International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Functional Outcomes of Larson Technique in Multiligament Knee Reconstruction with Posterolateral Corner Injuries in a Non - Tertiary Hospital

Nur Akmal I. M[1], M. D, Thevarayan Somasundaram, M. D[2], Mohamad Razip Sirat, M. D[3]

[1, 2, 3]Hospital Pakar Sultanah Fatimah, Malaysia

Abstract: ***Background: Multiligament injury (MLI) with posterolateral corner (PLC) involvement of the knee present significant diagnostic and management challanges. Multiple techniques has been describe for managing these injuries. The Larson technique, a fibula based approach, is an acceptable method that provides adequate stability. This study evaluates the functional outcomes of MLI reconstruction using the Larson technique with an allograft. Methods: A retrospective review of MLIs managed with the Larson procedure between January 2021 and December 2023 was conducted. Patient's demographic, ligament involvement, and preoperative and postoperative lower limb extremity score (LEFS) were evaluated. Results: Nine cases (one female, eight male) were included. Among them, two (22.2%) involved PCL and PLC, while seven (77.8%) involved ACL, PCL and PLC injuries. The mean preoperative LEFS score was 47.67, improving significantly to 65.22 postoperatively (p<0.018). Most patients experienced improved functional outcomes, with 66.7% achieving minimal or no functional limitations. Conclusion: In a population with lower activity demands, the Larson technique offers satisfactory functional outcomes and adequate stability in MLI cases involving PLC injuries.***

Keywords: Multiligament knee injury, posterolateral corner, Larson technique, knee stability, functional outcome

1. Introduction

Multiligament injury (MLI) of the knee is commonly defined as a tear of at least two of the major knee ligament structures; the anterior cruciate ligament (ACL), the posterior cruciate ligament (PCL), the posteromedial corner (PMC), and the posterolateral corner (PLC). Multiligament injury with lateral injuries of the knee is any cruciate ligament tears accompanied by PLC tear. It presents a significant challenge due to the complex biomechanics of the knee and potential instability in multiple planes.

There were multiple surgical technique described in managing multiligament knee injuries with PLC involvement. The most common approach includes the isometric fibular based technique and anatomic tibial based technique. The Larson technique offers a simpler approach that provides adequate stability for activity of daily living. Studis has shown that non - anatomical reconstruction of PLC can have high failure rate up to 36%, compared with anatomical reconstruction (Garrett R. Jackson, June 2024) . However, recent systematic review by Colatruglio in 2024 found out that there is no difference in patient reported outcome between the two technique (Matthew R. Colatruglio, 2024) .

In our centre, we used isometric fibular based reconstruction (Larson technique) in managing cases of MLI with PLC injuries. We choose Larson technique in the management of our patient because of the population of patient. Most of the patients is non - athlete and does not requires high knee stability for daily functions. We believed that even with the Larson technique, patients will have good or satisfactory functional outcome after the surgery.

This study aims to evaluate the functional outcome of the Larson technique for MLI with PLC injuries, assessing improvement in the Lower Extremity Functional Scale (LEFS) postoperatively. We hypothesize that patient will demonstrate significant improvement in lower limb functional score (LEFS) at least 1year postoperatively, despite the non - anatomical nature of the reconstruction. This study contributes valuable insights into the efficacy of the Larson technique in non - tertiary settings, particularly for patients with lower functional demands.

2. Materials and Methods

This is a retrospective cross sectional study done at Hospital Pakar Sultanah Fatimah, Malaysia. All cases of multiligament reconstruction with PLC injuries done using Achilles tendon allograft from January 2021 to December 2023 were reviewed. Revision cases, patient less than 18 years old and those with incomplete documentation were excluded. We evaluate patient's demographic and Lower extremity functional scale (LEFS) preoperatively and at least 1 year postoperatively.

Operative technique

All cases were done by the same surgeon. Surgery was done under combined spinal epidural or general anaesthesia. Patient were placed in supine position with leg hanging at the end of the bed while contralateral leg in lithotomy position. Tourniquet was applied at the proximal thigh. Diagnostic arthroscopy was done to confirm the diagnosis and procedure need to be done. All the ligaments were reconstructed using allograft. The cruciate ligament reconstruction was done first without fixation to the tibia. Then, PLC reconstruction is done using allograft as describe by Larson (Larson, 2001) . The cruciate tibial fixation was done followed by fixation of PLC at femoral tunnel.

Rehabilitation

The rehabilitation protocol was standardized for all patient. Postoperatively, patients were placed in immobilizer with posterior support of the lower limb for three weeks. Isometric quadriceps exercise, ankle pump, straight leg raising, hip abduction and adduction, and patella mobilization was start at day one post op. At three weeks postoperative, patient was put on knee brace with posterior support and locked at 0 degree. Patient was allowed passive range of motion in prone position up to 45 degree and increase sequentially. At 6 weeks, partial weight bearing was allowed. Full weight bearing and range of motion with knee brace up to 90 degree is allowed at 3 months. Knee brace was off at 6 months. Sports activities is allowed after 1 year.

Statistical analysis

The SPSS version 29.0 is used for the statistical analysis. The descriptive analysis was used for basic measures and the value presented as means. The paired T - test was used to evaluate the LEFS preoperatively and postoperatively.

3. Results

A total of 15 cases of multiligament knee reconstruction with PLC injuries were performed from January 2021 to December 2023. Out of these cases, 6 cases were excluded from the analysis: One revision case, one patient under18 years old and four patients with incomplete documentation. The final analysis included 9 patients. From 9 cases, two (22.2%) sustained injury involving PCL and PLC, while seven (77.8%) cases sustained injury involving ACL, PCL and PLC. Only 1 (11%) patient were female while 8 were male (89%). Patient age ranged from 19 to 44 years old, with mean age of 28 years old.

The most common mechanism of injury was motorvehicle accident (6 cases), followed by sports - related injury (2 cases) and 1 case was industrial injury. The Pre - operative LEFS were significantly associated with the specific ligaments injured ($t= 3.37$, $p<0.05$). However, the ligaments injured does not significantly impact the post - operative LEFS ($t = 1.98$, $p= 0.09$). The time of injury to surgery are between 6 to 60 months.

Preoperatively, 4 patients (44.4%) had moderate functional limitation, 2 (22.2%) had mild to moderate functional limitation and 3 (33.3%) had minimal functional limitation. The mean pre - operative LEFS is 47.67. Post - operatively, 3 (33.3%) patients had mild functional limitation and 6 (66.7%) had minimal or no functional limitation. The mean postoperative LEFS was 65.22. A paired sample t - test revealed a statistically significant improvement in the mean LEFS from pre - operative to post - operative LEFS ($p<0.018$).

There is only one reported complication. Patient has stiffness of the knee despite rehabilitation and patient was not keen for another surgery. There was no failure seen in all the cases.

4. Discussion

The management of multiligament knee injuries (MLI) with posterolateral corner (PLC) involvement remains a complex orthopaedic challenge. This study evaluated the functional outcomes of the Larson technique for PLC reconstruction in conjunction with cruciate ligament reconstruction in nine patients at our centre. Our findings demonstrate a statistically significant improvement in Lower Extremity Functional Scale (LEFS) scores from a preoperative mean of 47.7 to a postoperative mean of 65.2 ($p < 0.018$). This suggests that, despite being a non - anatomical reconstruction, the Larson technique can provide clinically significant functional improvement for patients with MLI and PLC injuries.

The observed improvement in LEFS scores were similar with some previous studies utilizing fibular - based PLC reconstruction techniques (Byoung Se Yang, 2013; Khalis Boksh, 2023; Matthew R. Colatruglio, 2024) . However, there are studies have shown that anatomical PLC reconstruction may lead to superior outcomes, and less failure rate compare to non - anatomical reconstruction (Garrett R. Jackson, June 2024; Robert F. LaPrade, 2019) . Some studies also shown that anatomical reconstruction shown to have better external rotation control (Jay Moran, 2024; Joshua T. Bram, 2024) . Despite some studies suggesting that anatomical reconstruction is superior biomechanically, there are studies suggested that both technique provide adequate constrain and can be use in the treatment of PLC injury (Stijn van Gennip, 2020; Vezeridid P. S., 2020) .

The choice of the Larson technique in our centre was primarily driven by the characteristics of our patient population, which predominantly consists of individuals with lower activity levels and a high proportion of trauma - related injuries, often from motor vehicle accidents. The Larson technique offers a relatively simpler and more reproducible surgical approach compared to anatomical reconstructions, potentially reducing operative time and complexity. This is particularly advantageous in a non - tertiary hospital setting with resource constraints. Furthermore, the isometric nature of the Larson technique, while not perfectly replicating the native PLC anatomy, may provide sufficient stability for activities of daily living in this patient population. However, it is important to remember that cases with concurrent proximal tibiofibular instability and asymmetry knee hyperextension are not suitable with fibular based technique.

Several limitations of this study warrant consideration. The retrospective study introduces the potential for selection bias and limits the ability to establish causal relationships. The relatively small sample size (n= 9) may limit the statistical power and the generalizability of our findings. Furthermore, the absence of a control group or a comparison with other PLC reconstruction techniques makes it difficult to definitively determine the superiority of the Larson technique. The use of the LEFS as the primary outcome measure, while widely accepted, may not fully capture all aspects of knee function and stability. Finally, the follow - up period of at least one year may not be sufficient to detect long - term complications or graft failures.

Despite these limitations, this study provides valuable insights into the functional outcomes of the modified Larson technique for PLC reconstruction in a non - tertiary hospital setting. The observed improvement in LEFS scores suggests that this technique can be a viable option for patients with

MLI and PLC injuries, particularly those with lower functional demands. Future research should focus on prospective, randomized controlled trials comparing the Larson technique with anatomical reconstruction techniques, as well as longer - term follow - up studies to assess graft survival and the development of osteoarthritis. Further investigation into patient - reported outcome measures that capture a wider range of functional activities and knee stability is also warranted.

5. Conclusion

This study demonstrates that the Larson technique provides meaningful functional improvements for patients with MLI and PLC injuries, particularly in a non - tertiary hospital setting. While the results are promising, future studies with larger sample sizes and comparative analyses against anatomical reconstruction are warranted.

References

[1] Byoung Se Yang, W. H. B., Jin Goo Kim. (2013). Posterolateral Corner Reconstruction Using the Single Fibular Sling Method for Posterolateral Rotatory Instability of the Knee. *The American Journal of Sport Medicine*, *41* (7). https: //doi. org/http: //doi. org/10.1177/0363546513488866

[2] Garrett R. Jackson, E. S. M., Joshua Condon, Daniel DeWald, Anjay Batra, Luis M. Salazar, Filippo Familiari, Matthew Matava, Derrick M. Knapik, Nikhil N. Verma, Robert F. LaPrade, Jorge Chala. (June 2024). Non - anatomical reconstruction of chronic posterolateral corner knee injuries show failure rates from 0% to 36% versus 4.3% to 24.2% for anatomic reconstruction techniques: An updated systematic review reflecting the 2019 expert consensus statement. *Journal of ISAKOS*, *9* (3), 362 - 370.

[3] Jay Moran, L. V. T., Christopher M. LaPrade, Robert F. LaPrade. (2024). Editorial Commentary: Anatomic Tibiofibular and Partially Anatomic - Based Fibular Posterolateral Corner Reconstruction Techniques Are Biomechanically Superior to Nonanatomic Reconstruction Techniques: A Tibial Tunnel Is the Gold Standard for an Anatomic Reconstruction. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* (11). https: //doi. org/https: //doi. org/10.1016/j. arthro.2024.11.053

[4] Joshua T. Bram, A. E. W., Antonio Cusano, Heidi Halvorsen, Sophia Zhuang, Bruce Levy, Robert G. Marx. (2024). Anatomic Fibular - Based Posterolateral Corner Reconstruction With 2 Femoral Tunnels Shows Lowest Residual Laxity With External Rotation and Varus Stresses: A Systematic Review and Network Meta - analysis of In Vitro Biomechanical Studies. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* (9), 1 - 21. https: //doi. org/https: //doi. org/10.1016/j. arthro.2024.08.046

[5] Khalis Boksh, A. G., Randip Aujla. (2023). Fibular - Versus Tibiofibular - Based Reconstruction of the Posterolateral Corner of the Knee: A Systematic Review and Meta - analysis. *American Orthopaedic Society for Sports Medicine*, *51* (14). https: //doi. org/https: //doi. org/10.1177/03635465221138548

[6] Larson, R. V. (2001). Isometry of the lateral collateral and popliteofibular ligaments and techniques for reconstruction using a free semitendinosus tendon graft. *Operative Techniques in Sports Medicine*, *9* (2), 84 - 90. https: //doi. org/https: //doi. org/10.1053/otsm.2001.21765

[7] Matthew R. Colatruglio, J. D. L., Jeff Murphy, David L. Bernholt. (2024). There Is No Difference in Clinical Outcomes of Tibial - Based Versus Fibular - Based Posterolateral Corner Reconstruction: A Systematic Review. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. https: //doi. org/https: //doi. org/10.1016/j. arthro.2024.05.008

[8] Robert F. LaPrade, J. C., Nicholas N. DePhillipo, Tyler Cram, Mitchell I. Kennedy, Mark Cinque, Grant J. Dornan, Luke T. O'Brien, Lars Engebretsen, Gilbert Moatshe. (2019). Single - stage multiple - ligament knee reconstructions for sports - related injuries: Outcomes in 194 patients. *The American Journal of Sport Medicine*, *47*, 2563 - 2571. https: //doi. org/10.1177/0363546519864539

[9] Stijn van Gennip, W. A. v. d. W., Petra J. C. Heestrebeek, Ate B. Wymenga, Vincent J. J. F. Busch. (2020). Posterolateral corner reconstruction in combined injuries of the knee: Improved stability with Larson's fibular sling reconstruction and comparison with LaPrade anatomical reconstruction. *The Knee*, *27* (1), 124 - 131. https: //doi. org/hyyp: //doi. org/10.1016/j. knee.2019.09.008

[10] Vezeridid P. S., E. I. D., Salzler M. J., Hosseini A., Gwathmey F. W., Gill T. J.,. (2020). Biomechanics following isolated posterolateral corner reconstruction comparing a fibular - based docking technique with a tibia and fibular - based anatomic technique show either technique is acceptable. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, *36* (5), 1376 - 1385. https: //doi. org/10.1016/j. arthro.2019.12.007