



Arthroscopic Primary Repair of Posterior Cruciate Ligament Injuries

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Posterior cruciate ligament (PCL) injury can present either as an isolated tear or in the setting of a multiligament-injured knee. Most PCL injuries are midsubstance tears and 10%-40% of tears are either bony avulsion or soft tissue avulsion of the femur or tibia. PCL reconstruction is the mainstay for treatment of midsubstance tears, but primary arthroscopic PCL repair can be considered for avulsion tears. Although the literature on PCL injuries and especially PCL repair is scarce, some studies show good results with primary repair techniques. In this article, we describe the surgical technique of arthroscopic primary PCL repair by passing Bunnel-type stitches into the ligament using a reloadable suture passer. Sutures are then fixed either to bone with a suture anchor technique or by passing the sutures through drill holes at the femoral footprint and tying them over a bony bridge or button. Patient selection and surgical indications, including radiographic assessment, are critical to successfully using this technique. The areas of concern and most common pitfalls of this technique are discussed, as well as the postoperative care regimen and reported clinical results to date. When these steps are carefully optimized, successful patient outcomes can be achieved. Although this technique is not meant to be the mainstay of surgical PCL treatment, we believe that the arthroscopic primary PCL repair technique is quite useful in select clinical situations, and should be in the armamentarium of every surgeon treating multiligament-injured knee or isolated PCL injuries.

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Introduction

Posterior cruciate ligament (PCL) injury can present either as an isolated tear or in the setting of a multiligament-injured knee (MLIK). The tears can be bony avulsion tears, soft tissue avulsion “peeloff” tears, or midsubstance tears. The most frequently occurring tear is midsubstance, followed by soft tissue avulsion and lastly bony avulsion tears.¹⁻³ Surgery is

generally indicated in cases with grade III tears or in the setting of MLIK.⁴⁻⁶ Approximately 15%-32% of the PCL injuries are reported to be isolated tears,⁷⁻⁹ although in the emergency setting much lower percentages (3%-4%) are reported.^{1,10} Between 2007 and 2011 in the United States 222 isolated PCL surgeries and 479 PCL surgeries in the MLIK were performed, which makes it a relatively uncommon surgical treatment.⁹

The literature on PCL injury is scarce and patient populations are often heterogeneous including other knee pathologies, such as posterolateral corner injuries, anterior cruciate ligament (ACL) injury, and neurovascular injuries.^{5,6,11} The most frequently discussed treatments of PCL injury in literature are conservative treatment, single-bundle reconstruction, double-bundle reconstruction, and primary repair.^{1,12-16} Historically, there was a role for acute open primary repair of PCL injury in both the isolated tears and in the MLIK.¹⁷⁻¹⁹ In the years that followed, primary repair of cruciate ligaments, mostly of the ACL, illustrated increasingly disappointing results and more attention shifted toward arthroscopic PCL reconstruction.²⁰⁻²³

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However, most of the evidence leading to abandonment of primary PCL repair technique is insufficient^{3,5,24} and many studies consisted of heterogeneous populations.^{3,5,25}

After closely examining this historical experience, many authors concluded that primary repair can be a good solution for the bony avulsion or soft tissue avulsion-type tears.^{3,24,26,27} In all, 2 studies showed that approximately 10%-17% of the PCL tears have a bony avulsion instead of a ligamentous tear whereas midsubstance tears remain the most common injury.^{3,8} Several authors also reported on arthroscopic primary repairs of these bony avulsions²⁸⁻³⁰ or peeloff avulsions.³¹⁻³³ The main benefits of primary repair are achieving better proprioception^{34,35} and earlier rehabilitation that prevents development of stiffness.³⁶ The benefits of the arthroscopic method of repair is to decrease surgical morbidity and prevent neurovascular damage, wound healing problems, and arthrofibrosis.³⁷ Moreover, PCL repair has shown better results than nonoperative treatment,²⁵ and performing a PCL repair does not generally preclude or complicate subsequent PCL reconstruction, if it becomes necessary.

Therefore, it is our opinion that it is of benefit for knee ligament surgeons to have this surgical technique within their operative toolbox. We believe there is still a role for primary PCL repair, both in the MLIK and isolated settings, with the caveat that strict patient selection is necessary to prevent higher rates of failure.

Patient Selection

Preoperative patient selection is of critical importance to achieve successful outcome of arthroscopic primary PCL repair. A few criteria are essential to consider before indicating a patient for primary repair:

Type of PCL Tear

Several types of PCL tears can occur. As reported in the literature, bony avulsion or soft tissue avulsion types can be repaired primarily.^{3,24,26,38} Richter et al³ compared the results of primary PCL repair after an avulsion lesion to the results of primary repair after a midsubstance tear. At 8.2 years of follow-up, the primary repair of avulsion lesions had better Lysholm and Tegner scores, and they found that a higher percentage of patients returned to work or sports activities. Furthermore, Moore and Larson¹⁸ reported on a case series using primary repair and presented relatively good results with 13 patients having a femoral or tibial tear and 3 patients having a midsubstance tear. Other studies confirmed that the good results with primary repair can be achieved also with the avulsion-type tears.^{24,28,30} Therefore, it is important to critically select the patients who are eligible for this surgical procedure: those patients with either bony avulsion- or soft tissue avulsion-type tears of the femoral or tibial insertion.

Grade of PCL Tear

Grade I and II PCL tears are partial tears, whereas grade III is a complete PCL tear. Several authors report good results of

nonoperative treatment of the grade I and II tears,^{38,39} although some patients are reported to experience instability and osteoarthritis at long-term follow-up.¹⁵ Outcomes of nonoperative treatment of grade III tears are less predictable and nonoperative treatment in these patients is frequently associated with development of chondral lesions and instability.^{39,40} Therefore, the general consensus is that surgery is often warranted in grade III tears and these tears are well visualized using magnetic resonance imaging (MRI).^{15,39}

Time Setting of the Surgical Repair

A balance should be sought between early and late intervention and the consensus is to perform surgery within 1-3 weeks.^{24,38} This time period is also reported in almost all case series where PCL repairs were performed.^{7,19,26,41,42} A week of waiting is recommended to allow time for capsular structures to heal and thus reduce fluid extravasation during arthroscopic surgery.^{24,38} Delaying repair by greater than 3 weeks is associated with an increased risk of capsular scarring,³⁸ fixed tibial posterior subluxation that is harder to reduce,³⁸ and decreased ligamentous tissue quality.^{32,43} It is important to note that in the setting of the MLIK, other injuries should be monitored and that these injuries can influence the timing of surgery or the decision to convert to open surgery.²⁴

Patient Variables

It is important to understand all patients, including occupational and activity levels before the surgery, and their individual expectations. It is possible that the patient may not want or is not able to undergo a PCL reconstruction with a full rehabilitation program. Arthroscopic primary PCL repair might be possible, whereas reconstruction is not, when weighing the risks and benefits to the patient. As always, it is important to discuss the situation and treatment options thoroughly with the patient.

Imaging

Radiographs should be examined to assess concomitant fractures or avulsion fractures that can point in the direction of associated injuries. Anteroposterior and lateral radiographs should be used to assess any bony avulsions, osteochondral lesions, or posterior tibial subluxation.³⁹ A gravity sag view can be performed to quantify the posterior subluxation and is performed by a lateral radiograph with the hip in 45° flexion and the knee in 90° flexion; however, this is generally more helpful with chronic injuries.⁴⁴ MRI is still considered the gold standard and has 100% sensitivity and 97%-100% specificity for PCL injury.⁴⁵⁻⁴⁸ The sagittal, coronal, and axial planes of the MRI are visualized to detect any femoral or tibial bony avulsions or "peeloff" lesions. Most of the bony avulsion fractures are reported to be at the tibial side,^{49,50} whereas most of the soft tissue avulsions tend to be from the femoral side.^{33,50,51} There is no standardized protocol on how best to evaluate PCL tears, but in general the PCL should be followed in both proximal and distal directions to assess if the

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