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Anatomical Reconstruction of Posterolateral Corner of The Knee

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ABSTRACT

Background: Most injuries of posterolateral corner (PLC) of the knee occur in combination with simultaneous knee ligament injuries. The incidence of posterolateral lesions associated with anterior cruciate ligament (ACL) tear is as high as 10% and those associated with posterior cruciate ligament (PCL) tear 27%. PLC injuries have been increasingly recognized and account for approximately 16% of all knee ligament injuries.

Aim of work: To evaluate management of cases of posterolateral corner instability by anatomical reconstruction with assessment of post-operative functional outcomes following rehabilitation protocols.

Patient and methods: From August 2017 to January 2019, a case series non-controlled prospective clinical study was done. The material of this study included twenty (20) patients with chronic posterolateral corner injury. All patients underwent anatomical PLC reconstruction. Surgery was done at El Hussein, Al-Azhar University Hospitals.

Results: In our study, we found satisfactory highly significant difference between pre and post-operative according Lyshlom score (P-value < 0.001). **Conclusion:** Anatomical reconstruction of chronic posterolateral corner instability resulted in satisfactory clinical outcomes in medium term follow-up.

Keywords: Posterolateral corner, Reconstruction.

INTRODUCTION

Most injuries of posterolateral corner (PLC) of the knee occur in grouping with synchronized knee ligament injuries. Posterolateral corner injuries are often associated with anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) tears [(1)].

Isolated lesions of the posterolateral corner structures estimate about 5.7% of knee sprains [(2)]. The frequency of posterolateral lesions concomitant with anterior cruciate ligament (ACL) tear is as high as 10% and those concomitant with posterior cruciate ligament (PCL) tear are 27%. Common peroneal nerve is involved in about 15% of cases [(3)].

Posterolateral instability may cause significant functional limitations. Although formerly considered rare, posterolateral corner injuries have been increasingly recognized and account for nearly 16% of all knee ligament injuries [(4)]. Failure to identify these injuries has been proven that is an important cause of recurrent instability and failed cruciate ligament reconstructions. Persistent instability of posterolateral corner leads to a varus thrust gait, which increases forces on the medial compartment of the knee. This may result in meniscal injuries and aggravated medial compartment osteoarthritis.

In order to identify PLC injuries, a high index of suspicious is mandatory and a detailed physical examination should be performed. A comprehensive review of radiographic and magnetic resonance imaging (MRI) studies are helpful to better determine the injured structures precisely. In the past, treatment of lateral side instability has been challenging due to inadequate data on the anatomy and biomechanics of the PLC structures and under-reporting of clinical outcomes following non-operative and operative treatment. However, lately, the anatomy and biomechanics have become distinct and good outcomes have been reported after PLC operative treatment following anatomic reconstruction principles [(5)]. Historically, both repair and reconstruction have been used for treating PLC tears. PLC cases treated by ligament repair have been reported to have a higher reoperation rate when compared to reconstructive techniques [(6)].

Poor outcomes have been reported for grade III PLC injuries treated non -operatively (resulting in varus and rotational instability of the knee) and thus, a reconstruction is indicated. A thorough knowledge of the anatomy is necessary for surgical treatment of this pathology, since anatomical reconstruction has proved improved outcomes [(7)].

PATIENTS AND METHODS

A: Patients

The material of this study included 20 adult patients having chronic posterolateral corner injury who have treated by anatomical reconstruction using hamstring tendon grafts in period between August 2017 and January 2019 (including follow up period) at orthopedic department of Al-Azhar University Hospitals. The period of follow up ranged from 4 to 9 months with an average of 6 ±1.5 months.

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Patient selection:

Inclusion criteria

• Patients with chronic injuries of the posterolateral corner of the knee associated with at least one of the cruciate ligaments injury or isolated injury.

The study was approved by the Ethics Board of Al-Azhar University and an informed written consent was taken from each participant in the study.

• Patients aged more than 18 years old.

Exclusion criteria

• Patients were excluded if they have neurological or vascular lesions.
• Patients have fractures around the knee.
• Pediatrics age group.

The youngest patient in this series aged 19 years old while the oldest one aged 41 years old (average age was 27.5 years). The highest age incidence was in age group between 20-30 years (55%).

There were 16 males (80%) and 4 females (20%). All patients were within normal weight with an average body mass index between "18.5-29 ".

Table (1): Age distribution.

Age	Frequency	Percent
<20	2	10%
20-30	11	55%
31-40	6	30%
>40	1	5%
Total	20	100%

The mode of trauma were found to be sport trauma (15 patient). The contact sport trauma was the main type of trauma (11 patients-55%), while the non-contact sport trauma was the cause in 4 patients (20%).

Motor vehicle accident was the cause in 4 patients (20%), while other causes like falling in one patient (5%).

- Chief complaint:

Pre-operative, there was 8 patients (40%) that were complaining of pain with activities, 4 patients (20%) experienced recurrent knee swelling especially after activities, while knee instability the chief complaint as 16 patients (80%) suffered from knee instability and 2 patients (10%) were complaining of recurrent knee locking. All patients can walk properly.

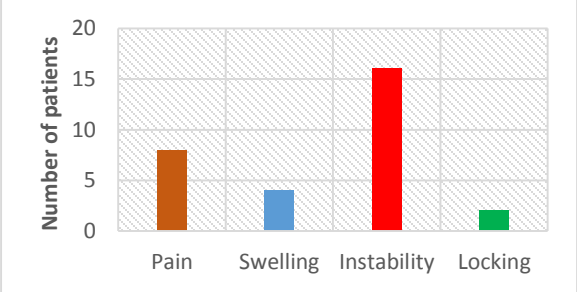

Fig. (1): Chief complaint distribution.

The shortest trauma to surgery period was 8 weeks and the longest period was 30 weeks with an average 19 weeks.

Table (2): Time elapsed to surgery incidence

Pre op. period	Frequency	Percent
<13 wks	14	70%
13-26 wks	5	25%
>26 wks	1	5%
Total	20	100%

Associated injuries:

There were patients with combined injuries in the form of anterior cruciate ligament tear (15 patient), posterior cruciate ligament tear (4 patient), and only one patient with an isolated injury (figure 2).

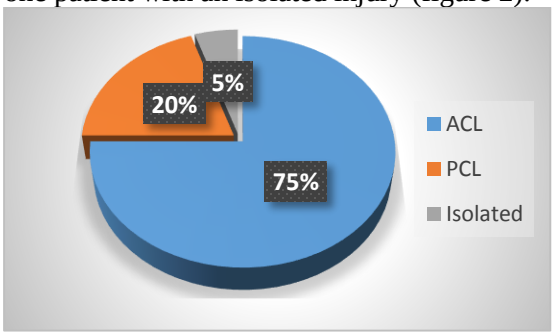

Fig. (2): Associated injuries incidence.

B: Methods:

On admission, all patients were subjected to history taking, clinical and radiological examination and laboratory investigations. Full counseling of participants in this research and informed consent was obtained with full privacy of participants and confidentiality of the data.

Methods includes:

1-Methods of diagnosis.
2-Methods pf treatment.
3-Methods of follow up.
4-Methods of assessment of results.

1- Methods of diagnosis:

Clinical examination:

• General examination

- Blood pressure, Pulse, Temperature, Respiration & other body systems.

• Local examination:

- Inspection: alignment, gait assessment (figure 3), deformity, muscle wasting, swelling, ecchymosis and skin changes.

Fig. (3): Varus thrust gait of right knee.

- Palpation: knee temperature, effusion, joint line, localized bony tenderness, muscles, patellar tendon and soft tissue masses.

- Range of motion (active and passive): Pre-operatively all patients had full range of motion but 5 had hyperextension (range 5º to 10º), the other knee for all patients was normal with normal range of motion.

- Stability tests: Knee ligaments were evaluated as following:

ACL and PCL instability tests: The first step in assessing ACL or PCL instability involves both knees viewed from the side when flexed to 90° to identify any posterior sag that may be misinterpreted as anterior instability. Then evaluation done by performing anterior drawer test, Lachman test, pivot shift test (for ACL), and posterior drawer test (for PCL).

Medial collateral ligament instability evaluated by performing valgus stress test.

- Special tests: to evaluate posterolateral corner instability that includes:

a- Varus stress test: lateral joint line opening.

Fig. (4): Varus stress test (right knee).

b- Dial test: increased degree of external rotation in injured knee.

Fig. (5): Dial test

c- External rotation recurvatum test:

Fig. (6): External rotation recurvatum test

The Posterolateral instability was confirmed intraoperatively by examination under anesthesia (EUA), and arthroscopy for further assessment or management of associated meniscal injuries.

- Neurovascular examination:

It is critical to examine and record the state of the common peroneal nerve, due to its anatomical proximity and high incidence of associated injury with PLC injuries. A dedicated vascular exam is also essential in the setting of posterolateral corner injuries.

» Radiological examination:

- The pre-operative plain X-ray include antero-posterior and lateral views of the knee. Stress radiographs are very supportive to assess chronic PLC injuries. Chronic PLC injury should be suspected if

an increased joint line opening of approximately 4 mm is found (figure 7).

Fig. (7): Varus stress radiograph

- Magnetic resonance imaging (MRI) can be a helpful diagnostic method in evaluating structural integrity of the PLC, as it has been found to accurately assess the integrity of most of its components. In addition, MRI is very useful in determining associated injuries like anterior cruciate ligament, posterior cruciate ligament and meniscal injuries.

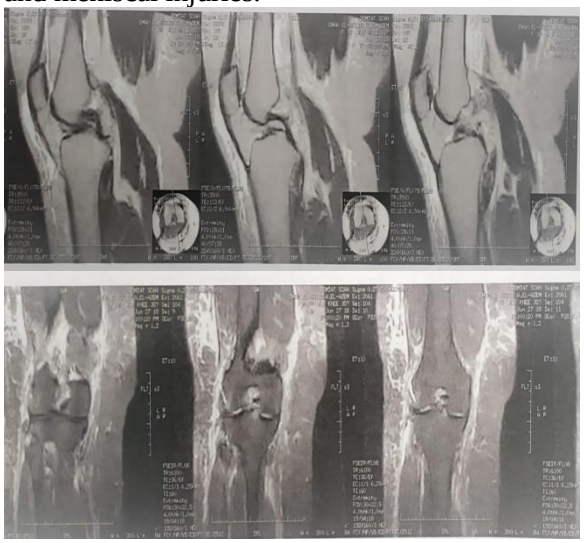

Fig. (8): Sagittal and coronal MRI showing complete ACL tear and PLC injury.

» Laboratory investigations:

- CBC
- Renal function tests.
- Liver function tests.
- Random blood sugar.

» ECG.

2- Methods of treatment:

» General consideration:

• Indication of reconstruction:

Grade III injuries of posterolateral corner which result in significant instability and have poor outcomes when treated nonoperatively. As a result, reconstruction is encouraged.

• Preoperative rehabilitation:

There is Carefulness against early multiligament reconstruction in the presence of a preoperative flexion contracture due to the higher arthrofibrosis possibility. To overcome this issue, patients were instructed to do pre-operative rehabilitation early after injury to decrease joint effusions and to establish ROM prior to reconstruction.

• Anesthesia:

Spinal anesthesia.

• Hospital stay:

Surgery was performed in all cases on a 24-48 hours stay basis, closely pre-operative a dose of prophylactic antibiotics was given and post-operatively antibiotics were planned for the 24-48 hour stay. While the patient stays in hospital IV narcotics were used for pain control, and at home.

» Surgical procedure:

• Patient Positioning:

The patient is positioned supine on the operating table, knee flexed to 90 degrees. A nother support is used to allow extension to 30 degrees and an examination under anesthesia is performed to confirm the diagnosis. A well-padded tourniquet is placed in the upper thigh of the operative leg which is then prepped and inflated in a standard fashion after patient examination and preparation.

• Surgical approach:

The first is a small longitudinal incision over the lateral epicondyle and the second incision located posterolaterally and in line with the fibula, extending from the posterolateral joint line to just proximal to the fibula neck (figure 9).

Fig. (9): Skin incision

The subcutaneous tissue is then dissected, the long and short heads of the biceps femoris are exposed. Next, a neurolysis of the common peroneal nerve is performed. The nerve is classically located

posteromedially to the long head of the biceps femoris and should be dissected up to 6 cm proximally.

• Tunnels drilling:

Two tunnels used in fibular based semitendinosus technique (fibular and femoral). Sub periosteal dissection of the lateral aspect of the fibular head is performed in an anterior to posterior direction. Next, an oblique anterior-to-posterior fibular tunnel is formed and oriented similarly to the course of the ligament. A passing suture is then located through the tunnel to facilitate future passage of the graft.

Just the distal tunnels are finished, the next step is to recognize the proximal insertions of the FCL and the popliteus tendon. Then, the ITB is split around 4 cm in line with its fibers slightly anterior to the palpated FCL attachment. Two femoral tunnels were produced at the anatomic insertion site of the FCL and popliteus tendons located distal to the femoral epicondyle and a passing suture is placed into each tunnel to facilitate graft passage.

Fig. (10): Femoral tunnels with passing pins

• Graft harvesting:

The hamstrings are harvested using semitendinosus and gracilis autograft from the ipsilateral or contralateral knee depending on whether it is being done in isolation or as a combined procedure.

Fig. (11): Prepared grafts for LCL

• Graft passage and fixation:

Tendon spans greater than 15 cm are necessary to complete the reconstruction. Using sutures previously left in place, the graft was pulled into fibular tunnel then the FCL graft is passed beneath the superficial layer of the ITB and then through the femoral tunnels and secured with a cannulated screw with the aid of a guide pin placed between the cancellous surface of the bone plugs and the rim of the tunnels. During this fixation, tension was applied to the graft and the knee should be at 30 º of flexion and neutral rotation, while applying a gentle valgus force to reduce any lateral compartment laxity.

• Post-operative rehabilitation:

After PLC reconstruction, patients use a knee immobilizer and mobilize non-weight bearing for 6 weeks. Proper rehabilitation begins directly post-operatively and stresses on restoration of tibiofemoral and patellofemoral range of motion, edema, and pain management in addition to restoration of quadriceps function. Passive range of motion is initiated on the first day post-operatively and is gradually progressed to full range of motion as tolerated. A goal of at least 90 º of knee flexion is anticipated by 2 weeks post-operatively. At 6 weeks, patients are allowed to begin spinning on a stationary bike and wean off crutches.

3- Methods of follow up:

Follow up of patients was achieved by clinical and radiological examination with an average time of 6.5 month.

4-Methods of assessment of results:

Assessment of end results was done using Lysholm knee scoring scale. The Lysholm Knee Scale is an 8-item questionnaire scored on a 0–100 scale measuring pain (25 points), instability (25 points), locking (15 points), swelling (10 points), limp (5 points), stair-climbing (10 points), squatting (5 points) and use of support (5 points). The scale was originally designed to assess ligament injuries of the knee but it is commonly used as an evaluating measure in surgical studies involving patients with chondral damage.

The result was graded according to total score as follows: (91-100) excellent, (84-90) good, (65-83) fair, (≤64) poor.

RESULTS

In this prospective study, 20 cases with chronic posterolateral corner injuries were operated through anatomical reconstruction using hamstring tendons auto graft. Analysis of clinical and radiological data was done. There was highly statistically significant difference between pre- and post-operative according Lyshlom score (P-value <0.001).

Clinical (functional) results:

According to Lysholm scoring system that evaluating outcomes of knee ligament surgery the clinical results were graded as excellent in16 patients (80%), good in 3 patients (15%), fair in 1 patients (5%) & no patients graded as poor (0%).

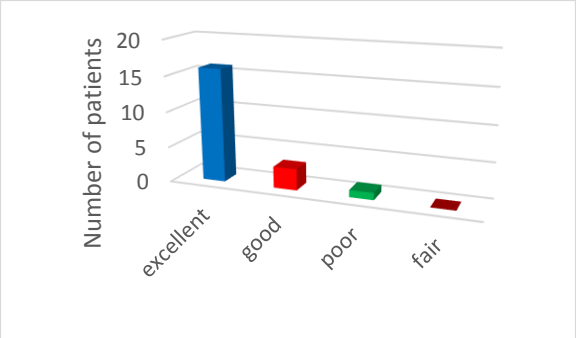

Fig. (12): Final clinical score grades

● Pre-operative and post-operative patients' complaints assessment:

Table (3): The mean of pre-operative patient complaints.

Lyshlom Score (pre)	Mini.	Max.	Mean
Limp	0.00	5.00	3.65
Support	0.00	5.00	4.15
Locking	6.00	15.00	9.61
Instability	5.00	15.00	9.25
Pain	5.00	20.00	9.75
Swelling	2.00	10.00	7.40
Stair climbing	2.00	10.00	5.20
Squatting	0.00	5.00	1.95
Total	20.00	85.00	50.96

Table (4): The mean of post-operative patient complaints.

Lyshlom Score(post)	Mini.	Max.	Mean
Limp	3.00	5.00	4.00
Support	2.00	5.00	4.85
Locking	15.00	15.00	15.00
Instability	20.00	25.00	22.50
Pain	20.00	25.00	23.75
Swelling	6.00	10.00	9.00
Stair climbing	6.00	10.00	7.60
Squatting	2.00	5.00	4.05
Total	74.00	100.00	90.75

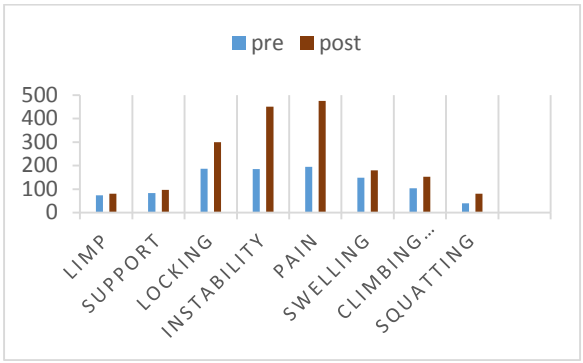

Fig. (13): Pre- and post- according to Lyshlom score for each complaint.

Factors affecting the end results:

(1) Age and the end results:

The mean age of patients with excellent results was 25.6 years old and of patients with good results was 33.3 years old, while the mean age in patients with fair results was 41years old. Studying the relation between different age groups and the results showed to be statistically significant with p-value 0.0011.

(2) Smoking and functional end results:

In this study, there were 4 smokers. One of them had excellent final end result, two had good final end results and one had fair end results. Studying the relation between smoking and the final end results showed to be statistically significant with p-value 0.0068.

(3) Mode of trauma and the functional end results:

Studying the relation between patient's mode of trauma and the final results showed it to be statistically significant (p-value 0.0019)

(4) Associated injuries and the functional end results:

Studying the relation between patient's associated injuries and the final results showed it to be statistically significant (p-value 0.0004).

(5) Elapsed time to surgery and the functional end results:

Studying the relation between elapsed time from injury to surgery and the final results showed it to be statistically significant with p-value 0.0005.

DISCUSSION

This study involved twenty patients with a primary diagnosis of chronic grade III posterolateral knee instability, nineteenth patients with chronic combined injuries (fifteen patients combined with ACL tear and four patients combined with PCL tear), and one patients with isolated injury, all of them underwent anatomical reconstruction.

Chronic PLC injury, whether isolated or combined, is probably best treated by reconstruction of the PLC along with reconstruction of any coexisting cruciate ligament injury.

The anatomic PLC reconstruction technique has verified improved subjective and objective patient outcomes compared with nonsurgical treatment or repair and has been reported to restore near native knee stability. Outcomes studies have demonstrate significant post-operative improvement in scores for varus opening at 20 degrees, external rotation at 30 degrees, reverse pivot shift.

Yoon and colleagues [8] made a comparison between non anatomic fibular sling PLC reconstruction technique and anatomic-based reconstruction that demonstrated improved Lysholm scores and improved varus and external rotation laxity in the anatomic reconstruction group.

Anatomical posterolateral corner reconstruction is the technique of the choice in our study. Our study data provided many important relations and results according to clinical assessment.

This study evaluated the clinical outcome and correlated the results of the affected knees with the duration of injury, ligament laxity and length of follow-up time in 20 patients undergoing anatomical posterolateral corner reconstruction with 9 months follow-up.

In our study we found satisfactory highly statistically significant difference between pre- and post- operative according Lyshlom score (P-value < 0.001). The mean pre-operative total Lyshlom score was 50.96 ± 59.80 in comparison to the mean post-operative total Lyshlom score 90.75 ± 162.23.

As a result of these findings, it is preferred to do anatomic reconstruction in most cases chronic PLC injuries with treatment of concomitant injuries in a single surgery.

SUMMARY AND CONCLUSION

Clinically, injuries to the PLC or "dark side" of the knee are becoming more recognized. Undiagnosed PLC injuries may lead to poor outcomes or failures of cruciate reconstructions, chronic instability with resulting early onset osteoarthritis, and chronic pain. Prompt diagnosis and appropriate treatment are essential for restoration of stability. Simultaneous surgical treatment of all injured structures is typically recommended. Anatomic techniques are generally preferred, with attention placed on reconstruction of the FCL, PFL, and popliteus tendon. Post-operative rehabilitation focuses on return of strength and ROM. Further research is needed to provide optimal surgical and rehabilitation protocols for this high energy injury.

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