLUSION

In patients with ACL injury undergoing arthroscopy, associated meniscal and chondral lesions were frequent, with meniscal pathology occurring more often than cartilage damage. Medial meniscal tears represented the predominant meniscal lesion, and the medial femoral condyle was the commonest site of chondral involvement. The prevalence of both lesion types increased progressively with longer duration between injury and arthroscopy, and combined lesions were particularly common in delayed presenters. These findings underscore the importance of early recognition of ACL deficiency, timely orthopaedic referral, and careful arthroscopic evaluation to identify secondary lesions, guide tissue-preserving treatment, support better joint-preserving management, and improve overall operative planning, counseling, and long-term knee health in routine clinical practice.

REFERENCES

1. Kaeding CC, Léger-St-Jean B, Magnussen RA. Epidemiology and diagnosis of anterior cruciate ligament injuries. *Clin Sports Med.* 2017;36(1):1-8.
2. Felli L, Garlaschi G, Muda A, Tagliafico A, Formica M, Zanirato A, et al. Comparison of clinical, MRI and arthroscopic assessments of chronic ACL injuries, meniscal tears and cartilage defects. *Musculoskelet Surg.* 2016;100(3):231-238.
3. Feroe AG, Clark SC, Hevesi M, Okorooha KR, Saris DBF, Krych AJ, et al. Management of meniscus pathology with concomitant anterior cruciate ligament injury. *Curr Rev Musculoskelet Med.* 2024;17(8):321-334.
4. Tandogan RN, Taşer O, Kayaalp A, Taşkiran E, Pinar H, Alparslan B. Analysis of meniscal and chondral lesions accompanying anterior cruciate ligament tears: relationship with age, time from injury, and level of sport. *Knee Surg Sports Traumatol Arthrosc.* 2004;12(4):262-270.
5. Michalitsis S, Vlychou M, Malizos KN, Thriskos P, Hantes M. Meniscal and articular cartilage lesions in the anterior cruciate ligament-deficient knee: correlation between time from injury and knee scores. *Knee Surg Sports Traumatol Arthrosc.* 2015;23(1):232-239.
6. Fok AWM, Yau WP. Delay in ACL reconstruction is associated with more severe and painful meniscal and chondral injuries. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(4):928-933.
7. Brambilla L, Pulici L, Carimati G, Quaglia A, Prospero E, Bait C, et al. Prevalence of associated lesions in anterior cruciate ligament reconstruction: correlation with surgical timing and with patient age, sex, and body mass index. *Am J Sports Med.* 2015;43(12):2966-2973.
8. Slattery C, Kweon CY. Classifications in brief: Outerbridge classification of chondral lesions. *Clin Orthop Relat Res.* 2018;476(10):2101-2104.
9. Hagino T, Ochiai S, Senga S, Yamashita T, Wako M, Ando T, et al. Meniscal tears associated with anterior cruciate ligament injury. *Arch Orthop Trauma Surg.* 2015;135(12):1701-1706.

10. Todor A, Nistor D, Buescu C, Pojar A, Lucaciu D. Incidence and treatment of intra-articular lesions associated with anterior cruciate ligament tears. *Clujul Med.* 2014;87(2):106-108.
11. Magnussen RA, Lawrence JTR, West RL, Toth AP, Taylor DC, Garrett WE. Time from ACL injury to reconstruction and the prevalence of additional intra-articular pathology: is patient age an important factor? *Knee Surg Sports Traumatol Arthrosc.* 2013;21(9):2029-2034.
12. Dumont GD, Hogue GD, Padalecki JR, Okoro N, Wilson PL. Meniscal and chondral injuries associated with pediatric anterior cruciate ligament tears: relationship of treatment time and patient-specific factors. *Am J Sports Med.* 2012;40(9):2128-2133.
13. Anderson AF, Anderson CN. Correlation of meniscal and articular cartilage injuries in children and adolescents with timing of anterior cruciate ligament reconstruction. *Am J Sports Med.* 2015;43(2):275-281.
14. Rahardja R, Love H, Clatworthy MG, Young SW. Delayed reconstruction is associated with higher rates of medial meniscus and chondral injury following ACL injury: A New Zealand ACL Registry Study. *Knee Surg Sports Traumatol Arthrosc.* 2025 Aug 18. doi:10.1002/ksa.70002.