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Original Research Article

PROSPECTIVE OBSERVATIONAL STUDY EVALUATING FUNCTIONAL OUTCOMES FOLLOWING ARTHROSCOPIC SINGLE-BUNDLE RECONSTRUCTION FOR GRADE III ISOLATED POSTERIOR CRUCIATE LIGAMENT TEARS

Basil S Mathew[1], Anusha S Pattanshetty[2], Amar Patil[3]

[1]Senior Registrar, Department of Orthopaedics, Manipal Hospital, Sarjapur, Karnataka, India
[2]Senior Resident, Department of Orthopaedics, Mahadevappa Rampure Medical College, Karnataka, India.
[3]Senior Registrar, Apollo Hospital, Bannerghatta Road, Bengaluru, Karnataka, India

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Corresponding Author:
Dr. Amar Patil,
Senior Registrar, Apollo Hospital, Bannerghatta Road, Bengaluru, Karnataka, India.
Email: amarpatil12345@gmail.com

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ABSTRACT

Background: Isolated posterior cruciate ligament (PCL) injuries are often underdiagnosed and undertreated in patients. While conservative management was once standard, current literature supports surgical intervention for improved stability and function. There remains limited data from Indian settings on outcomes following PCL reconstruction using hamstring autograft in patients above 30 years of age. The objective is to evaluate the clinical and functional outcomes of arthroscopic single-bundle PCL reconstruction using quadrupled hamstring autograft in patients over 30 years with isolated Grade III PCL tears.

Materials and Methods: A prospective observational study was conducted over 2 years at a multicentre. Thirty patients aged above 30 years with MRI-confirmed isolated Grade III PCL tears underwent arthroscopic single-bundle reconstruction using hamstring autograft. Functional outcomes were assessed preoperatively and at 12 and 24 months postoperatively using Lysholm score, IKDC subjective score and Tegner activity level. Radiographs were evaluated for graft position and osteoarthritic changes. Data analysis was performed using SPSS v26.

Results: There was a statistically significant improvement in all functional scores. The Lysholm score improved from 42.3 to 86.7, IKDC score from 48.1 to 76.5 and Tegner activity level from 2.1 to 4.3 at 24 months ($p < 0.001$). 56.7% of patients returned to their pre-injury activity level. Complication rates were low, with one superficial infection, one case of stiffness and two cases of early osteoarthritis. No graft failure or re-operations occurred.

Conclusion: Arthroscopic single-bundle PCL reconstruction using hamstring autograft offers significant functional improvement with minimal complications in patients with isolated PCL injuries. Early intervention and structured rehabilitation contribute to favorable outcomes. Larger studies from Indian settings are needed to further validate these findings and optimize treatment protocols.

Keywords: Posterior cruciate ligament, PCL reconstruction, Arthroscopy, Hamstring autograft, Functional outcome, Lysholm score.

INTRODUCTION

The posterior cruciate ligament (PCL) is one of the strongest ligaments in the knee, providing main support against posterior tibial translation, especially when the knee is flexed.[1] But isolated PCL injuries are often missed or taken lightly in early phase. Earlier it was thought that PCL heals by itself and doesn't need aggressive treatment like ACL, but now many studies show that delayed or untreated PCL injuries can lead to patellofemoral arthritis and medial compartment degeneration.[1]

Anterior cruciate ligament (ACL) injuries on the other hand are more commonly diagnosed and treated. Functional results after ACL reconstruction using hamstring graft, tightrope system or endobutton are widely reported in literature.[2-4] Functional scores like Lysholm, IKDC, Tegner are commonly used for outcome measurement. Initially both ACL and PCL injuries were managed conservatively. But newer studies suggest that surgical management gives better stability and long-term functional outcomes.[1,5] Even in cases of isolated PCL tear, early surgical intervention is now preferred if high grade or if symptoms persist after rehab. The surgical techniques have also evolved like single-bundle vs double-bundle reconstruction, transtibial vs tibial inlay, use of interference screw, endobutton or tightrope system for fixation.[3,6]

Hamstring tendon autograft remains the most commonly used graft in both ACL and PCL surgeries due to its ease of harvest and good functional outcomes.[1,2] Some studies compared it with peroneus graft too, showing similar results but with differences in donor site morbidity.[3] Most studies show significant improvement in postoperative Lysholm and IKDC scores, though return to pre-injury level of sport is still a concern especially in PCL reconstruction.[1,5] ACL patients tend to return earlier and at better level compared to PCL patients.

There is still limited literature on isolated PCL reconstruction from Indian and nearby settings. Also a long-term follow-up and functional outcomes using hamstring autograft in PCL tear are not much explored. Many studies focus more on ACL while PCL remains underreported. So this study was planned to fill that gap and provide local data on functional recovery after arthroscopic isolated PCL reconstruction using hamstring graft in patients above 30 years.

MATERIALS AND METHODS

This was a prospective observational study done in orthopaedics department of a multiple-tertiary hospital over 2 years. Ethical clearance was taken and consent was obtained from all patients. Patients above 30 years with isolated Grade III PCL tear on MRI were included. Those with multi-ligament injury, cartilage damage needing repair, previous surgery or less than 1-year follow-up were excluded. All patients underwent arthroscopic single-bundle PCL reconstruction using quadrupled hamstring autograft. Graft was taken from semitendinosus and gracilis tendon. Femoral fixation done with endobutton or tightrope and tibial side fixed using interference screw. Graft tensioned in 90° knee flexion. Same rehab protocol was followed for all. Non-weight bearing for 3 weeks with passive knee movement started on 2nd day, weight bearing after 6 weeks, return to normal activities after 3 months and sports after 6 months. Functional outcome measured using Lysholm score, IKDC score and Tegner scale before surgery and at final follow-up. Radiographs used to check tunnel position and arthritis if any. Data analysed with SPSS v26, paired t-test used, $p<0.05$ taken as significant.

RESULTS

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Value
Mean Age (years)	38.5 ± 6.2
Sex (M/F)	24 / 6
Dominant Knee Involved (Right/Left)	18 / 12
Time from Injury to Surgery (weeks)	7.8 ± 2.3
Mechanism of Injury	
– Road Traffic Accident	18 (60%)
– Sports-related	9 (30%)
– Fall from Height	3 (10%)
Pre-injury Tegner Activity Level	5.3 ± 1.1
Associated Meniscal Injury	4 (13.3%)

A total of 30 patients were enrolled in the study. The average age was 38.5 years, with majority being males (80%). The right knee was affected in 60% cases and the left in 40%. The mean time interval between injury and surgical intervention was approximately 7.8 weeks, reflecting a short-to-moderate delay often seen in tertiary referrals. The most common cause of injury was road traffic accidents (60%), followed by sports injuries (30%) and falls from height (10%). Additionally, 4 patients (13.3%) had associated meniscal injuries diagnosed intraoperatively. The pre-injury Tegner activity level was 5.3 ± 1.1, indicating a moderately active lifestyle in most patients.

Table 2: Functional Scores at Baseline and Postoperatively

Score	Preoperative Mean ± SD	12-Month Mean ± SD	24-Month Mean ± SD	p-value (baseline vs 24 mo)
Lysholm Score	42.3 ± 8.1	76.8 ± 7.3	86.7 ± 6.5	< 0.001
IKDC Subjective Score	48.1 ± 7.9	70.2 ± 8.2	76.5 ± 7.1	< 0.001
Tegner Activity Level	2.1 ± 0.6	3.5 ± 0.9	4.3 ± 0.8	< 0.01

Significant improvements were seen in all functional outcome measures over time. The mean Lysholm score rose from 42.3 preoperatively to 76.8 at 12 months and further to 86.7 at 24 months, showing near-complete recovery of knee function. Similarly, IKDC subjective scores improved from 48.1 at baseline to 76.5 at 24 months, suggesting consistent patient-perceived improvement in stability, pain and activity tolerance. Tegner scores, reflecting physical activity levels, increased from 2.1 preoperatively to 4.3, indicating successful reintegration into moderate activity. All observed changes were statistically significant, supporting the efficacy of surgical reconstruction.

Table 3: Return to Sport/Activity Level

Activity Return Level	Number of Patients (n)	Percentage (%)
Returned to Preinjury Level	17	56.7%
Returned to Slightly Lower Level	10	33.3%
Returned to Significantly Lower	3	10%

At the end of 24 months, 17 patients (56.7%) successfully returned to their pre-injury level of physical activity, indicating satisfactory functional recovery. Another 10 patients (33.3%) resumed at a slightly lower activity level, often due to personal lifestyle modifications or persistent fear of re-injury. Only 3 patients (10%) failed to regain functional capacity near baseline, mostly due to age-related limitations, psychological hesitation or early osteoarthritic symptoms.

Table 4: Complications and Radiographic Findings at 24 Months

Outcome	Number of Patients (n)	Percentage (%)
Superficial Infection	1	3.3%
Graft Failure	0	0%
Development of Grade I Osteoarthritis	2	6.7%
Knee Stiffness Requiring Intervention	1	3.3%
Re-operation	0	0%

The overall complication rate was low. Only one case (3.3%) of superficial surgical site infection occurred, which resolved with oral antibiotics. Two patients (6.7%) developed early radiographic signs of Grade I osteoarthritis at the final follow-up, although without significant clinical limitation. One patient developed postoperative stiffness, managed successfully with aggressive physiotherapy. Importantly, no graft failures or re-operations were reported, reflecting good graft integrity and surgical reliability over the 2-year follow-up period.

DISCUSSION

This study evaluated the clinical and functional outcome after arthroscopic reconstruction of isolated PCL tears in patients over 30 years of age using quadrupled hamstring autograft. As seen in Table 1, the majority of patients were males with dominant-side involvement and road traffic accidents as the main cause. This demographic pattern mirrors findings by Liu et al., who also reported male predominance and RTA as a common etiology.[7] Similar observations were made by Perumal et al. in an Indian population.[1]

[Table 2] illustrates consistent improvement across all functional scores. Our data showed significant enhancement in Lysholm, IKDC subjective and Tegner activity scores at 24 months. Devitt et al. reported similar trends with Lysholm improving from 49.6 to 84.2 and IKDC from 46.1 to 77.5.[5] In comparison our Lysholm score reached a slightly higher value of 86.7. Rahman et al. also documented a Lysholm score of 85.2 at one year postoperatively using hamstring graft.[8] Sudhakar et al. noted improvements from 42.3 to 85.6 in their cohort.[2] Radhik et al. stressed the impact of graft thickness, correlating thicker hamstrings with better IKDC outcomes.[4] These findings suggest that favorable outcomes are achievable even in non-athletic individuals.

Regarding activity resumption [Table 3] 56.7% of patients returned to their pre-injury level. Devitt et al. reported a slightly lower return rate of 44%.[5] Around one-third resumed slightly reduced activity while 10% had significant functional decline. The postoperative Tegner score of 4.3 in our cohort closely matches Liu et al.'s value of 4.6.[6,7] Sojitra et al. reported a 62% return to prior activity in their 2024 study, reinforcing the idea that structured rehab can overcome age-related barriers.[8,9] Tedeschi et al., in their scoping review, noted higher return-to-sport rates in surgical groups, although psychological readiness was a key variable.[10]

Complication rates remained low as shown in Table 4. We observed only one superficial infection, one stiffness and two early osteoarthritis cases. No graft failures or re-operations occurred. Liu et al. noted comparable results with one infection and two OA cases.[7] Perumal et al. also reported good graft outcomes with low complication frequency.[1] Agarwalla et al. emphasized the role of strong anatomical fixation to reduce graft failure & supported arthroscopic suture bridge repairs for optimal outcomes in tibial-sided PCL avulsions.[11] Rasmussen et al. explored non-operative rehab and found good IKDC improvement in lower grade PCL injuries but lower return to sport levels compared to surgical groups.[12] Shelbourne et al. also stated that while non-operative treatment can help in partial

injuries, surgery is preferred for restoring full functional outcome in complete tears.[13] A study highlighted the presence of associated injuries in over 40% of PCL trauma cases, with higher complication rates when multi-ligament involvement was present.[14] In our isolated PCL group, these were absent, possibly contributing to lower complication rates. Chahla's work highlighted the benefit of anatomical graft positioning and tunnel orientation in restoring posterior tibial translation and functional stability.[15] Their biomechanical analysis stresses the importance of precise reconstruction steps to mimic native ligament behavior.

Sojitra found that IKDC and Lysholm scores improved significantly postoperatively (45 to 76.3 and 50.1 to 84.5, respectively).[9] Their study also linked higher pre-operative Tegner levels with better return to sport, which matches our data patients with Tegner score above 5 had better recovery trajectories. While results are promising, some limitations exist. Small sample size, lack of a control group and exclusive reliance on subjective scores are constraints. Radiologic healing or tunnel changes were not assessed. Still, the prospective design and consistent rehabilitation enhance study validity. Future studies with larger cohorts in Indian settings are needed to validate these findings, compare graft options and refine rehabilitation protocols. Additional emphasis should be placed on psychological readiness and objective performance metrics to guide safe return to activity after PCL surgery.

CONCLUSION

Arthroscopic single-bundle PCL reconstruction using hamstring autograft gave good results in patients above 30 years. Functional scores like Lysholm, IKDC and Tegner improved significantly over 2 years. More than half patients could return to pre-injury activity while one-third had only slight reduction. Very few complications were seen. No graft failure or re-surgery was needed. Early OA changes seen in only 2 cases and stiffness in one. Using same rehab protocol helped in consistent recovery. So even non-athletic patients can benefit from early surgical management if symptoms persist. Still bigger studies are needed to confirm long-term outcomes and compare different grafts or fixation techniques. Also the psychological factors should be considered during rehab for better return to activity.

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