Technical Note

Excision of a Posterior Cruciate Ligament Cyst Using an Arthroscopic Trans-septal Approach

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Abstract: Posterior cruciate ligament (PCL) cysts are rare. Although they are usually asymptomatic and benign, in a few cases they may cause knee discomfort and restricted movements. Nonsurgical treatment is the initial approach, with medication and corticosteroid injections. However, there may be treatment failures, with some cysts needing to be excised surgically. Arthroscopic excision of PCL cysts located in the posterior compartment of the knee can be technically challenging. We describe the arthroscopic excision of a PCL cyst using a trans-septal portal, which is an easy and safe method for accessing and completely removing the lesion under direct vision.

Ganglion cysts of cruciate ligaments are rare benign lesions of the knee. There is a lower incidence of cysts originating from the posterior cruciate ligament (PCL) than from the anterior cruciate ligament. Not all PCL cysts are symptomatic; however, in a few cases, they may be clinically relevant, causing knee pain and limiting flexion.1-3 Most PCL cysts are found fortuitously by ultrasound, magnetic resonance imaging (MRI), or arthroscopy performed for other pathologies of the knee.3-7 Initial treatment with medication and corticosteroid injections resolves most cases. However, some patients do not respond, and the cyst must be removed surgically. Although arthroscopic excision is considered the gold standard, cysts located in the posterior compartment of the knee are technically challenging to remove. The aim of this Technical Note is to present an easy and safe method to access the posterior compartment of the knee arthroscopically, using an accessory trans-septal portal, and to remove the PCL cyst under direct vision (Video 1).

Surgical Technique

MRI Assessment

Preoperative MRI helps to pinpoint the location of the PCL cyst and identify any associated injuries (Fig 1).

Patient Setup

The patient is placed supine on the operating table in the standard arthroscopy position with a lateral post just proximal to the knee, at the level of the padded tourniquet, and a foot roll to prevent the hip from externally rotating, maintaining 90° of knee flexion (Table 1).

Exploration

First Step. The anterolateral portal is created at the highest possible position, which is level with the inferior border of the patella and approximately 4 mm lateral to the lateral border of the patellar tendon. The anteromedial portal is created immediately adjacent to the medial edge of the patellar tendon and the inferior border of the patella. A full diagnostic arthroscopy is performed, and any associated lesions are treated.
Second Step. The camera is pushed through the notch, and a posteromedial portal is established under direct arthroscopic view. The surgeon uses transillumination to identify the veins and nerves that must be avoided. The point where the needle is introduced is above the hamstring tendon, 1 cm posterior to the medial tibiofemoral joint line. The knee must be flexed 90° to avoid the popliteal structures. The needle must be introduced from outside to inside, in the direction of the posterior septum. The approach is performed with a No. 11 scalpel blade under arthroscopic control, with dissection through the same approach, again under arthroscopic control (Fig 2).

Third Step. The camera is placed through the anteromedial portal, viewing the PCL and the posterior septum. A shaver without suction is inserted through the posteromedial portal, pushing against the posterior septal structure. The arthroscope is then moved to the posterolateral compartment through the intercondylar notch, and the shaver is advanced through the posterior septum (Fig 3).

Fourth Step. The posterolateral portal is established in the same manner as the posteromedial portal, using the transillumination technique (Fig 4).

Excision
After the trans-septal portal has been made, all the structures in the posterior compartment of the knee can be viewed and accessed using the posteromedial and

| Table 1. Pearls and Pitfalls |
|-----------------------------|
| **Pearls**                  | **Pitfalls**                                    |
| Posteromedial approach      |  Transillumination allows the surgeon to identify the veins and nerves that must be avoided. If the portal is made too anteriorly, the sartorius branch of the saphenous nerve can be injured. There is a risk of popliteal neurovascular bundle injury by pushing the shaver too posteriorly and a risk of posterior PCL fiber injury by pushing the shaver too anteriorly. |
| Trans-septal approach       |  Placing the shaver just behind the PCL reduces the risk of popliteal neurovascular bundle injury and posterior PCL fiber injury. Direct trans-notch identification of the septum in the posterolateral compartment must always be performed before pushing the shaver through the septum. The shaver must always be positioned so that the blade faces anteriorly. |
| Posterolateral approach     |  Transillumination allows the surgeon to identify the veins and nerves that must be avoided. The needle is inserted in the posterolateral corner of the joint, aiming anteriorly. The portal must stay anterior and superior to the biceps tendon. If the portal is made too posteriorly, there is a risk of injuring the common peroneal nerve. |
| Cyst debridement            |  Using a monopolar electrode may prevent bleeding from the posterior compartment. Placing the scope through the posteromedial portal after posterior septum debridement provides a direct view of the posterior compartment. The monopolar electrode must always be positioned so that the electrode faces anteriorly to avoid popliteal injury. |

PCL, posterior cruciate ligament.
Fig 2. Trans-notch view of posteromedial compartment in right knee at 90° of flexion. (A) The needle is introduced from outside to inside; it should emerge slightly posterior to the medial femoral condyle (MFC) and superior to the posterior horn of the medial meniscus (PHMM) toward the posterior septum. (B) The posterior portal is established in the same direction as the needle under arthroscopic vision with a No. 11 scalpel blade. (C) Vertical incision of posteromedial portal (dashed oval).

Fig 3. Trans-notch view of posteromedial compartment in right knee. (A) The scope is introduced through the anterolateral portal and pushed under the space between the medial wall of the intercondylar notch and the medial edge of the posterior cruciate ligament (PCL) to access to the posteromedial compartment. The scope is used to look laterally toward the intercondylar posterior septum (ampersand) located posterior to the PCL’s posterior fibers. A shaver is pushed against the septum. The camera is removed, introduced through the anteromedial portal, and pushed into the space under the lateral edge of the anterior cruciate ligament (ACL) and the lateral wall of the intercondylar notch to access to the posterolateral compartment. (B) The camera is used to look medially toward the septum to identify the septum deformation generated by the shaver on the lateral side of the septum; the shaver is then pushed through the septum to create the trans-septum portal. The ampersand indicates the intercondylar posterior septum. (LM, lateral meniscus; MM, medial meniscus.)
posterolateral portals. Fragments of the cyst are harvested for histologic analysis, and then the entire cyst is excised using a shaver and radiofrequency ablation device (Fig 5).

**Postoperative Protocol**

The postoperative rehabilitation program includes early quadriceps activation and active motion. Partial weight bearing is allowed with crutches for the first 2 weeks, followed by full weight bearing. No recurrence was observed in our patient at 14 months’ follow-up (Fig 6).

**Discussion**

Intra-articular ganglion cysts are uncommon knee pathologies; few arise from the PCL. Their etiology is still unclear, but they seem to be associated mostly with trauma or chronic injuries.\(^1,4\) The main symptom of PCL cysts is knee pain during flexion. MRI is the gold standard to detect and accurately locate cysts associated with cruciate ligaments in the knee.

Various procedures such as computed tomography-guided joint paracentesis and ultrasound can be used to treat intra-articular ganglion cysts. However, several studies have shown that the cyst walls...
are not removed with these procedures, leading to a potentially higher risk of recurrence.\textsuperscript{1,3,6} The cyst walls can be removed completely using an arthroscopic procedure, although this is technically challenging to perform using anterior portals only.

In this technical note, we describe a reproducible and safe arthroscopic trans-septal technique that makes it easier to approach the posterior compartment of the knee and the PCL cyst. The main treatment for symptomatic PCL ganglion cysts is surgery, and the most common strategy is arthroscopic resection.\textsuperscript{5,8,9} Arthroscopy allows complete examination of the knee joint and subsequent treatment of any lesions.

Tsai et al.\textsuperscript{10} evaluated the clinical outcomes of arthroscopic excision of PCL ganglion cysts using the posterior trans-septal portal in a retrospective study of 15 patients. Our article focused on the technique itself, which can also be used for other pathologies located in the posterior compartment of the knee.

In conclusion, the arthroscopic trans-septal approach is a reliable and reproducible technique for PCL cyst resection. Advantages and disadvantages are shown in Table 2.

### Table 2. Advantages and Disadvantages

| Advantages                                      | Disadvantages                                      |
|------------------------------------------------|----------------------------------------------------|
| No need for cannula                            | Risk of popliteal neurovascular bundle injury      |
| Better view of tibial insertion of PCL          | Risk of common peroneal nerve injury               |
| Higher-quality debridement                      | Difficult in managing instruments passing in front of scope |
| Direct view of cyst                             | PCL, posterior cruciate ligament                   |

References

1. Tie K, Wang H, Zhao X, Tan Y, Qin J, Chen L. Clinical manifestation and arthroscopic treatment of symptomatic posterior cruciate ligament cyst. \textit{J Orthop Surg Res} 2018;13:84.
2. Joo YB, Kim YM. Symptomatic posterior cruciate ganglion cyst causing impingement between posterior root of the medial meniscus and anterior to the posterior cruciate ligament. \textit{Knee Surg Relat Res} 2012;24:52-55.
3. Shetty GM, Nha KW, Patil SP, et al. Ganglion cysts of the posterior cruciate ligament. \textit{Knee} 2008;15:325-329.
4. Mao Y, Dong Q, Wang Y. Ganglion cysts of the cruciate ligaments: A series of 31 cases and review of the literature. \textit{BMC Musculoskelet Disord} 2012;13:137.
5. Krudwig WK, Schulte KK, Heinemann C. Intra-articular ganglion cysts of the knee joint: A report of 85 cases and review of the literature. \textit{Knee Surg Sports Traumatol Arthrosc} 2004;12:123-129.
6. Lunhao B, Yu S, Jiashi W. Diagnosis and treatment of ganglion cysts of the cruciate ligaments. \textit{Arch Orthop Trauma Surg} 2011;131:1053-1057.
7. Kim MG, Kim BH, Choi JA, et al. Intra-articular ganglion cysts of the knee: Clinical and MR imaging features. \textit{Eur Radiol} 2001;11:834-840.
8. García-Alvarez F, García-Pequerul JM, Avila JL, Sainz JM, Castiella T. Ganglion cysts associated with cruciate ligaments of the knee: A possible cause of recurrent knee pain. \textit{Acta Orthop Belg} 2000;66:490-494.
9. Kim RS, Kim KT, Lee JY, Lee KY. Ganglion cysts of the posterior cruciate ligament. \textit{Arthroscopy} 2003;19:E36-E40.
10. Tsai TY, Yang YS, Tseng FJ, et al. Arthroscopic excision of ganglion cysts of the posterior cruciate ligaments using posterior trans-septal portal. \textit{Arthroscopy} 2012;28:95-99.