

Arthroscopic Surgery in the Posterior Compartment of the Knee: Suture Fixation of Anterior and Posterior Cruciate Ligament Avulsions

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Abstract: Anterior and posterior cruciate ligament avulsion injuries in the posterior compartment of the knee are most commonly dealt with using open approaches. We report an arthroscopic method of treatment using sutures, without the need of any metal implants, that can be safely used in patients with open physes and without the need of a 70° arthroscope. **Key Words:** ACL avulsion—PCL avulsion—Posterior knee compartment—Suture loop transporter—Posterior trans-septal portal—Suture fixation.

Most arthroscopic procedures fail in the posterior compartment of the knee because of difficulty in triangulation between the arthroscope and working instruments. Our method simplifies this triangulation process. Arthroscopic surgery in the posterior compartment of the knee can be difficult even in experienced hands. The Gillquist maneuver is not always possible, especially if the anterior portals are placed too far from the midline or if the intercondylar notch is too narrow. Eriksson and Sebik found that the transnotch approach in the knee was successful in only 89%. The posteromedial and posterolateral portals are the only alternative portals. These 2 portals have their inherent risk and some low-volume surgeons may not feel comfortable with using them. Even with experi-

ence, these portals often can only be used for simple procedures. There remains an area that is blind to the arthroscope in the posteromedial compartment.^{3,4}

Anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) avulsion injuries are rare conditions.⁵⁻⁷ Mid-substance failures of these ligaments are much more common. ACL avulsion injuries of the tibial eminence have been well documented. Open and arthroscopic treatment alternatives are available. We have previously described our experience with a minimally invasive technique.⁸ PCL avulsion of the tibia is most commonly dealt with by an open posterior approach. Open approaches necessitate extensive dissection and incur risks, which is far from ideal. ACL avulsion injury of the femur is exceedingly rare.⁹⁻¹² When they do occur, they tend to affect the younger population and those who are skeletally immature.⁹⁻¹³

The posterior trans-septal portal of the knee has recently been described.¹⁴ This technique significantly improves visualization in the posterior compartment for the arthroscope. Positive experience with suture fixation techniques in juxta-articular and intra-articular avulsion injuries has further encouraged their use.^{8,15,16} We describe a simple method using com-

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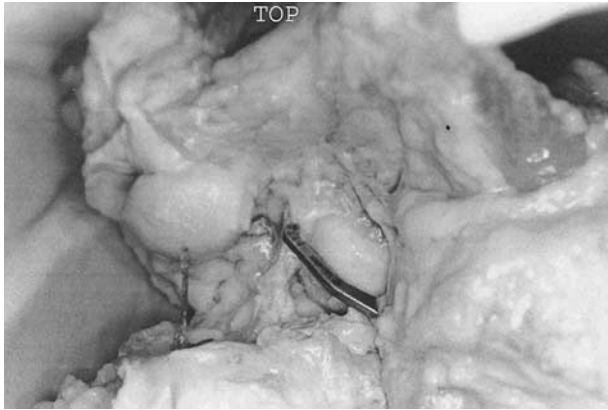


FIGURE 1. Posterior view of dissected specimen showing PCL aiming jig circumventing the lateral femoral condyle.

mon arthroscopic instruments. This method combines our earlier technique⁸ with the posterior trans-septal portal technique¹⁴ and it enables both femoral avulsion injuries of the ACL and tibial avulsion injuries of the PCL in the posterior compartment of the knee to be treated arthroscopically.

TECHNIQUE

Using 6 nonembalmed cadaveric knee specimens in a wet laboratory, we first performed a conventional diagnostic arthroscopy. We then created posteromedial and posterolateral portals. Using a long thin osteotome, we created avulsion injuries of the PCL and the ACL in their respective posterior insertions through these 2 posterior portals.

A posterior trans-septal portal was created as described by Ahn and Ha.¹⁴ We extended the superior margin in order to visualize the femoral origin of the ACL. The arthroscope was switched to the anteromedial portal to visualize the posterolateral compartment. The PCL avulsed fragment was reduced with a grasper introduced through the posterolateral portal. Two to 4 nonabsorbable sutures can be passed through the stump using arthroscopic suture passers (posterolateral portal). A PCL aiming jig was used to direct guide wires from the anterior tibial cortex to the tibial insertion of the PCL. Using the suture loop transporter technique,⁸ the PCL stump was eventually reduced and the sutures tied anteriorly over a bone bridge.

Similarly, the ACL avulsion stump was firstly secured with nonabsorbable sutures. A PCL aiming jig was also used to direct guidewires from the anterior femoral cortex to the ACL femoral insertion. The anterior site on the femur was chosen such that any

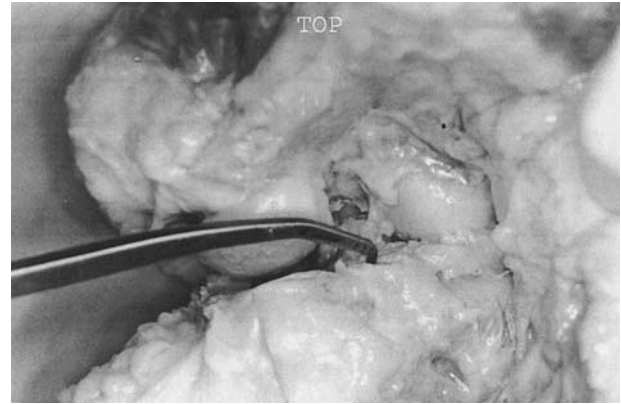


FIGURE 2. Posterior view of dissected specimen. PCL aiming jig implanted in the tibial stump of the PCL through a medial approach (posteromedial portal opened for visualization).

subsequent movement of the patella on the femur (patellofemoral joint) would not jeopardize the sutures.

The specimens were then dissected to review the quality of the fixations. Figure 1 shows the PCL aiming guide going around the medial femoral condyle to reach the femoral insertion site of the ACL. Figure 2 shows the PCL aiming jig reaching the tibial insertion of the PCL via the posterolateral portal. Further trial and error with different jigs showed that, depending on how wide the posterior trans-septal portal is, the PCL jigs could be introduced from either the posteromedial (Fig 3) or the posterolateral side. An ACL aiming guide could not, however, circumvent the condyles.

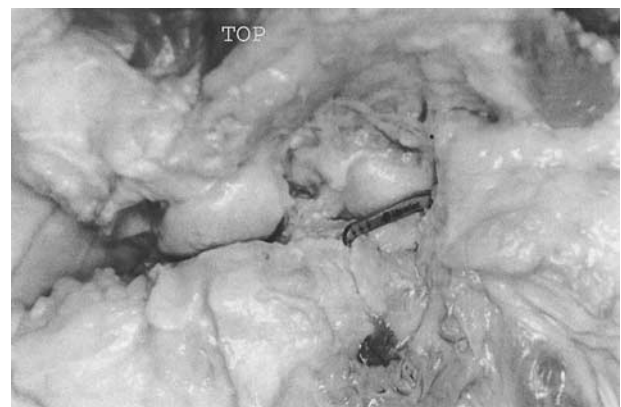


FIGURE 3. Posterior view of dissected specimen. PCL aiming jig implanted in the tibial stump of the PCL via the lateral approach (compare with Fig 2).

DISCUSSION

A PCL aiming guide can be so used because of the increased length and the angle near the tip. This was originally designed to reach low below the tibial articular surface in a conventional PCL reconstruction scenario.

In the original article by Ahn and Ha,¹⁴ they stated that the middle genicular artery limits the superior margin of the posterior trans-septal approach. In an ACL femoral avulsion injury, we feel that this is likely to be already damaged and, therefore, this technique does not incur unnecessary damage to this vessel. Furthermore, the current open approaches¹⁷⁻²⁰ frequently injure this vessel without the surgeon knowing. Should the bleeding vessel be encountered during surgery, arthroscopic ablaters are readily available.

Previous reports on arthroscopic techniques have relied mostly on cannulated screws or wires introduced from the anterior tibial surface.²¹⁻²³ Unfortunately, the bony components in avulsion injuries are very small and cancellous in nature and, thus, the purchase of the screws or wires is unreliable. Tension band fixation has been adapted, but working with wires is very tedious inside the knee joint.²¹ Previous works have reported excellent results with these methods. All the previous techniques use metallic implants, which generally require staged removal and, more importantly, require drilling of significant sized bone tunnels. Therefore, the potential for physeal injury in children is greater. Use of the suture loop transporter technique in young patients with open physis is safe. Similar techniques in which only very small caliber holes are drilled through the physis have been reported with no adverse complications to the physis.²⁴

The direct popliteal approach has always been an unfriendly one, both perioperatively and postoperatively. The ease of visualization in such an open procedure, no matter what incision is used, is directly related to the magnitude of postoperative pain, risk of hematoma formation, risk of infection, and the probability of an unsightly scar. Although techniques to improve visualization are available, such as the use of Steinmann pins as retractors, these carry considerable risk.

The combination of the 2 techniques makes the procedure very fast and simple. Thus, the risk of significant extravasations posteriorly is not a significant issue. The versatility of the trans-septal approach also allows the arthroscopist to use the working instrument in either the medial or lateral portal to suit

his side of hand dominance. Such factors do help to further minimize operative time.

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