Original Article

Functional Outcome of Single-Stage Reconstruction for the Multi-Ligament Injuries of the Knee

Bhadra Hamal,[1] Mahesh Karmacharya,[1] Sijan Bhattachan,[1] Pawan Kumar Hamal[1]

[1]National Academy of Medical Sciences, National Trauma Center, Kathmandu, Nepal.

ABSTRACT

Background: Multi-ligament injuries of the knee are rare injuries that can cause significant impairment of the knee function. There is controversy in the treatment regarding staged versus single-stage surgery. This study was performed to assess the outcome of the single-staged reconstruction of the multi-ligament injury of the knee.

Methods: This prospective observational study was done from January 15, 2022 to January 14, 2023. The outcome was analyzed by comparing the preoperative and 12-month postoperative Visual Analog Scale score, Lysholm Score, and International Knee Documentation Committee Score.

Results: The mean age of the patients was 28.35 years. among 12 patients 9 were male and 3 were female. Single-staged multi-ligament reconstruction was done in all the cases. The Lysholm score was improved from preoperatively 36.42 ± 1.46 to 95.36 ± 2.84, IKDC score was improved from 24.38 ± 1.64 to 93.86 ± 3.14, VAS score 8.14 ± 1.44 to 0.40 ± 0.60 at 12 months postoperative follow-up which all came to be clinically significant with p-value < 0.001.

Conclusions: Single-stage multi-ligament reconstruction of the knee is an effective method of treatment and has excellent outcomes.

Keywords: Multi-ligament injury; reconstruction; single-stage.

INTRODUCTION

Multi-ligament knee injuries (MLKI) are rare injuries that can lead to significant knee instability and impair the activity of daily living.[1] These injuries involve disruptions of two or more ligaments of the knee: anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL), and posterolateral corner (PLC).[2,3] These injuries comprise 0.02%-0.2 % of all orthopedic injuries.[4] These injuries occur due to high-velocity injuries like road traffic accidents, sports activities, and falls from substantial heights.[5,6] The patient may present with knee subluxations, dislocations with decreased knee range of motion, and knee instability.[7] Schenk described a classification system based on the pattern of multi-ligament injuries in knee dislocation.[3] The treatment of MLKI remains controversial.[2] In the past, these injuries were managed by knee immobilization however these days many authors advocate surgical interventions.[8-10] Surgical intervention can be staged or single-stage surgery. In our setup, we do single-stage surgery.

METHODS

This prospective study was done from January 15, 2022, to January 14, 2023, after approval from the Institutional Review Board (Ref. no. 70/2079/80). 12 patients who were treated by single-stage multi-ligament reconstruction surgery and who met the inclusion criteria for the study especially patients actively involved in sporting activities were enrolled. The data were analyzed for patients' demographics, mode of injuries, surgical findings, preoperative and postoperative knee range of motion (ROM), and post-operative complications. The patients' questionnaire included the Visual Analogue Scale (VAS) Score[11], the International Knee Documentation Committee (IKDC) form[12], and the Lysholm knee scoring system.[13]

All the patients with multi-ligament knee injuries were

Correspondence: Dr Bhadra Hamal, Department of Orthopaedics, National Academy of Medical Sciences, National Trauma Center, Kathmandu, Nepal. Email: drbhadrahamal@gmail.com, Phone: +9779841366188.

operated by uniform surgical procedures. Spinal anesthesia was used in all the cases. The involved knee was positioned in a leg holder at 90 degrees of knee flexion. The tourniquet was placed around the thigh. The diagnostic arthroscopy was done by the standard anterolateral portal. The diagnosis was confirmed by arthroscopic visualization. Then the hamstring, and peroneus longus autografts were harvested according to the need for multiple ligament reconstruction. Arthroscopic single bundle transportal ACL and transeptal PCL reconstruction were done. The lateral corner was reconstructed by modified Larson and the medial corner was reconstructed by Kim's method. The associated knee injuries like meniscus tear, and chondral injuries were addressed at the same time. After the surgery, physiotherapy was started from postoperative day one. Ankle pump, quadriceps, and hamstring muscle strengthening exercises, and the gradual knee range of motion were started. The knee was kept in a hinge knee immobilizer. The stitch removal was done on the tenth postoperative day. The knee range of motion, IKDC Score, Lysholm score, and VAS score were assessed at 3, 6, and 12 months postoperatively.

The statistical analysis was done by spss version 20 and preoperative and 12 months postoperative data were compared using paired t-tests and p values < 0.05 were considered statistically significant.

Figure 1. T2 weighted sagittal MRI of right knee showing Multi-ligament (ACL + PCL) Tear.

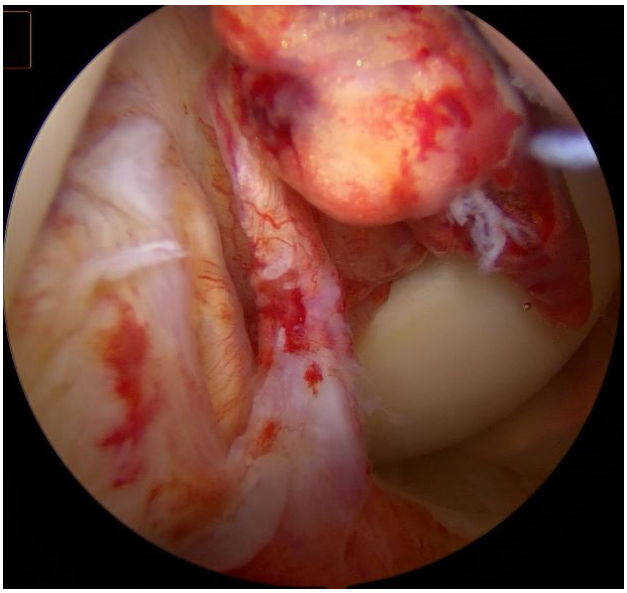

Figure 2. Arthroscopic view of multi-ligament (ACL + PCL) tear.

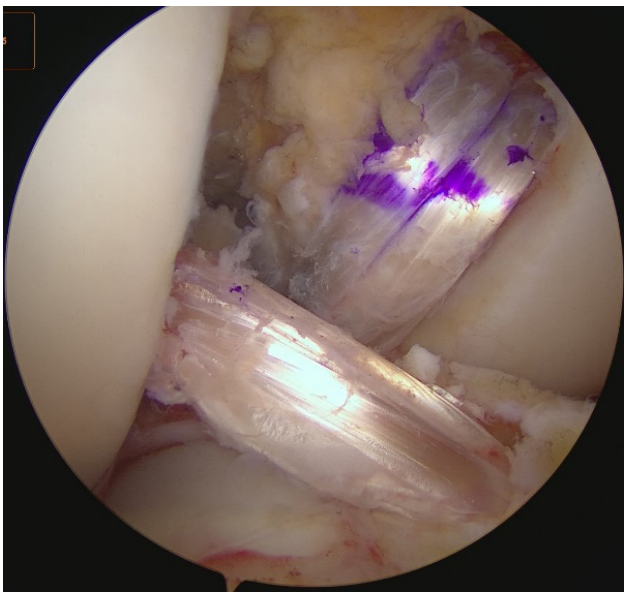

Figure 3. Arthroscopic view of multi-ligament (ACL+ PCL) reconstruction.

RESULTS

Twelve patients who met the criteria with complete follow-up were enrolled in this study. Among them 9 were male and 3 were female with a ratio of 3:1. The mode of injury was mainly a road traffic accident i.e., a fall from a motorbike followed by a fall from height. While comparing preoperative knee range of motion (ROM), IKDC Score, Lysholm Score, and VAS Score with

12 months of postoperative follow-up data, we found the data to be significant (P< 0.05). There were no signs of knee instability at 12 months follow-up. The IKDC Score, VAS Score, Lysholm Score, and the knee ROM were significantly improved. Two patients complained of knee pain on and off which was relieved by analgesics and proper physiotherapy. There were no other complications noted.

Table 1. Demographic variables of the patients.

SN	Variables		Number of patients (%)
1.	Gender	Male	9 (75%)
		Female	3 (25%)
2.	Side involved	Right	7 (58.33%)
		Left	5 (41.66%)
3.	Mean Age (Years)		28.36
4.	Mode of injury	RTA	8 (66.67%)
		Fall Injury	3 (25%)
		Sports Injury	1 (8.33)
5.	Associated injuries	Lateral Meniscus	3 (25%)
		Medial Meniscus	1 (8.33%)
		Both Meniscus	1 (8.33)
6.	Schenk Classification	KD II	6 (50%)
		KD IIIM	5 (41.67%)
		KDIIIL	1 (8.33%)

Table 2. Preoperative and 12 months postoperative Score

SN	Variables	Preoperative	12 months post-op	p-value
1.	Lysholm score	36.42 ± 1.46	95.36 ± 2.84	<0.001
2.	IKDC score	24.38 ± 1.64	93.86 ± 3.14	<0.001
3.	VAS score	8.14 ± 1.44	0.40 ± 0.60	<0.001
4.	Knee ROM	32.00 ± 6.82	132.26 ± 2.98	<0.001

DISCUSSIONS

Treatment of the multi-ligament knee injury remains controversial. In the past, these injuries were managed by immobilization of the knees however these days many authors advocate multi-ligament reconstruction. Surgical interventions can be staged surgery or single-stage surgery which have their own advantages and disadvantages. The consensus regarding staged or single-stage surgery is lacking.[14] Some authors claim that single-stage surgery can damage the soft tissues and capsule of the knee which will impair the functional outcome.[15] In contrast, many authors advocate the single-stage surgery that leads to significantly improved outcomes.[16] Our study aims to evaluate the functional outcome of single-stage surgery.

In this study, the mean age of the patients was 28.36 years. There was a male preponderance of 75%. The mode of injury was road traffic accidents mainly due to motorbike accidents which consisted of 66.67% followed by fall injuries which accounted for 25%. The fall injuries were from fall from trees while harvesting the grass and fall from the slope of the fields. Sports injuries accounted for around 8.33% and occurred mainly while playing football. The concomitant injuries consisted of lateral meniscus injury of 25% followed by medial meniscus injury of 8.33%. These injuries were managed at the same time of multi-ligament reconstruction. The Schenk classification was KD II of 50%, KDIIIM of 41.67%, and KDIIIL of 8.33%. The time of the surgeries was less than 4 weeks from the injuries in 41.67% of the cases, 4 weeks to 12 weeks in 33.33%, and more than 12 weeks in 25% of the cases. The delayed hospital presentation was because of a delay in referrals from the remote areas.

In this study, the knee ROM was 32.00 ± 6.82 preoperatively which improved to 132.26 ± 2.98 which was very significant. All the patients returned to their previous job and all were satisfied with the surgery. The VAS score was 8.14 ± 1.44 which improved to 0.40 ± 0.60 at the final follow-up. The patients' complaint was almost nil regarding pain. The IKDC score improved to 93.86 ± 3.14 at the final follow-up from 24.38 ± 1.64 preoperatively which was significant. The Lysholm score was 36.42 ± 1.46 preoperatively which improved to 95.36 ± 2.84 at the final follow-up. These all have a significant p-value of <0.001. These data show that the outcome score improved significantly. There were no complications. Besides improvement in the outcome scores single-stage surgery limits the cost of multiple surgeries, hazards of multiple times anesthesia, multiple times hospital stays, and multiple times absenteeism from work. The proper rehabilitation after the surgery from postoperative day one should be started to aid in the improvement of the outcome. In our patients active knee range of motion and muscle strengthening exercises were started at postoperative day one, and for the next six to eight weeks non-weight-bearing mobilization with a hinged knee brace was allowed. In our study no major complications were noted. However reported complications are popliteal vessel injury, common peroneal nerve injury, compartment syndrome, arthrofibrosis of knee joint.

In one study done in forty-seven patients with multi-

ligament knee injuries, the outcome of staged versus single staged surgery was found to be similar.[17] Other studies show superior and better outcome of single-stage multi-ligament reconstruction.[18-20] Our study also shows that single-stage surgery has excellent outcomes. The limitations of this study is a small sample size and relatively short duration follow-up period.

CONCLUSIONS

Single-stage multi-ligament reconstruction of the knee is an effective method of surgery that restores the function of the knee and has an excellent outcome.

CONFLICT OF INTEREST

None

REFERENCES

1. Woodmass JM, O'Malley MP, Krych AJ, Reardon PJ, Johnson NR, Stuart MJ, et al. Revision Multiligament Knee Reconstruction: Clinical Outcomes and Proposed Treatment Algorithm. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2018 Mar;34(3):736-744.e3. [PubMed]

2. Cook S, Ridley TJ, McCarthy MA, Gao Y, Wolf BR, Amendola A, et al. Surgical treatment of multiligament knee injuries. Knee Surg Sports Traumatol Arthrosc. 2015 Oct;23(10):2983-91. [PubMed]

3. Schenck RC. The dislocated knee. Instr Course Lect. 1994;43:127-36. [PubMed]

4. Howells NR, Brunton LR, Robinson J, Porteus AJ, Eldridge JD, Murray JR. Acute knee dislocation: An evidence based approach to the management of the multiligament injured knee. Injury. 2011 Nov;42(11):1198-204. [PubMed]

5. Harner CD, Waltrip RL, Bennett CH, Francis KA, Cole B, Irrgang JJ. Surgical management of knee dislocations. J Bone Joint Surg Am. 2004 Feb;86(2):262-73. [PubMed]

6. Brautigan B, Johnson DL. THE EPIDEMIOLOGY OF KNEE DISLOCATIONS. Clinics in Sports Medicine. 2000 Jul;19(3):387-97. [PubMed]

7. Karataglis D, Bisbinas I, Green MA, Learmonth DJA. Functional outcome following reconstruction in chronic multiple ligament deficient knees. Knee Surg Sports Traumatol Arthr. 2006 Sep;14(9):843-7. [PubMed]

8. Engebretsen L, Risberg MA, Robertson B, Ludvigsen TC, Johansen S. Outcome after knee dislocations: a 2-9 years follow-up of 85 consecutive patients. Knee Surg Sports Traumatol Arthrosc. 2009 Sep;17(9):1013-26. [PubMed]

9. Richter M, Bosch U, Wippermann B, Hofmann A, Krettek C. Comparison of surgical repair or reconstruction of the cruciate ligaments versus nonsurgical treatment in patients with traumatic knee dislocations. Am J Sports Med. 2002 Oct;30(5):718-27. [PubMed]

10. Wong CH, Tan JL, Chang HC, Khin LW, Low CO. Knee dislocations-a retrospective study comparing operative versus closed immobilization treatment outcomes. Knee Surg Sports Traumatol Arthrosc. 2004 Nov;12(6):540-4. [PubMed]

11. Wewers ME, Lowe NK. A critical review of visual analogue scales in the measurement of clinical phenomena. Res Nurs Health. 1990 Aug;13(4):227-36. [PubMed]

12. Irrgang JJ, Anderson AF, Boland AL, Harner CD, Kurosaka M, Neyret P, et al. Development and validation of the international knee documentation committee subjective knee form. Am J Sports Med. 2001 Oct;29(5):600-13. [PubMed]

13. Lysholm J, Gillquist J. Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. Am J Sports Med. 1982 Jun;10(3):150-4. [PubMed]

14. Goyal T, Paul S, Banerjee S, Das L. Outcomes of one-stage reconstruction for chronic multiligament injuries of knee. Knee Surg & Relat Res. 2021 Dec;33(1):3. [PubMed]

15. Taylor AR, Arden GP, Rainey HA. Traumatic dislocation of the knee. A report of forty-three cases with special reference to conservative treatment. J Bone Joint Surg Br. 1972 Feb;54(1):96-102. [PubMed]

16. LaPrade RF, Chahla J, DePhillipo NN, Cram T, Kennedy MI, Cinque M, et al. Single-Stage Multiple-Ligament Knee Reconstructions for Sports-Related Injuries: Outcomes in 194 Patients. Am J Sports Med. 2019 Sep;47(11):2563-71. [PubMed]

17. Obremskey WT, Molina C, Richards JE, Staples KS, Streubel PN, Avilucea F. Early Surgical Treatment of High-grade Multiligamentous Knee Injuries. Techniques in Orthopaedics. 2019 Mar;34(1):58–68. [Article]

18. Tardy N, Boisrenoult P, Teissier P, Steltzlen C, Beaufils P, Pujol N. Clinical outcomes after multiligament injured knees: medial versus lateral reconstructions. Knee Surg Sports Traumatol Arthrosc. 2017 Feb;25(2):524–31. [PubMed]

19. Hohmann E, Glatt V, Tetsworth K. Early or delayed reconstruction in multi-ligament knee injuries: A systematic review and meta-analysis. The Knee. 2017 Oct;24(5):909–16. [PubMed]

20. Tao J, Li X, Zhou Z, Zhu Z. Acute Single-Stage Reconstruction of Multiligament Knee Injuries Using the Ligament Advanced Reinforcement System. Med Princ Pract. 2013;22(4):373–8. [PubMed]