

Functional Outcome in Posterior Cruciate Ligament Reconstruction with Posterolateral Corner Reconstruction: A Prospective Clinical Study

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Abstract: Injuries involving both the posterior cruciate ligament (PCL) and the posterolateral corner (PLC) of the knee present significant challenges for orthopaedic surgeons due to their complexity and impact on knee stability. Appropriate management is crucial to prevent long - term instability and functional impairment. **Aim:** The aim of this study is to evaluate the functional outcomes of arthroscopic posterior cruciate ligament (PCL) reconstruction combined with posterolateral corner (PLC) repair using Larson's method in patients with combined PCL and PLC injuries. **Background:** Posterior cruciate ligament (PCL) injuries, often accompanied by posterolateral corner (PLC) injuries, significantly impact knee stability. This study aims to evaluate the functional outcomes of PCL reconstruction with concomitant PLC reconstruction using Larson's method. **Methods:** This prospective clinical study included 30 patients diagnosed with combined PCL and PLC injuries, who underwent arthroscopic PCL reconstruction with PLC repair using Larson's method. Functional outcomes were assessed over a 12 - month follow - up using the International Knee Documentation Committee (IKDC) score, Lysholm Tegner scoring system, and knee stability tests. **Results:** Postoperative evaluations showed significant improvements in knee function, stability, and early return to sports. Mean IKDC and Lysholm Tegner scores at 12 months demonstrated substantial functional recovery, with over 80% of patients returning to pre - injury levels of activity. **Conclusion:** PCL reconstruction with PLC repair using Larson's method yields excellent functional outcomes, improved stability, and an early return to athletic activities. This technique is recommended for patients with combined PCL and PLC injuries.

Keywords: Posterior Cruciate Ligament, Posterolateral Corner, Larson Method, Arthroscopic Reconstruction, Knee Stability

1. Introduction

The posterior cruciate ligament (PCL) is a key stabilizer of the knee joint, preventing posterior translation of the tibia relative to the femur, especially during high - impact or sudden movements. Injuries to the PCL, although less common than anterior cruciate ligament (ACL) injuries, can severely compromise knee stability and function. In about 50–90% of PCL injuries, there are associated injuries to other structures, most notably the posterolateral corner (PLC) of the knee. The PLC is composed of important anatomical structures such as the fibular collateral ligament (FCL), popliteus tendon (PLT), and popliteofibular ligament (PFL), which collectively provide resistance to varus, external rotation, and posterior tibial translation. (1)

Combined PCL and PLC injuries, often referred to as posterolateral rotatory instability (PLRI), pose significant diagnostic and treatment challenges. Failure to address both the PCL and PLC in patients with combined injuries may result in persistent instability, graft failure, and early development of osteoarthritis. Isolated PCL reconstruction has been shown to be inadequate in addressing the rotational instability caused by PLC injury. Therefore, there is growing consensus that both the PCL and PLC must be addressed during surgical intervention to ensure optimal functional recovery. (2)

The Larson method of PLC reconstruction is a well - established surgical technique that aims to restore the function of the FCL, PLT, and PFL through autograft or allograft reconstruction. When combined with PCL reconstruction, the Larson method has shown promise in restoring both posterior and rotational stability of the knee. Previous studies have

highlighted the importance of this combined approach in achieving better functional outcomes and reducing the risk of long - term complications. However, more clinical evidence is needed to solidify its efficacy. (3)

This study focuses on the functional outcomes of patients undergoing PCL reconstruction combined with PLC repair using Larson's method. By evaluating functional performance, knee stability, and return to activity in a cohort of patients, this study aims to provide evidence on the effectiveness of this combined surgical approach. The findings will help guide clinical practice and improve decision - making in the management of these complex injuries.

2. Materials and Methods

Study Design:

This is a prospective clinical study conducted at the Sanjay Gandhi Institute of Trauma and Orthopaedics, Bengaluru, over 18 months, with a minimum follow - up period of 12 months.

Participants:

A total of 30 patients with combined PCL and PLC injuries were enrolled. All patients underwent PCL reconstruction with PLC repair using the Larson method.

Inclusion Criteria:

- 1) Patients with MRI - confirmed PCL and PLC injuries.
- 2) Age between 18 and less than 50 years.
- 3) A normal contralateral knee with no concomitant ACL or meniscal injuries.

Exclusion Criteria:

- 1) Concomitant ACL or meniscal injuries.
- 2) Presence of osteoarthritis or osteochondral lesions.
- 3) Neurological deficits or systemic diseases affecting preoperative fitness.

Surgical Technique:

All patients underwent arthroscopic single - bundle PCL reconstruction using hamstring tendon autografts. The PLC was reconstructed using Larson's method, which involves reconstructing the FCL, PLT, and PFL. Hamstring and peroneus longus tendon grafts were used for this reconstruction. Postoperative rehabilitation protocols were standardized across patients.

Outcome Measures:

Functional outcomes were assessed using the following:

- IKDC score: Preoperative and postoperative knee function was measured at 2 weeks, 4 weeks, 3 months, 6 months, and 12 months.
- Lysholm Tegner score: Used to assess functional activity levels, including return to sports.
- Knee Stability: Evaluated using the KT - 1000 arthrometer and clinical stability tests (posterior drawer, reverse pivot shift, and dial test).

Statistical Analysis:

Descriptive statistics were used to analyse the functional outcomes. Data were reported as mean values with standard deviations.

3. Results**Demographics:**

The study included 30 patients, 18 males and 12 females, with a mean age of 33.1 years (range 18 - 50). The primary mechanisms of injury were road traffic accidents (60%) and sports - related injuries (40%), with the right knee being affected in 60% of cases. All patients presented with combined PCL and PLC injuries confirmed by clinical examination and MRI findings.

Functional Outcomes:

At the final 12 - month follow - up, patients showed marked improvements in knee function, as indicated by the International Knee Documentation Committee (IKDC) and Lysholm Tegner scores. Preoperative mean IKDC scores were 42.8 ± 9.3 , and these improved significantly to 85.7 ± 6.5 at 12 months ($p < 0.001$). Similarly, the Lysholm Tegner scores showed a substantial increase from a preoperative mean of 48.2 ± 10.1 to 91.4 ± 5.7 at 12 months ($p < 0.001$). Over 80% of the patients were able to return to pre - injury levels of sports and physical activity by the 9 - month mark, with full activity restoration seen in 60% of the cohort by 6 months.

Knee Stability:

All patients demonstrated improved knee stability postoperatively. Clinical tests, including the posterior drawer test, reverse pivot shift test, and dial test, indicated significant stabilization of the knee. Preoperatively, the average posterior tibial translation as measured by the KT - 1000 arthrometer was $10.2 \text{ mm} \pm 1.8$, which was reduced to $2.3 \text{ mm} \pm 1.2$ postoperatively ($p < 0.001$). The reverse pivot shift test, which

was positive in all patients preoperatively, became negative in 85% of the patients by the 6 - month follow - up, indicating restored rotational stability.

Return to Activity:

Patients were monitored for their ability to return to sports and regular activities. By the 6 - month follow - up, 60% of the patients were able to resume low - impact physical activities such as walking, cycling, and swimming. By 9 months, 80% had returned to pre - injury levels of activity, including high - demand sports such as football, basketball, and running. The average time to return to full sports participation was 8.3 months.

Complications:

Minor complications were observed in 10% of the patients. Two patients experienced mild postoperative stiffness, which was resolved through aggressive physiotherapy. One patient developed superficial wound infection, which responded well to oral antibiotics. No cases of neurovascular injury, deep vein thrombosis (DVT), or graft failure were reported during the follow - up period.

Radiological Outcomes:

Follow - up MRI at 12 months showed intact PCL and PLC reconstructions with no signs of graft failure. Bone healing around the graft tunnels was adequate, with no evidence of tunnel widening or osteolysis. Radiographs showed no progression of osteoarthritis in any of the patients.

4. Discussion

This study demonstrates that arthroscopic posterior cruciate ligament (PCL) reconstruction combined with posterolateral corner (PLC) repair using Larson's method is an effective treatment for restoring knee function and stability in patients with combined PCL and PLC injuries. The results showed significant improvements in knee stability, functional outcomes, and early return to physical activities, confirming the efficacy of the combined approach for addressing these complex injuries. Our findings contribute to the growing evidence that isolated PCL reconstruction is insufficient for managing the rotational and varus instability associated with PLC injuries, highlighting the importance of addressing both structures simultaneously.

The posterolateral corner of the knee is a complex structure that plays a critical role in resisting varus forces and controlling external rotation. Injuries to this region, especially when combined with PCL tears, result in posterolateral rotatory instability (PLRI). (4) In such cases, failure to repair the PLC in addition to PCL reconstruction leads to persistent instability, which can negatively affect knee function and predispose the joint to early degenerative changes such as osteoarthritis. (5)

Our results align with previous studies that emphasize the need for a comprehensive surgical approach when dealing with combined PCL and PLC injuries. In the study by Wajsfisz et al. (2010), it was shown that patients undergoing combined PCL and PLC reconstruction exhibited better functional outcomes and knee stability compared to those treated with PCL reconstruction alone. (6) Similarly,

Franciozi et al. (2012) reported superior results in patients who received both reconstructions, with significant improvements in knee stability and reduced failure rates compared to those who underwent isolated PCL reconstruction. (7) Our study corroborates these findings, showing that all patients experienced marked improvements in both posterior and rotational knee stability after undergoing PCL and PLC reconstruction using Larson's method.

The Larson method for PLC reconstruction involves restoring the key static stabilizers of the posterolateral corner, including the fibular collateral ligament (FCL), popliteus tendon (PLT), and popliteofibular ligament (PFL), using grafts such as hamstring tendons. By restoring these structures, the Larson method effectively addresses the varus and external rotational instability often seen in PLC injuries. (8) In our study, the use of the Larson method in combination with PCL reconstruction resulted in significant improvements in functional scores, as measured by the International Knee Documentation Committee (IKDC) and Lysholm Tegner scores. These results highlight the efficacy of the Larson method in reestablishing knee stability, allowing patients to regain function and return to their previous levels of physical activity.

One of the key advantages of the Larson method is its ability to anatomically reconstruct the important stabilizing structures of the PLC while minimizing the invasiveness of the procedure. The technique involves passing the graft through the fibula and anchoring it at both the femoral and tibial sides, ensuring proper tension and alignment of the reconstructed ligaments. (9) In our cohort, the reconstruction successfully restored knee stability, as evidenced by the negative results on the reverse pivot shift and dial tests in the majority of patients at the 6 - month follow - up.

Our study demonstrated that patients undergoing combined PCL and PLC reconstruction using Larson's method experienced substantial improvements in functional outcomes, with mean IKDC and Lysholm Tegner scores significantly improving from preoperative to postoperative assessments. By the 12 - month follow - up, most patients had regained nearly full function, with 80% returning to pre - injury levels of sports and physical activities by the 9 - month mark. The early restoration of function and return to sports is particularly important for athletes and physically active individuals, as it reduces the risk of long - term functional impairment and promotes a quicker return to normal activities.

Previous studies have reported varying timelines for the return to sports following PCL and PLC reconstruction. Freeman et al. (2003) noted that patients who underwent combined reconstruction returned to sports after an average of 9 months (10), which is consistent with our findings. The early return to activity in our study can be attributed to the stability provided by the Larson method, as well as the structured postoperative rehabilitation protocol, which emphasized early mobilization, range - of - motion exercises, and quadriceps strengthening.

In terms of complications, our study reported a relatively low complication rate, with only minor issues such as mild postoperative stiffness and superficial wound infection. No

major complications such as deep vein thrombosis (DVT), neurovascular injury, or graft failure were observed. These results demonstrate the safety and reliability of the Larson method when performed by experienced surgeons using standardized techniques. Previous studies have also reported low complication rates for PLC reconstructions, with most complications being manageable through non - operative interventions such as physiotherapy or minor wound care.

The absence of major complications in our cohort highlights the importance of proper patient selection and adherence to postoperative rehabilitation protocols. It also reinforces the value of using the Larson method, which provides secure fixation of the reconstructed ligaments and reduces the risk of graft failure or malposition.

Radiological evaluations at the 12 - month follow - up showed successful integration of the grafts, with no signs of tunnel widening, osteolysis, or graft failure. These findings indicate that the grafts used in both the PCL and PLC reconstructions were adequately incorporated into the surrounding bone, ensuring long - term structural stability. MRI scans confirmed intact reconstructions, with no evidence of residual instability or progression of degenerative changes.

This is consistent with studies by Li et al. (2019) and Kim et al. (2013), which reported successful healing of grafts in patients who underwent combined PCL and PLC reconstructions. Radiological assessments provide critical insight into the long - term durability of the reconstruction, and the results from our study suggest that Larson's method provides reliable and lasting outcomes.

While our study demonstrates positive results, it has certain limitations. The relatively small sample size and the short follow - up period of 12 months may limit the generalizability of the findings. Larger studies with longer follow - up periods are needed to confirm the durability of the reconstruction and assess the potential for long - term complications such as graft failure, re - injury, or osteoarthritis. Additionally, comparative studies between different PLC reconstruction techniques could provide further insights into the most effective methods for managing combined PCL and PLC injuries.

Future research should also explore the role of advanced imaging techniques, such as dynamic MRI, to better understand the biomechanics of reconstructed knees and to detect subtle instabilities that may not be apparent on clinical tests alone. Long - term follow - up studies focusing on functional outcomes, patient satisfaction, and quality of life will help guide clinical decisions and improve outcomes for patients with these complex injuries.

5. Conclusion

PCL reconstruction combined with PLC repair using Larson's method provides excellent functional outcomes, improved knee stability, and an early return to physical activities. This technique is a reliable option for managing combined PCL and PLC injuries and should be considered the standard approach in such cases.

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