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Outcome of arthroscopic evaluation followed by reconstruction of anterior cruciate ligament injury

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Abstract

Background: Anterior cruciate ligament (ACL) injury is a common cause of knee instability, especially among young and athletic individuals. Arthroscopic ACL reconstruction is the gold-standard treatment, offering reliable restoration of knee stability and function.

Methods: This prospective observational study was conducted at the Nilphamari Medical College, from July 2024 to June 2025. The study involved skeletally mature patients with confirmed ACL tears and symptomatic instability who underwent arthroscopic reconstruction using hamstring or patellar tendon autografts with standardized rehabilitation. Functional outcomes (Lysholm, International Knee Documentation Committee [IKDC], Tegner scores, knee motion, muscle strength, return to sport) and complications were assessed. Data were analyzed using SPSS v26, with $P < 0.05$ considered statistically significant.

Results: Most patients were young males (20–39 years) with sports-related ACL injuries, predominantly affecting the right knee. Complete ACL tears were common (82.9%), and over half had associated meniscal injuries. Hamstring autograft was the preferred graft in most cases. Postoperatively, there was a significant improvement in functional outcomes, with Lysholm, IKDC, and Tegner scores all increasing markedly, along with better knee flexion and quadriceps strength. Early complications were minor and infrequent, while late complications such as graft failure and stiffness were rare. Regression analysis showed that meniscal and cartilage injuries, delayed surgery, and poor rehabilitation compliance negatively impacted outcomes, whereas regular rehabilitation significantly improved post-operative recovery.

Conclusion: Arthroscopic ACL reconstruction is a safe and effective procedure that restores knee stability and function with significant improvement in clinical scores. Outcomes depend on timely surgery, management of associated injuries, and consistent rehabilitation.

Keywords: Anterior cruciate ligament reconstruction, Arthroscopic surgery, Functional outcomes and Hamstring autograft

Introduction

Anterior cruciate ligament (ACL) injury is one of the most frequent and functionally disabling knee injuries in both athletic and general populations. It typically results from sudden deceleration, pivoting, or awkward landings, leading to pain, instability, and loss of knee function.[1] ACL tears account for a large proportion of sports-related knee injuries and often require surgical reconstruction to restore joint stability and prevent secondary intra-articular damage.[2] The ligament plays a critical role in preventing anterior translation and rotational instability of the tibia; thus, its disruption leads to

recurrent giving-way episodes and an increased risk of meniscal and chondral injury.[3] Globally, the annual incidence of ACL injuries is estimated at 68.6/100,000 person-years, with roughly 200,000 ACL reconstructions performed annually in the United States.[4] The increasing participation in competitive and recreational sports has contributed to a steady rise in ACL injuries across all age groups.[5] The burden is exceptionally high among athletes involved in pivoting and cutting sports such as football, basketball, and soccer.[6] Female athletes are disproportionately affected, with a 2–4-fold higher risk of ACL injury compared to males in the same sporting events, attributed to anatomical, hormonal, and neuromuscular differences.[7] In South Asia, including Bangladesh, the epidemiology of ACL injuries shows both similarities and contextual differences compared to Western countries. Regional studies report that the majority of patients are young males aged between 20 and 30 years, reflecting the high participation of this demographic in sports and physically demanding occupations.[8] In Bangladesh, over 90% of ACL injury patients are male, with the peak incidence occurring in the third decade of life.[9] Sports-related trauma remains the leading cause of injury (approximately 60%), followed by road traffic accidents and falls.[9,10] The higher proportion of trauma-related ACL injuries compared with Western populations likely reflects regional lifestyle factors, transportation patterns, and occupational hazards. ACL injuries impose profound functional limitations, especially for young, active individuals. Instability following ACL rupture predisposes patients to repeated meniscal tears and chondral injuries, accelerating degenerative changes and the onset of osteoarthritis.[11] Arthroscopic ACL reconstruction has become the gold-standard treatment to restore knee stability and allow a return to pre-injury activity levels.[12] This minimally invasive approach permits simultaneous diagnosis and management of concomitant intra-articular lesions, such as meniscal and cartilage injuries, in a single session.[13] Successful reconstruction not only improves knee kinematics but also reduces the likelihood of secondary damage and long-term degenerative changes.[14] Despite advances in surgical techniques, outcomes remain variable. Around 70–75% of athletes return to sport following ACL reconstruction, but fewer than half regain their previous competitive level.[15,16] Younger athletes are particularly prone to reinjury, with recurrence rates reported as high as 20%.[17] Furthermore, psychosocial barriers such as fear of reinjury and limited post-operative rehabilitation support contribute to suboptimal recovery, particularly in low-resource settings.[18] Although numerous studies have investigated ACL reconstruction outcomes in developed countries, limited evidence is available from low- and middle-income nations such as Bangladesh.[8,9] Most published data are small, single-center studies lacking long-term follow-up or standardized outcome measures. Furthermore, resource constraints, variations in surgical expertise, and limited access to physiotherapy may influence treatment success in ways not captured by Western studies. Consequently, extrapolating global data to the South Asian context may be misleading. There remains a pressing need for region-specific outcome studies to evaluate how local patient demographics, injury mechanisms, and healthcare systems affect results. Understanding ACL injury outcomes in Bangladesh is essential to inform clinical practice and optimize patient care. Therefore, this study aimed to evaluate the outcomes of arthroscopic evaluation followed by reconstruction of ACL injuries in a Bangladeshi tertiary care setting.

Methods

This prospective observational study was conducted at Nilphamari Medical College, Nilphamari, Bangladesh, from July 2024 to June 2025. All participants had clinically and radiologically confirmed ACL tears and fulfilled the inclusion criteria of being skeletally mature individuals with symptomatic instability following trauma. Patients with associated fractures, revision ACL reconstruction, or significant comorbidities were excluded from the study. A detailed history and physical examination were performed, followed by arthroscopic evaluation to assess the extent of ACL tear, meniscal injury, cartilage lesion, and

synovial condition. Reconstruction was performed using either hamstring tendon autograft or bone–patellar tendon–bone–bone autograft, depending on intraoperative findings and surgeon preference. Standard post-operative rehabilitation protocols were applied, focusing on early mobilization, range-of-motion exercises, and progressive muscle strengthening.

Functional outcomes were assessed preoperatively and postoperatively at regular follow-up using the Tegner Knee Scoring Scale,[19] International Knee Documentation Committee (IKDC) Subjective Knee Score,[20] and Lysholm Knee Scoring Scale.[21] Additional parameters such as knee range of motion, quadriceps strength, and time to return to sports were recorded. Complications were documented during the early and late post-operative periods. Ethical approval was obtained from the institutional review committee, and informed consent was secured from all participants.

Data were analyzed using SPSS (version 26.0). Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequency and percentage. Paired-sample t-tests were applied to compare pre- and post-operative functional scores. Associations between categorical variables were assessed using the Chi-square test. To identify independent predictors of post-operative outcomes, multivariable linear regression analysis was performed separately for Lysholm and IKDC scores. Predictor variables included the type of ACL tear, presence of meniscal injury, cartilage lesion grade, delay from injury to surgery, and rehabilitation compliance. Regression coefficients (β), 95% confidence intervals (CI), *t*-values, and *P*-values were calculated. A $P < 0.05$ was considered statistically significant.

Results

In this study, most of the participants were aged 20–29 years (45.7%), followed by 30–39 years (31.4%), with fewer patients below 20 years or aged ≥40 years (both 11.4%). Males predominated (74.3%) compared to females (25.7%). The right knee was more frequently affected (57.1%) than the left (42.9%). Sports-related injuries were the most common cause (60%), followed by road traffic accidents (25.7%) and falls from height (11.4%). Regarding the time from injury to surgery, 40% underwent surgery within 3 months, while 37.1% waited 3–6 months, and 22.9% more than 6 months. Over half of the patients (57.1%) had an associated meniscal tear, while 31.4% had no associated injury, and 11.4% had collateral ligament involvement [Table 1].

The majority of cases involved complete ACL tears (82.9%), while partial tears accounted for 17.1%. Meniscal injuries were common, with medial meniscus tears observed in 37.1% of patients, lateral tears in 14.3%, and both medial and lateral involvement in 5.7%; however, 42.9% had no meniscal tear. Most patients (65.7%) had

Table 1: Baseline characteristics of patients undergoing arthroscopic ACL reconstruction (*n*=70)

Variable	Category	Frequency (*n*)	Percentage
Age (years)	<20	8	11.4
	20–29	32	45.7
	30–39	22	31.4
	≥40	8	11.4
Sex	Male	52	74.3
	Female	18	25.7
Laterality	Right knee	40	57.1
	Left knee	30	42.9
Mechanism of Injury	Sports-related	42	60.0
	Road traffic accident	18	25.7
	Fall from height	8	11.4
	Other	2	2.9
Duration from injury to surgery	<3 months	28	40.0
	3–6 months	26	37.1
	>6 months	16	22.9
Associated Injuries (exclusive)	None	22	31.4
	Meniscal tear	40	57.1
	Collateral ligament injury	8	11.4

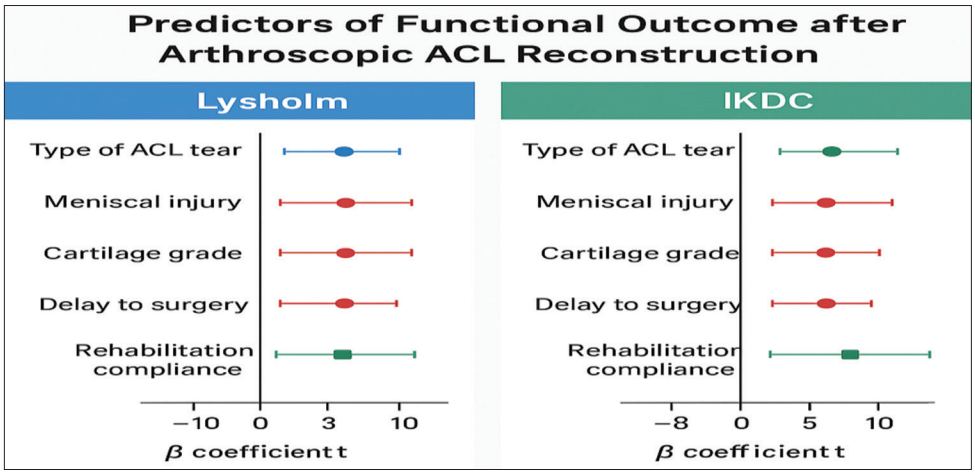

Figure 1: Predictors of Functional Outcome after Arthroscopic Reconstruction of the Anterior Cruciate Ligament. This figure illustrates the multivariable regression analysis assessing independent predictors of post-operative knee function in 70 patients who underwent arthroscopic anterior cruciate ligament (ACL) reconstruction. Panel A (Lysholm Score) and Panel B (International Knee Documentation Committee Score) both demonstrate that meniscal injury, higher cartilage grade, and longer delay to surgery were significantly associated with lower functional outcomes, as indicated by negative β coefficients. In contrast, regular rehabilitation compliance showed a strong positive β coefficient, highlighting its crucial role in improving post-operative recovery. The type of ACL tear (partial vs. complete) showed a mild, non-significant negative effect in both models. The visual comparison confirms that both Lysholm and International Knee Documentation Committee models exhibit consistent trends, emphasizing that early surgical intervention and structured rehabilitation programs are key to achieving optimal functional recovery after ACL reconstruction [Figure 1]

no cartilage lesion (Outerbridge Grade 0), whereas 22.9% exhibited mild-to-moderate lesions (Grades I–II), and 11.4% had severe lesions (Grades III–IV). Synovial reactions were predominantly moderate (48.6%), followed by mild (34.3%) and severe (17.1%) changes. Regarding graft selection, hamstring autograft was the most frequently used (77.1%), followed by patellar tendon autograft (20.0%) and allograft (2.9%) [Table 2].

The mean Lysholm Knee Score increased markedly from 55.2 ± 9.8 preoperatively to 89.1 ± 6.7 postoperatively (mean difference = +33.9, $P < 0.001$). Similarly, the Tegner Activity Scale improved from 3.1 ± 1.0 to 5.8 ± 1.1 (mean difference = +2.7, $P < 0.001$), reflecting enhanced activity levels. The IKDC Subjective Score rose from 54.0 ± 10.5 to 87.5 ± 7.3 (mean difference = +33.5, $P < 0.001$), indicating better perceived knee function. Objective measures also showed notable gains: mean knee flexion improved from 110° ± 15° to 132° ± 10° (mean difference = +22°, $P < 0.001$), and quadriceps strength increased from 3.6 ± 0.5 to 4.6 ± 0.4 (mean difference = +1.0, $P < 0.001$). These findings collectively demonstrate significant post-operative functional recovery following ACL reconstruction [Table 3].

Early complications were relatively infrequent, with pain and swelling reported in 17.1% of patients, hemarthrosis in 5.7%, and superficial infection in 4.3%. The majority (72.9%) experienced no early complications. Late complications were uncommon, with graft failure occurring in 2.9%, stiffness or loss of motion in 7.1%, and persistent instability in 4.3%, whereas 85.7% had no late issues. Most patients (80%) were compliant with regular rehabilitation protocols, while 20% followed rehabilitation irregularly. Regarding return to sports, over half of the patients (51.4%) resumed activity within 6–12 months post-surgery, 31.4% returned within 6 months, and 17.1% either required more than 12 months or had not returned to sports [Table 4].

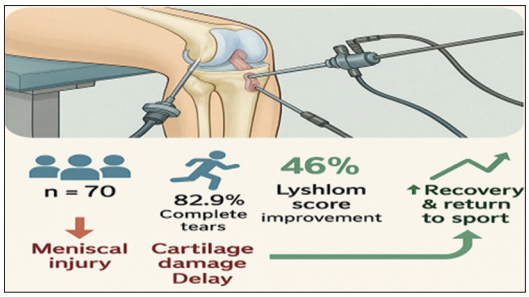

Figure 2: Predictors Influencing Functional Recovery after Arthroscopic anterior cruciate ligament (ACL) Reconstruction. This infographic visually summarizes the clinical findings from a 70-patient analysis of arthroscopic ACL reconstruction outcomes. It highlights that meniscal injury, cartilage damage, and delayed surgery are major negative predictors of post-operative recovery, each contributing to reduced knee stability and slower functional improvement. Conversely, regular rehabilitation compliance is a strong positive determinant, significantly improving Lysholm scores, promoting return to sport, and enhancing overall recovery. The illustration emphasizes that optimal outcomes depend not only on the surgical technique but also on timely intervention and structured post-operative physiotherapy. Together, these findings reinforce a multifactorial approach addressing both intra-articular pathology and patient adherence to achieve the best possible functional restoration after ACL reconstruction [Figure 2]

The model intercept was 92.3 (95% CI: 85.3–99.4, $P < 0.001$), representing the baseline score for the reference group. Complete ACL tears were associated with a borderline reduction in Lysholm score ($\beta = -3.2$, $P = 0.052$). The presence of a meniscal injury significantly decreased the post-operative score by an average of 4.8 points ($\beta = -4.8$, $P = 0.010$), while each unit increase in cartilage lesion grade corresponded to a 2.1-point reduction ($\beta = -2.1$, $P = 0.004$). A longer delay to surgery was also linked to poorer outcomes ($\beta = -0.45$ per month delay, $P = 0.015$). In contrast, regular rehabilitation compliance emerged as a strong positive predictor, improving the Lysholm score by approximately 6.2 points ($\beta = +6.2$, $P = 0.002$) [Table 5].

The model intercept was 90.5 (95% CI: 82.9–98.1, $P < 0.001$), representing the baseline IKDC score for the reference group. Complete ACL tears showed a nonsignificant negative trend toward lower scores ($\beta = -2.8$, $P = 0.104$). In contrast, the presence of a meniscal injury significantly reduced post-operative IKDC scores by 4.5 points on average ($\beta = -4.5$, $P = 0.021$). Similarly, higher cartilage lesion grades were associated with poorer outcomes, showing a 1.9-point decrease per grade increase ($\beta = -1.9$, $P = 0.017$). Each month of surgical delay was linked to a 0.38-point reduction in the IKDC score ($\beta = -0.38$, $P = 0.028$), indicating the adverse effect of prolonged intervals between injury and surgery. Conversely, regular rehabilitation compliance was a strong positive predictor, improving scores by 5.8 points ($\beta = +5.8$, $P = 0.005$) [Table 6].

Table 2: Arthroscopic findings and graft choices (n=70)

Variable	Findings	Frequency (n)	Percentage
Type of ACL tear	Partial	12	17.1
	Complete	58	82.9
Meniscal involvement	Medial meniscus tear	26	37.1
	Lateral meniscus tear	10	14.3
	Both medial and lateral	4	5.7
	None	30	42.9
Cartilage lesion (Outerbridge)	Grade 0	46	65.7
	Grade I–II	16	22.9
	Grade III–IV	8	11.4
Synovial reaction	Mild	24	34.3
	Moderate	34	48.6
	Severe	12	17.1
Graft used	Hamstring autograft	54	77.1
	Patellar tendon autograft	14	20.0
	Allograft	2	2.9

Discussion

The demographic profile in this study, showing a predominance of young adult males and sports-related ACL tears, aligns closely with global trends.[22,23] The mean age (~27 years)

Table 3: Functional outcomes before and after ACL reconstruction (*n*=70)

Outcome measure	Pre-operative (Mean±SD)	Post-operative (Mean±SD)	Mean difference	*P*-value
Lysholm knee score (0–100)	55.2±9.8	89.1±6.7	+33.9	<0.001
Tegner activity scale (0–10)	3.1±1.0	5.8±1.1	+2.7	<0.001
IKDC subjective score (0–100)	54.0±10.5	87.5±7.3	+33.5	<0.001
Knee range of motion, flexion (°)	110±15	132±10	+22	<0.001
Quadriceps strength (MRC 0–5)	3.6±0.5	4.6±0.4	+1.0	<0.001

Testing: Paired comparisons; values reflect clinically meaningful gains across all domains

Table 4: Post-operative complications, rehabilitation compliance, and return-to-sport (*n*=70)

Variable	Category	Frequency (*n*)	Percentage
Early complications	Pain and swelling	12	17.1
	Superficial infection	3	4.3
	Hemarthrosis	4	5.7
	None	51	72.9
Late complications	Graft failure	2	2.9
	Stiffness/loss of motion	5	7.1
	Persistent instability	3	4.3
	None	60	85.7
Rehabilitation compliance	Regular	56	80.0
	Irregular	14	20.0
Return to sports (months)	<6 months	22	31.4
	6–12 months	36	51.4
	>12 months/ not returned	12	17.1

Totals for early complications may exceed 70 because some patients experienced>1 early event

and male majority (74%) are comparable to a recent multicenter study reporting a mean age of 29.7 years and 93% male participants.[22] Sports trauma, particularly pivoting movements, remains the leading cause of ACL injury.[23] Our observation of right knee predominance (57%) parallels findings by Rai *et al*., who reported up to 78% right-sided injuries, possibly related to limb dominance.[24] Surgical timing varied in our cohort, with over one-third delayed beyond six months. Delayed reconstruction was associated with worse Lysholm and IKDC scores, corroborating findings by Forsythe *et al*.,[25] who demonstrated poorer outcomes when surgery was delayed beyond six months. Similarly, Shen *et al*.[26] reported slightly superior functional outcomes with early ACL reconstruction (<6 months). These findings emphasize the importance of timely surgical intervention to prevent secondary intra-articular damage. Most patients (83%) had complete ACL tears, comparable to previous series where complete ruptures comprised the majority.[24] Associated injuries were common 57% had meniscal tears, and 11% had collateral ligament injury. This agrees with other studies where 21–64% of ACL reconstructions had concomitant meniscal pathology.[27] Our predominance of medial meniscus tears (37%) is consistent with prior literature showing higher rates of medial involvement due to chronic instability.[28] Cartilage lesions were present in 34% of patients, consistent with a study by Wang *et al*.[29] Both meniscal and chondral injuries significantly reduced post-operative functional scores, consistent with Motiffard *et al*.[22] and Everhart *et al*.,[30] who found that these associated lesions predict inferior outcomes. While long-term studies show that full-thickness cartilage lesions may not affect 10-year outcomes,[28] short-term recovery, as seen here, is clearly impacted. Our findings reinforce the importance of meniscal preservation and chondral management during ACL reconstruction to optimize outcomes.[27,28] Hamstring autografts were used in 77% of patients, aligning with global practice trends where hamstring grafts account for 70–90% of ACL reconstructions.[24] Although bone–patellar tendon-bone (BTB) grafts remain a strong alternative, contemporary evidence suggests comparable long-term outcomes between BTB

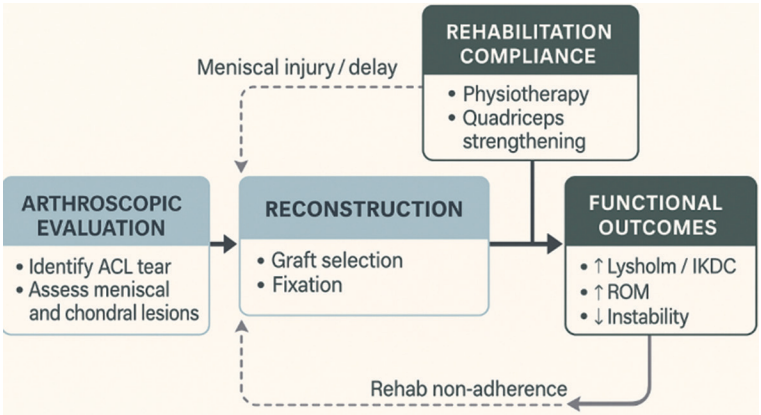

Figure 3: Determinants of Functional Recovery after Arthroscopic anterior cruciate ligament (ACL) Reconstruction. This conceptual framework illustrates the overall process and key determinants influencing outcomes following arthroscopic ACL reconstruction. The pathway begins with arthroscopic evaluation, where ACL tears and associated meniscal or chondral lesions are identified. This leads to the reconstruction phase, emphasizing optimal graft selection and fixation technique. Postoperatively, rehabilitation compliance including physiotherapy and quadriceps strengthening acts as the strongest positive determinant of recovery. Adverse factors such as meniscal injury, cartilage damage, delay to surgery, or rehabilitation non-adherence negatively influence the chain, leading to suboptimal results. When all components align, patients achieve improved Lysholm and International Knee Documentation Committee scores, increased range of motion, and reduced knee instability [Figure 3]

Table 5: Multivariable linear regression analysis for predictors of post-operative Lysholm knee score (*n*=70)

Predictor variable	β coefficient	Standard error	95% confidence interval	*t*-value	*P*-value	Interpretation
Constant (Intercept)	92.3	3.5	85.3–99.4	26.4	<0.001	Baseline score for reference group
Type of ACL Tear (complete=1)	−3.2	1.6	−6.4–0.1	−1.98	0.052	Borderline lower score in complete tears
Meniscal Injury (yes=1)	−4.8	1.8	−8.3–−1.3	−2.67	0.010	Significantly reduced functional outcome
Cartilage Grade (per unit increase)	−2.1	0.7	−3.5–−0.7	−3.00	0.004	Higher grade→lower score
Delay to Surgery (months)	−0.45	0.18	−0.81–−0.09	−2.50	0.015	Delay associated with poorer recovery
Rehabilitation Compliance (regular=1)	+6.2	1.9	+2.3–+10.1	+3.26	0.002	Strong positive predictor of outcome

and hamstring grafts.[31] However, BTB grafts carry a higher risk of anterior knee pain, while hamstring grafts are associated with less donor-site morbidity.[31] Our high post-operative stability rate (>95%) supports prior studies showing excellent outcomes with modern anatomic arthroscopic techniques.[24] This underscores the effectiveness of both graft types when applied appropriately within anatomical reconstruction principles. Functional recovery in our cohort was substantial: Lysholm scores improved from 55.2 to 89.1, and IKDC scores from 54.0 to 87.5. These results mirror those of previous studies where post-operative Lysholm scores typically ranged from 85–92.[24,32] Tegner activity scores improved by +2.7, indicating restoration of moderate-to-high-level physical activity. Return-to-sport (RTS) rates were high, 82% of patients resumed sports within one year,

Table 6: Multivariable linear regression analysis for predictors of post-operative IKDC subjective score (*n*=70)

Predictor variable	β coefficient	Standard error	95% confidence interval	*t*-value	*P*-value	Interpretation
Constant (Intercept)	90.5	3.8	82.9–98.1	23.8	<0.001	Baseline IKDC score for the reference group
Type of ACL Tear (complete=1)	−2.8	1.7	−6.2–+0.6	−1.65	0.104	Slight negative trend (not significant)
Meniscal Injury (yes=1)	−4.5	1.9	−8.3–−0.7	−2.37	0.021	Meniscal injury significantly reduces score
Cartilage Grade (per unit increase)	−1.9	0.8	−3.5–−0.3	−2.45	0.017	Higher grade associated with poorer IKDC
Delay to Surgery (months)	−0.38	0.17	−0.72–−0.04	−2.24	0.028	Longer delay linked to lower function
Rehabilitation Compliance (regular=1)	+5.8	2.0	+1.9–+9.7	+2.93	0.005	Regular rehab predicts better outcomes

consistent with the 80–85% RTS rates reported by Ardern *et al*.[33] Our findings also align with Grindem *et al*.,[34] who highlighted that delaying RTS to ≥9 months markedly reduces reinjury risk. Notably, 80% of our patients maintained strict rehabilitation adherence, which emerged as a strong independent predictor of better functional outcomes, in line with Çakar *et al*.[35] This confirms the principle that ACL reconstruction success depends equally on surgical precision and rehabilitation compliance. Quadriceps strength recovery was also notable, improving by an average of one MRC grade. Persistent quadriceps weakness remains a common post-operative concern,[36] yet our structured rehabilitation minimized this deficit. Regular physiotherapy contributed significantly to higher functional scores and earlier return to activity, supporting the rehabilitation-focused findings of Barber-Westin and Noyes.[37] Our overall complication rate was low (27%), with minor events such as transient pain, swelling, and superficial infection predominating. The overall complications were reported in a prospective study (13.1%; *n* = 796/6,069),[38] which is nearly half our findings. Clinically, our findings affirm several key principles. Timely reconstruction prevents progressive meniscal and cartilage damage;[25,26] meticulous arthroscopic evaluation facilitates detection and management of associated injuries;[27] and comprehensive rehabilitation is essential for optimal recovery.[35,37] RTS counseling should emphasize strength symmetry and psychological readiness to reduce re-tear risk.[34] Overall, our study demonstrates that arthroscopic ACL reconstruction offers excellent outcomes comparable to international benchmarks, provided that surgical timing, graft selection, and rehabilitation adherence are optimized.

Limitations of the study

The study was conducted on a relatively small sample size from a single center, which may limit the generalizability of the findings. The follow-up duration was short, preventing assessment of long-term outcomes such as graft durability or osteoarthritis development. Functional outcomes were based on subjective scoring systems, which may introduce reporting bias. In addition, variations in rehabilitation compliance and surgical timing among patients could have influenced results.

Conclusion

Arthroscopic ACL reconstruction provides excellent restoration of knee stability and function with significant improvements in Lysholm, IKDC, and Tegner scores. Outcomes are influenced by the timing of surgery, associated meniscal or cartilage injuries, and adherence to rehabilitation

protocols. Hamstring autograft provided favorable stability with minimal complications, and overall complication rates remained low. Timely surgical intervention, precise arthroscopic technique, and consistent physiotherapy are key to achieving optimal recovery and a safe return to sport and daily activities.

Recommendations

Future research should include larger, multicentric studies with more extended follow-up periods to assess better long-term graft survival, joint stability, and the development of degenerative changes. Standardized rehabilitation protocols and early surgical intervention should be emphasized to optimize outcomes. Comparative studies between different graft types, fixation methods, and rehabilitation strategies are also recommended to establish evidence-based guidelines for ACL reconstruction and post-operative care.

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Conflict of Interest

None declared.

Ethical Approval

The study was approved by the Institutional Ethics Committee.

References

1. Diermeier T, Rothrauff BB, Engebretsen L, Lynch AD, Ayeni OR, Paterno MV, *et al*. Treatment after anterior cruciate ligament injury: Panther symposium ACL treatment consensus group. Orthop J Sports Med 2020;8:2325967120931097.
2. MOON Knee Group, Spindler KP, Huston LJ, Chagin KM, Kattan MW, Reinke EK, *et al*. Ten-year outcomes and risk factors after anterior cruciate ligament reconstruction: A MOON longitudinal prospective cohort study. Am J Sports Med 2018;46:815-25.
3. Racine J, Aaron RK. Post-traumatic osteoarthritis after ACL injury. RI Med J 2014;97:25-8.
4. Sanders TL, Maradit Kremers H, Bryan AJ, Larson DR, Dahm DL, Levy BA, *et al*. Incidence of anterior cruciate ligament tears and reconstruction: A 21-year population-based study. Am J Sports Med 2016;44:1502-7.
5. Mall NA, Chalmers PN, Moric M, Tanaka MJ, Cole BJ, Bach BR Jr., *et al*. Incidence and trends of anterior cruciate ligament reconstruction in the United States. Am J Sports Med 2014;42:2363-70.
6. Montalvo AM, Schneider DK, Yut L, Webster KE, Beynnon B, Kocher MS, *et al*. "What's my risk of sustaining an ACL injury while playing sports?" A systematic review with meta-analysis. Br J Sports Med 2019;53:1003-12.
7. Shultz SJ, Cruz MR, Casey E, Dompier TP, Ford KR, Pietrosimone B, *et al*. Sex-specific changes in physical risk factors for anterior cruciate ligament injury by chronological age and stages of growth and maturation from 8 to 18 years of age. J Athl Train 2022;57:830-76.
8. Joshi A, Singh N, Basukala B, Bista R, Maharjan B, Pradhan I. Epidemiological profile of anterior cruciate ligament injuries in a tertiary referral trauma center of Nepal. BMC musculoskelet Disord 2022;23:595.
9. Mahmud CI, Rahman MN, Salimullah AZ, Faisal MA, Forhad S, Rahman MM. Epidemiological Profile of ACL injuries in a tertiary care setting in Bangladesh. Pac J Med Res 2025;2:123-30.
10. Hasan MA, Morshed T, Alam MK, ul Matin MA, Roy LK, Rahman MM, *et al*. Evaluation of the results of arthroscopic anterior cruciate ligament reconstruction with peroneus Longus Autograft. J Comilla Med Coll Teach Assoc 2025;29:26-31.
11. Dare D, Rodeo S. Mechanisms of post-traumatic osteoarthritis after ACL injury. Curr Rheumatol Rep 2014;16:448.
12. Harris JD, Abrams GD, Bach BR, Williams D, Heidloff D, Bush-Joseph CA, *et al*. Return to sport after ACL reconstruction. Orthopedics 2014;37:e103-8.
13. Jones HP, Appleyard RC, Mahajan S, Murrell GA. Meniscal and chondral loss in the anterior cruciate ligament injured knee. Sports Med 2003;33:1075-89.
14. Johnson CC, Garcia GH, Garner MR, Marx RG. Quality of life following ACL reconstruction: baseline predictors of patient-reported outcomes. HSS J 2016;12:94-7.
15. Kotsifaki R, King E, Bahr R, Whiteley R. Is 9 months the sweet spot for male athletes to return to sport after anterior cruciate ligament reconstruction? Br J Sports Med 2025;59:667-75.
16. Ardern CL, Taylor NF, Feller JA, Webster KE. Return-to-sport outcomes at 2 to 7 years after anterior cruciate ligament reconstruction surgery. Am J Sports

Med 2012;40:41-8.

17. Wiggins AJ, Grandhi RK, Schneider DK, Stanfield D, Webster KE, Myer GD. Risk of secondary injury in younger athletes after anterior cruciate ligament reconstruction: A systematic review and meta-analysis. Am J Sports Med 2016;44:1861-76.
18. Baez SE, Hoch MC, Hoch JM. Psychological factors are associated with return to pre-injury levels of sport and physical activity after ACL reconstruction. Knee Surg Sports Traumatol Arthrosc 2020;28:495-501.
19. Tegner YE, Lysholm JA. Rating systems in the evaluation of knee ligament injuries. Clin Orthop Related Res 1985;198:43-9.
20. Irrgang JJ, Anderson AF, Boland AL, Harner CD, Kurosaka M, Neyret P, *et al*. Development and validation of the international knee documentation committee subjective knee form. Am J Sports Med 2001;29:600-13.
21. Lysholm J, Tegner Y. Knee injury rating scales. Acta Orthop 2007;78:445-53.
22. Motififard M, Akbari Aghdam H, Ravanbod H, Jafarpishe MS, Shahsavan M, Daemi A, *et al*. Demographic and injury characteristics as potential risk factors for anterior cruciate ligament injuries: A multicentric cross-sectional study. J Clin Med 2024;13:5063.
23. Gornitzky AL, Lott A, Yellin JL, Fabricant PD, Lawrence JT, Ganley TJ. Sport-specific yearly risk and incidence of anterior cruciate ligament tears in high school athletes: A systematic review and meta-analysis. Am J Sports Med 2016;44:2716-23.
24. Rai SK, Varma R, Wani SS. Study of outcome of 300 cases of arthroscopic anterior cruciate ligament reconstruction with quadrupled hamstrings tendon graft using anterior cruciate ligament tightrope for femoral fixation. J Musculoskelet Surg Res 2018;2:26.
25. Forsythe B, Lu Y, Agarwalla A, Ezuma CO, Patel BH, Nwachukwu BU, *et al*. Delaying ACL reconstruction beyond 6 months from injury impacts likelihood for clinically significant outcome improvement. Knee 2021;33:290-7.
26. Shen X, Liu T, Xu S, Chen B, Tang X, Xiao J, *et al*. Optimal timing of anterior cruciate ligament reconstruction in patients with anterior cruciate ligament tear: A systematic review and meta-analysis. JAMA Netw Open 2022;5:e2242742.
27. Feroe AG, Clark SC, Hevesi M, Okoroha KR, Saris DB, Krych AJ, *et al*. Management of Meniscus pathology with concomitant anterior cruciate ligament injury. Curr Rev Musculoskelet Med 2024;17:321-34.
28. Warren RF, Levy IM. Meniscal lesions associated with anterior cruciate ligament injury. Clin Orthop Relat Res 1983;172:32-7.
29. Wang K, Eftang CN, Ulstein S, Årøen A, Jakobsen RB. Concomitant full-thickness cartilage lesions do not affect patient-reported outcomes at minimum 10-year follow-up after ACL reconstruction. Knee Surg Sports Traumatol Arthrosc 2022;30:1836-45.
30. Everhart JS, DiBartola AC, Swank K, Pettit R, Hughes L, Lewis C, *et al*. Cartilage damage at the time of anterior cruciate ligament reconstruction is associated with weaker quadriceps function and lower risk of future ACL injury. Knee Surg Sports Traumatol Arthrosc 2020;28:576-83.
31. Gopinatth V, Tartibi S, Smith MV, Matava MJ, Brophy RH, Knapik DM. Long-term results of bone-patellar tendon-bone versus hamstring tendon autograft for primary anterior cruciate ligament reconstruction: A meta-analysis of randomized controlled trials. Orthop J Sports Med 2025;13:23259671251330307.
32. Wierer G, Herbst E, Hoser C, Gföller P, Fink C. High rate of return to activity after ACL reconstruction in patients over 40 years of age: A systematic review. J ISAKOS 2017;2:200-4.
33. Ardern CL, Taylor NF, Feller JA, Webster KE. Fifty-five per cent return to competitive sport following anterior cruciate ligament reconstruction surgery: An updated systematic review and meta-analysis including aspects of physical functioning and contextual factors. Br J Sports Med 2014;48:1543-52.
34. Grindem H, Snyder-Mackler L, Moksnes H, Engebretsen L, Risberg MA. Simple decision rules can reduce reinjury risk by 84% after ACL reconstruction: The Delaware-Oslo ACL cohort study. Br J Sports Med 2016;50:804-8.
35. Çakar B, Uzun E, Xıaokaıtı W, Canbaz SB, Güney A. Positive impact of patient participation in arthroscopic anterior cruciate ligament reconstruction surgery on clinical and functional outcomes, rehabilitation and patient satisfaction. BMC Musculoskelet Disord 2025;26:252.
36. Schmitt LC, Paterno MV, Hewett TE. The impact of quadriceps femoris strength asymmetry on functional performance at return to sport following anterior cruciate ligament reconstruction. J Orthop Sports Phys Ther 2012;42:750-9.
37. Gokeler A, Dingenen B, Hewett TE. Rehabilitation and return to sport testing after anterior cruciate ligament reconstruction: Where are we in 2022? Arthrosc Sports Med Rehabil 2022;4:e77-82.
38. Jackson GR, Mameri E, Tuthill T, Guntin J, DeWald D, McCormick J, *et al*. Adverse events and complications reported in prospective vs. retrospective investigations of ACLR with BTB autograft: A systematic review. JOINTS 2025.