

Original Article

Functional Outcomes and Return to Sports Following Arthroscopic-Assisted Anterior Cruciate Ligament Reconstruction Using Quadrupled Hamstring Autograft: A Prospective Cohort Study

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ABSTRACT

Background: Anterior cruciate ligament (ACL) reconstruction is commonly performed to restore knee stability and facilitate return to physical activity. This study evaluated functional outcomes and return to sports following arthroscopic ACL reconstruction using a quadrupled hamstring autograft.

Methods A prospective cohort study was conducted in 38 patients aged 18–45 years with clinically and/or MRI-confirmed ACL tears. All patients underwent arthroscopic ACL reconstruction using a quadrupled semitendinosus-gracilis hamstring autograft. Functional outcome was assessed using the Lysholm Knee Score preoperatively and at 6 months postoperatively. Return to sports and postoperative complications were also assessed.

Results The mean Lysholm score improved from 61.8 ± 6.2 preoperatively to 91.5 ± 5.8 at 6 months ($p < 0.001$). Good-to-excellent functional outcomes were achieved in 84.2% of patients. 63.2% returned to their pre-injury level of sports, while 26.3% returned with reduced activity and 10.5% did not return. No postoperative complications were reported in 84.2% of patients. Age was significantly associated with functional outcome ($p = 0.04$), while mode of injury was associated with return to pre-injury sports ($p = 0.03$) and preoperative functional status with postoperative outcome ($p = 0.02$). Gender was not significantly associated with functional outcome ($p = 0.32$).

Conclusion Arthroscopic ACL reconstruction using a quadrupled hamstring autograft resulted in significant improvement in knee function and favorable return-to-sport outcomes at 6 months, with a low frequency of postoperative complications. Further studies with larger cohorts and longer follow-up are warranted.

Keywords: Anterior cruciate ligament; ACL reconstruction; hamstring autograft; quadrupled hamstring graft; Lysholm score; functional outcome; return to sport; knee reconstruction.

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INTRODUCTION

Anterior cruciate ligament (ACL) injury is a common knee injury, particularly among young and physically active individuals, and can result in substantial limitations in sports participation and knee function. Although ACL reconstruction enables most patients to return to sports, return to the pre-injury level is achieved less consistently.² Persistent functional deficits, muscle weakness, instability, and subsequent degenerative changes may affect long-term outcomes. Graft selection is an important consideration in ACL reconstruction. Autografts are widely used because of their favorable clinical outcomes, with bone–patellar tendon–bone (BPTB) and hamstring tendon grafts being the most commonly used options.^{3, 4} BPTB grafts provide reliable fixation but may be associated with anterior knee pain and donor-site morbidity.^{5, 6} Hamstring autografts offer an alternative while preserving the extensor mechanism and have demonstrated satisfactory functional outcomes with relatively low donor-site morbidity.^{5, 6} Comparative evidence has generally demonstrated similar functional outcomes between hamstring and BPTB grafts, although differences may exist in graft-related complications and specific functional outcomes.⁸ Hamstring harvest has also not been shown to produce clinically significant long-term impairment of hip extension strength.⁹ Despite these favorable findings, assessment of functional recovery and return to sports remains important in patients undergoing ACL reconstruction.

Therefore, the present study evaluated the functional outcomes and return to sports following arthroscopic ACL reconstruction using a quadrupled hamstring autograft, with functional outcome assessed using the Lysholm knee scoring system.

Aim

To evaluate the functional outcomes and return to sports following arthroscopic-assisted anterior cruciate ligament reconstruction using a quadrupled hamstring autograft.

Objectives

1. To assess functional recovery using the Lysholm Knee Scoring System before and after ACL reconstruction.
2. To evaluate return to sports, including return to the pre-injury level and reduced activity.
3. To assess the postoperative complication profile following reconstruction.
4. To assess the association of demographic and clinical factors with postoperative functional outcome and return to sports.

MATERIALS AND METHODS

A prospective cohort study was conducted over 18 months among 38 patients aged 18–45 years with clinically and/or MRI-confirmed ACL tears. Patients with multiligamentous injuries, fractures, osteoarthritis, revision surgery, infection, or other major contraindications were excluded. All patients underwent arthroscopic-assisted ACL reconstruction using a quadrupled semitendinosus–gracilis hamstring autograft, with anatomical femoral and tibial tunnel reconstruction and interference-screw fixation. Functional outcome was assessed using the Lysholm Knee Score preoperatively and at 6 months postoperatively. Return to sports and postoperative complications were also assessed. Data were analyzed using SPSS version 26; pre- and postoperative Lysholm scores were compared using the paired t-test, and categorical associations were assessed using the chi-square or Fisher exact test. A p value <0.05 was considered statistically significant.

RESULTS

A total of **38 patients** were included. The largest proportion of patients was in the 26–35-year age group (42.1%), and **30 patients (78.9%) were male**. Sports-related injury was the most common mechanism (63.2%), followed by road traffic accidents (26.3%). The right knee was involved in 57.9% of cases.

Table 1. Baseline characteristics

Characteristic	n (%)
Age, years	
18–25	12 (31.6)
26–35	16 (42.1)
36–45	10 (26.3)
Male sex	30 (78.9)
Mechanism of injury	

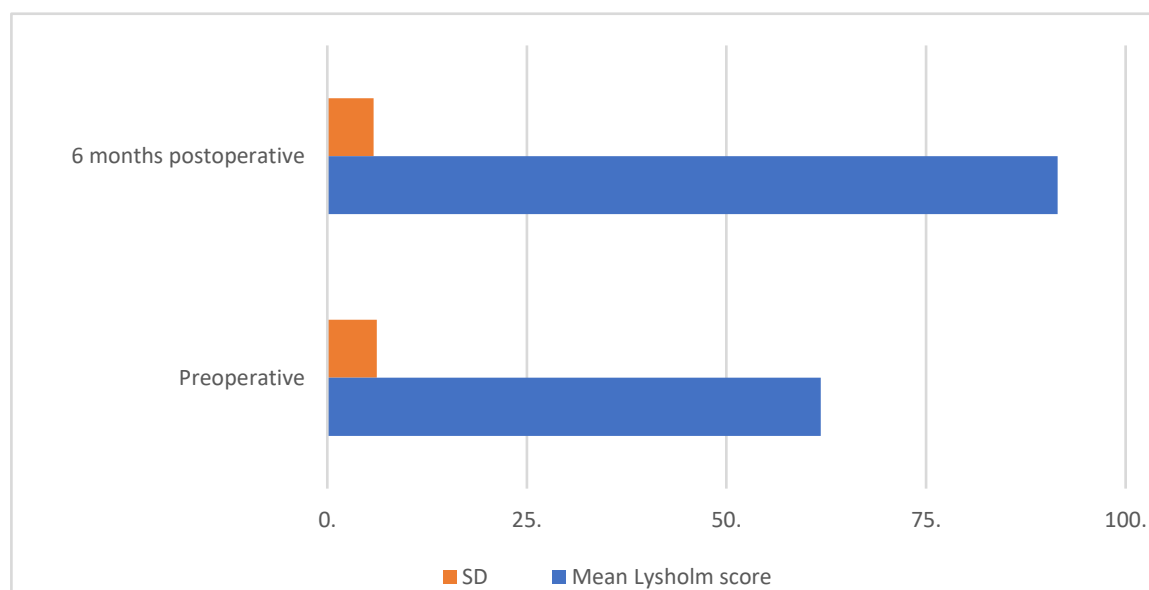
Sports injury	24 (63.2)
Road traffic accident	10 (26.3)
Other	4 (10.5)
Side involved	
Right	22 (57.9)
Left	16 (42.1)

Preoperatively, the mean Lysholm score was **61.8 ± 6.2**; 52.6% of patients had poor and 36.8% had fair functional scores. At 6 months, the mean score improved to **91.5 ± 5.8 (p < 0.001)**. Good-to-excellent functional outcomes were achieved in **32 patients (84.2%)**.

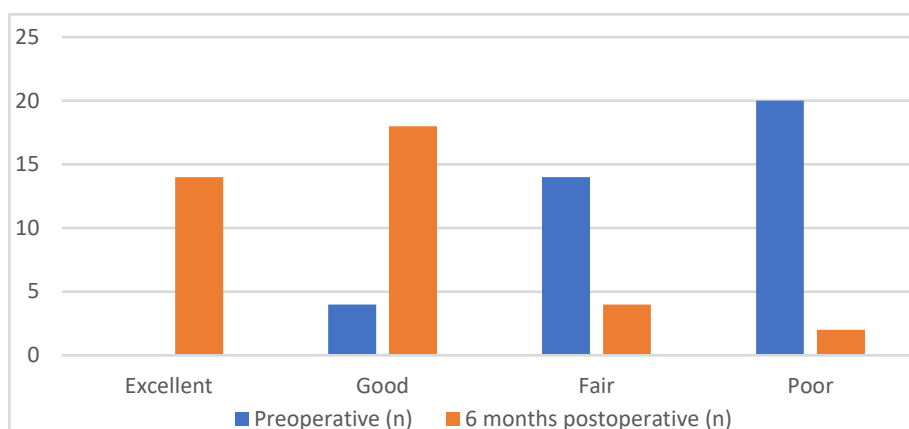
Table 2. Functional outcomes following ACL reconstruction

Outcome	Preoperative	6 months
Lysholm score, mean ± SD	61.8 ± 6.2	91.5 ± 5.8
Excellent, n (%)	0 (0)	14 (36.8)
Good, n (%)	4 (10.5)	18 (47.4)
Fair, n (%)	14 (36.8)	4 (10.5)
Poor, n (%)	20 (52.6)	2 (5.3)

p < 0.001 for preoperative versus postoperative Lysholm score.



Graph 1. Preoperative vs postoperative Lysholm score



Graph 2. Functional outcome distribution

Regarding sports participation, **24 patients (63.2%) returned to their pre-injury level**, 10 (26.3%) returned with reduced activity, and 4 (10.5%) did not return. No complications were reported in 84.2% of patients; stiffness, pain, and infection occurred in 7.9%, 5.3%, and 2.6%, respectively.

Table 3. Return to sports and complications

Variable Category	n (%)
Return to sports	
Pre-injury level	24 (63.2)
Reduced activity	10 (26.3)
No return	4 (10.5)
Complications	
None	32 (84.2)
Stiffness	3 (7.9)
Pain	2 (5.3)
Infection	1 (2.6)

Age was significantly associated with functional outcome ($p = 0.04$), with good-to-excellent outcomes in 91.7%, 87.5%, and 70.0% of patients aged 18–25, 26–35, and 36–45 years, respectively. Mode of injury was significantly associated with return to pre-injury sports level ($p = 0.03$), while preoperative functional status was associated with postoperative outcome ($p = 0.02$). Gender was not significantly associated with functional outcome ($p = 0.32$).



Figure 1: Arthroscopic graft placement



Figure 2: Nine-month postoperative knee flexion

DISCUSSION

The present study demonstrated a significant improvement in knee function following arthroscopic ACL reconstruction with a quadrupled hamstring autograft. The mean Lysholm score increased from 61.8 ± 6.2 preoperatively to 91.5 ± 5.8 at 6 months ($p < 0.001$), with 84.2% of patients achieving good-to-excellent functional outcomes. These findings support the effectiveness of hamstring autograft reconstruction in improving postoperative knee function.¹⁰

The study population was predominantly young, with 73.7% of patients aged ≤ 35 years, and 78.9% were male. Sports injury was the most common mechanism (63.2%), followed by road traffic accidents (26.3%). The observed functional improvement is consistent with previously reported outcomes following hamstring autograft ACL reconstruction, with substantial improvement in postoperative knee function reported after reconstruction.^{11,12}

The 84.2% good-to-excellent outcome rate in the present study is comparable with previously reported results following quadrupled hamstring graft reconstruction.¹³ These findings support the favorable functional outcomes observed with hamstring autograft reconstruction. Return to the pre-injury level of sports was achieved in 63.2% of patients, while 26.3% returned with reduced activity and 10.5% did not return. This is consistent with evidence that, despite satisfactory functional recovery, return to the previous level of sport is not achieved by all patients following ACL reconstruction.² The majority of patients (84.2%) had no postoperative complications. Stiffness, pain, and infection occurred in 7.9%, 5.3%, and 2.6%, respectively. The low frequency of complications indicates a favorable short-term postoperative profile, although interpretation is limited by the small sample size.¹⁴ Age was significantly associated with functional outcome ($p = 0.04$), while gender was not ($p = 0.32$). Mode of injury was significantly associated with return to pre-injury sports ($p = 0.03$), and preoperative functional status was significantly associated with postoperative outcome ($p = 0.02$).

Overall, arthroscopic ACL reconstruction using a quadrupled hamstring autograft resulted in significant functional improvement and a favorable rate of return to sports at 6 months.

CONCLUSION

Arthroscopic ACL reconstruction using a quadrupled hamstring autograft resulted in significant improvement in knee function, with 84.2% of patients achieving good-to-excellent Lysholm outcomes at 6 months. Return to the pre-injury level of sports was achieved in 63.2% of patients. Younger age was associated with better functional outcome, while mode of injury and better preoperative functional status were associated with more favorable return-to-sport and postoperative functional outcomes, respectively. Overall, quadrupled hamstring autograft reconstruction provided favorable short-term functional and return-to-sport outcomes with a favorable short-term complication profile.

Limitations

This study has several limitations. The small sample size (n = 38) and single-center design may limit the generalizability of the findings. The 6-month follow-up provides information on short-term functional recovery but does not allow assessment of long-term graft survival, recurrent instability, or development of osteoarthritis. In addition, return to sports was assessed categorically and may have been influenced by factors such as rehabilitation, activity level, and psychological readiness that were not independently evaluated. The absence of a comparison group also limits direct comparison with other graft choices or treatment strategies.

DECLARATIONS

Ethics Approval and Consent to Participate

The study protocol was approved by the Institutional Ethics Committee, Sai Tirupati University, Udaipur, Rajasthan. Written informed consent was obtained from all participants before enrollment.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

All authors contributed to the study conception and design, data collection, analysis and interpretation of results, and preparation and revision of the manuscript. All authors approved the final manuscript.

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