

Original Research Article

Outcome of arthroscopic anterior cruciate ligament reconstruction by hamstring and medial collateral ligament reconstruction by peroneus longus autograft in anteromedial knee instability

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ABSTRACT

Background: Combined anterior cruciate ligament (ACL) and medial collateral ligament (MCL) injuries are a common cause of anteromedial knee instability and often require surgical reconstruction to restore function and stability. This study evaluated the functional outcomes, knee stability and complications following arthroscopic ACL reconstruction using a hamstring autograft and MCL reconstruction using a peroneus longus autograft.

Methods: This prospective observational study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation, Dhaka, from September 2021 to March 2024. A total of 23 patients with combined ACL-MCL injuries underwent reconstruction and were evaluated preoperatively and at 9 months postoperatively using Lachman's test, valgus stress test, Lysholm Knee Score and knee flexion range of motion (ROM). Postoperative complications, including surgical site infection, donor site morbidity and residual instability, were also assessed.

Results: Significant improvements in knee stability and function were observed at 9 months postoperatively ($p < 0.001$). Lachman's test was negative in 86.96% of patients, while valgus stress testing demonstrated medial stability in 82.61%. The mean Lysholm Knee Score increased from 52.83 ± 9.11 preoperatively to 87.30 ± 6.30 postoperatively ($p < 0.001$). Normal knee flexion was achieved in 82.61% of patients. Complications were minimal, including surgical site infection in 4.35%, donor site morbidity in 13.04% and residual instability in 13.04% of patients.

Conclusions: Hamstring autograft ACL reconstruction combined with peroneus longus autograft MCL reconstruction provides excellent functional recovery and knee stability with minimal complications. Larger studies with longer follow-up are needed to confirm these findings.

Keywords: ACL reconstruction, Anteromedial knee instability, Hamstring autograft, MCL reconstruction, Peroneus longus autograft

INTRODUCTION

ACL and MCL injuries are among the most common knee ligament injuries, often resulting in anteromedial knee instability, which significantly impacts joint function, mobility and long-term musculoskeletal health. ACL injuries alone are prevalent in both athletic and non-athletic populations, with incidence rates ranging from 29

to 38 cases per 100,000 people annually and more than half of these cases requiring surgical reconstruction.¹ Sports-related trauma remains the leading cause of ACL injuries, accounting for 82.4% of ACL ruptures, with contact injuries contributing 27.5% and non-contact injuries 72.5%.² Additionally, the co-occurrence of ACL and MCL injuries is relatively high, with approximately 20% of all knee ligament injuries involving both ligaments,

often due to rotational forces applied to the knee during high-impact movements or road traffic accidents.³ Despite advancements in surgical techniques, anteromedial knee instability caused by these combined injuries remains a challenge, necessitating innovative grafting strategies for optimal stabilization. Anteromedial knee instability is primarily a consequence of combined ACL and MCL injuries, leading to increased valgus laxity and excessive tibial external rotation due to disruption of key ligamentous stabilizers, particularly the superficial and deep MCL layers.⁴ Biomechanical analyses confirm that isolated ACL reconstruction in patients with untreated or inadequately managed MCL injuries leads to increased ACL graft stress, which elevates the risk of secondary meniscal damage and progressive degenerative joint disease.⁵

A study by Miyaji et al demonstrated that MCL reconstruction significantly enhances knee stability by mitigating excessive anteromedial subluxation, reinforcing the need for concurrent ACL and MCL repairs in patients with complex knee instability.⁶ However, the choice of grafts for these reconstructions remains an area of ongoing debate, particularly in determining the most biomechanically viable and functionally restorative graft combination. ACL reconstruction has traditionally been performed using autografts such as hamstring tendon (HT), patellar tendon, quadriceps tendon and allografts, each with distinct advantages and limitations.⁷ Among these, hamstring autografts are widely favored due to their superior biomechanical properties, with studies demonstrating higher long-term stability and lower donor-site morbidity compared to allografts.^{8,9} However, the role of Peroneus Longus Tendon (PLT) autograft as an alternative for ligamentous reconstruction has recently gained attention due to its favorable graft diameter, comparable tensile strength and reduced donor-site complications.¹⁰ While PLT has been primarily explored for ACL reconstructions, its application in MCL reconstruction remains understudied, despite promising findings on its ability to provide larger graft size and enhanced knee stability compared to hamstring autografts.¹¹

Recent comparative studies suggest that PLT autografts yield clinical outcomes comparable to hamstring autografts, particularly in terms of knee function and stability. A systematic review by He et al analyzed 23 studies including 925 patients undergoing ACL reconstruction and found that PLT and HT demonstrated no significant differences in functional outcomes, graft survival rates or postoperative knee stability.¹² Furthermore, PLT grafts exhibited a significantly larger diameter than HT, with an average size of 8.8 mm vs 8.2 mm for hamstring autografts, potentially reducing the risk of graft failure.¹³ Despite these advantages, there remains a notable lack of large-scale or long-term studies evaluating the combined use of PLT for MCL reconstruction alongside HT for ACL reconstruction, creating a critical knowledge gap in clinical practice.

Although MCL injuries are often treated conservatively, evidence suggests that untreated or improperly rehabilitated MCL injuries contribute to chronic anteromedial instability and ACL reconstruction failure.⁶ A meta-analysis by Fermin et al, highlighted that no definitive evidence currently supports PLT as a superior autograft, yet it remains a promising alternative, particularly in multi-ligamentous knee injuries requiring additional graft sources.¹⁴

Moreover, limited research exists on the long-term outcomes of MCL reconstructions performed using PLT in conjunction with ACL repairs, necessitating further investigation into this graft combination's efficacy in restoring knee biomechanics. In South Asia, particularly in Bangladesh, large-scale studies on ACL-MCL injury management remain scarce, despite the high incidence of ligamentous injuries due to sports, occupational hazards and road traffic accidents.¹⁵ A prospective study involving 439 Bangladeshi patients undergoing ACL reconstruction with PLT autografts reported promising short-term outcomes but did not evaluate MCL reconstructions or long-term knee function post-surgery.¹⁵

The lack of region-specific data on surgical outcomes, rehabilitation efficiency and patient satisfaction further underscores the urgent need for localized research to validate the applicability of emerging graft techniques in diverse populations. This study aims to evaluate the functional and clinical outcomes of ACL reconstruction using hamstring autograft and MCL reconstruction using Peroneus Longus autograft in patients with anteromedial knee instability. Additionally, this study will contribute to regional knowledge by offering data specific to the Bangladeshi population, potentially guiding future surgical strategies and rehabilitation protocols in resource-limited settings.

METHODS

This prospective observational study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation, Sher-E-Bangla Nagar, Dhaka, Bangladesh, over a study period spanning from September 2021 to March 2024. The study population included patients who sought medical care at NITOR for the complete management of clinically diagnosed combined ACL and MCL injuries. A total of 23 patients who underwent arthroscopic ACL and MCL reconstruction were included in the study. Patients were selected based on predefined inclusion and exclusion criteria. Inclusion criteria consisted of symptomatic anteromedial knee instability, age between 20 and 50 years, injury duration of less than three years, BMI below 35 kg/m² and inclusion of both affected limbs. Exclusion criteria included open knee injuries, previous knee surgery, history of knee infections, fractures around the knee (femoral condyle, tibial plateau, patella) and osteoarthritis. Clinical assessment involved the Lachman test and valgus stress test to evaluate knee stability, while functional outcomes were assessed using

the Lysholm knee score and knee flexion range of motion (ROM). Data were systematically collected and analyzed to determine the clinical and functional outcomes following arthroscopic ACL reconstruction using a hamstring autograft and MCL reconstruction using a peroneus longus autograft.

RESULTS

The study included 23 patients who underwent arthroscopic ACL and MCL reconstruction. The mean age of the participants was 30.74 ± 8.97 years, with the majority (39.13%) falling within the 20-25 years age group, followed by 17.39% in both the 26-30- and 31-35-years age groups. Patients aged 41-45 years accounted for 4.35%, while those aged 46-50 years made up 13.04% of the study population. The majority of patients were male (91.30%), with only 8.70% being female. Regarding occupation, students comprised the largest group (43.48%), followed by athletes (17.39%), farmers (13.04%), service holders (8.70%), housewives (8.70%) and businessmen (8.70%).

The most common mechanism of injury among the 23 patients was sports-related trauma, accounting for 65.22% of cases, followed by road traffic accidents (21.74%) and falls from height (13.04%). Regarding the side of injury, the left knee was affected in the majority of cases (65.22%), while the right knee was involved in 34.78% of patients. The duration from injury to surgery varied, with 43.48% of patients undergoing surgery between 6 to 12 months post-injury, 30.43% undergoing surgery after 12 months and 26.09% receiving surgical intervention within 6 months.

The mean intraoperative quadrupled hamstring graft diameter among the 23 study patients was 7.52 ± 0.128 mm. The majority of patients (60.87%) had a graft diameter of 7.5 mm, followed by 21.74% with a graft diameter of 8 mm and 17.39% with a graft diameter of 7 mm. The mean intraoperative peroneus longus graft diameter among the 23 study patients was 8.02 ± 0.32 mm. The majority of patients (60.87%) had a graft diameter of 8 mm, followed by 21.74% with a diameter of 8.5 mm and 17.39% with a diameter of 7.5 mm.

Preoperatively, all 23 patients (100.00%) had Grade 3+ Lachman's test results, indicating severe anterior knee instability. However, at the final follow-up (9 months postoperatively), 86.96% of patients had a negative Lachman's test, reflecting a significant improvement in knee stability. Additionally, 8.70% of patients showed Grade 1+ laxity, while 4.35% exhibited Grade 2+ laxity.

No patients had Grade 3+ instability postoperatively. The improvement in Lachman's test results was statistically significant ($p < 0.001$).

Preoperatively, all 23 patients (100.00%) had a positive valgus stress test, indicating significant medial knee instability due to MCL deficiency. However, at the final follow-up (9 months postoperatively), 82.61% of patients demonstrated a negative valgus stress test, signifying restored medial knee stability. Despite substantial improvement, 17.39% of patients continued to exhibit a positive valgus stress test, though at a lower severity compared to preoperative assessment. The difference between preoperative and postoperative results was statistically significant ($p < 0.001$).

Preoperatively, the majority of patients (91.30%) had poor knee function with a Lysholm knee score of less than 65, while the remaining 8.70% had a fair score (65-83). At the final follow-up (9 months postoperatively), significant improvements were observed, with 43.48% of patients achieving excellent knee function (>90), 30.43% classified as good (84-90) and 26.09% remaining in the fair category (65-83). No patients remained in the poor category postoperatively. The mean Lysholm score improved significantly from 52.83 ± 9.11 preoperatively to 87.30 ± 6.30 postoperatively, demonstrating a statistically significant difference ($p < 0.001$).

Preoperatively, 60.87% of patients had normal knee flexion (135°), while 21.74% had near-normal flexion (130° - 134°) and 17.39% exhibited abnormal flexion (120° - 129°). At the final follow-up (9 months postoperatively), the proportion of patients with normal knee flexion increased to 82.61%, while near-normal flexion was observed in 17.39% of patients. Notably, no patients had abnormal knee flexion (120° - 129°) postoperatively and there were no cases of severely abnormal knee flexion ($<120^\circ$) either preoperatively or postoperatively. The improvement in knee flexion was statistically significant ($p < 0.001$).

Among the 23 patients who underwent arthroscopic ACL reconstruction using a hamstring autograft and MCL reconstruction with a peroneus longus autograft, postoperative complications were observed in a minority of cases. Surgical site infection occurred in one patient (4.35%), while haemarthrosis and locking sensation were not reported in any case (0.00%). Donor site morbidity was noted in 3 patients (13.04%), primarily associated with the peroneus longus autograft harvest. Additionally, 3 patients (13.04%) reported a persistent feeling of giving way, which may indicate residual knee instability.

Table 1: Baseline demographic characteristics (n=23).

Base line characteristics	N	%
Age (in years)		
20-25	9	39.13
26-30	4	17.39

Continued.

Base line characteristics	N	%
31-35	4	17.39
36-40	2	8.70
41-45	1	4.35
46-50	3	13.04
Mean±SD	30.74±8.97	
Gender		
Male	21	91.30
Female	2	8.70
Occupation		
Athlete	4	17.39
Student	10	43.48
Service holder	2	8.70
Farmer	3	13.04
Housewife	2	8.70
Businessman	2	8.70

Table 2: Distribution of injury related characteristics (n=23).

Injury related characteristics	N	%
Mechanism of injury		
Road traffic accident	5	21.74
Fall from height	3	13.04
Sports injury	15	65.22
Side of injury		
Right	8	34.78
Left	15	65.22
Duration from injury to operation		
<6	6	26.09
6-12	10	43.48
>12	7	30.43

Table 3: Intraoperative quadrupled hamstring graft diameter (mm) of study patients.

Graft diameters (mm)	N	%
7	4	17.39
7.5	14	60.87
8	5	21.74
Mean±SD	7.52±0.128 mm	

Table 4: Intraoperative peroneus longus graft diameter (mm) of study patients (n=23).

Graft diameters (mm)	N	%
7.5	4	17.39
8	14	60.87
8.5	5	21.74
Mean±SD	8.02±0.32 mm	

Table 5: Assessment of function by Lachman's test (n=23).

Lachman's test grades	Preoperative		Post-operative final follow-up (9 months)		P value
	N	%	N	%	
Negative	0	0.00	20	86.96	<0.001
Grade 1+	0	0.00	2	8.70	
Grade 2+	0	0.00	1	4.35	
Grade 3+	23	100.00	0	0.00	

Table 6: Assessment of pre- and post-operative valgus stress test (n=23).

Valgus stress tests	Preoperative		Post-operative final follow-up (9 months)		P value
	N	%	N	%	
Negative	0	0.00	19	82.61	<0.001
Positive	23	100.00	4	17.39	

Table 7: Assessment of pre- and post-operative Lysholm knee score (n=23).

Lysholm knee scores	Preoperative		Post-operative final follow-up (9 months)		P value
	N	%	N	%	
Poor (<65)	21	91.30	0	0.00	<0.001
Fair (65-83)	2	8.70	6	26.09	
Good (84-90)	0	0.00	7	30.43	
Excellent (>90)	0	0.00	10	43.48	
Mean±SD	52.83±9.11		87.30±6.30		<0.001

Table 8: Assessment of pre- and post-operative knee flexion (n=23).

Knee flexion (ROM)	Preoperative		Post-operative final follow-up (9 months)		P value
	N	%	N	%	
Normal 135°	14	60.87	19	82.61	<0.001
Near normal (130°-134°)	5	21.74	4	17.39	
Abnormal (120°-129°)	4	17.39	0	0.00	
Severely abnormal (<120°)	0	0.00	0	0.00	

Table 9: Assessment of postoperative complications (n=23).

Complications	N	%
Surgical site infection	1	4.35
Haemarthrosis	0	0.00
Donor site morbidity	3	13.04
Locking sensation	0	0.00
Feeling of giving away	3	13.04

DISCUSSION

ACL and MCL injuries represent a significant challenge in orthopedic surgery, particularly in patients with anteromedial knee instability. The present study evaluated the functional outcomes and complication rates following arthroscopic ACL reconstruction with a hamstring autograft and MCL reconstruction using a peroneus longus autograft, demonstrating significant improvements in knee stability, functional scores and range of motion. These findings align with existing literature while offering new insights into the efficacy and safety of peroneus longus autografts in ligament reconstruction. The demographic characteristics of our study population revealed a predominance of young, active males, with a mean age of 30.74±8.97 years, a distribution consistent with prior studies where ACL-MCL injuries are frequently observed in younger, physically active individuals, particularly athletes.¹⁶ The high incidence of sports-related injuries (65.22%) aligns with reports from Granan et al and Mei et al, who found sports injuries to be the leading cause of ACL-MCL injuries in their respective cohorts.^{17,18}

Additionally, our findings that left knee injuries (65.22%) were more frequent than right knee injuries (34.78%) mirror results from Sagar et al, reinforcing the need for further exploration into biomechanical factors that may predispose the left knee to injury.¹⁹ A crucial aspect of ACL-MCL reconstruction is graft selection, as it directly influences functional outcomes and complication rates. In our study, the mean hamstring autograft diameter was 7.52±0.128 mm, while the mean peroneus longus autograft diameter was 8.02±0.32 mm, with most peroneus longus grafts measuring 8 mm (60.87%). These findings are consistent with those of Keyhani et al and Rhatomy et al who reported that peroneus longus autografts tend to provide larger and mechanically robust grafts compared to hamstring autografts, reinforcing their potential as a viable alternative.^{10,11} Similarly, Gök et al demonstrated that peroneus longus grafts resulted in better structural integrity and biomechanical support, further supporting the choice of this graft in MCL reconstruction.¹³ Functional outcomes, as assessed by the Lachman's test and valgus stress test, demonstrated significant improvements postoperatively. At 9 months, 86.96% of

patients had a negative Lachman's test, indicating restored ACL stability, with only 8.70% showing Grade 1+ laxity and 4.35% showing Grade 2+ laxity. These results are superior to the findings by Singh et al, who reported a 10% residual laxity rate postoperatively and Ganguli & Jash, who found that ACL stability improved progressively over 12-24 months.^{20,21} Similarly, valgus stress test results improved significantly, with 82.61% of patients achieving medial knee stability ($p < 0.001$), closely matching results from LaPrade et al who found that MCL reconstruction significantly reduced medial joint opening postoperatively.²²

The 17.39% residual valgus laxity rate in our study is comparable to the findings of D'Ambrosi et al, suggesting that while MCL reconstruction is effective, some degree of residual laxity may persist.²³ Knee function and patient satisfaction were further evaluated using the Lysholm Knee Score, which improved from 52.83 ± 9.11 preoperatively to 87.30 ± 6.30 postoperatively ($p < 0.001$). This degree of improvement aligns closely with Jeon et al., who reported a mean Lysholm score of 88.0 post-ACL reconstruction and Boyle et al who found similar improvements at long-term follow-up.^{24,25}

Furthermore, the proportion of patients achieving excellent (43.48%) and good (30.43%) functional outcomes in our study is comparable to findings by Soni et al, reinforcing the reliability of this graft combination in restoring knee function.¹⁶ Postoperative range of motion (ROM) is a critical parameter influencing rehabilitation success. At 9 months, 82.61% of patients achieved full knee flexion (135°), while 17.39% had near-normal ROM (130° - 134°) and no patients had abnormal knee flexion ($< 129^\circ$). These results are consistent with previous reports by Carlson and Alirezaei-Noghondar et al who found that ACL rehabilitation generally restores near-full ROM within 9-12 months.^{26,27} The absence of severe ROM restrictions in our study highlights the benefits of early mobilization and structured rehabilitation protocols. Despite the favorable functional outcomes, postoperative complications remain a concern in ligament reconstruction. The infection rate in our study was 4.35%, slightly higher than rates reported by Gobbi et al, (0.68%) and Westermann et al (0.61%).²⁸

However, Baron et al demonstrated that infection rates can be significantly reduced with intraoperative vancomycin use, which could be an area for improvement in future practice.²⁹ Donor site morbidity was observed in 13.04% of patients, slightly higher than the 4% rate reported by Kusumastutia et al for peroneus longus autografts.³⁰ This discrepancy may be attributed to variability in harvesting techniques or differences in patient rehabilitation adherence. Additionally, 13.04% of patients reported a sensation of giving way, a rate consistent with findings from Grassi et al, indicating that while ligament reconstruction significantly improves stability, some patients may still experience residual instability.³¹

Limitations

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study demonstrates that arthroscopic ACL reconstruction using a hamstring autograft and MCL reconstruction with a peroneus longus autograft is an effective and reliable approach for managing anteromedial knee instability. The findings indicate statistically significant improvements in knee stability, functional outcomes and range of motion, with minimal postoperative complications. The Lachman's test and valgus stress test results confirmed restored ligamentous integrity, while the Lysholm Knee Score and knee flexion ROM assessments further validated the functional recovery achieved at 9 months postoperatively.

The larger graft diameter of the peroneus longus autograft, compared to traditional hamstring autografts, highlights its potential as a superior graft choice for MCL reconstruction, providing better biomechanical support. Postoperative complications were low, with only 4.35% of patients developing a surgical site infection, 13.04% experiencing donor site morbidity and 13.04% reporting residual instability, all of which align with previous findings in the literature. Despite these promising results, continued refinement of surgical protocols, infection prevention strategies and rehabilitation programs remains crucial for optimizing long-term patient outcomes. Future studies with larger sample sizes and extended follow-up durations are necessary to confirm the long-term benefits and durability of this graft combination in ACL-MCL reconstruction.

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