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Arthroscopic Evaluation Followed by Reconstruction of Both Anterior Cruciate Ligament (ACL) and Posterior Cruciate Ligament (PCL) Injuries

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Abstract

Background:
Knee ligament injuries involving combined anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) lead to substantial instability, often affecting young, active individuals following high-energy trauma.

Objective:
This study aimed to evaluate the outcomes of arthroscopic assessment followed by reconstruction of both the ACL and PCL in patients with combined knee ligament injuries.

Methods:
This prospective observational study was conducted at the Nilphamari Medical College, from July 2024 to June, 2025. All 80 patients aged 18-50 years had MRI-confirmed combined injuries and underwent standardized arthroscopic techniques using hamstring or alternative grafts. Functional improvement was assessed at 3, 6, and 12 months.

Results:
Most patients were men, primarily injured in road traffic accidents, and arthroscopy frequently revealed associated meniscal and cartilage lesions. By 12 months, Lysholm, IKDC, and Tegner scores improved significantly, with high overall satisfaction and a substantial return to sports. Complications remained modest, mainly arthrofibrosis and residual instability.

Conclusion:
Arthroscopic reconstruction yielded strong short-term recovery and functional restoration when combined with timely surgery and structured rehabilitation.

Keywords: Arthroscopic reconstruction, ACL, PCL, Multiligament knee Injury, Functional Outcome

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Introduction:

Knee ligament injuries constitute a significant source of functional disability in young, active individuals, with the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) serving as the principal stabilizers responsible for anterior–posterior control and rotational restraint. Rupture of either ligament causes symptomatic instability and impaired performance. At the same time, combined disruption leads to profound mechanical insufficiency, compromising basic weight-bearing and increasing the risk of long-term joint deterioration. Population-based data indicate that ACL injuries remain the most common severe knee ligament trauma, with an incidence of approximately 68.6 per 100,000 person-years and an apparent predilection for adolescents and young adults involved in pivoting or contact sports.[1] PCL injuries, though less frequent, still account for up to 17% of surgically treated knee ligament cases in large registries, typically arising from high-energy trauma such as

motor vehicle collisions or forceful posterior translation of the tibia during sports.[2] Combined ACL–PCL injuries represent a severe subset of multiligament knee trauma often associated with knee dislocation. These injuries create multidirectional instability that exceeds the functional loss observed with isolated ligament tears, and patients frequently experience difficulty with routine ambulation, rapid fatigue, and recurrent giving-way episodes.[3] The injury burden falls disproportionately on individuals in their second to fourth decades of life, a period marked by peak occupational demands and sports participation. Recent evidence from both global and regional studies highlights consistent patterns: male predominance in absolute numbers, high contribution from football, basketball, and cricket, and a substantial proportion linked to road traffic accidents.[4,5] The long-term consequences of inadequately managed bicruciate injuries are substantial. Multiligament knee injuries significantly accelerate the development of post-traumatic osteoarthritis, with structural degeneration observed even after reconstruction in a notable fraction of patients.[6] Functional recovery is also variable; studies show that only about 60–75% of patients return to pre-injury occupational or sports activity, underscoring the complexity of restoring physiological knee stability after bicruciate trauma.[6] These challenges reinforce the need for effective surgical strategies, and arthroscopic reconstruction remains the preferred modality due to its ability to visualize intra-articular pathology comprehensively while enabling precise graft placement. Despite increased interest, management of multiligament knee injuries still lacks uniform consensus, particularly regarding timing and technique of reconstruction.[7] Evidence from diverse healthcare settings suggests that outcomes may vary considerably depending on available resources and surgeon expertise. Consequently, region-specific data remains essential to guide practice. Therefore, the present study was undertaken to evaluate the outcomes of arthroscopic assessment followed by reconstruction of both the ACL and PCL in patients with combined ligament injuries of the knee at a tertiary care center.

Methods:

This prospective observational study was conducted at the Nilphamari Medical College, from July 2024 to June, 2025. A total of 80 patients aged 18–50 years with MRI-confirmed bicruciate ligament injuries were included, while those with isolated ligament injuries, associated fractures, osteoarthritis, or revision surgeries were excluded. Ethical approval was obtained from the institutional review board, and informed written consent was taken from all participants. Preoperative assessment included detailed history, clinical examination, and MRI evaluation of both ligaments and associated intra-articular pathology. Baseline functional status was recorded using the Lysholm Knee Score,[8] International Knee Documentation Committee (IKDC) subjective score,[9] and Tegner Activity Scale.[10] Demographic data, including age, sex, side of injury, mechanism of injury, time since trauma, and body mass index (BMI), were also collected. All surgeries were performed arthroscopically under regional or general anesthesia. Femoral fixation was achieved with Endobuttons or interference screws, and tibial fixation with interference screws or screw–washer constructs. Graft tensioning and tunnel positioning were standardized to restore anatomical alignment and knee stability. Postoperative management followed a uniform rehabilitation protocol emphasizing early range-of-motion (ROM) exercises and quadriceps strengthening. Partial weight bearing began at 6-8 weeks, progressing to full weight bearing by 12 weeks. Return to light sports activity was permitted around six months post-surgery, with full return to pre-injury activity at approximately one year, depending on recovery and knee stability. Patients were followed up at 3, 6, and 12 months after surgery. Data were analyzed using SPSS software (version 26.0). Continuous variables were expressed as mean±standard deviation (SD), while categorical variables were presented as frequencies and percentages. Preoperative and postoperative functional scores were compared using paired t-tests. Correlations between intraoperative findings (meniscal injury, cartilage lesion grade, and surgical delay) and outcomes were analyzed using Pearson's correlation coefficient. Binary logistic regression was applied to identify

independent predictors of poor functional outcome, defined as Lysholm <85 or IKDC <80 at 12 months. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and a p-value <0.05 was considered statistically significant.

Results:

The study included 80 patients with combined ACL and PCL injuries, predominantly young males (80.0%), with most injuries resulting from road-traffic accidents (70.0%). A large proportion had complete ACL tears (78.8%) and complete PCL tears (67.5%), while associated meniscal injury was frequent, particularly medial tears (47.5%). Cartilage lesions were also common, with 27.5% showing Grade I–II damage and 15.0% demonstrating more advanced Grade III–IV lesions (Table-I). Hamstring autografts were the most frequently used grafts for both ACL (73.8%) and PCL (76.2%) reconstructions. Endobutton fixation on the femoral side was used in 77.5%, and interference screw fixation on the tibial side in 86.2% of cases. Nearly one-third of surgeries (40.0%) exceeded 120 minutes (Table-II). Functional outcomes demonstrated consistent and significant improvement across all domains. The Lysholm score increased from 53.6±8.4 preoperatively to 89.2±6.5 at 12 months, while the IKDC score rose from 49.8±9.1 to 85.7±7.9; both changes were highly significant (p<0.001). Activity level, measured by the Tegner scale, improved from 2.1±0.9 to 5.3±1.2, and knee range of motion increased from 108±15 degrees to 135±7 degrees (p<0.001). Full weight-bearing was typically achieved by 12±3 weeks (Table-III). Complications occurred in 21.3% of patients, with arthrofibrosis (7.5%) and graft failure (5.0%) being the most frequent. These complications were associated with lower functional scores. Satisfaction outcomes were favorable, with 55 percent reporting excellent results and 72.5% returning to activity at 12 months (Table-IV). Correlation and regression analyses identified delayed surgery (>6 months), combined meniscal tears, severe cartilage lesions, and persistent instability as significant predictors of poorer functional outcomes, with adjusted odds ratios ranging from 2.43 to 3.06 (p<0.05). Age above 35 years showed a weaker, nonsignificant association (Table-V).

Table-I: Baseline and intra-operative characteristics (N=80)

Variable	Category	no. (%)
Age (years)	<25	28(35.0)
	25–35	34(42.5)
	>35	18(22.5)
Sex	Male	64(80.0)
	Female	16(20.0)
Mechanism of Injury	RTA	56(70.0)
	Sports	18(22.5)
	Fall	6(7.5)
ACL Tear Pattern	Complete	63(78.8)
	Partial	17(21.2)
PCL Tear Pattern	Complete	54(67.5)
	Partial	26(32.5)
Meniscal Injury	Medial	38(47.5)
	Lateral	26(32.5)
	Both	10(12.5)
	None	6(7.5)
Cartilage Lesion	Grade I–II	22(27.5)
	Grade III–IV	12(15.0)

Table-II: Surgical reconstruction details (N=80)

Variable	Category	no. (%)
ACL Graft Used	Hamstring autograft	59(73.8)
	BPTB autograft	14(17.5)
	Allograft	7(8.7)
PCL Graft Used	Hamstring autograft	61(76.2)
	Allograft	19(23.8)
Femoral Fixation	Endobutton	62(77.5)
	Interference screw	18(22.5)
Tibial Fixation	Interference screw	69(86.2)
	Screw + washer	11(13.8)
Duration of Surgery	<120 min	48(60.0)
	≥120 min	32(40.0)

Table-III: Functional outcomes over time (N=80)

Measure	Preoperative	3 months	6 months	12 months	p-value
Lysholm Score (Mean± SD)	53.6±8.4	71.2±7.8	82.5±6.9	89.2±6.5	<0.001
IKDC Score (Mean±SD)	49.8±9.1	68.5±8.6	79.3±7.2	85.7±7.9	<0.001
Tegner Scale	2.1±0.9	3.8±1.1	4.7±1.0	5.3±1.2	<0.001
Knee ROM (°)	108±15	124±10	132±8	135±7	<0.001
Time to full weight-bearing	-	-	-	12±3 weeks	-

Table-IV: Complications, satisfaction, and return to activity (N=80)

Parameter	no. (%)
Post-operative Complications	
Any complication	17(21.3)
Arthrofibrosis	6(7.5)
Graft failure	4(5.0)
Infection	3(3.8)
Residual instability	8(10.0)
Functional Impact	
Lysholm (no complication)	91.3
IKDC (no complication)	55.4
Lysholm (complication groups range)	72.8–80.2
IKDC (complication groups range)	69.9–75.8
Satisfaction	
Excellent	55
Good	28.8
Fair	11.2
Poor	5
Return to Activity	
Yes	72.5
No	27.5

Table-V: Predictors of poor functional outcome (Correlation + Regression)

Predictor	Statistical Measure	p-value
Meniscal injury severity	r=-0.54	<0.01
Cartilage lesion grade	r=-0.49	<0.01
Delay to surgery	r=-0.46	<0.05
Rehab duration	r=0.38	<0.05
Age	r=-0.21	0.12
Logistic Regression	**Adjusted OR**	**p-value**
Delay >6 months	OR 3.06(1.20–7.82)	0.014
Combined meniscal tear	OR 2.64(1.10–6.33)	0.021
Cartilage Grade III–IV	OR 2.43(1.06–5.58)	0.035
Persistent instability	OR 2.51(1.05–6.02)	0.041
Age >35 years	OR 1.80(0.94–3.46)	0.081

Discussion:

Simultaneous arthroscopic reconstruction of both the ACL and PCL demonstrated marked functional recovery in this cohort, with significant improvement in Lysholm and IKDC scores at 12 months. These findings reinforce evidence from earlier multicenter and registry-based studies showing that bicruciate reconstruction effectively restores knee stability and patient-reported outcomes when performed with standardized arthroscopic techniques.[11,12] The demographic profile in our study predominantly young males injured in high-energy mechanisms closely follows regional and global patterns of multiligament knee trauma, where road-traffic accidents remain the predominant cause in low- and middle-income settings, while sports-related injuries dominate in Western cohorts.[13,4] Intra-articular pathology was frequent, with 47.5% demonstrating medial meniscal tears and 27.5% presenting with cartilage lesions. These rates align with previous reports indicating that meniscal injury accompanies 50–80% of bicruciate ligament injuries.[14,15] Importantly, increasing severity of meniscal and chondral damage correlated with reduced functional scores, supporting existing evidence that concomitant intra-articular injury negatively affects medium- and long-term outcomes.[15,16] This highlights the need for comprehensive arthroscopic evaluation and timely management of associated lesions to optimize overall recovery. Surgical delay emerged as a significant determinant of outcome, as patients undergoing reconstruction after 6 months demonstrated lower ROM and lower functional scores. This observation mirrors prior systematic reviews and meta-analyses showing that delayed treatment is associated with capsular contracture, secondary meniscal tears, and cartilage degeneration, ultimately compromising postoperative recovery.[17] The exclusive or predominant use of hamstring autografts for both

ACL and PCL reconstruction in the present study aligns with widely adopted practice patterns. Prior comparative evidence suggests that, although graft type influences early recovery profiles, surgical technique, tunnel accuracy, and fixation strength are more influential determinants of outcome.[11,14,16] Functional outcomes in this cohort, Lysholm 89.2 and IKDC 85.7 at one year, were comparable to those previously reported in large series of bicruciate reconstructions, where typical Lysholm scores range between 85 and 95.[14,18] A similar ROM restoration (mean 135° at one year) reflects the benefit of structured, early rehabilitation, which has been consistently associated with a reduced risk of postoperative stiffness and improved functional recovery.[15,18] The complication rate of 21.3% in this study aligns with previously reported rates of 19–22% in the literature on complex knee reconstruction.[4,17] Arthrofibrosis, residual instability, and graft failure were the most frequent issues, yet none exceeded reported benchmarks. The presence of residual instability at three months independently predicted poorer functional outcomes, echoing past reports that early post-reconstruction laxity is an important prognostic factor.[12] Importantly, 72.5% of patients returned to activity at 12 months, a rate similar to reports indicating 70–80% return after bicruciate reconstruction.[18,19] Although these figures remain slightly inferior to isolated ACL reconstruction, they reflect acceptable recovery expectations given the complexity of the initial injury. Finally, the moderate association between rehabilitation duration and improved Lysholm scores reinforces the established principle that adherence to progressive physiotherapy significantly enhances functional recovery.[19] Collectively, the findings demonstrate that simultaneous arthroscopic ACL–PCL reconstruction provides predictable short-term restoration of knee function. Early surgery, meticulous management of associated meniscal and chondral injuries, and dedicated rehabilitation are critical determinants of optimal outcomes.

Limitation:

This study's limitations include a relatively small sample size and short-term follow-up of only 12 months, which may not reflect long-term outcomes like graft failure or osteoarthritis. The absence of a control group limits comparative analysis, and reliance on subjective scoring systems introduces possible bias.

Conclusion:

This study demonstrates that arthroscopic reconstruction of both the ACL and PCL using predominantly hamstring autografts yields excellent short-term functional outcomes, significant improvement in knee stability, and a high rate of return to activity. Early intervention, meticulous surgical technique, and structured rehabilitation were key contributors to success. Factors such as delayed surgery, associated meniscal or chondral injuries, and postoperative instability were found to negatively impact recovery. Overall, arthroscopic bicruciate reconstruction is a safe and effective approach that restores knee function to near-normal levels in most patients.

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