Arthroscopic reconstruction of the posterior cruciate ligament

Adel H. Awad Allah, Tharwat M. Abdel Rahman, Faisal A. Hashem Elsherief, Mohamed G. Ragheb Abd Albaki

Background Posterior cruciate ligament (PCL) tears have historically been underdiagnosed because they are often asymptomatic. It now appears that PCL tears occur more frequently than has been previously appreciated. The PCL is named for its insertion on the tibia.

Objective The aim of this study was to clarify when and how to go for arthroscopic reconstruction of the PCL, reviewing the latest arthroscopic techniques.

Patients and methods This prospective study included 20 patients (17 males and three females). Their mean age was 48 years [48.23±10.53 (range 20–60) years]. All patients presented with PCL injury, whether isolated injury or combined with other ligamentous injury, closed knee injury, with no previous ligamentous reconstruction of PCL on the same side, and all being fit for surgery. Preoperative radiographs and MRI were done to establish PCL injury diagnosis together with the clinical evaluation.

Results We found that PCL injury was found to be combined with other ligamentous injury rather than isolated (60% combined injury). We found satisfactory highly statistically significant difference between preoperative and postoperative results according to Lysholm Score. The mean preoperative total Lysholm Score was 24.77 in comparisons with the mean postoperative total Lysholm Score of 90.13. Clinical examination according to IKCD Score shows less significant difference in general. In contrast, comparison between preoperative and postoperative results according to posterior drawer test and total score shows highly significant difference ($P<0.001$).

Conclusion In our study, we reached the concept that arthroscopic reconstruction of PCL injuries has low rate of complications, within 13.33%. Arthroscopic single-bundle reconstruction may be complicated with hardware complications, loss of motion, infection, and donor site morbidity.

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Department of Orthopedic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

Correspondence to Mohamed G. Ragheb Abd Albaki, MBBCH, MSc, Tel: (+2) 0111-6633-633;
e-mail: dr.mohamedgad@gmail.com

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Introduction

Renewed interest in injuries to the posterior cruciate ligament (PCL) and its associated structures has resulted in an increasing number of reports on the anatomy, biomechanics, diagnosis, and treatment. Injuries to the PCL are much less common; an individual surgeon encounters very few each year, and therefore, his/her experience regarding it is limited. Acute cases are often missed, either from lack of experience of the original examiner or because the patient does not realize the severity of the injury and does not seek medical help at the acute stage. Attempts at treatment in the past have produced relatively poor results, and the indications for surgery are unclear [1].

It is uncommon to see a patient presenting with an acute, isolated injury to the PCL, and the diagnosis is easily missed. The symptoms may be mild, with the patient regarding the condition as a sprain, which will resolve. The diagnosis may be missed initially because the signs may be minimal or the index of suspicion low. In the acute stage, there may be an abrasion over the front of the tibia associated with a swollen knee [2]. Over the next few days, bruising may develop in the popliteal fossa from rupture of the posterior capsule. In the early stages, a posterior sag may be difficult to identify on clinical examination. The clinical features and natural history of this injury have been reported many times. The etiology of the injury may be mixed, including sports injury and high-speed road-traffic accidents. The degree of injury to the ligament may vary. In reports that are prospective, the number of patients may be small or the follow-up too short. All these factors lead to confusing and misleading conclusions. Most authors comment on the incidence of pain, which is aching in nature and frequently localized to the medial and patellofemoral compartments of the knee [3,4].

Routine radiographs may show an avulsion fracture of the insertion of the PCL into the posterior aspect

of the tibia. Injury to the posterolateral corner may be associated with bony avulsion of the head of the fibula. Long-standing cases of rupture of the PCL may show degenerative disease in the medial compartment of the knee and possibly the patellofemoral compartment. MRI is useful for diagnosing a tear and may give information on the position along the ligament of the rupture which may affect treatment. On MRI, it should be emphasized that the anterior cruciate ligament may give a false impression of laxity because of posterior sag. The PCL can be identified in all three conventional MRI planes. In patients with aching pain after rupture of the PCL, it is important to differentiate the pain of 'instability' from degenerative knee pain. Radioactive bone scanning has been suggested for this purpose. If the scan is 'hot' and provided that there is no significant degenerative change on MRI or arthroscopy, a stabilization procedure may resolve the symptoms [5].

The role of arthroscopy in acute tears of the PCL is debated. Many surgeons argue that history taking, clinical examination, and MRI are sufficient for diagnosis. Others state that arthroscopy can provide further information, which is useful in the management of the patient [6].

Treatment of isolated injuries to the PCL, an acute isolated midsubstance rupture of the PCL, may heal. The knee may be treated in a brace in full extension for a period of six weeks followed by mobilization. Bony avulsion of the insertion of the PCL into the back of the tibia is an indication for early operative treatment [7]. PCL reconstruction is more commonly performed in combination with ACL reconstruction in patients who have knee dislocations. However, the PCL can be left to heal, and ACL laxity and other medial or lateral ligamentous laxity can be addressed nonoperatively or surgically as indicated for the patient. There is almost no indication for reconstruction of an isolated intrasubstance rupture of the PCL in view of the natural history of the injury. Treatment of injuries to the posterolateral corner and to the PCL acute injuries. Studies have not found any significant difference between allograft of tendo-Achilles and autogenous patellar tendon. Fixation devices are numerous and include interference screws, both metal and bioabsorbable, soft tissue, and bone. Transfixation methods such as the Rigidfix and Transfix have increased the surgical options and may be better than the Endbutton type of device, which fixes the graft at a distance from the mouth of the tunnel, increasing the potential for the 'windscreen-wiper' effect [7].

Aim

The aim of this study was to clarify when and how to go for arthroscopic reconstruction of the PCL, reviewing the latest arthroscopic techniques.

Patients and methods

From December 2016 to September 2018, a prospective clinical study was done on patients with PCL injuries. In this study, 20 patients with PCL injuries were treated by arthroscopic reconstruction of the PCL using both patellar tendon and hamstrings tendons. The age range was from 20 to 45 years. Follow-up period was 3–6 months. Inclusion criteria were PCL injury whether isolated or combined with other ligamentous injuries, skeletally mature patients, age from 20 to 60 year old, closed injury, and fit for surgery, whereas exclusion criteria were vascular injuries, open fractures, skeletally immature patients, previous knee ligamentous reconstruction, and unfit for surgery. Routine plain radiography was done, with anteroposterior and lateral views of affected knee and limb, as well as skeletal radiographic survey (chest, pelvis, and cervical spine). MRI scan was crucial to determine the type of injury whether isolated or associated with other ligamentous injuries. Extraction of the routine preoperative laboratory values was done in the emergency room such as complete blood count, prothrombin time, partial thromboplastin time, international normalized ratio, aspartate aminotransferase, alanine aminotransferase, random blood sugar, urea, and creatinine. Single-bundle PCL reconstruction technique was used for all patients in this study. After clinical and radiographic assessment, the postoperative rating scales were calculated. The Lysholm Knee Score was used for subjective evaluation, and the International Knee Documentation Committee (IKDC) scoring system (knee examination form) was used for objective evaluation. All complications in this study were documented for either its follow-up or management or both.

Case presentation

A 30-year-old male nonathlete (sedentary work, employee) patient fell from stairs with trauma to the right knee. Was complaining of giving way. Time to surgery was 3 months. Diagnosis was torn PCL and torn medial collateral ligament.

	Lysholm Score	
	Preoperative	Postoperative
Limp	3	5
Support	5	5
Locking	6	15
Instability	0	25
Pain	0	20
Swelling	0	10
Stairs climbing	2	6
Squatting	2	5
Total	18 (poor)	91 (excellent)
International Knee Documentation Committee		
Effusion	C	A
Lack of extension	A	A
Lack of flexion	A	A
Anterior knee pain	C	A
Posterior drawer	D	A
One leg hop	C	A

Operative finding

Complete tear of the PCL was the operative finding, for which arthroscopic anatomic single-bundle reconstruction was done with semitendinosus tendon and gracilis tendon from the contralateral side. Fixation was done of the femoral and tibial bones by two interference screws. The patient had a torn medial collateral ligament grade I who was conservatively managed (Figs 1 and 2).

Results

The average age at the time of surgery was 48 years (48.23±10.53), range 20–60 years. There were only three (15%) female patients, whereas most of the patients were males (17 patients, 85%) (Figs 3 and 4, Table 1).

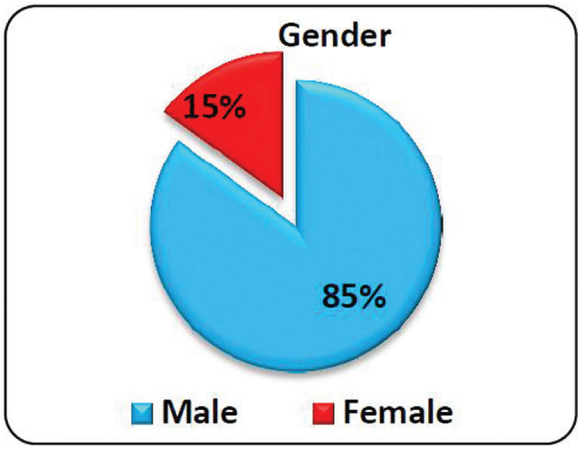
Our data in all parameters and averages clearly show that there is highly statistically significant difference between preoperative and postoperative values according to Lysholm Score ($P<0.001$). Data are expressed as mean±SD. Better postoperative Lysholm Score is provided by our patient's data than preoperative scores (Fig. 5).

Discussion

The treatment of PCL injury remains controversial. The trend for treatment of PCL injuries is toward performing more PCL reconstructions. However, the natural history of PCL shows that the injured PCLs can heal without treatment, even in the presence of other ligamentous injuries.

Follow-up cases have shown that PCL laxity does not change with time from injury, and patients with lesser PCL laxity do not have better subjective survey scores or less radiographic evidence of OA than patients with greater PCL laxity. The patient's symptoms and physical examination may vary greatly depending on the severity of the PCL injury [8].

Figure 1

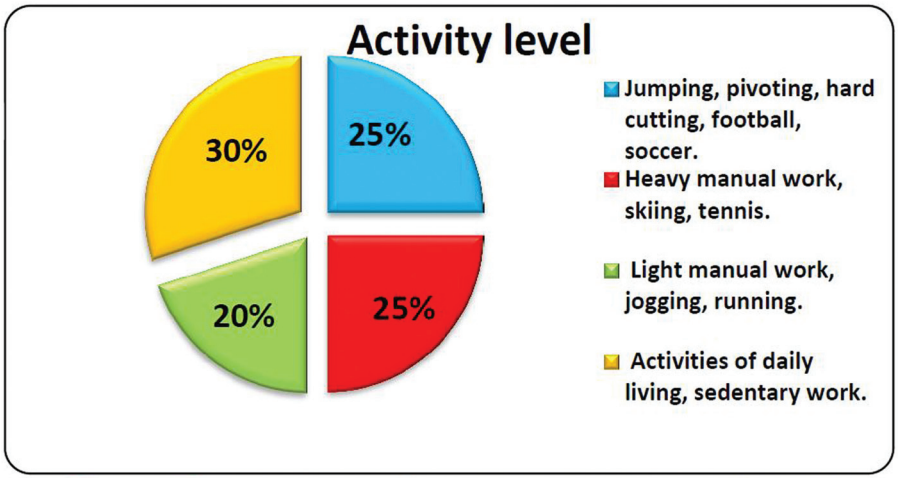


Description of sex in studied patients.

The long-term outcome of nonoperative treatment shows an incidence of OA to range from 17 to 53% as compared with a range of 36–59% with PCL reconstruction. At a mean follow-up of 7 years after PCL injury, Parolie *et al.* [9] found arthritis in 36% of their patients at a mean of 8.4 years after PCL injury. Boynton and Tietjens [10] reported articular degeneration in the medial tibiofemoral compartment in 53% of their patients at a mean time of 13.2 years after PCL injury. Finally, at a mean of 14 years after injury, Shelbourne *et al.* [11] found evidence of some OA in 41% of patients overall, but moderate to severe OA was found in only 11% of patients. These results of nonoperative treatment compare favorably with long-term outcome of PCL reconstruction for isolated PCL injuries. With a mean of 9 years after PCL reconstruction, Shelbourne *et al.* [5] found medial joint line narrowing in 59% of their patients, and the IKDC ratings of radiographs were normal for nine (41%) of 22 patients, nearly normal for 10 (45%), and abnormal for three (9%).

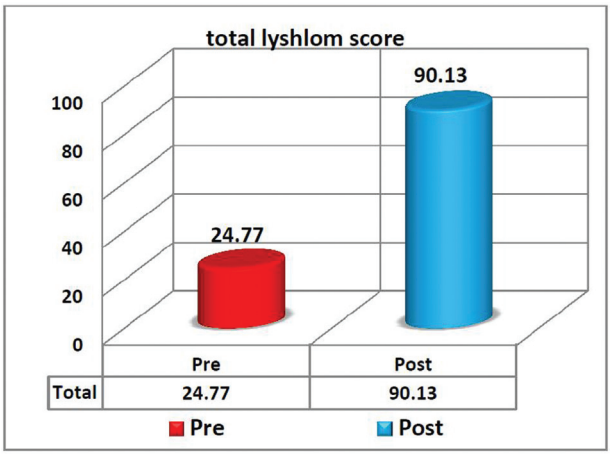
Long-term subjective evaluations of patients after nonoperative treatment and PCL reconstruction are strikingly similar. At a mean of 17 years after nonoperative treatment, Shelbourne *et al.* [12] found that patients had a mean IKDC score of 73 points, which compares to IKDC Scores of 75 and 87 found by studies of operative treatment, which had much less follow-up times of 9–10 years.

Figure 2



Showing activity levels of studied patients.

Figure 3



Bar chart between preoperative and postoperative values according to total Lysholm Score.

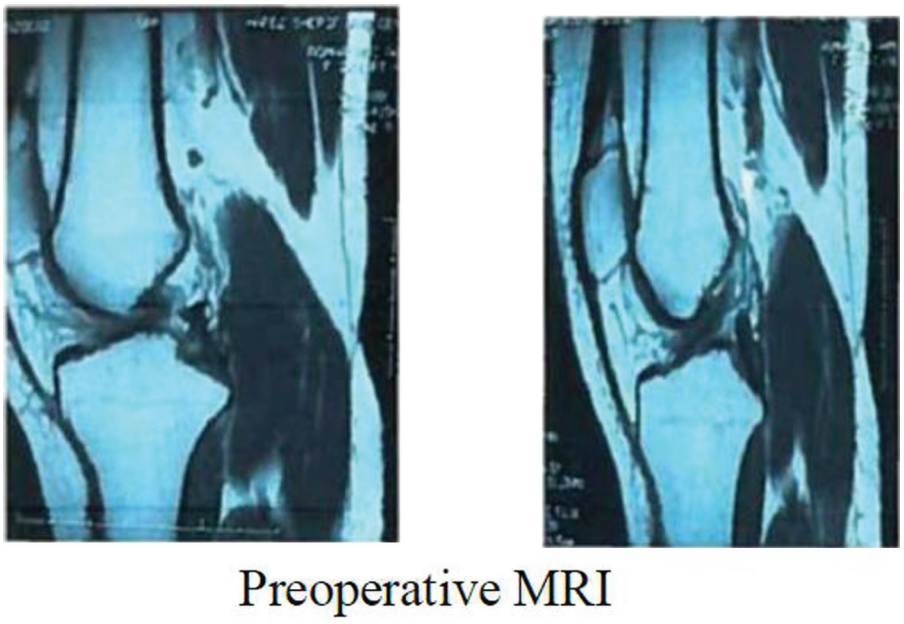
Dejour *et al.* [8] in a study examined 47 patients (40 chronic and seven acute) treated conservatively with nonoperative treatment for mixed isolated and combined PCL injuries. The mean follow-up was 15 years. They have reported worsening of stability and pain with time. Three phases of evolution of PCL injured knee were functional adaptation in 3–18 months after injury; functional tolerance with progressive deterioration of patellofemoral and tibiofemoral joints over next 15 years; and frank OA after ~15 years. Many studies on the clinical results of PCL reconstruction showed good early functional results, but the posterior laxity of the knee was not completely eliminated.

Arthroscopic single-bundle reconstruction is the technique of choice in our study. Our study data provide many important relations and results according to clinical assessment.

In our study, we found satisfactory highly statistically significant difference between preoperative and postoperative results according to Lysholm Score ($P<0.001$). The mean preoperative total Lysholm Score was 24.77±13.16 in comparison with the mean postoperative total Lysholm Score of 90.13 ±24.77. We also found that the mean preoperative instability Lysholm Score was 2.10±1.73 in comparison with the mean postoperative total Lysholm Score of 4.87±0.51. In our study report, all patients with isolated PCL injury (eight patients) were graded C in IKCD Score (10-mm posterior drawer test) in preoperative clinical assessment. In contrast, 12 patients with multiligamentous PCL injuries were graded D in IKCD Score (>10 mm) and five patients were graded C in IKCD Score. This clearly shows a highly significant relationship ($P<0.001$) when we compare multiligamentous and isolated PCL injuries according to preoperative posterior drawer test. Isolated PCL injuries show higher scores compared with multiligamentous.In contrast, we found a lesser significant relationship when we assess the same comparison in the postoperative results ($P=0.033$) [7]. Patients with isolated PCL injury were graded A (2-mm posterior drawer test) in IKCD Score and only one patient was graded B (5-mm posterior drawer test), whereas 12 patients with multiligamentous PCL results were graded as 6A, 3B, 2C, and 1D. Isolated PCL reconstruction shows relatively better results than multiligamentous.

Kennedy *et al.* [12] found that a number of mechanisms of injury to the PCL have been described in the literature. Probably the most recognized is the 'dashboard injury', comprising a posterior blow to

Figure 4



Preoperative MRI of Right knee.

Table 1 Comparative relationship between multiligamentous and isolated posterior cruciate ligament injury

	Multiligamentous (*n*=12) [*n* (%)]	Isolated (*n*=8) [*n* (%)]	χ^2	*P*-value
Posterior drawer (preoperative)				
C	3 (25)	8 (100)	10	0.001
D	9 (75)	0 (0)		
Posterior drawer (postoperative)				
A	6 (50)	7 (87.5)	1.9	0.4
B	3 (25)	1 (12.5)		
C	3 (25)	0 (0)		

Figure 5

Arthroscopic view of drilling the femoral tunnel.

the proximal tibia with the knee flexed especially in a high-velocity trauma like road traffic accident or motor car accident.

Our study group data show that the major mechanism of injury is dashboard injuries. It was identified in four (20%) cases. Road traffic accident is the mode of trauma in 10 (50%) cases followed by motor car accident, represented in six (30%) cases.

Conclusion

Controversy still exists with respect to the indications for nonoperative and surgical intervention and techniques of reconstruction. The relatively infrequent occurrence of this injury has unfortunately led to clinical studies with small sample sizes and short-term follow-up. The limited understanding of the PCL and associated injuries has additionally resulted in studies that are frequently a collection of differing patterns of PCL injury, that is, acute, chronic, isolated, combined, partial, and complete, and also lack well-defined indications for surgical management.

Current surgical indications for PCL injuries include combined ligamentous injuries involving the PCL,

symptomatic grade III laxity, and bony avulsion fractures.

This study evaluated the clinical outcome and correlated the results and degenerative changes of the affected knees with the duration of injury and preoperative and postoperative ligament laxity with arthroscopic single-bundle reconstruction technique.

Our study group data obviously show that arthroscopic single-bundle reconstruction for complete PCL tear produces satisfactory clinical results in medium-term follow-up.

Finally, our study is limited by a number of factors. First, the average follow-up is short and further long-term follow-up is necessary to ensure instability does not recur over time and for proper assessment of degenerative changes of the articular cartilage and anterior knee pain. Second, most surgical procedures are not for isolated PCL knee reconstructions. The difference between single-bundle and double-bundle PCL reconstruction, if any, can be concluded only with long-term results and larger number of patients.

The arthroscopic tibial inlay technique may provide benefits of both open inlay and transtibial reconstruction techniques and comparable stability to the conventional PCL reconstruction methods according to several biomechanical studies.

In our study, we reached the conclusion that arthroscopic reconstruction of PCL injuries has low value of complications, within 13.33%. Arthroscopic single-bundle reconstruction may be complicated with hardware complications, loss of motion, infection, and donor site morbidity.

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Conflicts of interest
None declared.

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