Treatment modalities in management of posterolaterl corner injuries of the knee, Case series

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Background
Lateral side injuries of the knee are complex. Although the author now understand this group of complicated tissues better, it is still unclear which surgical procedure is ideal. The author hypothesize that acute repair of cases is enough for posterolateral corner (PLC) injury. Also, Larson's technique is equal to biceps femoris tenodesis reconstruction of posterolateral corner.

Methods
Case series study of 41 patients included in this series with 14 cases of repair and 27 cases of reconstructions using Larson's technique or biceps femoris tenodesisis. Patients were followed clinically and recorded with IKDC score.

Results
41 patients had a minimum clinical follow-up of 24 months. 14 patients underwent acute primary repairs; with 11 having successful results and three (21%) being unsuccessful. 15 patients had reconstructions using the Larson's approach, with 14 successful outcomes and 1 (6.6%) failure. 12 patients underwent biceps tenodesis, with 9 (75%) successful results, and three (25%) being unsuccessful. Clinical evaluation results showed no discernible difference in stability between repairs and reconstructions ($P > 0.05$). 17 (41.5%) knees were found to be normal, 17 (41.5%) near-normal, 4 (9.8%) abnormal, and 3 (7.3%) severely abnormal according to the IKDC score final assessments.

Conclusion
When compared with the results from reconstruction, results from repair of soft tissue injury were significantly inferior. Results of repair of avulsion fracture have been significantly superior in comparison with result of soft tissue repair. Results of Larson's technique have been significant superior when compared with results from biceps femoris tenodesis.

Keywords:
knee, posterolateral corner (PLC), reconstruction, repair

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Introduction

Over the last two decades, posterolateral corner (PLC) of the knee has received increased interest in the literature [1]. PLC injuries are most commonly seen in conjunction with anterior or posterior cruciate ligament ruptures; but isolated PLC injuries are uncommon. On the other hand, a PLC injury can be easily missed [2].

Failure of management of PLC injuries has been linked to early failure in anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) reconstructions. Early detection of concurrent PLC injuries prior to cruciate ligament graft reconstructions is therefore critical for successful outcomes [3].

Although various physical examination tests for the diagnosis of PLC lesions are described. These lesions are missed in 72% of cases at initial presentation [4].

Clinical examination is challenging due to the frequent association with injuries to other knee stabilizing structures [5].

A knee injury may not only necessitate surgery and several months of recovery; it may also result in permanent disability from employment or sports, and even from both [6].

The concomitant injuries, the degree of chronicity of the damage, and the reconstructive technique all affect the clinical outcome of a PLC injury [7].

PLC injuries are severe injuries that need will planned surgery. Improper steps during surgery can cause morbidity [8].

A systematic approach for management is still absent, and there is still a lot of debate in the clinical literature [9].

There is no a reconstruction method that clearly overcome the others. Individual cases should be considered while making treatment decisions [9].

Despite recent developments in knowledge of the PLC of the knee, there is still disagreement over the best reconstruction surgery. We aim to try to clarify the outcome of different surgical treatment of PLC injury and which is suitable for these heterogeneous groups of injuries.

Materials and methods

A prospective research done at the Department of Orthopedics, Faculty of Medicine, Assiut University, Assiut, Egypt. With IRB local approval number 04-2023-100022 in the period between January 2012 and December 2019. The study included 46 consecutive patients with 46 injured knees were enrolled. 29 patients required reconstructions, whereas 17 individuals underwent direct repair of their PLC injuries. 41 patients made up the study cohort, with 41PLC knees, as three individuals underwent repairs and two underwent reconstructions lost follow-up before one year. A minimum follow-up of 24 months. Those who were excluded from the study included patients having advanced osteoarthritis who are not candidate for ligament reconstruction, Open knee injuries, Paralytic patient, and mentally handicapped patients.

Regarding the technique of treatment of their PLCs injuries, patients who participated in this trial were not randomly assigned. If a patient presented within three weeks after the injury, the PLC injury underwent repair. Patients presented late after 4 weeks treated with reconstruction.

We collected information on basic demographics as well as the mechanism of injury. Throughout the follow-up period, the subjective and objective IKDC scores were also obtained.

Repair of the PLC were performed in patients with acute injuries. In 5 cases, there were soft tissue injuries. In that instance, the injury was directly repaired using nonabsorbable sutures. In 9 cases, Bony avulsions from either the fibular head or lateral femoral epicondyle were repaired using open reduction and internal fixation (Fig. 1).

Reconstructions were accomplished with Larson's technique using hamstring auto graft in 15 cases. Following skin incision, subcutaneous fat is incised, the iliotibial band is identified, and a window in the iliotibial band is made over the lateral femoral epicondyle. After graft harvesting and preparation tunnel is drilled in the fibular head with a cannulated drill bit of equal diameter to the graft's diameter (Fig. 2).Then the ends of the suture were introduced into the eyelet wire to pass the suture ends through the fibular tunnel. A femoral tunnel is drilled in distal femur from lateral to medial starting just anterior and just proximal to the lateral femoral epicondyle for about 30-40 mm depth. Tension is then applied to the graft from the medial side of the femur through traction applied to the suture ends from medial side and fixation is done with biodegradable screws while tension is applied to the graft (Fig. 3).

Reconstructions were accomplished with Biceps tenodesis in 12 cases. The same approach As In previous group, the anterior half of the biceps femoris tendon was dissected from the muscle fibers, released proximally from the muscle belly, and preserved its distal bony insertion into the fibular head. The tendon was then re-directed deep to the iliotibial band and fixed by interference screw inside femoral tunnel made similarly to the previous technique.

Following surgery, the injured knee was placed for 6–8 weeks in an adjustable hinged knee brace.

Statistical Package of Social Science (SPSS), version 20 from IBM, was used to gather, tabulate, and statistically analyze the data (IBM Co., Armonk, NY, USA). The comparison of postoperative and preoperative data within each group was done using a paired *t*-test. Unpaired *t*-tests for parametric data and Mann-Whitney tests for nonparametric data were used to compare data between groups; a *P* value of 0.05 was used to indicate significance. An independent statistician carried out the statistical study.

Results

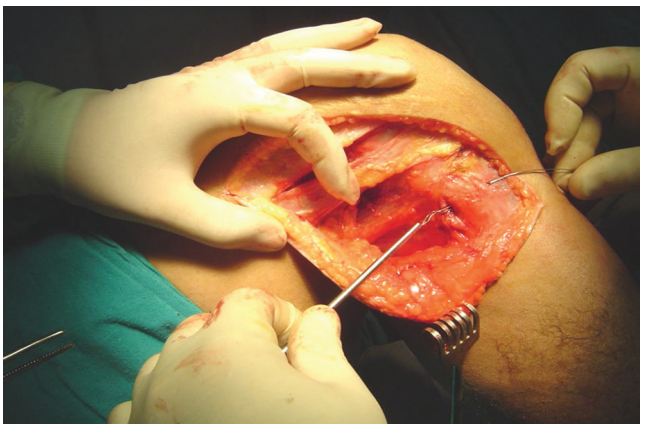
Our patients were on average 27 years old. There were 22 right knees and 18 left knees among the 40 male and one female patients. Most of the patients in our research had high-energy trauma, which usually resulted in fractures (26 patients). The repair group had 12 multiligament knee injuries, whereas the reconstruction group had 27 multiligament injuries and two isolated PLC injuries.

Three patients had successful PLC repairs, whereas two had unsuccessful repairs. Six patients had successful open reduction internal fixation of PLC avulsion fractures, whereas one had a failed fixation. Larson's technique resulted in 14 successful PLC reconstructions and one failure. Nine patients had

Figure 1

Male patient sustained motor cycle accident with right knee multi ligaments avulsion fractures. Fixation of PCL tibia attachment and lateral epicondle with plate and screws.

Figure 2



Showing passing the suture ends through the fibular tunnel with eyelet wire.

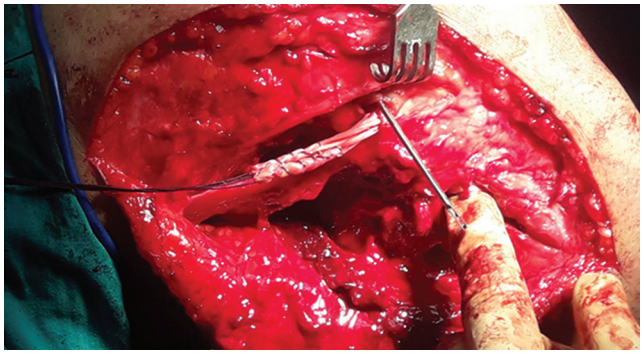
successful PLC reconstructions using the biceps tenodesis technique, while three cases failed (Table 1). With a *P* value of 0.23, the difference in success based on clinical, assessment stability between the repair and reconstruction groups was negligible (Fisher exact test). Three of the 12 patients who had failed PLC repairs and four of the patients who had failed reconstructions had their PLCs successfully revised. In all cases, the clinical failure seemed to be failure (either strain or rupture) inside the ligament or tendon rather than fixation failure.

Table 1 Relation between final evaluation and timing of operation from injury time

Final evaluation	Timing of operation from injury time		*P*
	Acute (*n*=12) No. (%)	Chronic (*n*=29) No. (%)	
Preoperative:			
Normal	0	0	
Nearly normal	0	0	0.073
Abnormal	1 (8.3)	11 (37.9)	
Severe abnormal	11 (91.7)	18 (62.1)	
Postoperative:			
Normal	4 (33.3)	13 (44.8)	
Nearly normal	6 (50.0)	11 (37.9)	0.236
Abnormal	0	4 (13.8)	
Severe abnormal	2 (16.7)	1 (3.4)	

At the end of the trial, the IKDC scores were used to evaluate every patient both subjectively and objectively. 17 patients had normal knees (41.5%), 17 had near-normal knees (41.5%), four had abnormal knees (9.8%), and three had severely abnormal knees (4.3%), according to the objective ratings for the entire group. Using the IKDC objective evaluation,

Figure 3



Passage of eyelet wire after femur tunnel drilling.

Figure 4

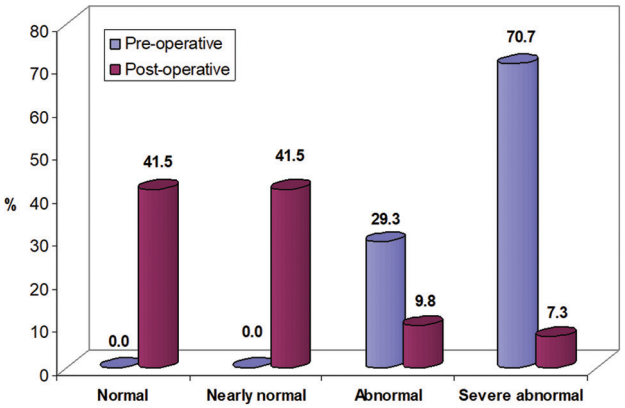


Diagram showing Final evaluation of patients.

83% of our patients had knees that were either normal or very close to being normal. At the final follow-up, there was no significant difference in the IKDC scores across the various groups (Fig. 4).

We assessed our patients' capacity to return to their prior jobs after an accident. Nineteen patients got their old jobs back. Four patients did not return to work, while eighteen patients did so on light duty only.

Patients in this research also had a variety of problems in addition to the unsuccessful PLC repairs and reconstructions. Arthrofibrosis, which affected seven patients (17%) in our research, hematoma, which affected two patients (4.8%), and peroneal nerve damage, which affected one patient (2.4%).

Discussion

There is still a disagreement about the most effective treatment method despite advance of research on PLC of the knee.

This study involved 41 patients with a diagnosis of grade III posterolateral knee instability, five patients with acute injuries underwent repair, nine patients with bony avulsion injuries underwent open reduction internal fixation (ORIF), twelve patients with chronic injuries underwent reconstruction using biceps tenodesis and fifteen patients with chronic injuries received reconstruction using Larson's technique. All patients were evaluated using international knee documentation committee (IKDC) score preoperative and postoperatively.

The failure rate was 40% for repair group, 11% for fixation group, 25%for biceps femoris tenodesis group and 6.6% for Larson's group.

The final overall rating postoperatively 17 patients (41.4%) were rated normal, 17 patients (41.4%) were rated nearly normal, four patients (9.7%) were rated abnormal and three patients (7.3%) were rated severely abnormal (Fig. 4).

In the group treated with exploration and repair of soft tissues postoperatively two patients rated severely abnormal, two patients rated abnormal, and one patient rated near normal. A study were done on 10 knees with acute PLC injury, repair was done, and followed-up for 34 months. Four of the 10 PLC repairs (40%) failed and need revision which is similar to our results [10].

Shelbourne and colleagues reported successful outcomes with PLC knee structural repair. In his study 13 (81%) of the 16 patients who had sports-related injuries were able to resume their previous level of activity. The authors have advised anatomical repair of the PLC [11].

But a lot of factors play a role in whether or not the PLC should be repaired. The extent of soft tissue injury, others ligamentous injuries, the location of the PLC tissue damage, and the rehabilitation protocol can all have an impact on how well a repair works. Which may explain this conflict between Shelbourne and colleagues results and our results? In our study repaired group patients sustained high energy motor vehicle accident, had sever soft tissue damage, multiligament knee injury all of these explain this high failure rate in these patients group. Despite the repair suggestion, there are few documented series of PLC repairs using approved knee scores in current literature.

In the group of bony avulsions fractures treated with open reduction internal fixation. All healed within 10-14 weeks with normal in four cases, nearly normal in four cases and abnormal in one case.

In a research by Sharma and colleagues, six patients with fibular head fractures were included in a prospective study. These fractures treated with ORIF utilizing a

variety of fixation techniques. The excellent and good result was 83% [12].

A case report of femoral avulsion of the lateral collateral ligament with complete tear of PCL is presented by Jae Ho Yoo and colleagues. An internal fixation with two staples was used to repair the avulsion fracture of the lateral epicondyle. At six months following surgery, the patient was able to engage in all activities of daily life with complete knee range of motion [13].

In spite of paucity of literature to describe avulsion fractures around the knee we documented avulsion fractures of lateral epicondyle in six cases fixed either with stables, mini plates or screws and three cases of avulsion fracture head of fibula treated with tension band technique, screws or anchors.

In the group of patients were treated with biceps tenodesis postoperative IKDC score were normal in six cases (50%), nearly normal in three cases (25%), abnormal in two cases (16.6%) and severely abnormal in one case (8.3%).

A research on 41 arthroscopically assisted combination PCL/PLC reconstructions was conducted by Fanelli, 2006. Combining biceps femoris tendon transfer and posterolateral capsular shift procedures were used to treat PLI in all 41 instances. According to his findings, combined PCL/PLC instabilities can be successfully treated with arthroscopic PCL reconstruction and biceps tendon transfer combined with posterolateral capsular shift procedure [14].

In comparison to this study we cannot precisely compare these results with us. Our result differ may be due to different technique we used, different fixation methods and different rehabilitation program.

In the group of patients were treated with reconstruction by Larson's technique postoperative IKDC score were normal in seven case (46.6%), nearly normal in seven cases (46, 6%) and abnormal in one case (6.6%).

In a study by van Gennip and colleagues [15] were done on eleven patients with PLC injury combined with ACL or PLC, Larson's reconstruction were done in association with cruciate ligament reconstruction. IKDC score improved significantly postoperatively.

Byoung Se Yang and colleagues conducted a research on 60 patients with combined PLC injuries treated with Larson's reconstruction. In this research there were two cases unsuccessful (3.3%). in comparison to our result we have one case of failure (6.6%) this deference in percentage may be due to small sample size in our study [16].

We propose that Larson's technique, as compared with the biceps tenodesis technique, better corrected posterior translation and external rotational laxity (Table 2).

In our study, two patients were able to resume their preinjury levels of jumping exercise, pivoting and football, seventeen patients returning to heavy manual work, eighteen patients returning light manual work, and four patient become sedentary work at the end of follow-up.

Latimer H.A. and colleagues [17] reported on a study of ten patients with combined cruciate ligament and PLC instability who underwent reconstruction, five patients returned to their preinjury level of activity, while the other five returned to a lesser level.

Baker CL and colleagues [18] conducted a study of seventeen consecutive patients who were treated for acute PLC instability with surgical repair. 85% of these individuals had recovered to preinjury levels. The remaining 15% did not. Our result is differ as we calculate returning to activity level for all patient sample collectively.

One patient (7.6%) had a residual varus laxity greater than 5 mm postoperative at the time of evaluation. Yoon and colleagues [19] compared anatomical reconstruction in 21 knees, there was greater than 5 mm varus laxity in 14% of anatomical reconstructed knees which is similar to our results.

One patient had drop foot as PLC injury complication which resolved 2 months after surgery.

According to a 2001 study by Fanelli and Larson[14], complications from PCL and PLC procedures can include osteonecrosis, compartment syndrome, mobility loss, anterior knee discomfort, fractures, infections, and issues with wound healing.

Table 2 Final evaluation of patients treated with Larson technique and biceps tenodesis technique

Final evaluation	Surgical procedures		*P*
	Biceps tenodesis (*n*=12) No. (%)	Larson's technique (*n*=15) No. (%)	
Preoperative:			
Normal	0	0	
Nearly normal	0	0	0.706
Abnormal	5 (41.7)	5 (33.3)	
Severe abnormal	7 (58.3)	10 (66.7)	
Postoperative:			
Normal	6 (50.0)	7 (46.7)	
Nearly normal	3 (25.0)	7 (46.7)	0.438
Abnormal	2 (16.7)	1 (6.7)	
Severe abnormal	1 (8.3)	0	

When compared with the existing literature on PLC injury, this study's strengths included a patient group that was rather big. Additionally, our patients were tracked prospectively, and they were fulfilling the minimum 1 year follow-up requirements.

We are aware that this study has several limitations. An inherent selection bias was introduced because patients were not randomized into groups. The fact that we compared PLC repair and reconstruction is another drawback of our study. This study's inability to quantify varus and posterolateral laxity using more scientific techniques, such as stress radiography, is another drawback.

Conclusion

Our findings led us to limit PLC repair to avulsions with sizeable bone fragments that permit internal fixation. The outcomes in our series supported PLC reconstruction over direct repair. Despite considerable concomitant bone injuries in the majority of patients, patients have been able to resume their jobs in the great majority of reconstructive instances.

Additionally, we propose that Larson's treatment more effectively restored posterior translation and external rotational laxity as compared with biceps tenodesis.

With such a small sample size in a cohort of only 41 individuals, it is difficult to extrapolate this conclusion to a wider population. Larger-scale studies examining the failure rate of repair with reference to tear location would undoubtedly be useful in validating or rejecting the validity of our findings.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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