

## ORIGINAL ARTICLE

# Single Stage Reconstruction of ACL, PCL and Posterolateral Corner Reconstruction in Multiligamentous Knee Injury

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## ABSTRACT

**Background:** Posterolateral corner (PLC) injury leads to significant knee instability, particularly in the presence of both anterior and posterior cruciate ligament injuries comprise significant portion of knee ligamentous injuries and debates continue to reconstruct only one ligament at a time or single staged combined reconstruction.

**Objective:** The purpose of this article is to determine short to mid-term functional outcome of single stage reconstruction of ACL, PCL and Posterolateral Corner reconstruction in multiligamentous knee injury.

**Methodology:** This descriptive case series was conducted in department of Orthopedic, Medical teaching Institute Hayatabad Medical Complex Peshawar, Pakistan from Jan 2019 to June 2022. Ethical approval was taken from hospital ethical committee. 15 (KDIII L) patients of multiligament knee injuries of both cruciate ligaments and posterolateral corner injuries were included in the study. All others (KD1, KDII, KDIII M, KD IV) multiligament knee injuries were excluded. 12 cases were referred from other facilities after initial reduction and management. Two cases primarily presented to our trauma unit, urgent joint reduction was performed under general anesthesia and neurovascular status was assessed before and after reduction. Functional outcome determined in terms of Lysholm scoring system and the international Knee Documentation committee (IKDC). Patients were graded according to eight different variables: limping, weight bearing, stair climbing, squatting, instability, pain, swelling, and locking. Maximum score was 100. Scores below 68 was considered poor, from 68 to 77 was considered fair, from 77 to 90 was considered good, and above 90 considered excellent. Physical activity level was assessed by Tegner Activity Scale. Data were entered and analyzed with statistical analysis program (IBM-SPSS 23). Frequency and percentages were computed for qualitative variables like gender, type of knee injuries. Mean  $\pm$ SD presented for quantitative variables.  $p \leq 0.05$  were considered statistically significant.

**Results:** 10 (66.67%) patients reported excellent outcome, 3 (20%) patients have good outcome while 1 (6.67%) have fair and 1 patient (6.67 %) reported poor results respectively on IKDC scoring system. Tegner activity level was 5.4 (range, 2 - 7) 13.33% patients were level 7 activity, 40% patients were level 6 activity, 33.3% patients were having level 5 score, 6.6% were level 4 activity and 6.6% were level 2 activity. The average Lysholm score was 88.3% range from (66 to 96). 13.3 % patients were having Exceptional, 66.6% patients were acceptable and 20 % patients were Fair.

**Conclusion:** Multiligaments knee injuries are complex injuries with diverse injury pattern and clinical presentations and challenging job for sports surgeon to treat these injuries. Single stage combined reconstruction of ACL and PCL with posterolateral corner injuries with immediate postoperative rehabilitation have excellent functional outcome with low complication rate and should be followed in clinical practice.

**Keywords:** Single stage reconstruction; ACL; PCL; Posterolateral Corner reconstruction; multiligamentous knee injury

## INTRODUCTION

Multi ligament knee injury defined as the disruption of a least two or more than two major knee ligaments such as anterior cruciate ligament, posterior cruciate ligament, posteromedial corner and posterolateral corner [1]. Posterolateral corner (PLC) once considered the "dark side" of the knee because of its poor understanding of local complex anatomy, clinical examination findings, invalidating diagnostic imaging and lack of evidence based reconstructive procedures. [1-4] Multi ligament Knee Injury (MLKI) constitute 0.02% of orthopedic injuries, with high velocity road traffic accident (RTA) are the most common mode of injuries [4-8]. PLC injuries account for 16% of all knee ligament injuries and mostly associated with either Anterior Cruciate ligament (ACL) or Posterior Cruciate ligament (PCL) injuries and of all PLC injuries 28% occurred in isolation. [9, 10]

There is limited published data on single stage reconstruction of both ACL and PCL with posterolateral corner injuries. Posterolateral corner as major stabilizer of the knee and its relationship with ACL and PCL has generated lot of academic debits in recent years about its reconstruction like early verses delayed, single stage verses multistage reconstruction but it remain gray area in the management of Multiligament knee injuries. [11-15] Therefore, this study has been conducted to determine short to mid-term functional outcome of single stage reconstruction of ACL, PCL and Posterolateral Corner reconstruction in multiligamentous knee injury.

## MATERIALS & METHODS

This descriptive case series was conducted in department of Orthopedic, Medical teaching Institute Hayatabad Medical

Complex Peshawar, Pakistan from Jan 2019 to June 2022. Ethical approval was taken from hospital ethical committee.



Figure1: Traumatic dislocation of knee

15 (KDIII L) patients of multiligament knee injuries of both cruciate ligaments and posterolateral corner injuries were included

in the study. All others (KD1, KDII, KDIII M, KD IV) multiligament knee injuries were excluded. 12 cases were referred from other facilities after initial reduction and management. Two cases primarily presented to our trauma unit, urgent joint reduction was performed under general anesthesia and neurovascular status was assessed before and after reduction (Fig 1 and Fig 2)



Figure 2: Post operative reconstruction of ACL, PCL and PLC.



Figure 3: Radiograph of failed ACL reconstruction



Figure 4: Magnetic Resonance Imaging of patient with insitu screws failed ACL graft, PCL and PLC injury



Figure 5: Post-operative Radiograph after reconstruction ACL, and PCL and PLC reconstruction

One patient was kept in hinged knee brace after reduction and one patient was unstable even after reduction that was kept in spanning external fixator initially for two weeks then mobilized with continuous passive motion. One patient present with failed ACL reconstruction done somewhere else, where PCL and PLC were neglected (Fig 3, Fig 4, Fig 5)

Magnetic resonance imaging (MRI) was performed to delineate injury pattern according to the classification of Schenk (IIIL).<sup>[16]</sup> Two patients had common peroneal nerve injury. Surgical reconstruction was delayed for 3-4 weeks to allow capsular structures to heal and minimize fluid extravasation during arthroscopy. Range of motion was achieved in all cases prior to surgical reconstruction.

Routine arthroscopy with low fluid pressure was performed to prevent fluid extravasation. Diagnostic arthroscopy performed meniscal, cartilage and cruciate injuries documented, with meniscal repair or partial menisectomy performed subsequently. Posteromedial working portal was established under direct visualization to facilitate exposure and preparation of tibial insertion of PCL. In contrast to total debridement of ACL and PCL foot print, we tried to preserve remnants and foot print of both cruciate ligaments to serve as biologic to maximize growth of the original tissue and preserved some vascular and proprioceptive nerve supply. ACL and PCL reconstruction were performed followed by posterolateral corner reconstruction according to LaPrade et al surgical technique. The PCL graft was first tightened and fixed to the tibia by interference screws with 90° knee flexion in neutral rotation. The ACL was then fixed with an interference screw into tibial tunnel with knee in 20-30° flexion. For posterolateral corner reconstruction single incision was given (Fig 6)



Figure 6: Single lateral surgical incision

Common peroneal nerve dissected and isolated. Tunnels preparation for grafts was performed. Fibular collateral ligament was tightened and fixed at 30° flexion followed by popliteal tendon tightened and fixed at 60° flexion.

The limb was initially locked in full extension in knee immobilizer. Isometric quadriceps strengthening in full extension started in first post-operative day. In first two weeks 30° flexion were allowed, increasing progressively to 90° by the 4th postoperative week. Patients were allowed full range of motion and weight bearing mobilization after 6 weeks. Patients were kept in brace for 12 weeks.

Functional outcome determined in terms of Lysholm scoring system and the international Knee Documentation committee (IKDC). Patients were graded according to eight different variables: limping, weight bearing, stair climbing, squatting, instability, pain, swelling, and locking. Maximum score was 100. Scores below 68 was considered poor, from 68 to 77 was considered fair, from 77 to 90 was considered good, and above 90 considered excellent. Physical activity level was assessed by Tegner Activity Scale.

**Statistical Analysis:** Data were entered and analyzed with statistical analysis program (IBM-SPSS 23). Frequency and percentages were computed for qualitative variables like gender, type of knee injuries. Mean  $\pm$ SD presented for quantitative variables.  $p \leq 0.05$  were considered statistically significant.

## RESULTS

Mean age was  $29.33 \pm 6.43$  years; age range was from 19 to 40 years. 13(86.66%) were male and 2(13.33%) were female. Mean time interval between the injury and surgery was  $2.6 \pm 1.47$  months. Mean surgical time was  $3.50 \pm 1.06$  hours.

Functional outcome were assessed using Lysholm, Tegner and IKDC scoring system. Knee Functional Scores at final follow up (Table 1) 10 (66.67%) patients reported excellent outcome, 3(20%) patients have good outcome while 1 (6.67%) have fair and 1 patient (6.67 %) reported poor results respectively on IKDC scoring system

(Table I) One case developed deep infection, where multiple sessions of debridement done and grafts removed on 6 weeks. There were no sign of compartment syndrome or deep venous thrombosis in any case.

Table 1: Knee Functional Scores at final follow up

Case No	Age (years)	Gender	Lysholm score	Tegner score	IKDC score
1	36	M	92	5	A
2	40	M	72	4	C
3	22	F	84	5	B
4	26	M	92	6	A
5	19	M	94	6	A
6	35	M	66	2	C
7	30	F	80	5	B
8	25	M	92	6	A
9	20	M	90	6	B
10	21	M	96	7	A
11	23	M	94	6	A
12	34	M	92	5	A
13	37	M	94	6	A
14	22	M	91	5	A
15	27	M	96	7	A

Mean age was  $29.33 \pm 6.43$  years; age range was from 19 to 40 years. 13(86.66%) were male and 2(13.33%) were female. Mean time interval between the injury and surgery was  $2.6 \pm 1.47$  months. Mean surgical time was  $3.50 \pm 1.06$  hours

IKDC score were excellent in 10 (66.67%) patients, good in 3(20%) patients while 2 (13.33%) have fair result. (Fig 7)

Tegner activity level was 5.4 (range, 2 -7) 13.33% patients were level 7 activity, 40% patients were level 6 activity, 33.3% patients were having level 5 score, 6.6% were level 4 activity and 6.6% were level 2 activity.

The average Lysholm score was 88.3% range from (66 to 96). 13.3 % patients were having Exceptional, 66.6% patients were acceptable and 20 % patients were Fair.

Our sample result shows that elder ages have more fair results both in IKDC Score and Lysholm score but this effect was insignificant. May be the sample is small. (Table 2).

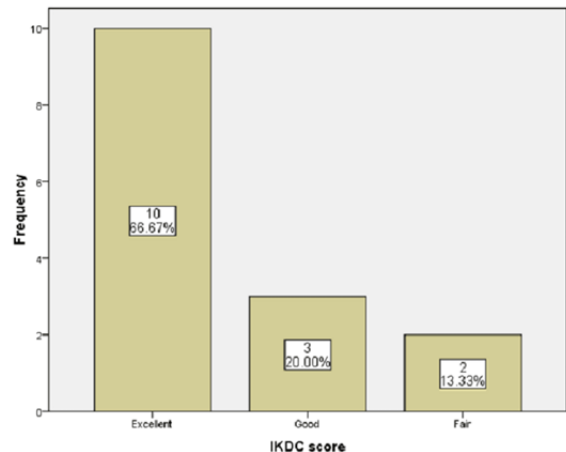


Figure 7: IKDC Score at final follow up

Table 2: IKDC Score and Lysholm score according to age

	Age (in years)			p-value	
	$\leq 20.00$	21.00 - 30.00	31.00+		
IKDC score	Excellent	1 50.0%	6 75.0%	3 60.0%	0.185
	Good	1 50.0%	2 25.0%	0 .0%	
	Fair	0 .0%	0 .0%	2 40.0%	
Lysholm	Fair	0 .0%	1 12.5%	2 40.0%	0.439
	Exceptional	0 .0%	2 25.0%	0 .0%	
	Acceptable	2 100.0%	5 62.5%	3 60.0%	

Similarly gender shows significant role while using IKDC scoring, But contrary to IKDC scoring, Lysholm shows more fair results in female patients as compared to male, although this was insignificant statistically. (Table 3)

Table 3: Lysholm and IKDC scoring according to gender

	Gender			p-value
		Male	Female	
IKDC score	Excellent	10	0	0.010
		76.9%	.0%	
	Good	1	2	
		7.7%	100.0%	
Fair	2	0		
	15.4%	.0%		
Lysholm	Fair	2	1	0.486
		15.4%	50.0%	
	Exceptional	2	0	
		15.4%	.0%	
	Acceptable	9	1	
		69.2%	50.0%	

## DISCUSSION

Single stage reconstruction of combine ACL, PCL and PLC reconstruction achieve good functional outcome at short to mid-term follow up. Multi ligament knee injury especially KD III or KD IV is rare entity with varied presentation makes it difficult to assess the outcome. Management of MLKI evolved from Non operative



prolonged immobilization in the past to recent day's single stage surgical management.<sup>[1, 17], and [18]</sup>

Earlier studies have analyzed conservative versus surgical, early versus delayed, repair versus reconstruction, one stage versus two stages and various aspect of operative management such as graft selection, tensioning sequence, and rehabilitation protocols and different variables that affect its clinical outcome.<sup>[19-21]</sup>

Anatomic reconstruction of MLKI has been found to be significantly better results and lower failure rate as compared to primary repair.<sup>[22,23]</sup> Age has significant impact on clinical outcome of MLKI. Levy et al found that patient less than 30 years of age at the time of multiligament reconstruction have better Lysholm and IKDC scores as compared to patients older than 30 years of age.<sup>[24]</sup> A systematic review and meta-analysis, Hohmann found that early reconstruction within 3 weeks after injury has better functional results as compared to delayed reconstruction after 3 weeks after injury. Significant trauma, life threatening injuries, soft tissue swelling or other associated injuries may be rationale for delaying initial reconstruction. In our series we delayed reconstruction for initial 3 weeks so that soft tissue swelling to subside and capsule to heal and to prevent extravasation of fluid at the time of reconstruction.<sup>[25]</sup>

Due to high failure rate associated with knee ligament repair, the current literature favors single-stage anatomic knee reconstruction of MLKI. Braaten et al<sup>[26]</sup> reported single-stage anatomic reconstruction is the preferred surgical treatment for multiligament knee injuries. Optimal graft sequencing and reconstruction orientation essentially reduces the risk of tunnel convergence and graft failure. LaPrade et al<sup>[20]</sup> reported that single stage anatomic reconstruction of MLKI lead to significantly improved functional outcome with low complication rates. Staging surgery could lead to graft failure, LaPrade et al<sup>[27]</sup> in a biomechanical study found that PCL reconstruction without PLC reconstruction in MLKI would affect to PCL graft forces.

Hatch et al<sup>[28]</sup> determine variables that influence the quality of life after multiligament knee reconstruction and reported that patients with a previous knee ligament reconstruction had significantly worse quality of life based on Multiligament Quality of Life assessment. They reported that patient with Schenk classification III or IV had worse score than patients with Schenk classification I or II. Early functional rehabilitation has shown to be critical factor for predicting prognosis after MLKI. Multiligament reconstruction is necessary to establish stability to allow early rehabilitation.<sup>[29]</sup>

## CONCLUSIONS

Multiligaments knee injuries are complex injuries with diverse injury pattern and clinical presentations and challenging job for sports surgeon to treat these injuries. Single stage combined reconstruction of ACL and PCL with posterolateral corner injuries with immediate postoperative rehabilitation have excellent functional outcome with low complication rate and should be followed in clinical practice.

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