

Posterolateral Bundle Resection for an Anterior Cruciate Ligament Ganglion Cyst



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Abstract: The incidence of intra-articular ganglion cysts of the anterior cruciate ligament (ACL) is low and symptomatic presentation of this pathology is even lower. Nevertheless, symptomatic cases pose a real challenge for the orthopaedic community, as no general consensus exists regarding the most appropriate treatment. The purpose of this Technical Note is to describe the surgical treatment of an ACL ganglion cyst by arthroscopic resection of the entire posterolateral bundle of the ACL in a figure-of-four position after conservative treatment has failed.

Introduction

The existence of intra-articular ganglion cysts in the anterior cruciate ligament (ACL) was first described by Caan in 1924.¹ Since then, numerous cases have been reported in the literature.^{2,3} The incidence of ACL ganglion cysts is between 0.6% and 2% in arthroscopic studies and between 1 and 1.3% on magnetic resonance imaging (MRI) studies.⁴⁻⁹ One of the reasons for this low prevalence is assumed to be the asymptomatic nature of these cysts. Indeed, only 10% of cases are symptomatic, and these patients present with vague pain in the knee, unexplained knee effusions, or limitations to activity without any history of real trauma.^{2,3,8,10-12}

Diagnosis is based mainly on MRI findings. Debate still exists regarding the appropriate treatment of this lesion. Although arthroscopic resection of the cyst is considered the gold standard for definitive treatment, such a resection can lead to iatrogenic injury to the ACL.^{8,13,14} Computed tomography (CT) or ultrasound-guided aspiration of the ACL cyst remains an alternative treatment, avoiding any additional surgical risks.^{4,12,15,16}

Surgical Technique

Investigation was performed at Centre Orthopédique Santy, FIFA Medical Centre of Excellence, Groupe Ramsay-Générale de Santé, Hôpital Privé Jean Mermoz, Lyon, France.

This Technical Note describes, with video illustration, arthroscopic resection of the entire posterolateral bundle of the ACL in a figure-of-four position (Video 1). Pearls and pitfalls of this procedure are described in Table 1.

Indications

The indication for ACL ganglion cysts arthroscopic resection is the presence of symptoms combined with MRI diagnosis. Asymptomatic patients do not require any treatment and often go undiagnosed as a result. On the contrary, the treatment of symptomatic cases varies from a CT- or ultrasound (US)-guided aspiration of the cyst or arthroscopic resection of the ACL cyst. Numerous criteria must be taken into consideration before choosing the right procedure: level of activity, time for recovery, risk of intra-articular damage, risk of recurrence, and risk of ACL injury. The treatment of choice should be individualized to meet the needs of each patient.

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Table 1. Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none"> • Figure-of-four position facilitates visualization of the posterolateral bundle of the ACL. • Ensure the PL and AM bundles are clearly identified before beginning the resection of the PL bundle. • A radio frequency ablation wand should be used to resect the final fibers of the PL bundle to avoid iatrogenic injury. 	<ul style="list-style-type: none"> • Iatrogenic injury to the ACL • Resection of the PL bundle can lead to the remaining fibers of the ACL being fragile, which could lead to chronic instability

ACL, anterior cruciate ligament; PL, posterolateral.

Patient Positioning and Diagnostic Arthroscopy

The patient is placed in the supine position on the operating table with a lateral support at the level of a padded tourniquet and a foot roll positioned to stabilize the leg at 90° of knee flexion. The affected leg is prepared and draped using the surgeon's preferred method, similar to any arthroscopic procedures around the knee.

High anterolateral and anteromedial portals are established.¹⁷ A diagnostic arthroscopy is then performed. The ACL cyst is located in the posterolateral (PL) bundle of the ACL. (Fig 1).

In order to facilitate the visualization and the arthroscopic resection of the cyst, the knee is mobilized in a figure-of-four position,¹⁸ enabling instruments to pass between the ACL and the lateral femoral condyle (Fig 2).

Figure 3 shows the anatomical location of the PL bundle of the ACL at 90° of knee flexion and in a figure-of-four position.

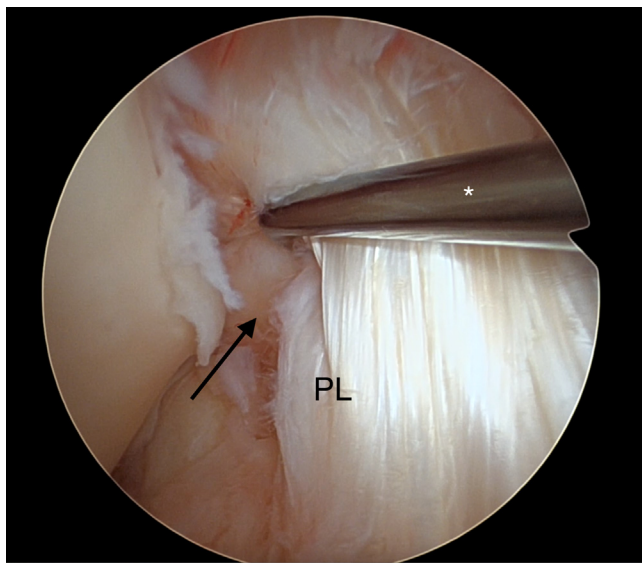


Fig 1. Diagnostic arthroscopy. Right knee, arthroscopic view. The anterior cruciate ligament (ACL) is probed (*), and a ganglion cyst (black arrow) is identified within the posterolateral (PL) bundle.

Posterolateral Bundle Resection

A 4-mm shaver (Stryker, Kalamazoo, MI) is initially used in the figure-of-four position, which allows the majority of the PL bundle to be carefully resected (Fig 4).

The leg is then repositioned at 90° of knee flexion to complete the resection. A radio frequency ablation wand (Smith & Nephew, Memphis, TN) is used to remove any remaining fibers (Fig 5).

A final arthroscopic assessment of the ACL ensures the PL bundle has been fully resected and the cyst decompressed. Furthermore, it ensures there has been no iatrogenic injury to the AM bundle of the ACL (Fig 6).

Postoperative Rehabilitation

Postoperative rehabilitation consists of brace-free, immediate full-weight bearing, and progressive range-of-motion exercises. Early rehabilitation focuses on maintaining full extension and quadriceps activation exercises.

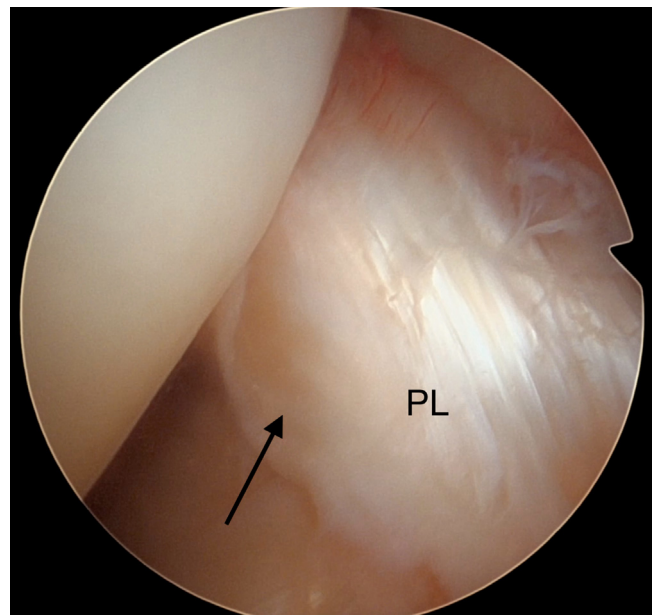


Fig 2. Figure-of-four position. Right knee, arthroscopic view. The ganglion cyst (black arrow) and the posterolateral (PL) bundle of the anterior cruciate ligament are easily identified.

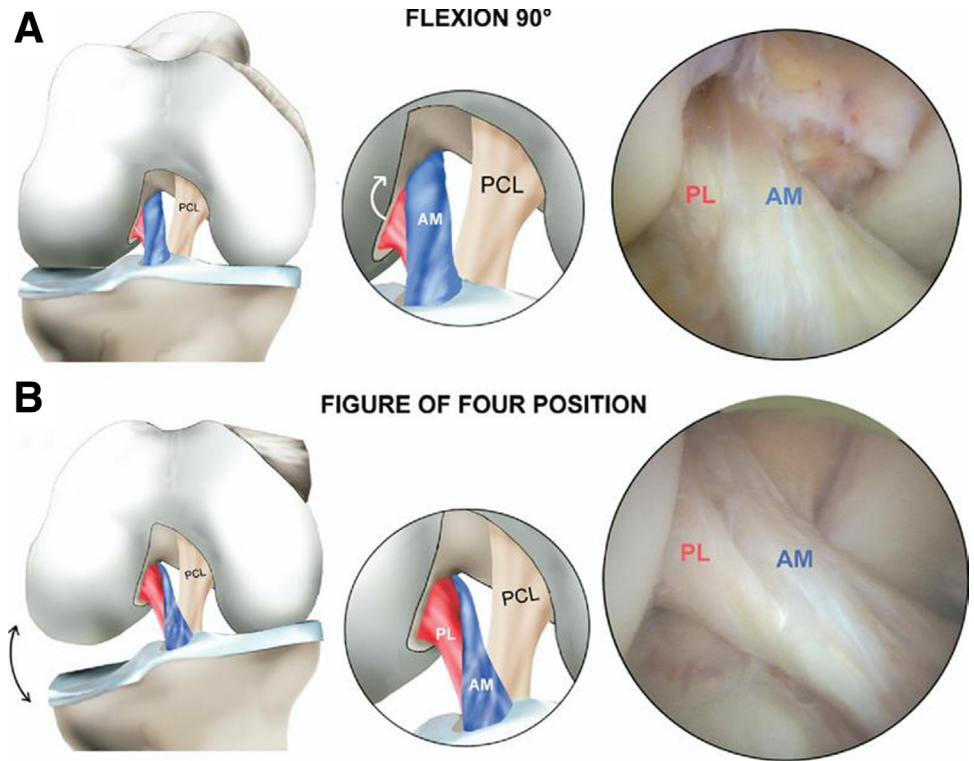


Fig 3. Schematic presentation of the different bundles of the anterior cruciate ligament in 90° flexion (A) and in a figure-of-four position (B). AM, anteromedial bundle; PCL, posterior cruciate ligament, PL, posterolateral bundle.

Discussion

The prevalence of intra-articular ganglion cysts in the ACL is considered to be rare.^{3,4,6-8} Moreover, the large majority of these cysts remain asymptomatic, and only

10% of cases manifest symptoms, such as vague knee pain, limitation of range of motion or even recurrent effusions.^{2,3,5,8-11} The exact cause and pathogenesis of ACL ganglion cysts still remain unclear. It is

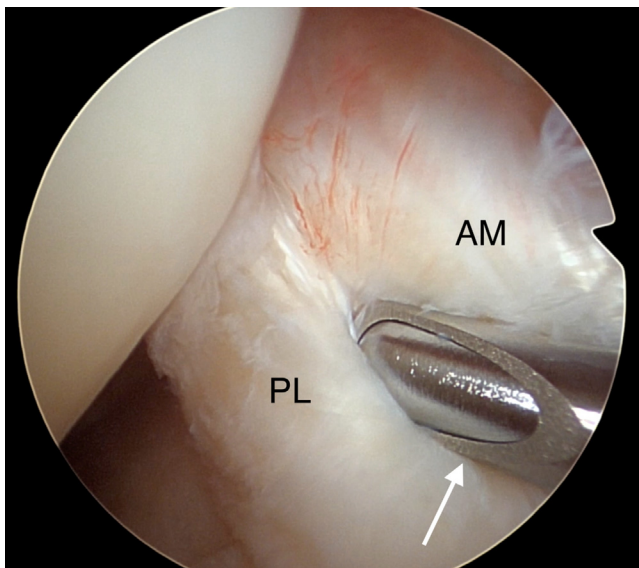


Fig 4. Posterolateral bundle resection. Right knee, arthroscopic view. The posterolateral (PL) and anteromedial (AM) of the ACL are clearly identified allowing the shaver (white arrow) to be introduced between the bundles to carefully resect the PL bundle.



Fig 5. Completion of the resection. Right knee, arthroscopic view. The remaining fibers of the PL bundle are resected using a radiofrequency ablation wand (*).

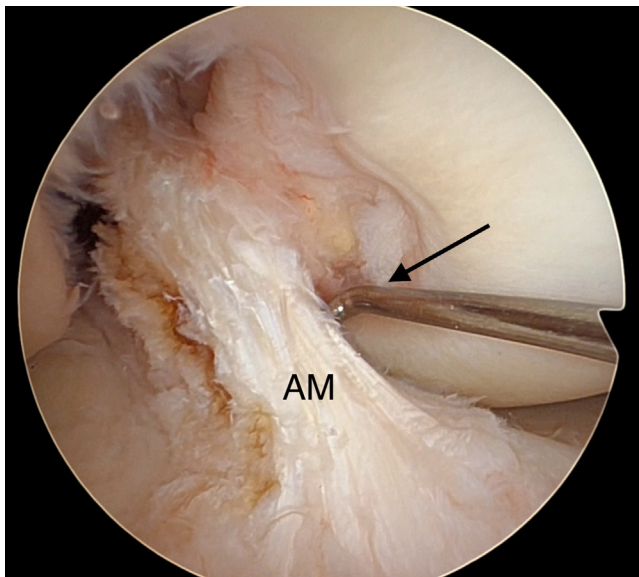


Fig 6. Final arthroscopic assessment. Right knee, arthroscopic view. The anteromedial (AM) bundle of the anterior cruciate ligament is assessed using a probe (black arrow) following complete resection of the PL bundle.

hypothesized that displacement of the synovium into the surrounding tissue during development, herniation of synovium into the surrounding tissues, or degenerative and proliferative changes of pluripotent mesenchymal cells following trauma may be causative.⁸ Another hypothesis is of trauma to the ACL, which leads to a release of hyaluronic acid, which is thought to dissect through the tissue planes producing capsular ducts and eventually coalescing into a cystic structure.¹⁹

MRI is considered the gold standard for the diagnosis of an ACL cyst.^{9,20} On T2-weighted imaging, they are predominantly homogeneously hyperintense, while on T1-weighted imaging, they are hypointense. The cysts vary from lobulated to fusiform in shape and may contain internal septations or be multiloculated.^{8,21} Bergin et al.²⁰ used two out of three criteria for diagnosis: 1) T2 signal within the ACL, hyperintense to joint fluid, 2) lobulated (or multiloculated) lesion, and 3) mass effect on ligament fibers. The differential diagnosis should include ACL mucoid degeneration. In contrary to an ACL cyst, mucoid degeneration of the ACL fibers is poorly visible in T1-weighted images.

Asymptomatic patients do not require any treatment and often go undiagnosed as a result. On the contrary, the treatment of symptomatic cases varies from a CT or US guided aspiration of the cyst or arthroscopic resection of the ACL cyst. Numerous criteria must be taken into consideration before choosing the right procedure: level of activity, time for recovery, risk of intra-articular damage, risk of recurrence, and risk of ACL injury. The treatment of choice should be individualized to meet

the needs of each patient. Radiological guided aspiration of the cyst can often lead to complete resolution of the symptoms, providing faster recovery time without any additional surgical risks.^{4,15,16} However, arthroscopic resection remains the gold standard, with good efficacy, patient satisfaction, and a low recurrence rate.^{3,12,13,15} Although, the risk of iatrogenic injury of the native ACL exists. In our case, an arthroscopic resection of the entire posterolateral bundle of the ACL in a figure-of-four position was performed because of the large volume of the ganglion cyst. The increased risk of such a resection is weakening the ligament and also the iatrogenic injury to the ACL.

In summary, this Technical Note describes the surgical treatment of an ACL ganglion cyst by arthroscopic resection of the entire posterolateral bundle of the ACL in a figure-of-four position. It is a safe and reliable procedure and effective for large volume cysts.

References

1. Caan P. Cyst formation (ganglion) in the anterior cruciate ligament of the knee Zystenbildung (Ganglion) im Ligamentum cruciatum ant. genus. *Dtsch Zeitschrift Chir* 1924;186:403-408.
2. Demircay E, Ofluoglu D, Ozel O, Oztop P. Simultaneous bilateral ganglion cysts of the anterior cruciate ligaments. *Singapore Med J* 2015;56:e59-e61.
3. Krudwig WK, Schulte KK, Heinemann C. Intra-articular ganglion cysts of the knee joint: A report of 85 cases and review of the literature. *Knee Surg Sports Traumatol Arthrosc* 2004;12:123-129.
4. Sonnery-Cottet B, Guimarães TM, Daggett M, et al. Anterior cruciate ligament ganglion cyst treated under computed tomography-guided aspiration in a professional soccer player. *Orthop J Sports Med* 2016;4:2325967116644585.
5. Dinakar B, Khan T, Kumar AC, Kumar A. Ganglion cyst of the anterior cruciate ligament: A case report. *J Orthop Surg (Hong Kong)* 2005;13:181-185.
6. McLaren DB, Buckwalter KA, Vahey TN. The prevalence and significance of cyst-like changes at the cruciate ligament attachments in the knee. *Skeletal Radiol* 1992;21:365-369.
7. Burk DL, Dalinka MK, Kanal E, et al. Meniscal and ganglion cysts of the knee: MR evaluation. *Am J Roentgenol* 1988;150:331-336.
8. Bui-Mansfield LT, Youngberg RA. Intraarticular ganglia of the knee: Prevalence, presentation, etiology, and management. *Am J Roentgenol* 1997;168:123-127.
9. Vaishya R, Esin Issa A, Agarwal AK, Vijay V. Anterior cruciate ligament ganglion cyst and mucoid degeneration: A review. *Cureus* 2017;9:e1682.
10. Parish EN, Dixon P, Cross MJ. Ganglion cysts of the anterior cruciate ligament: A series of 15 cases. *Arthroscopy* 2005;21:445-447.
11. Zantop T, Rusch A, Hassenpflug J, Petersen W. Intra-articular ganglion cysts of the cruciate ligaments: Case report and review of the literature. *Arch Orthop Trauma Surg* 2003;123:195-198.

12. Lunhao B, Yu S, Jiashi W. Diagnosis and treatment of ganglion cysts of the cruciate ligaments. *Arch Orthop Trauma Surg* 2011;131:1053-1057.
13. Brown MF, Dandy DJ. Intra-articular ganglia in the knee. *Arthroscopy* 1990;6:322-323.
14. Rolf C, Watson TP. Case report: intra-tendinous ganglion of the anterior cruciate ligament in a young footballer. *J Orthop Surg Res* 2006;1:11.
15. DeFriend DE, Schranz PJ, Silver DA. Ultrasound-guided aspiration of posterior cruciate ligament ganglion cysts. *Skeletal Radiol* 2001;30:411-414.
16. Antonacci VP, Foster T, Fenlon H, Harper K, Eustace S. Technical report: CT-guided aspiration of anterior cruciate ligament ganglion cysts. *Clin Radiol* 1998;53:771-773.
17. Sonnery-Cottet B, Archbold P, Zayni R, et al. High lateral portal for sparing the infrapatellar fat-pad during ACL reconstruction. *Orthop Traumatol Surg Res* 2011;97:870-873.
18. Sonnery-Cottet B, Chambat P. Arthroscopic identification of the anterior cruciate ligament posterolateral bundle: the figure-of-four position. *Arthroscopy* 2007;23:1128.e1-1128.e3.
19. Roeser WM, Tsai E. Ganglion cysts of the anterior cruciate ligament. *Arthroscopy* 1994;10:574-575.
20. Bergin D, Morrison WB, Carrino JA, Nallamshetty SN, Bartolozzi AR. Anterior cruciate ligament ganglia and mucoid degeneration: Coexistence and clinical correlation. *Am J Roentgenol* 2004;182:1283-1287.
21. Huang GS, Lee CH, Chan WP, et al. Ganglion cysts of the cruciate ligaments. *Acta Radiol* 2002;43:419-424.