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ORIGINAL ARTICLE

Stability and Functional Outcome of ACL Reconstruction Using Semitendinosus Autograft: A Prospective Study of 20 Patients

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ABSTRACT

Background: Anterior cruciate ligament (ACL) reconstruction is one of the most frequently performed procedures in young, active patients. Graft selection remains debated, with hamstring autografts increasingly preferred due to reduced donor-site morbidity.
Objective: To evaluate stability, functional outcomes, and predictors of success in patients undergoing ACL reconstruction using semitendinosus autograft.
Methods: Twenty patients underwent arthroscopic ACL reconstruction with quadrupled semitendinosus autograft and were followed for 12 months. Functional outcomes were measured using International Knee Documentation Committee (IKDC) subjective score, Lysholm knee score, and Tegner activity scale. Stability was assessed with Lachman, pivot shift, and KT-1000. Statistical analysis included paired t-tests for continuous outcomes, chi-square for categorical outcomes, and logistic regression to identify predictors of excellent IKDC outcome.
Results: At 12 months, mean IKDC improved from 52.6 to 86.3 ($p<0.001$), Lysholm from 55.8 to 91.5 ($p<0.001$), and Tegner from 3.1 to 6.8 ($p<0.001$). Negative Lachman was present in 90% and negative pivot shift in 85% of patients. KT-1000 revealed side-to-side difference ≤3 mm in 90% of patients. Complications included transient stiffness (10%) and hamstring weakness (15%). Logistic regression showed age <30 years and sports-related injury were significant predictors of excellent IKDC outcome ($p<0.05$).
Conclusion: Semitendinosus autograft is an effective graft choice for ACL reconstruction, providing reliable stability, excellent functional recovery, and minimal donor-site morbidity. Younger age and sports-related injuries were associated with superior outcomes.
Keywords: ACL reconstruction; semitendinosus graft; hamstring autograft; functional outcome; logistic regression

INTRODUCTION

Anterior cruciate ligament (ACL) injury is a common cause of knee instability, particularly in young and athletic populations[1]. Chronic ACL deficiency predisposes to meniscal injury, cartilage damage, and early-onset osteoarthritis[2]. Reconstruction of the ACL has therefore become the gold standard for restoring knee function and stability[3].

For decades, bone–patellar tendon–bone (BPTB) autograft was considered the benchmark for ACL reconstruction due to its strong fixation and long-term success rates[4]. However, it is associated with donor-site morbidity, anterior knee pain, and difficulty kneeling[5,6]. Hamstring autografts, particularly semitendinosus (with or without gracilis), have emerged as alternatives offering adequate biomechanical strength, improved cosmesis, and fewer donor-site complications[7–9].

The biomechanical properties of quadrupled semitendinosus tendon have been shown to exceed the tensile strength of the native ACL[10]. Functional outcomes are comparable to BPTB grafts, with significantly less anterior knee pain[11]. Despite these advantages, concerns regarding graft elongation, fixation strength, and long-term durability remain[12,13].

In addition to clinical outcomes, identifying predictors of success is important to optimize graft choice and patient selection. Age, activity level, mechanism of injury, and preoperative function have been suggested as determinants of recovery[14,15].

This prospective study aimed to evaluate stability and functional outcomes in patients undergoing ACL reconstruction with semitendinosus graft, and to determine predictors of excellent outcomes using logistic regression analysis.

METHODOLOGY

This prospective observational study was conducted in the Department of Orthopedics at DHQ Teaching Hospital Haripur between 1st January 2022 and 31st Dec 2022. Twenty consecutive patients with isolated ACL tears confirmed clinically and by MRI were included.

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Inclusion Criteria: were age 18–40 years, isolated ACL rupture, symptomatic instability affecting daily activities or sports, and willingness to provide informed consent.

Exclusion Criteria: included multi-ligament injuries, prior surgery on the same knee, advanced osteoarthritis, and active infection.

All patients underwent arthroscopic ACL reconstruction using quadrupled semitendinosus tendon autograft. The graft was harvested via a pes anserinus incision. Femoral fixation was performed using an Endobutton, and tibial fixation with a bioabsorbable interference screw.

Postoperatively, patients followed a standardized rehabilitation protocol. Early quadriceps activation and range-of-motion exercises began on day one. Partial to full weight-bearing was allowed as tolerated. Running was permitted at 3–4 months and pivoting sports at 8–9 months.

Outcome Measures: included functional assessment using the International Knee Documentation Committee (IKDC) subjective score, Lysholm knee score, and Tegner activity scale. Stability was assessed with Lachman, pivot shift, and KT-1000 arthrometer side-to-side difference. Complications including stiffness, infection, graft failure, and hamstring weakness were recorded. Follow-up assessments were performed at 3, 6, and 12 months.

Statistical Analysis: Continuous variables were expressed as mean ± standard deviation and categorical variables as frequencies and percentages. Pre- and postoperative functional scores were compared using paired t-tests. The association between categorical variables and outcomes was tested with chi-square analysis. Binary logistic regression analysis was performed to identify independent predictors of excellent functional outcome, defined as IKDC ≥85 at 12 months. Variables included in the model were age (<30 vs ≥30), sex, mechanism of injury (sports vs others), and preoperative IKDC score (>55 vs ≤55). Statistical significance was set at $p<0.05$.

RESULTS

The mean age was 26.8 ± 5.4 years, with a predominance of males (80%). Sports-related injuries accounted for the majority (60%), followed by road traffic accidents (30%). The right knee was involved in 55% of cases.

Table 1: Demographic profile of patients (n=20).

Variable	Value
Mean age (years)	26.8 ± 5.4
Male : Female	16 : 4
Mechanism of injury	Sports (12), RTA (6), Others (2)
Side involved	Right (11), Left (9)
Mean follow-up (months)	12

Functional outcomes improved significantly at 12 months (Table 2). IKDC increased from a mean of 52.6 to 86.3 ($p<0.001$). Lysholm score improved from 55.8 to 91.5 ($p<0.001$). Tegner activity scale rose from 3.1 to 6.8 ($p<0.001$).

Table 2: Functional outcome scores before and after ACL reconstruction.

Score	Pre-op Mean ± SD	Post-op Mean ± SD	p-value
IKDC	52.6 ± 8.1	86.3 ± 5.9	<0.001
Lysholm	55.8 ± 9.3	91.5 ± 6.2	<0.001
Tegner activity	3.1 ± 0.8	6.8 ± 1.2	<0.001

Surgical Outcomes: Stability outcomes are detailed in Table 3. Preoperatively, all patients had positive Lachman and KT-1000 >3 mm. At 12 months, 90% achieved negative Lachman and 85% had negative pivot shift. KT-1000 revealed side-to-side difference ≤3 mm in 90% of patients.

Table 3: Surgical stability outcomes before and after ACL reconstruction.

Test	Pre-op n (%)	Post-op n (%)
Lachman positive	20 (100%)	2 (10%)
Pivot shift positive	18 (90%)	3 (15%)
KT-1000 >3 mm	20 (100%)	2 (10%)

Complications were minimal (Table 4). Two patients (10%) developed transient postoperative stiffness, which resolved with physiotherapy. Three patients (15%) reported mild hamstring weakness at deep flexion. No infections or graft failures occurred.

Table 4: Complications following ACL reconstruction.

Complication	n (%)
Transient stiffness	2 (10)
Hamstring weakness	3 (15)
Infection	0 (0)
Graft failure	0 (0)

Logistic regression identified predictors of excellent functional outcome (IKDC ≥85). Younger age (<30 years) and sports-related injuries were significant independent predictors ($p<0.05$).

Table 5. Logistic regression predictors of excellent IKDC outcome.

Predictor	OR (95% CI)	p-value
Age <30 years	4.2 (1.1–15.9)	0.03*
Male sex	1.5 (0.3–6.9)	0.58
Sports injury	3.9 (1.0–14.8)	0.04*
Pre-op IKDC >55	2.1 (0.5–8.9)	0.31

*Significant

DISCUSSION

This prospective study of 20 patients undergoing ACL reconstruction with semitendinosus autograft demonstrated significant improvements in stability and function at 12 months. Functional outcomes, measured by IKDC, Lysholm, and Tegner scores, all improved markedly ($p<0.001$). These findings are consistent with previous reports demonstrating comparable functional recovery with hamstring autografts compared to patellar tendon grafts[5,7,8].

The stability results were encouraging, with 90% of patients achieving negative Lachman and 85% negative pivot shift at 12 months. KT-1000 testing confirmed objective stability in 90% of patients, in line with large meta-analyses reporting equivalent or superior outcomes with hamstring grafts[16,18]. The functional recovery seen here was similar to Sajovic et al[9], who reported sustained outcomes at 5 years, and Gifstad et al[10], who demonstrated long-term durability of hamstring grafts.

Complication rates were low, with transient stiffness (10%) and hamstring weakness (15%) being the main issues. Importantly, no infections or graft failures occurred. These complication rates are comparable to those reported by Freedman et al[8] and Kartus et al[11], with donor-site morbidity being less severe than in BPTB reconstructions[4,6].

An important addition of this study is the logistic regression analysis. Younger patients (<30 years) and those with sports-related injuries had significantly higher odds of achieving excellent IKDC scores. This finding is in agreement with registry data suggesting that younger, more active patients are more motivated and compliant with rehabilitation, leading to superior recovery[14,15,19].

Despite overall positive results, concerns regarding hamstring weakness remain. Although mild in our study, this complication has been consistently reported[11,20]. Long-term implications of persistent hamstring deficit on function require further research.

Our findings also highlight the practical advantage of semitendinosus graft in populations where kneeling is culturally important, as anterior knee pain was absent in our cohort a known drawback of patellar tendon grafts[6,7].

Limitations: This study is limited by its small sample size (n=20), short follow-up (12 months), and lack of a control group (BPTB or allograft). Larger randomized controlled trials with longer follow-up are required to validate these findings.

Clinical Implications: Semitendinosus autograft offers excellent stability, functional recovery, and low complication rates, making it a reliable graft choice for ACL reconstruction. Predictive factors such as age and injury mechanism should be considered when counseling patients.

CONCLUSION

This prospective study demonstrated that ACL reconstruction using semitendinosus autograft provides excellent functional outcomes and stable knees at 12 months follow-up. Functional scores including IKDC, Lysholm, and Tegner showed significant improvements postoperatively, while objective tests such as Lachman, pivot shift, and KT-1000 confirmed restoration of stability in the majority of patients. Complications were minimal, limited to transient stiffness and mild hamstring weakness, with no graft failures observed. Logistic regression analysis identified younger age and sports-related mechanism of injury as independent predictors of excellent functional outcomes. Thus, semitendinosus autograft can be considered a reliable graft choice in ACL reconstruction, particularly in young and active individuals.

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