



Arthroscopic Transtibial Tunnel Posterior Cruciate Ligament Reconstruction

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The goals leading to successful posterior cruciate ligament (PCL) reconstruction surgery include identification and treatment of associated pathology such as posterolateral instability, posteromedial instability, and lower extremity malalignment. The use of strong graft material, properly placed tunnels to approximate as closely as possible the PCL insertion sites, and minimization of graft bending also enhance the probability of PCL reconstruction success. In addition, mechanical graft tensioning, primary and backup PCL graft fixation, and the appropriate postoperative rehabilitation program are also necessary ingredients for PCL reconstruction success. Both single-bundle and double-bundle PCL reconstruction surgical techniques are successful when evaluated with stress radiography, KT-1000 arthrometer measurements, and knee ligament rating scales. Indications for double-bundle PCL reconstruction as of this writing include severe hyperextension of the knee and revision PCL reconstruction. In combined PCL, anterior cruciate ligament, medial- and lateral-side knee injuries (global laxity), 2-18-year postsurgical results revealed very successful posterior cruciate ligament reconstruction using the arthroscopic transtibial tunnel surgical technique. The purpose of this article is to describe the arthroscopic transtibial tunnel posterior cruciate ligament reconstruction surgical technique, and present the author's results with this surgical procedure.

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Introduction

Posterior cruciate ligament (PCL) injuries in my practice rarely occur as an isolated knee ligament injury. The PCL injuries are most often combined with at least one other knee ligament injury.^{1,2} The reasons for PCL reconstruction surgical failure most commonly are failure to address associated ligament instabilities, failure to address lower extremity malalignment, and incorrect tunnel placement.³ Identifying the multiple planes of instability in these complex knee ligament injuries is essential for successful treatment of the PCL injured knee. The PCL disruption leads to increased posterior laxity at 90° of knee flexion. Recognition and correction of the medial

and lateral side instability patterns is the key to successful posterior and anterior cruciate ligament (ACL) surgery.

There are 3 different types of instability patterns that I have observed in medial- and lateral-side knee injuries.⁴⁻⁶ They are Type A (axial rotation instability only), Type B (axial rotation instability combined with varus and valgus laxities with a firm end point), and Type C (axial rotation instability combined with varus and valgus laxities with little or no end point). In my experience, the axial rotation instability (Type A) medial or lateral side is most frequently overlooked. It is also critical to understand that combined medial- and lateral-side instabilities of different types occur with bicruciate and unicruciate multiple-ligament knee injuries. Examples include PCL, ACL, lateral-side Type C, and medial-side Type A, or PCL, medial-side Type B, and lateral-side Type A instability patterns.

A combination of careful clinical examination, radiographs, and MRI studies aid in determining the correct diagnosis of multiple-ligament knee injuries. Knee examination under

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anesthesia combined with fluoroscopy, stress radiography, and diagnostic arthroscopy also contributes to accurately diagnosing the multiple planes of instability.^{7,8} The purpose of this article is to describe the arthroscopic transtibial tunnel PCL reconstruction surgical technique.⁹⁻¹²

Operating Room Preparation

PCL-based reconstruction procedures are routinely performed in an outpatient setting unless specific circumstances indicate the necessity of an inpatient environment.⁹⁻¹² The same experienced surgical teams are assembled for these complex surgical procedures. Experienced and familiar teams provide for a smoother operation, shorter surgical times, enhanced patient care, and a greater probability of success in these difficult surgical procedures. Preoperative and postoperative prophylactic antibiotics are routinely used in these complex and time-consuming surgical procedures to decrease the probability of infection.

Graft Selection

My preferred graft for the PCL reconstruction is the Achilles tendon allograft for single-bundle PCL reconstructions, and Achilles tendon (anterolateral bundle) and tibialis anterior (posteromedial bundle) allografts for double-bundle PCL reconstructions. The allograft tissue used is from the same tissue bank with the same methods of tissue procurement and preservation that provides a consistent graft of high quality. It is very important for the surgeon to “know the tissue bank,” and to obtain high-quality allograft tissue that maximizes the probability of surgical success.

PCL Reconstruction Surgical Technique

The principles of PCL reconstruction are to identify and treat all pathologies, accurately place tunnels to produce anatomical graft insertion sites, use strong graft material and mechanical graft tensioning, secure graft fixation, and deliberate a postoperative rehabilitation program.⁹⁻¹⁴

The patient is placed on the operating room table in the supine position, and after satisfactory induction of anesthesia, the operative and nonoperative lower extremities are carefully examined. A tourniquet is applied to the upper thigh of the operative extremity but is not routinely inflated, and that extremity is prepared and draped in a sterile fashion. The normal leg is supported by the fully extended operating room table, which also supports the surgical leg during medial- and lateral-side surgery. A lateral post is used to control the surgical extremity. An arthroscopic leg holder is not used. Preoperative and postoperative antibiotics are given, and antibiotics are routinely used to help prevent infection in these time-consuming, difficult, and complex cases. Allograft tissue is prepared before bringing the patient into the operating room to minimize general anesthesia time for the patient. The Biomet

Sports Medicine PCL/ACL System (Biomet Sports Medicine, Warsaw, IN) is the surgical instrument used for this surgical procedure. Intraoperative radiography and C-arm image intensifier are not routinely used for this surgical procedure.¹⁰⁻¹²

The arthroscopic instruments are inserted with the inflow through the superolateral patellar portal. Instrumentation and visualization are positioned through inferomedial and inferolateral patellar portals, and they can be interchanged as necessary. Additional portals are established as necessary. Exploration of the joint consists of evaluation of the patellofemoral joint, the medial and lateral compartments, medial and lateral menisci, and the intercondylar notch. The residual stumps of the PCLs are debrided; however, the posterior (and ACL when applicable) anatomical insertion sites are preserved to serve as tunnel reference points. The notchplasty for the ACL portion of the procedure in combined PCL and ACL reconstruction cases is performed at this time.

An extra capsular extra-articular posteromedial safety incision is made by creating an incision approximately 1.5-2-cm long starting at the posteromedial border of the tibia approximately 1 in below the level of the joint line and extending distally (Fig. 1). Dissection is performed down to the crural fascia, which is incised longitudinally. An interval is developed between the medial head of the gastrocnemius muscle and the nerves and vessels posterior to the surgeon's finger, and the capsule of the knee joint anterior to the surgeon's finger. The posteromedial safety incision enables the surgeon to protect the neurovascular structures, confirm the accuracy of the PCL tibial tunnel, and to facilitate the flow of the surgical procedure. The neurovascular structures of the popliteal fossa are close to the posterior capsule of the knee joint, and are at risk during

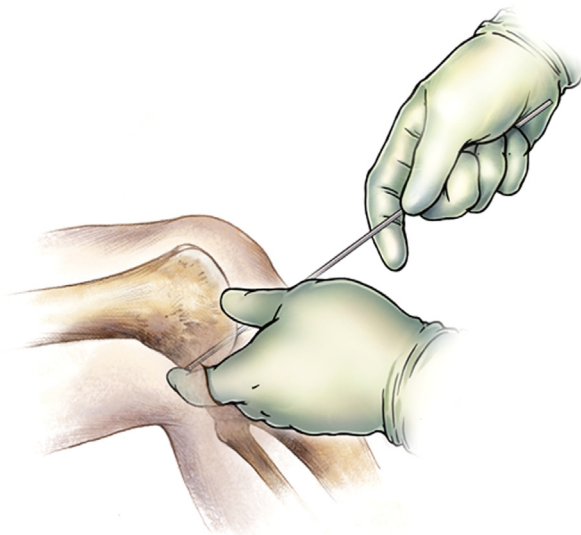


Figure 1 Posteromedial extra-articular extra capsular safety incision. The surgeon is able to palpate the posterior aspect of the tibia through the extra capsular extra-articular posteromedial safety incision. This enables the surgeon to accurately position guide wires, create the tibial tunnel, protect the neurovascular structures, and facilitate the flow of the surgical procedure. (Adapted with permission from Fanelli.¹¹) (Color version of figure is available online.)

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