

Ganglion Cysts of the ACL and Meniscus: A Review of Literature

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Abstract

Introduction: Ganglion cysts of the anterior cruciate ligament (ACL) and meniscus may have generalized clinical symptoms that can make them difficult to diagnose, especially considering their rarity. The aim of this study is to provide a comprehensive review of cysts arising in and around the knee with a focus on differential diagnosis to emphasize the importance of proper evaluation.

Methods: A literature search using the database PubMed, Cochrane, and Google Scholar was performed to find the information that comprehensively covered information relevant to this review.

Conclusion: Intra-articular ganglion cysts of the knee are a rare occurrence that typically cause generalized symptoms. Each type of cyst is different with regards to its origin and location, but their similar clinical presentation makes differentiation based on a history and physical exam difficult. MR imaging is of utmost importance for the evaluation of pathologies in and around the knee joint. Once a proper diagnosis is achieved, direct arthroscopic excision of the cyst or treatment of the underlying cause in the case of a meniscus cyst can definitely treat symptoms with minimal concern for recurrence.

Introduction

Ganglion cysts are pseudomembranous, mucin-containing structures that are usually associated with joints or tendon sheaths, most commonly arising in the dorsum of the hand. However, they can occur on any part of the body and may rarely arise within the knee joint. In and around the knee joint, there may be several types of cysts; ganglion cysts of the ACL and two types of meniscal cysts, true meniscal cyst and the baker's cyst which is further from the meniscus¹⁻³. These cysts are relatively rare, with less than 2% incidence on MRI or arthroscopy and of the reported cases, close to two-thirds of intra-articular ganglion cysts are located on the ACL^{4,5}. The mean age of patients with ACL ganglion cysts has been reported as 39 years of age with a range of 19 to 60 years with male predominance⁶. Baker's cysts, or popliteal cysts, have two age incidence peaks at 4-7 and 35-70 years of age⁷. Meniscus cysts occur in a wide range of populations due to their association with meniscus tears, but are found most frequently in 20-30 year old males⁸.

Pathology

Cystic formations in the knee are categorized into two types: those featuring a synovial cell layer (known as synovial cysts) and those composed solely of fibrous tissue lacking a distinct enclosed capsule (referred to as ganglion cysts). Distinguishing between synovial and ganglion cysts relies on pathological examination and

holds no clinical significance; as such, the term “ganglion cyst” is used inclusively to denote both types in this context⁹.

The origin of ganglion cysts remains a subject of debate in terms of their pathophysiology, it is believed to arise from a combination of factors including trauma, mucoid degeneration, and synovial herniation^{10,11}. These mechanisms, when occurring gradually, are thought to culminate in the formation of a non-epithelial layer that retains fluid from the tendon sheath or joint. Different theories concerning the cause of ganglion cysts explain an acquired or congenital origin^{10,11}.

To avoid ambiguity in classification of intraarticular ganglion cysts in the knee joint, the Vahlensieck classification has been created in which it divides intraarticular ganglion cysts into three types based on their origin. The first type describes cysts that originate anterior to the ACL. The second type includes cysts that grow in between the ACL and PCL. Finally, the third type includes cysts posterior to the PCL¹².

Physical Findings

Most ganglion cysts are asymptomatic, but if the size of the cyst is large enough, vague pain in the knee is frequently encountered⁹. Other nonspecific symptoms include knee locking, reverse locking, clicking, snapping, joint-line tenderness, and a positive McMurray test have been reported⁹. Besides size of the cysts, the location of the cysts matters in terms of symptom presentation with cysts near the femoral attachment of the ACL are more likely to be symptomatic⁹. Anterior ganglion cysts tend to cause knee locking, whereas posterior cysts cause limited knee flexion⁹.

Ganglion Cysts of the Anterior Cruciate Ligament

Ganglion cysts involving the cruciate ligament are difficult to diagnose due to a nonspecific symptomatology but can cause pain in the knee and may interfere with knee motion. They are rare and are not discretely discernable on physical exam as ACL ganglion cysts are identical to the ganglion cysts that are seen everywhere. The pathogenesis of ACL ganglion cysts is unclear but may result from mucoid degeneration of the ACL, herniation of synovium or proliferation of mesenchymal cells secondary to trauma. There has been shown to be a relationship between cruciate ganglion cysts and trauma, as trauma can allow dissection of synovial hyaluronic acid into extra synovial structures such as the ACL. This may then cause initiation of the production of mucin and subsequent development of a ganglion cyst associated with the ACL¹³⁻¹⁵. The most common manifestations may include arthralgias, joint swelling, and effusion¹⁶. In some cases, patients note chronic or intermittent knee pain with a limited range of motion

with extension up to 15 degrees¹⁷. Most notably, patients likely do not have instability but may have symptoms of catching or locking. Symptoms could include pain at the medial or lateral joint lines or even a positive McMurray test in some patients¹⁸. The symptoms are usually poorly localized, and the differential diagnosis should remain broad to cover unusual presentations of other common pathology. The vast majority of intra articular cysts of the knee joint may present asymptotically and are rather an incidental discovery as a result of arthroscopic surgery. In order for a definitive diagnosis, imaging techniques are required. Imaging can similarly be nonspecific but to properly visualize soft tissue pathology, magnetic resonance imaging (MRI) is the diagnostic imaging modality of choice. X-ray, computed tomography (CT), or ultrasound may be performed but are nonspecific. MRI findings of a cruciate ligamentous ganglion cyst will show a cystic structure within the anterior cruciate ligament (ACL). This will be characterized by a fluid filled lesion extending along the surface of the ligament with an increased T2 signal^{16,18}. T1-weighted imaging may incorrectly depict ACL cysts as partial tears of the ACL, which highlights the importance of using T2 weighted imaging to visualize the presence of a cyst on an intact ACL⁴. Cysts that occur on the posterior cruciate ligament (PCL) will also appear as low-intensity signals on T1 images and high-intensity signals on T2 images occurring along the surface of the ligament⁴. Arthroscopy may be performed for a definitive diagnosis that would aid in assessing the location, size, and nature of the cysts within the knee joint¹⁶.

Differential Diagnosis

The symptom presentation for intra-articular knee joint cysts is vague and may mimic other conditions such as meniscal injury, chondral injury, and chondromalacia⁹. Furthermore, the diagnosis of early ganglion cysts is likely to be missed¹⁹. As such, it is common for ganglion cysts to be misinterpreted and thus MRI becomes a necessity in working up early ganglion cysts. The differential diagnosis to intra-articular ganglion cysts is broad and includes the following: hemangioma, pigmented villonodular synovitis (PVNS), lipoma arborescens, synovial cell sarcoma, chondromatosis, and meniscal cysts⁹.

Hemangioma occurs in the Hoffa fat pad and present on T1-weighted sequence as an isointense to hypointense signal compared to surrounding muscle⁹. Other features of hemangiomas include a high signal on T2-weighted sequence, lobulated surface, less likely to cause mass effect symptoms, and can have a fluid-fluid level⁹.

PVNS is a subtype of tenosynovial giant cell tumors that diffusely affect the soft tissue lining of joints and tendons. PVNS most commonly affects the knee, hip, and ankle joints. PVNS are frequently found in the Hoffa fat pad/

suprapatellar recess⁹. On MRI, they present as a low signal on T1-weighted MRI, heterogeneous on T2-weighted MRI; elevated signal on gradient echo sequence⁹.

Lipoma arborescent often occurs in the suprapatellar recess and they follow fat signal on all sequences⁹. Synovial cell sarcoma arises more commonly extracapsular and less commonly intracapsular in the Hoffa fat pad⁹. On MRI, they appear as hypointense on T1-weighted MRI and hyperintense on T2-weighted MRI and IV gadolinium can enhance visualization of the tumor⁹.

Chondromatosis, a rare and noncancerous condition affecting the synovial membrane in joints, tendon sheaths, and bursae, can lead to significant disability and impaired function of the affected joint. They frequently occur in the internal synovial membrane and are associated with intrasynovial loose bodies⁹. On MRI, they appear as numerous small, clearly outlined nodules that display moderate to reduced signal strength on T1-weighted MRI and high signal strength on T2-weighted MRI. They exhibit a blooming artifact on gradient echo sequences and don't become more prominent with gadolinium. CT scans or standard X-rays reveal multiple well-defined bony nodules near the joints⁹. Finally, meniscal cysts occur near the menisci and on MRI they appear as a circumscribed lesion with a low signal on T1-weighted MRI and high signal on T2-weighted MRI⁹.

Baker's Cyst

Also known as popliteal cyst, a Baker's cyst is a periarticular fluid-filled mass that communicates with the knee joint. Based on its name, it is found in the popliteal fossa. It is usually posteromedial and presents between the medial head of the gastrocnemius and the semimembranosus. Communication with the joint is unusual and sets the Baker's cyst apart from other periarticular cysts. The pathogenesis is likely due to intra-articular pathology inside the joint that causes filling of the joint with fluid and pouring of the fluid into the cyst. They are considered to be an extension of the bursa that lies underneath the medial head of the gastrocnemius muscle²⁰. Some cases may arise in the absence of other associated conditions, but the majority of cases occur in the setting of coexisting joint pathology such as trauma, joint disease, or meniscus tear⁷. The fluid will travel in one direction into the cyst causing gradual enlargement over time. Baker's cysts are almost always secondary to a pathologic process, causing communication of the knee joint with the bursa. It is therefore important to maintain suspicion of a Baker's cyst in patients who present with posterior knee pain with concurrent degenerative knee disease, meniscal tears and other inflammatory pathologies due to a significant association²⁰. Patients typically complain of posterior knee pain, fullness and tenderness that is worse when the

knee is extended^{21,22}. Ultrasound can be used for an initial assessment and has a near 100% rate for detecting Baker's cysts. However, they are nonspecific and are unable to detect secondary causes for potential cysts²². MRI is the gold standard for a diagnosis and will show the cyst as well as any other associated intra-articular pathology. Baker's cysts will appear as a fluid-filled collection with high intensity on T2-weighted images²². The intra-articular pathology is usually either knee arthritis or a meniscus tear, especially the posterior horn of the meniscus. If the cyst is present in an atypical location, then it is important to rule out a tumor or another differential diagnosis. Treatment for a Baker's cyst is conservative therapy consisting of ice, NSAIDs, steroid injections, and physical therapy before aspiration and excision if the cyst causes too much pain to the patient. Recurrence is common if a concurrent intra-articular pathology is untreated and continues to cause effusion. The best definitive treatment is arthroscopy and debridement of the intra-articular pathology (torn meniscus)^{7,20}.

Medial Meniscal Tear

The pain typically characterized by patients with an ACL ganglion cyst is most similar to that of a tear of the medial meniscus. To rule out a medial meniscal tear, it is important to elicit a thorough history and physical exam in order to check for medial joint line tenderness and ligamentous instability. The McMurray test is highly specific and sensitive and can guide further diagnostic testing. If there exists a high index of suspicion for medial meniscal tear, MRI is the imaging modality of choice to detect tearing. If indeed a tear is noted along with appropriate symptoms, the patient can be treated conservatively or surgically via arthroscopic repair of the meniscus^{23,24}.

Meniscal Cyst

Meniscal cysts are believed to be an extrusion of synovial fluid through a tear of the meniscus. They can be located intrameniscal, parameniscal, both²⁵. This is an uncommon diagnosis that usually occurs in the middle third of the lateral meniscus. The tear allows extrusion of a small amount of fluid which allows the formation of a cyst adjacent to the meniscus. This type of cyst is usually seen in a horizontal tear or a horizontal cleavage tear. The incidence of meniscus cysts ranges anywhere from 4-8% and are most often asymptomatic, though some patients may complain of aching knee pain, limited range of motion, or even a palpable abnormality²⁶. Symptoms consistent with a tear of the meniscus may also be present. Evaluation for suspected meniscus cysts includes a combination of history, physical examination, and diagnostic imaging. Ultrasound may show hypoechoic fluid-filled masses and a meniscus injury. As with most cases of intra-articular cysts, MRI is considered the gold standard method of imaging.

The cysts may appear with high intensity on T2 images that communicate with tears of the meniscus. Surgical repair of the meniscus is necessary to prevent recurrence of the cysts^{27,28}. If the tear communicates with the joint, it can be treated arthroscopically with a partial meniscectomy and cyst decompression. If the tear does not communicate with the joint, it can be treated arthroscopically, however it can also be treated via an open procedure²⁵⁻²⁹.

Treatment

Management of ACL ganglion cysts is conservative with rest, NSAIDs and physical therapy being the mainstay of treatment to provide symptomatic relief. If symptoms do not resolve with long term conservative therapy, the cyst may be removed arthroscopically. A standard anteromedial or anterolateral approach with appropriate visualization and resection of the cyst and cyst walls is the recommended approach^{4,16}. CT or ultrasound guided joint paracentesis may also be considered, but do not remove the cyst walls and thereby may be associated with increased rates of recurrence¹⁶. The recurrence rate after arthroscopy is unclear but appears low making it a viable long-term treatment option^{16,18}.

Conclusion

Ganglion cysts of the knee joint are a rare occurrence that may present with vague symptoms of pain, limited range of motion, and joint effusion. Proper evaluation with history, clinical examination, and diagnostic imaging with MRI is important in differentiating these intra-articular cysts from other similarly presenting pathologies. Conservative treatment or image-guided aspiration may be performed, but arthroscopic removal of the cyst and cyst walls is considered the mainstay of treatment in order to provide resolution of symptoms as well as preventing recurrence.

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