

Symptomatic tibial tunnel ganglion cyst presenting four years following an ACL hamstring autograft reconstruction: a case report of a rare complication of ACL surgery

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Objective: To highlight a case of an athlete with a symptomatic pretibial cyst 4-years post-ACL reconstruction surgery.

Case presentation: A 23-year-old female soccer athlete presented with right-sided knee pain, locking and catching, and diminished sensation along the anteroinferior knee. She had a history of an ipsilateral ACL hamstring autograft four years prior. Physical evaluation revealed a visible and palpable swelling medial to the patellar tendon, limited and painful range, and hypoesthesia within the infrapatellar branch of the

Kyste ganglionnaire symptomatique du tunnel tibial se présentant quatre ans après une reconstruction par autogreffe du ligament croisé antérieur: rapport de cas d'une complication rare de la chirurgie du LCA. Objectif : Mettre en évidence le cas d'un athlète présentant un kyste ganglionnaire symptomatique du tunnel tibial quatre ans après une chirurgie de reconstruction du LCA.

Exposé de cas : Une athlète de soccer âgée de 23 ans s'est présentée avec une douleur au genou droit, un blocage et un accrochage, et une diminution de la sensation le long du genou antéro-inférieur. Elle avait subi une autogreffe du ligament croisé antérieur ipsilatéral quatre ans auparavant. L'examen physique a révélé un gonflement visible et palpable en dedans du tendon rotulien, une amplitude limitée et douloureuse, et une hypoesthésie dans la branche sous-rotulienne du nerf saphène. L'IRM a révélé un kyste ganglionnaire

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saphenous nerve. MRI revealed a tubular ganglion cyst along the anterior aspect of the tibial tunnel, medial to the patellar tendon, and anterior to the ACL graft.

Summary: Post-surgical ganglion cyst formation in the reconstructed ACL is a rare complication that can present years following ACL surgery. This case aims to bring awareness to this condition as a potential long-term complication in the ACL-reconstructed athlete.

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KEY WORDS: ACL, ganglion cyst, knee, reconstruction, complication, chiropractic

Introduction

Anterior cruciate ligament (ACL) graft reconstruction surgery is the preferred management strategy for active young patients wishing to return to pivoting and cutting sports.¹ The main purpose of ACL reconstruction (ACL-R) surgery is to mimic the native ACL in terms of its structure, orientation of collagen fibers, and insertion.¹ Previous literature has demonstrated that only 65% of ACL-R patients will return to their pre-injury level of sport participation and only 55% returning to competitive level sports.^{1,2}

The risk of ACL ruptures for female adolescent athletes was reported as 1 in 10,000 athlete exposures and 1.5 times more likely than males across all sports.³ Specifically, the recommended first-line management from a post-operative perspective includes manual therapy, rehabilitation exercises, and soft tissue therapy with the goal to restore knee function.^{4,5} As such, chiropractors are well positioned to manage pre- and post-operative care for athletes with ACL-R.

Furthermore, ACL-R has been associated with several complications including knee pain and stiffness, secondary meniscal and cartilage injury, graft rupture, or hardware failures.⁶⁻⁸ A recent meta-analysis reported a re-rupture rate of 3.5% out of 226 patients who underwent ACL-R.⁹ One retrospective study reported 6.5% of 70,457 ACL-R cases had a subsequent surgery on either knee within one year of an ACL-R.¹⁰ While some complications may appear in the short-term, there are some com-

tubulaire le long de la face antérieure du tunnel tibial, en dedans du tendon rotulien et en avant de la greffe du LCA.

Résumé : La formation d'un kyste ganglionnaire post-chirurgical dans le LCA reconstruit est une complication rare qui peut se présenter des années après la chirurgie du LCA. Ce cas vise à attirer l'attention sur ce problème comme une complication potentielle à long terme chez l'athlète dont le LCA a été reconstruit.

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MOTS CLÉS : LCA, kyste ganglionnaire, genou, reconstruction, complication, chiropratique.

plications that may appear years following an ACL-R.⁶⁻⁸ One rare long-term complication is the formation of a tibial tunnel or pretibial ganglion cyst.¹¹ A pretibial cyst typically manifests over a number of years and while some are incidentally discovered on follow-up imaging, some pretibial cysts can cause joint pain, locking, and swelling.¹¹ This is important in the management of athletes with ACL-R as clinicians should include a pretibial cyst on a differential diagnosis list in athletes who develop mechanical symptoms post-operatively. The purpose of this case report is to highlight the clinical and imaging presentation and diagnosis of a unique complication of a symptomatic tibial tunnel cyst that presented four years post-ACL-R in a young female soccer athlete.

Case presentation

A 23-year-old, female, former competitive soccer athlete presented for evaluation of right-sided knee pain which began two months prior and was recently exacerbated from a lower limb workout that involved jumping and kneeling. She described her pain as dull and stiff in nature and experienced swelling after walking greater than 30 minutes. She also reported occasional clicking and locking of her knee with a “giveaway sensation”. Her previous medical history was significant for a complete right ACL rupture while playing soccer that was surgically reconstructed with a hamstring autograft four years prior. She denied any history of rheumatological conditions or previous knee injuries. Following her ACL-R, she reported a



Figure 1.

Visual mapping of the boundaries of hypoesthesia of the patient's right knee that measured 9 cm horizontally (left) and 8 cm vertically (right).

successful return to sport and denied any subsequent knee complaints or injuries. She maintained a healthy lifestyle with resistance training 6 days per week.

Physical examination of her right knee revealed mild anteromedial joint effusion with full ranges of motion and end-range flexion producing pain at the anteromedial joint line and passive extension producing a pinching sensation at end-range. She was able to complete a duck walk test but experienced pain in the right knee. She demonstrated apprehension with provocation tests of the meniscus including a right Thessaly's test with internal foot rotation and a McMurray's test. No laxity was noted with a McMurray's test however, a pivot shift on the right was graded as 2+. Similarly, an anterior drawer test was graded as 2+ on the right-side. Palpation of the right knee revealed pain over the medial joint line and a focal

area of hypoesthesia within the territory of the infrapatellar branch of the saphenous nerve that measured 9x7 cm (Figure 1). Notably, Wilson's, and valgus and varus stress tests of the right knee and Lachman's tests were negative for laxity with a firm endpoint bilaterally. Neurological exam of the lower limbs including myotome and dermatomal testing (light touch and pin prick) of the L2-S1 levels were normal. Patellar and Achilles reflexes were graded as 2+ bilaterally with the exception of the right patellar reflex which was difficult to elicit and graded as 1+ with a Jendrassik manoeuvre.

Due to a concern for mechanical symptoms, she was referred back to her surgeon to obtain additional imaging to rule out any potential intra-articular joint lesions and laxity of the graft. The surgeon sent her for MRI of the knee and confirmed the diagnosis of a large pretibial cyst.



Figure 2.

Sequential MRI, T2 sagittal slices through the ganglion cyst (white arrow), demonstrates its course through the tibial tunnel, and its anterior position relative to the ACL graft (white star).

Imaging (Figures 2 and 3)

Axial, coronal, and sagittal proton density fat saturated (PD FS), and sagittal T2 weighted MRI images demonstrate a tubular unilocular high signal intensity cystic mass with internal low signal debris (measuring 34 x 14 x 13 mm in size) arising from the central aspect of the tibiofemoral joint. It extends obliquely through the entirety of the post-surgical tibial tunnel (excavated for the ACL graft) and extrudes through the anterior medial tibial cortex. The cystic structure focally bulges the intact medial aspect of the patellar tendon/patellar retinaculum just proximal to its insertion at the tibial tuberosity, and abuts the anterior aspect of the ACL graft along its course through the tibial tunnel. There is no corresponding bone marrow edema. The ACL graft, PCL, collateral ligaments, and the meniscus demonstrate normal signal intensity and morphology.

Discussion

During ACL-R surgery, femoral and tibial tunnels are made to accommodate the graft.¹¹ The tibial tunnel is drilled parallel to the slope of the intercondylar roof, commonly known as the Blumensaat line, to ensure correct anatomical position of the graft and isometry to the native

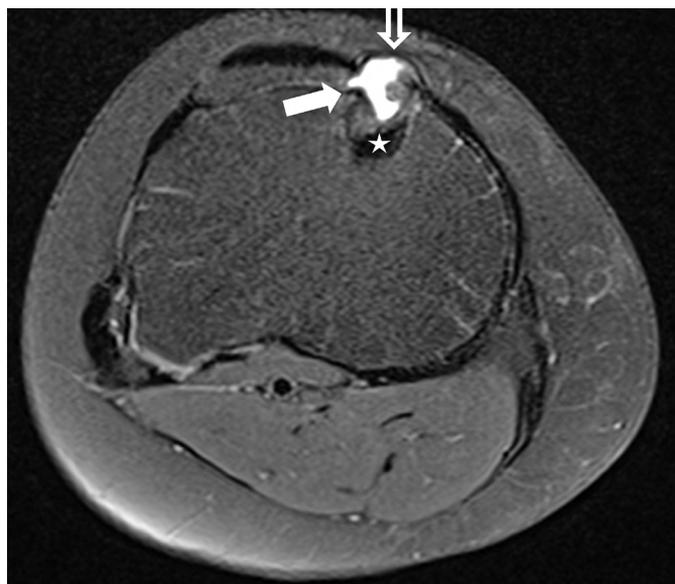


Figure 3.

Sequential MRI, PD FS axial slices through the ganglion cyst (white arrow), demonstrates its extension through the anterior cortex of the proximal tibia, and confinement by the medial patellar retinaculum (white outlined arrow). The ACL graft is represented by the white star.

ACL.¹¹ Although rare, some patients can develop a tibial tunnel ganglion cyst that can originate within or adjacent to the osseous tibial tunnel made during ACL-R.¹⁰ Normal widening of the tibial tunnel can appear in the first three months and is anticipated to stabilize and decrease in size one year after reconstruction.¹¹ Furthermore, small amounts of fluid may be present within these tunnels during the first year after ACL-R, but are typically reabsorbed within 18 months following surgery.¹¹ An association between tibial tunnel width and development of a pretibial cyst has not been established. It is believed that cyst formation can occur during this period based on several hypotheses. Excess micromotion of the graft near the graft-bone interface can interrupt normal ligamentization and lead to the formation of a synovialized tract within the osseous tunnel.¹¹ Alternatively, partial necrosis of the graft from a traumatic event can lead to the formation of a slowly growing ganglion cyst.¹¹ Higher rates of pretibial cyst formation have been reported with hamstring autografts and the use of bioabsorbable interference screws.¹⁰⁻¹² The following section aims to highlight the clinical and imaging presentation of tibial tunnel cysts, followed by considerations for the non-surgical management of these patients.

Clinical presentation

There are few reported studies on the incidence or prevalence of pretibial cysts in the ACL-R knee. In one prospective study of 89 ACL-R patients, only two cases developed a tibial tunnel cyst approximately 12-months following surgery.¹³ The average timeline for the onset of cyst presentation is however much longer with most cases presenting greater than three years post-operation.^{10,12,14} Data from a recent scoping review¹⁵ reported a mean age of patients with tibial cysts of 31-years-old (range 14 to 57) and the range of time to presentation following surgery between two and 70 months.

Tibial tunnel cysts are generally asymptomatic and incidentally discovered on post-operative follow-up imaging.^{10,12} However, patients with symptomatic pretibial cysts can present suddenly with pain and swelling near the graft site on the anterior tibia.^{10,13-16} Furthermore, some patients may report feelings of instability, but pretibial cyst formation has not been associated with failure of the graft.^{10,11,13-15} Depending on the size of the cyst, patients may report pain and limited terminal knee extension as

the cyst would contact the roof of the intercondylar notch before full extension of the knee.¹⁰ Similarly, patients may report pain and limited end-range flexion as the cyst would contact the posterior cruciate ligament.¹⁰

In this case, our patient presented similarly to others in the literature¹⁴⁻¹⁶ and was asymptomatic following her ACL-R until four years post-operation. One of the first sport-related cases was reported in a 16-year-old female basketball player.¹⁶ In this case, her pretibial cyst was identified more than five years after her ACL reconstruction with a hamstring autograft.¹⁶ Similar to our case, this patient also presented with anteromedial knee pain as well as a stable Lachman and pivot shift test.¹⁶ One other article documents three pretibial cysts that formed following a sport-related ACL-R.¹⁴ The authors reported that these patients experienced varying symptoms which included swelling and joint-related pain more than three to five years post-operatively without complaints prior to cyst formation.¹⁴ Given our patient's clinical findings, the constellation of joint locking, giveaway instability, joint line tenderness, and positive McMurray's test poses a challenge for the correct diagnosis considering other ACL-R complications including secondary meniscal tears.^{1,10,17} We suspect the large 34 mm diameter of the tibial tunnel cyst to be the causative factor for this patient's symptoms. In other symptomatic cases, the diameter of the tibial cyst has ranged from 5.5 to 20 mm.¹³⁻¹⁶ Our patient also presented with hypoesthesia within the territory of the infrapatellar branch of the saphenous nerve. Based on our patient's cyst extrusion, we suspect that the cyst caused a compressive peripheral neuropathy to this sensory nerve.

Imaging presentation

Magnetic resonance (MR) is the modality of choice to evaluate tibial tunnel cysts.^{10,11} The cyst typically appears as a uni- or multilocular fluid-filled signal on all MR pulse sequences with well-defined margins.^{10,12,18} Due to its origin in the osseous tibial tunnel, extension of the cyst can be seen into the pretibial space, the intercondylar notch, as far as the popliteal fossa without evidence of graft disruption.¹⁰ In our case, the tubular cyst extended anteriorly along the tibial tunnel into the pretibial soft tissues. Furthermore, palpable swelling was appreciated in cysts greater than 10 mm in diameter.¹³⁻¹⁶ In some cases, reactive marrow edema can be visualized adjacent to the pretibial cyst which indicate signs of pressure erosion and

bony remodeling^{10,15}, this is something that was not seen in our case.

Two main categories of tibial tunnel cysts have been reported in the literature based on their pathophysiology: communicating or non-communicating cysts.¹⁰ Non-communicating cysts are believed to arise from a sterile foreign-body reaction against fixation hardware near the graft¹⁰, and do not communicate with the tibiofemoral joint. Alternatively, communicating cysts are described to be continuously connected with the synovial fluid within the knee joint space.¹⁰ It is believed that communicating cysts arise due to an incomplete attachment between the graft and the osseous tunnel.^{10,12} Classification of a communicating cyst requires histological evaluation for the presence of chondroitin sulfate.¹⁰

Non-operative management considerations

Generally, surgical removal of the cyst by curettage is the most commonly cited management strategy for pretibial cysts.^{10,11,13-16} However, in some rare cases, recurrence of the cyst is possible leading to multiple surgical revisions.¹⁶ There are no studies on the non-operative management for pretibial cysts. Clinicians should take a precautionous approach to manual therapy including joint manipulation due to the potential of ganglion cyst rupture. Similarly, clinicians should approach rehabilitation in a shared decision-making model with patients to ensure safe and appropriate exercises to mitigate injuries to the pretibial cyst.

Summary

This case report details a unique case of a pretibial cyst 4-years following an ACL-R. Discussion surrounded the clinical and imaging presentation of a pretibial cyst and precautions for clinicians to consider when managing patients with a pretibial cyst. This case posed a diagnostic challenge from a clinical perspective as test results can be conflated with other intra-articular knee joint lesions following an ACL-R including secondary meniscal tears, hardware failures, graft ruptures, or cyclops lesions. This case highlights the importance of obtaining timely imaging to assist with the proper diagnosis. Although rare, it is important for clinicians to have an index of suspicion for longer-term complications including tibial tunnel cysts that can arise in athletes years following an ACL-R.

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