Surgical Options and Procedure-Modified Rehabilitation for PCL Injury

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Posterior cruciate ligament (PCL) injury is uncommon in sports, and PCL repair and reconstructive surgery are even more rare. PCL-reconstructive surgery seems to be evolving similarly to the way anterior cruciate ligament (ACL) surgery evolved in the 1980s. The ACL experience can be extrapolated for the PCL to give us information about graft strengths and fixation. In addition, correct anatomic positioning of the ACL and PCL grafts solves a myriad of postoperative problems including graft failure. Unfortunately, tunnel and bundle issues make a consensus difficult on the PCL surgery. The international PCL Study Group is undertaking a survey of its members to write a consensus document for diagnosing and managing PCL ligament injuries. But to date, there is no “gold standard” for PCL reconstruction. Although many surgeons have developed a comfort level with a particular method of PCL reconstruction, there is no consensus as to what the “best” method is. Recent literature reflects the controversies over graft sources, incision location, number of femoral tunnels, whether to use a tibial tunnel at all, graft tensioning, and fixation. This article describes common alternatives for PCL reconstruction and their implications for modifying rehabilitation.

**Repair of Avulsion**

The PCL can remain viable when it pulls off of its tibial insertion. If the avulsion of the PCL from the tibia involves at least 1 cm of bone, an anatomic repair with solid fixation can be performed to reattach the bony fragment to the tibia. This surgery can be performed through a single lazy-S posterior incision (Burks & Schaffer, 1990) or, although rarely, arthroscopically. When an open procedure is performed, the interval between the semimembranosis and medial gastrocnemius is defined (Figure 1), the capsule is split, and the bony fragment is reattached with one or two (preferably two if the fragment is large enough) screws to the tibia (Bergfeld & Graham, 2001). When repaired arthroscopically, fixation is usually some form of suture fixation and is less rigid. If the PCL is not recessed when reattached, it might actually be too loose because of the stretching of the PCL that occurred before the avulsion. For this reason, some have advocated countersinking the bone into the tibia. From a rehabilitation perspective, the arthroscopic repair presents a problem. The postoperative morbidity might be lower, with less pain, but the risk of fixation loss and graft failure is higher if the patient allows how the knee feels to guide his or her activity level.
Isolated Acute or Chronic PCL Rupture: PCL Reconstruction

The traditional PCL reconstruction involved replacing only the anterolateral bundle of the PCL with a single robust graft through single femoral and tibial tunnels (Lipscomb, Anderson, Norwig, Hovis, & Brown, 1993; Paulos & Bair, 2001). Some mechanical studies have suggested, however, that reconstruction of the two-bundle structure of the PCL might be more reliable in restoring and maintaining the normal posterior laxity of the knee. Because of the large number of failures occurring at the intra-articular portion of the tibial tunnel, it has been suggested that one can avoid this “killer turn” by using a tibial-inlay or -onlay technique (Bergfeld & Graham, 2001).

Graft Source

Restoring the mechanical strength of the PCL requires a large graft. The autogenous tissues that are commonly used include bone-patellar tendon-bone (ipsilateral or contralateral), semitendinosus and gracilis, and quadriceps tendon-bone. Allograft choices include Achilles tendon and bone-patellar tendon-bone, as well as semimembranosus and tibialis anterior (Bullis & Paulos, 1994). All appear to be of adequate strength if used properly.

Surgical Exposure—Incisions

The site and number of incisions can have implications for rehabilitation. The anterior tibial incision is fairly consistent and not dissimilar to the proximal tibial incision in ACL reconstruction. The other incisions commonly used in PCL reconstruction are the posterior lazy-S incision discussed previously (PCL-avulsion repair) and a superior medial incision over the distal femur for femoral drilling. The posterior incision has implications for rehabilitation because the posterior capsule of the knee is violated. Care must be taken to maintain full knee extension in the early postoperative period in order to avoid posterior-capsular contracture. The femoral incision can involve removing and reattaching the vastus medialis to the patella or elevating the muscle from the adductor tubercle. In the former case, the tendon is repaired with durable suture, but caution should be taken to prevent forceful quadriceps contraction for 2 weeks after surgery.

Femoral Tunnels

Historically, only the anterolateral bundle (the larger bundle) of the PCL was reconstructed using a single femoral tunnel, but single-bundle reconstruction often resulted in more laxity than in the normal knee. More recently, both anterolateral and postero medial bands have been reconstructed using two femoral tunnels (Stahelin, Sudkamp, & Weiler, 2001).

Single-Bundle Arthroscopically Assisted Reconstruction

Single-bundle reconstruction often uses Achilles tendon allograft or autologous bone-patellar tendon-bone from the ipsilateral or contralateral knee. Surgery is arthroscopically assisted. The femoral tunnel is drilled in the anterior portion of the femoral PCL footprint.

Double-Bundle Arthroscopically Assisted Reconstruction

With the double-bundle technique, two femoral tunnels are drilled: a larger anterolateral tunnel and a smaller postero medial tunnel (Figure 2). Each is in the middle of the footprint of its respective bundle of the original PCL. Care is taken to drill at least 2 mm posterior to the articular surface, in order to avoid devascularizing the base of the articular surface, and to allow 2–3 mm between tunnels to prevent tunnel compromise at the time of fixation.