Combined anterior cruciate ligament and posterolateral corner reconstruction in chronic instabilities

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Background
Combined anterior cruciate ligament (ACL) and posterolateral corner (PLC) injury is not an uncommon knee injury. Missed PLC injuries are the main cause of ACL reconstruction failure. Combined reconstruction of ACL and PLC is recommended for these injuries. However, the main disadvantages of the combined reconstruction are the possibility of tunnel convergence.

Aim
The aim of this study was to evaluate functional results of simultaneous reconstruction of ACL and PLC over a 2-year follow-up.

Setting and design
A case series study was held at Alexandria University.

Patients and methods
From 2012 to 2014, 23 patients had concomitant ACL with posterolateral instability. All cases underwent a simultaneous PLC reconstruction with the ACL reconstruction. The median age of the participants was 32 years (range: 23–39 years). The median follow-up was 32 months (range: 24–38 months). There were 22 males and one female. The median duration from the time of injury to the operation was 5 months. International Knee Documentation Committee and Lysholm score were used for the evaluation of the results.

Statistical analysis
MedCalc was used for statistical analysis.

Results
Based on the International Knee Documentation Committee evaluation form the last evaluation, 15 of the 23 patients (65%) were rated as A (normal), whereas five (21%) were rated as B (nearly normal), two (8%) as C (nearly abnormal), and one (4%) as D (abnormal). According to Lysholm score, the overall results were excellent in 22 patients (95% of the patients). The median Lysholm score improved from 56 points preoperatively to 94 points postoperatively. Only one patient had poor score owing to residual rotational instability.

Conclusion
Combined reconstruction of ACL and PLC had very good results over a 2-year follow-up, with no residual laxity in most of the patients.

Keywords:
combined posterolateral corner-anterior cruciate ligament injury, modified Larson technique, multi-ligamentous knee injury

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Introduction

Combined injuries involving the anterior cruciate ligament (ACL) and posterolateral corner (PLC) occur in ~10% of complex knee injuries [1].

To address this problem, two main protocols can be adopted. The first is isolated reconstruction of ACL or PLC reconstruction followed by anatomical reconstruction of the other in a separate session. The second approach is anatomical simultaneous reconstruction of both. The main disadvantage of the staged approach is that the persistence of residual laxity can lead to failure of the reconstructed ligament. Biomechanical studies have demonstrated that PLC structures functionally interact with the ACL. They have shown that the deficiency of posterolateral structures significantly increases the varus load on the ACL graft, resulting in an increased risk for failure [2,3].

Therefore, in the combined injury setting, the consequence of missing a posterolateral lesion may affect the outcome of ACL reconstruction. The initially missed PLC lesions is the key variable to explain the high number of ACL revisions that occurred in ACL ligament–reconstructed knees [3]. The difficulty of PLC injuries lies in the anatomic complexity of this region, historically considered as the 'dark side' of the knee [4].

Owing to the low incidence of these concomitant lesions and to the difficulty in precisely identifying all the injured structures, especially in chronic situations, a consensus on the treatment of combined ACL and PLC injuries is still lacking. There are two main treatment options. The first is staged repair starting with PLC reconstruction. The other option is simultaneous reconstruction of both structures [5,6].

The main disadvantage with the staged protocol is persistence of PLC laxity in ACL-deficient knees, whereas the main disadvantages of the combined reconstruction is the convergence of femoral tunnels [7,8].

The aim of this study was to evaluate the functional results of simultaneous reconstruction of ACL and PLC over a 2-year follow-up.

Patients and methods

The study took place at El-Hadrah University Hospital from 2012 to 2014. It included 23 patients with concomitant ACL with PLC injury. All cases underwent a simultaneous reconstruction of ACL with PLC injuries.

Cases with acute injuries, associated injury to the PCL or the medial collateral ligament, previous repair of PLC structures, and intra-articular avulsion fracture of the ACL were excluded from the study.

The median age of the participants was 32 years (range: 23–39 years). The median follow-up was 32 months (range: 24–38 months). There were 22 males and one female. The median duration from the time of injury to the operation was 5 months (range: 3–18 months).

The most common cause of injury was sports, especially football (20 patients, 86%). The other injuries were due to traffic accidents (three patients, 13%). The concomitant injuries in the knee joint were meniscal injuries in 21 (91%) patients and chondral lesions in four (17%) patients.

ACL laxity was determined by the anterior drawer test, Lachman test, and pivot shift test. Posterolateral rotatory instability was determined by difference in external rotation more than 10° in Dial test and external rotation recurvatum test [9–11]. These tests were positive in all patients (100% of cases).

With the knee flexed in 30°, a varus stress test was performed and a stress X-ray film was obtained. Compared with the normal side, the difference in the lateral joint space opening and the presence of firm end point were used to determine and grade varus instability as follows: grade 0, when the difference was less than 3 mm; grade I, when the difference was 3–5 mm; grade II, when the difference was 5–10 mm and there was a firm end point; and grade III, when the difference was greater than 10 mm and a firm end point was absent [8]. A total of 19 patients (82%) had varus instability grade III and four patients (17%) had grade II. Varus thrust was present in all cases.

No abnormality was detected during neurovascular examination in all cases.

The radiological workup included weight-bearing anteroposterior, lateral views of the involved knee, patellofemoral views of both knees, in addition to varus and valgus stress views.

MRI was done in all patients to evaluate spectrum of injury. T2-weighted coronal oblique series that includes the entire fibular head and styloid was ordered to evaluate PLC structures injury.

Informed consent was taken from every participant enrolled in the study, and approval of the Local Ethics Committee of the Alexandria University was taken.

Surgical technique

In all patients, single-bundle ACL reconstruction was done using anatomical transportal technique through accessory anteromedial portal. A bone patellar tendon bone graft was used for ACL reconstruction. The tibial tunnel was made at the following intra-articular landmarks: 3 mm anterior to the inner border of the anterior horn of the lateral meniscus, just lateral to the medial eminence, the posteromedial aspect of the native ACL footprint, and 7–9 mm anterior to the PCL with ACL guide set at 55°. A femoral tunnel was made just posterior and superior to bifurcate line in 120 flexion. A biointerference screw was used for the fixation of the ACL graft in the femur and tibia.

The Hamstring graft was used for the reconstruction of the posterolateral corner using modified Larson technique [12], which involves passing through the fibular head tunnel. In all patients, a hamstring tendon autograft (semitendinosus tendon) was used to reconstruct the posterolateral corner. For this, two separate 2–3-cm incisions were made transversely over the lateral epicondyle and obliquely over the fibular head, respectively.

For the fibular tunnel, a 5-mm or 6-mm tunnel (depending on the size of the graft) was drilled obliquely from the anteroinferior aspect to the posterosuperior aspect on the fibula with the aid of the ACL guide. Dissecting on the peroneal nerve and protecting it using a spatula help prevent this nerve from being injured when the fibula head is reamed.

Two separate femoral tunnels were done. One at the lateral epicondyle for LCL reconstruction and the other tunnel was 18-mm anterior and inferior to the first one for popliteus tendon reconstruction. Femoral tunnels were drilled at 20° axial/20° coronal angulation to avoid tunnel convergence with anatomical ACL femoral tunnel. Both ends of the grafts were passed underneath the iliotibial band in a figure-of-8 pattern. The grafts were fixed with a bioabsorbable interference screws at the femoral tunnels in neutral rotation and 70 flexion of the knee after cyclic loading 20 times.

All preoperative evaluations were performed the day before surgery, and postoperative evaluations were performed at the follow-ups. The clinical results were evaluated by using the Lysholm [13] and IKDC (International Knee Documentation Committee) [14] knee scoring systems. Patients were evaluated clinically and radiologically (anterior stress test and varus stress test using Telos device, telos Arzt- und Krankenhausbedarf GmbH, Ottostraße 261200 Wölfersheim, Germany) for at least 24 months for residual laxity.

Statistical analysis

The clinical score results were analyzed by using MedCalc software. Comparisons between preoperative and final follow-up data were made by using a Wilcoxon signed-rank test. *P* values of less than 0.05 were considered statistically significant.

Results

Based on the IKDC evaluation form at the last evaluation, 15 of the 23 patients (65%) were rated as A (normal), whereas five (21%) were rated as B (nearly normal), two (8%) as C (nearly abnormal), and one (4%) as D (abnormal). Therefore, 20 of the 23 patients (86%) had a satisfactory result according to the IKDC system.

According to Lysholm score, the overall results were excellent in 22 patients (95% of the patients). The median Lysholm score improved from 56 points preoperatively to 94 points postoperatively. Only one patient had poor score owing residual instability. His score was 69 points.

Regarding anterior stability, as measured by an anterior stress radiograph, the mean side-to-side difference in displacement decreased significantly from 6.4±0.9 preoperatively to 1.8±1.3 mm at the final follow-up. At the last follow-up examination, one patient (4%) of the 23 patients had a positive Lachman test which was +2.

The rotational stability was restored in 22 patients with negative dial test results and external rotation recurvatum test results. Only one patient had marked posterolateral instability (IKDC D). Regarding varus instability, all patients had a score of grade 0 varus instability. Varus stress radiographs revealed the mean side-to-side difference in displacement decreased from 4.3±1.7 mm preoperatively to 0.4±0.2 mm at the final follow-up.

The complications of surgery included knee joint stiffness in two patients, one of whom was subjected to manipulation under anesthesia 6 months after surgery. The other one was improved after 9 months on physiotherapy alone. On the final follow-up, both patients were able to flex up to 130 but could not squat fully (both were IKDC C). There were no cases of nerve injury related to the surgery in any of the participants. Two patients developed a superficial skin infection of the surgical wound of the PLC reconstruction that healed after serial dressings. No single case reported tunnel convergence during surgery.

Discussion

The frequency with which PLC injuries accompany ACL injuries is poorly investigated. Several studies suggested that up to 10–15% of ACL tears are partnered by PLC injuries [15,16]. Lee *et al.* [17] had shown 12.5% of their patients with ACL had a PLC injury. Missing a PLC injury in the presence of a known ACL tear can result in the failure of ACL reconstruction [16].

Modified Larson [18] technique and Clancy biceps tenodesis are among the most common reconstruction techniques [19]. Laprade introduced anatomic reconstructions of PLC [20]. Biomechanical studies showed that anatomical PLC reconstruction did not perform better than the single fibular sling technique [21].

This study showed that combined ACL-PLC reconstruction revealed satisfactory results according to IKDC score. Of the 23 patients, 20 (86%) had a satisfactory result according to the IKDC system. According to Lysholm score, the overall results were excellent in 95% of the patients. The median Lysholm score improved from 56 points preoperatively to 94 points postoperatively.

The results were comparable to the similar studies in the literature. Lee *et al.* [17] reported that 40 of the 44 knees with posterolateral rotatory instability were successfully surgically corrected, as shown by the posterolateral drawer test. They reported 39 of the 44 patients (89%) had a satisfactory result according to the IKDC system.

Fanelli *et al.* [22] evaluated the results of 34 chronic combined ACL posterolateral reconstructions in 34 knees using allograft. Postoperative Lysholm knee ligament rating scale mean scores were 91.8 out of 100 (range: 83–100). Postoperative HSS knee ligament mean scores were 90.9 out of 100 (range: 75–100). Using the Tegner activity scale, 58.8% of patients returned to their same preinjury Tegner level of function postoperatively; 5.9% returned to one Tegner level of function lower than their preinjury level postoperatively.Cartwright-Terry *et al.* [23] conducted a prospective comparative study to compare the results of combined ACL and PLC reconstruction versus isolated ACL reconstruction over a 5-year follow-up. All patients in the ACL-PLC group resumed preinjury employment, and 23 of 25 had resumed sports.

The main disadvantages with simultaneous reconstruction of both ACL and PLC is the possibility of tunnel collision, especially when

anatomic reconstruction of the ACL is performed. In this type of reconstruction, the femoral tunnel is more horizontal and closer to the fibular collateral ligament (FCL) and popliteus origins [24]. Single femoral tunnel was suggested by some authors [25–27]. If two tunnels are to be drilled, several methods were described. The most common recommendation suggested that popliteus tendon tunnels should be drilled at 30° axial/30° coronal angulations, and FCL tunnels should be drilled at 30° axial/0° coronal angulations. However, Gali *et al.* [24] found that drilling popliteus and FCL femoral tunnels at 20° axial/20° coronal angulation is a safer positioning for simultaneous ACL and PLC reconstructions. Following this technique of Gali and colleagues, there was not a single case of tunnel convergence in all patients.

This study had some limitations. First, the small size was relatively small, but this was accounted for by the relative rarity of this type of injury. Second, this study is not comparative, as most literature supported the combined technique. Therefore, it seemed to the author that adding a group with staged reconstruction would be unethical. The follow-up period was not very long, with an average of 32 months.

Conclusion

This study suggested that combined ACL and PLC reconstruction in one session was associated with good outcome as long as the surgeon is aware of the possible convergence of femoral tunnels.

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Conflicts of interest

There are no conflicts of interest.

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