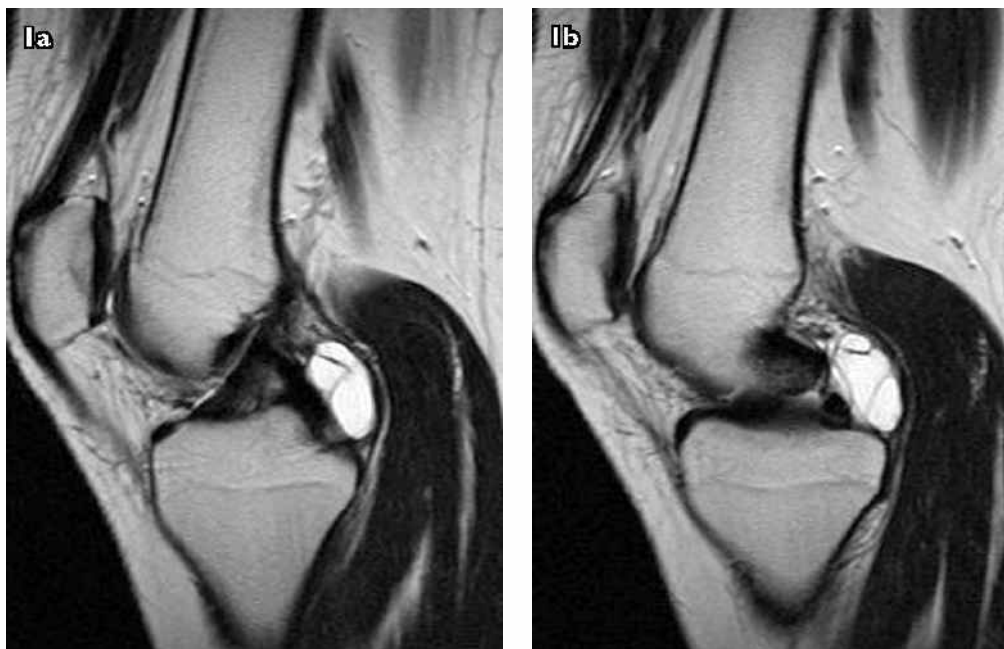


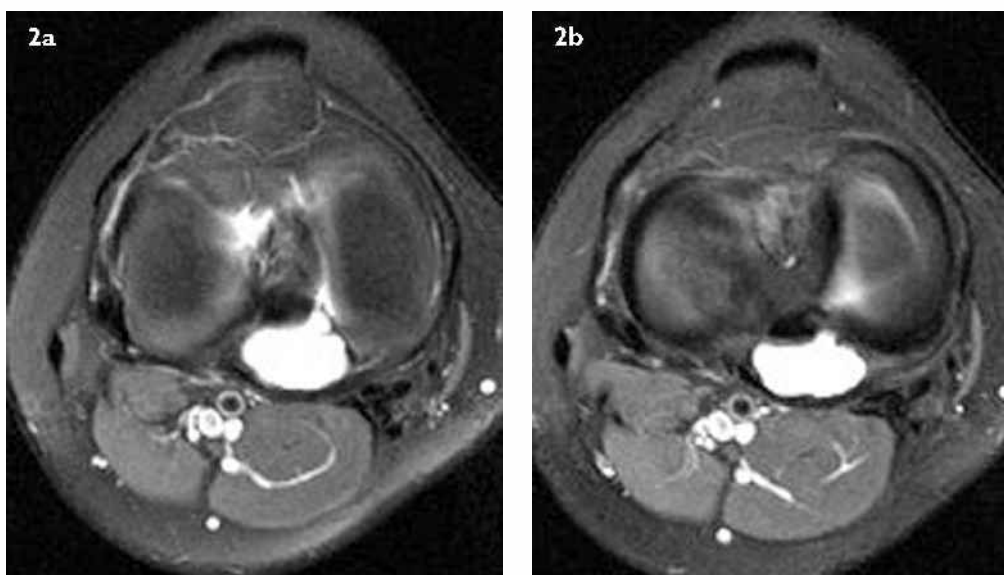
**CME Article**

# Clinics in diagnostic imaging (I29)

See P P L, Peh W C G, Wong L Y, Chew K T L



**Fig. 1** (a–b) Contiguous sagittal T2-W MR images of the right knee taken at the plane of the posterior cruciate ligament.



**Fig. 2** (a–b) Contiguous axial T2-W MR images of the right knee, taken at the level of the distal posterior cruciate ligament.

**CASE PRESENTATION**

A 21-year-old Chinese female university student presented with pain in her right knee. She had sustained a twisting injury to the knee six months prior to presentation. She did not experience locking or the sensation of giving way, but the pain was exacerbated by squatting. The patient had no other history of trauma and was not an avid sportsperson. She had not undergone any prior treatment.

On physical examination, she had a full range of motion of the right knee. There was moderate tenderness over the posteromedial joint line, but no palpable lump was detected. The Lachman, posterior drawer, McMurray, and varus and valgus stress tests were all negative. Radiographs of the right knee were normal. Magnetic resonance (MR) imaging of the knee was performed (Figs. 1 & 2). What do these images show? What is the diagnosis?

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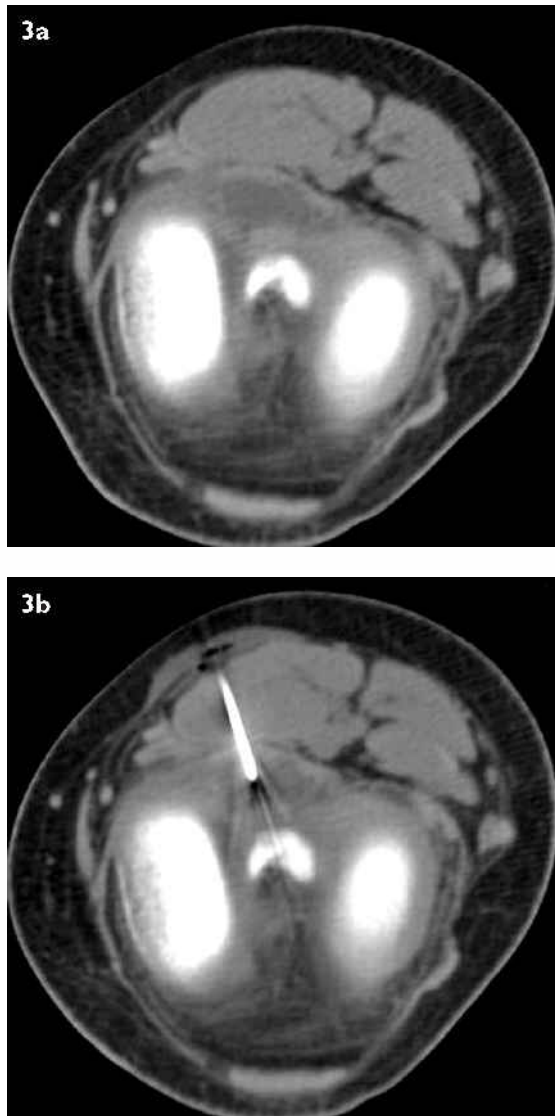
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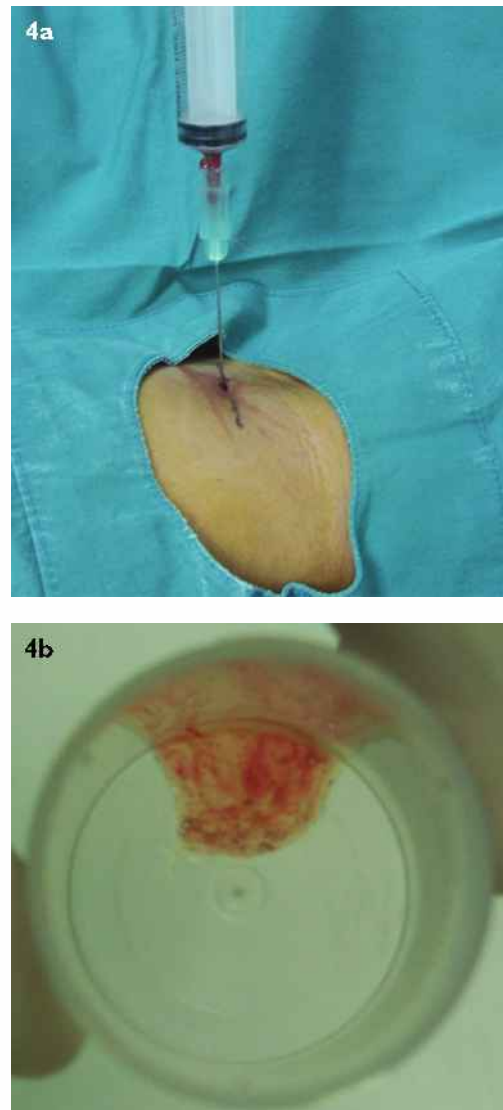
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**Fig. 3** Axial CT images taken with the patient lying in a prone position. (a) Pre-aspiration image shows the ganglion cyst as a lobulated hypodense mass located posterior to the rounded isodense posterior cruciate ligament. (b) The needle has passed through the medial gastrocnemius muscle with its tip located in the ganglion cyst, with avoidance of the popliteal vessels and the posterior cruciate ligament itself.

#### IMAGE INTERPRETATION

MR imaging of the right knee showed a well-defined ovoid lesion that was closely related to the posterior aspect of the posterior cruciate ligament (PCL). The lesion measured 2.3 cm × 2.0 cm × 2.0 cm, and except for thin internal septations, showed homogeneously low-signal intensity on T1-weighted images (not shown) and homogeneously high-signal intensity on T2-weighted images (Figs. 1 & 2). The features were those of a PCL ganglion cyst. The other internal structures of the knee, including the anterior cruciate ligament (ACL), menisci and collateral ligaments, had a normal appearance. There was only a trace amount of fluid within the knee joint.



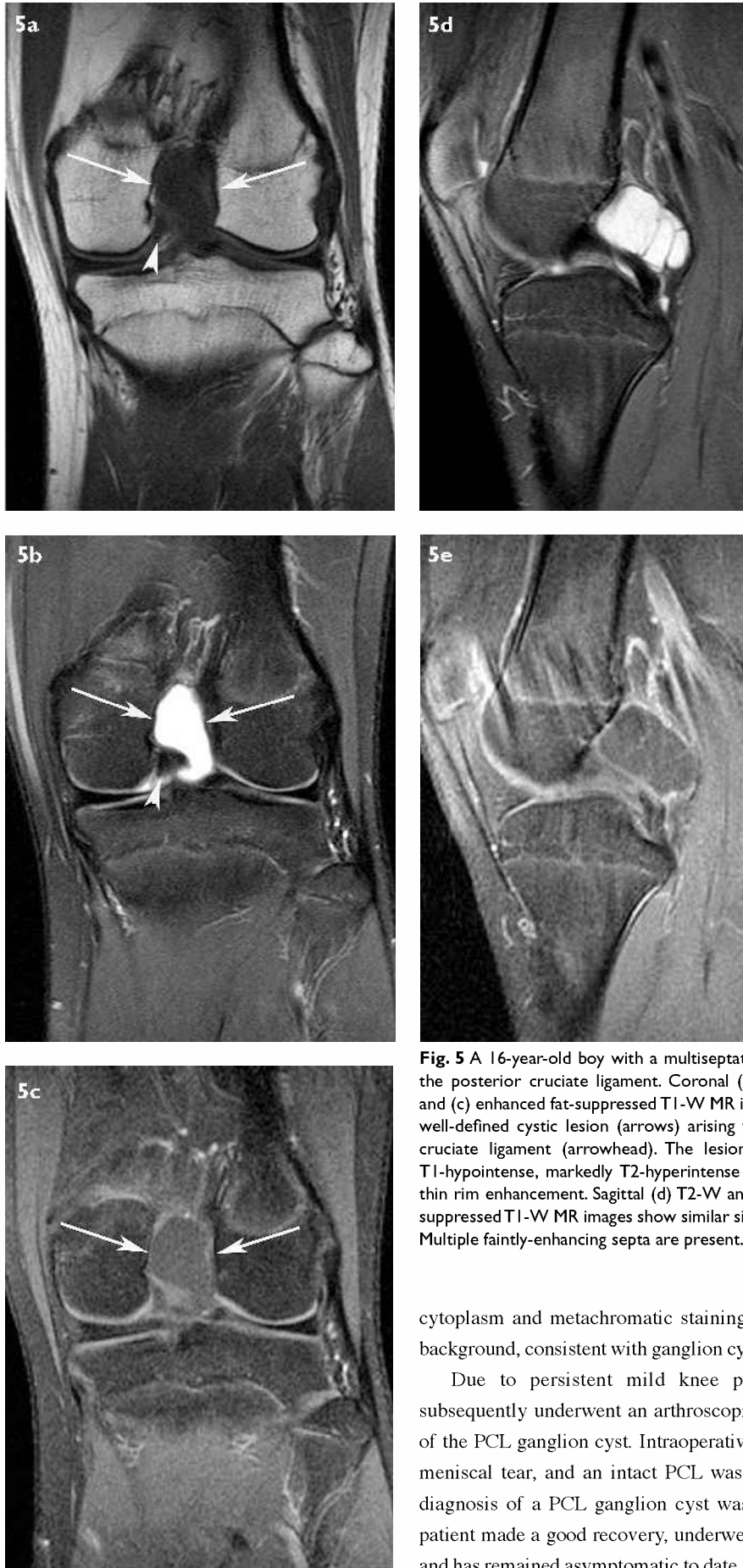
**Fig. 4** Clinical photographs show (a) the needle placement into the back of the knee, and (b) the slightly blood-tinged but clear yellow gelatinous aspirate.

#### DIAGNOSIS

Posterior cruciate ligament ganglion cyst

#### CLINICAL COURSE

Subsequent to the MR imaging, a computed tomography (CT)-guided aspiration of the cyst was undertaken, in order to confirm the diagnosis. Using a posterior approach and with the patient lying prone, a 21G needle was inserted through the subcutaneous fat and gastrocnemius muscle, and directed into the cystic mass (Fig. 3). Aspiration yielded approximately 1 ml of clear yellow gelatinous substance, which had a tinge of blood-staining (Fig. 4). Due to the viscous nature of the aspirate, it was difficult to withdraw a large volume of material, given the relatively-small needle calibre. Microscopical examination of the specimen showed occasional histiocytic cells with abundant foamy



**Fig. 5** A 16-year-old boy with a multisepated ganglion cyst of the posterior cruciate ligament. Coronal (a) T1-WW, (b) T2-WW, and (c) enhanced fat-suppressed T1-WW MR images show a large well-defined cystic lesion (arrows) arising from the posterior cruciate ligament (arrowhead). The lesion is homogeneously T1-hypointense, markedly T2-hyperintense and shows a mild thin rim enhancement. Sagittal (d) T2-WW and (e) enhanced fat-suppressed T1-WW MR images show similar signal characteristics. Multiple faintly-enhancing septa are present.

cytoplasm and metachromatic staining materials in the background, consistent with ganglion cyst contents.

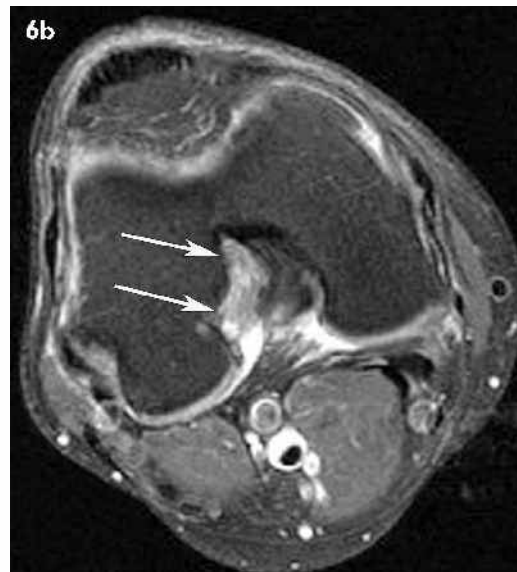
Due to persistent mild knee pain, the patient subsequently underwent an arthroscopic decompression of the PCL ganglion cyst. Intraoperatively, there was no meniscal tear, and an intact PCL was noted. The final diagnosis of a PCL ganglion cyst was confirmed. The patient made a good recovery, underwent physiotherapy, and has remained asymptomatic to date.

## DISCUSSION

A ganglion cyst is a benign cystic lesion that can arise from variable locations such as the tendon sheaths and muscles, and which may communicate with the synovium of the tendon sheath of a joint. Intra-articular ganglion cysts are rare, and those arising from the cruciate ligaments are very uncommon, with a reported prevalence of 0.2%–1.3% on MR imaging,<sup>(1-5)</sup> and 0.1%–0.6% on knee arthroscopy.<sup>(6,7)</sup> PCL ganglion cysts occur less frequently than those arising from the ACL. Brown and Dandy found that only six of 35 ganglion cysts arising from the cruciate ligaments were from the PCL,<sup>(6)</sup> similar to the findings of Bui-Mansfield and Youngberg, where eight of 23 cruciate ligament ganglion cysts arose from the PCL,<sup>(3)</sup> and those of Krudwig et al, where only 16 of 49 cruciate ligament ganglion cysts arose from the PCL.<sup>(7)</sup> However, Recht et al found that nine of 16 cruciate ligament ganglion cysts were from the PCL,<sup>(2)</sup> while Kim et al found ten of 20 cruciate ligament ganglion cysts originating from the PCL.<sup>(4)</sup>

Ganglion cysts of the cruciate ligaments are usually asymptomatic, and are often hard to diagnose clinically due to the lack of specific symptoms and signs. Symptomatic patients may present with pain aggravated with flexion or athletic activity, increased pain during posture change, locking, clicking or popping sensations, and a decreased range of motion.<sup>(1,8-13)</sup> The intra-articular location and size of the cyst are closely related to the symptoms and signs. Ganglion cysts arising from the PCL may impinge between the ligament and the intercondylar roof, limiting flexion through mechanical block.<sup>(9)</sup> Because the intercondylar notch is relatively spacious, it may take time for the mass to develop into a size large enough to cause symptoms. The resultant slow progression of symptoms may account for our patient's delay in seeking medical attention. Kim et al postulated that the cause for the increased pain in the flexion position and during posture change, as well as the limitation of flexion, may be due to the stimulation of nerve endings in the synovial membrane stretched by changes in the shape and dimension of the ganglion cyst with knee motion and posture.<sup>(13)</sup> While the exact aetiology for ganglion cysts remains unknown, it has been theorised that they may be due to mucoid degeneration, herniation of the synovium into the surrounding tissue, displacement of the synovial tissue during embryogenesis, or proliferation of the pluripotential mesenchymal cells. Trauma, as in our patient, may be a precipitating event.<sup>(5,9,11,13)</sup>

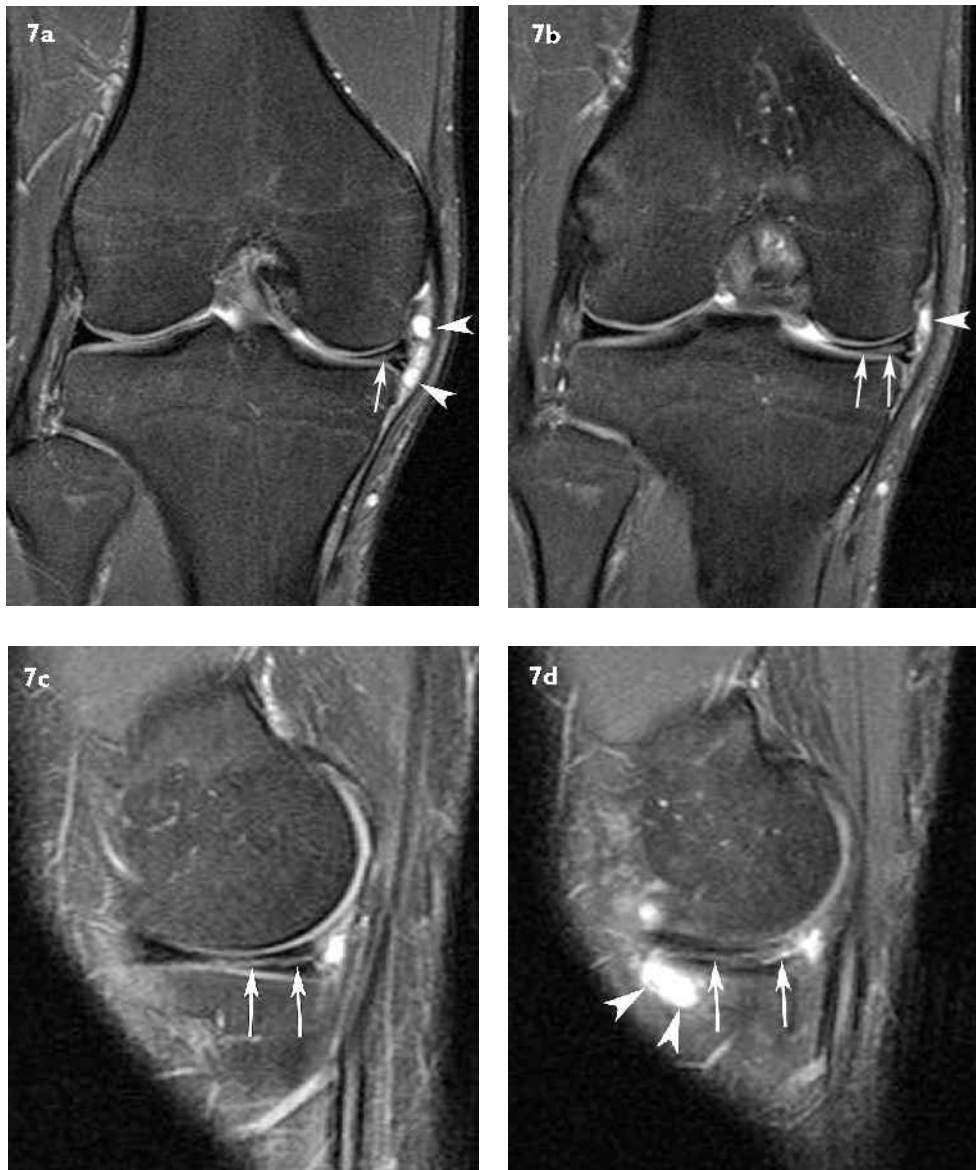
Since the 1991 report by Garcia et al,<sup>(8)</sup> MR imaging is now considered the modality of choice for diagnosing cystic lesions of the knee. MR imaging is sensitive, specific, accurate and noninvasive, while providing multiplanar imaging capability with its attendant advantages. Superior



**Fig. 6** A 63-year-old man with a ganglion cyst of the anterior cruciate ligament (ACL). (a) Sagittal and (b) axial T2-W MR images show fusiform enlargement (arrows) of the ACL, with fluid interspersed within the ACL fibres (arrowheads).

identification of the anatomical and morphological relationship of the synovial tissue to the surrounding structures is possible, and additional intra-articular lesions can also be detected. Cystic lesions posterior to the PCL may be difficult to visualise on arthroscopy using the normal anterior ports during arthroscopy; hence, posteromedial and posterolateral portals are required in these cases.<sup>(14)</sup> Imaging thus plays the added role of guiding the arthroscopic approach.

On MR imaging, ganglion cysts may appear unilocular or multilocular, round to lobular in configuration, and often contain sharply-defined internal septa (Figs. 1a & b). They appear as cystic masses with homogeneous low-



**Fig. 7** A 20-year-old man with a meniscal cyst arising from an underlying meniscal tear. Contiguous (a–b) coronal, and (c–d) sagittal proton-density MR images show a meniscal cyst (arrowheads) associated with an extensive tear of the medial meniscus (arrows).

signal intensity on T1-weighted images and high-signal intensity on T2-weighted images<sup>(2,5,8,15)</sup> (Fig. 5). Long-standing lesions often have a more complex appearance, especially if complicated by previous haemorrhage or infection. Rarely, high proteinaceous content or internal haemorrhage may result in the lesion being isointense to slightly hyperintense relative to skeletal muscle on T1-weighted images. Rim enhancement (Figs. 5c & e), in addition to diffuse enhancement, may be seen following gadolinium administration.<sup>(16)</sup> Ganglion cysts associated with the ACL usually have a fusiform appearance and may be interspersed within the ACL fibres (Fig. 6), while those associated with the PCL usually appear as a well-defined uniloculated or, more commonly, multiloculated cyst,<sup>(17)</sup> as in our patient.

Meniscal cysts are another cause of pain in the knee, usually resulting from the accumulation of synovial fluid after a meniscal tear (Fig. 7). A pericruciate meniscal cyst arises from a tear of the posterior horn of the medial meniscus and may simulate a PCL ganglion cyst, as it extends centrally within the joint predominantly posterior to the PCL. Accurate preoperative differentiation of the two may be beneficial given the potential differences in treatment planning. Successful treatment of a meniscal cyst requires intra-articular surgery to decompress the cyst and to address the meniscal tear.<sup>(18)</sup> Symptomatic cysts that are not related to a meniscal tear can be aspirated percutaneously or removed surgically without meniscal surgery.<sup>(18,19)</sup>

Lektrakul et al proposed that the four MR imaging

findings of pericruciate meniscal cysts that may aid in distinguishing the two include: (1) identification of a meniscal tear, typically in the posterior horn of the medial meniscus; (2) connection between the torn meniscus and the cyst; (3) location mainly posteriorly to the PCL and generally centred on it; and (4) location surrounding the PCL.<sup>(17)</sup> PCL ganglion cysts tend to be located at the femoral or tibial insertions, rarely surround the ligament and do not communicate with a meniscal tear, even on the rare occasion when an associated one is identified. The further differential diagnoses for an intracapsular cystic mass of the knee include pigmented villonodular synovitis, synovial sarcoma and synovial chondromatosis. However, each of these entities has a characteristic MR imaging appearance that should not present a diagnostic problem.<sup>(20,21)</sup>

Symptomatic ganglion cysts that are seen on MR imaging or encountered during arthroscopy invariably need treatment. While asymptomatic intra-articular masses incidentally found on MR imaging do not need any treatment, those detected on arthroscopy should be resected because of the risk that they may become symptomatic.<sup>(7,9,11)</sup> Surgery has been the mainstay of treatment of ganglia. Brown and Dandy found that 95% of patients had good or excellent results after the arthroscopic excision of ganglion cysts in the knee.<sup>(6)</sup> Imaging-guided aspiration of intra-articular ganglia of the knee was first described in 1994 by Nokes et al, who successfully performed CT-guided aspiration on two patients with cruciate ligament ganglion cysts. Both patients had pain relief and no recurrence at the two-year follow-up.<sup>(1)</sup> Campagnolo et al and Antonacci et al also reported successful aspiration of ACL ganglion cysts under CT guidance.<sup>(22,23)</sup> The only report, to date, of ultrasound-guided aspiration of PCL ganglion cysts was by DeFriend et al in 2001.<sup>(12)</sup>

Imaging-guided percutaneous aspiration of cruciate ligament ganglion cysts does not require general anaesthesia, can be done rapidly, and has the advantages of being cheap and relatively easy to perform, and having a quick recovery time and lower patient morbidity. The cyst itself, adjacent neurovascular structures and needle position can be easily visualised.<sup>(1,22,23)</sup> Ultrasound-guided aspiration has the additional advantage of having no ionising radiation and real-time imaging of needle movement.<sup>(12)</sup> DeFriend et al injected 1 ml of triamcinolone hexacetamide, while Antonacci et al injected a mixture of 2 ml of 0.25% bupivacaine and 2 ml of 80 mg methylprednisolone into ganglion cysts, with both authors achieving post-procedural pain relief.<sup>(12,23)</sup> It is, however, not clear whether the use of steroids for ganglia adds to the effectiveness of aspiration alone.<sup>(24)</sup>

In summary, MR imaging is a useful modality that is able to provide an accurate diagnosis of ganglion cysts arising from the cruciate ligaments. Imaging-guided percutaneous aspiration of cyst contents should be considered initially for symptomatic patients, with arthroscopic surgery reserved for patients that do not respond satisfactorily.

## ABSTRACT

**Ganglion cysts arising from the posterior cruciate ligament (PCL) of the knee are rare. We describe a 21-year-old Chinese woman who presented with right knee pain following a twisting injury six months prior. Her pain was exacerbated by squatting, although her range of knee motion was full. Magnetic resonance imaging showed a lobulated, well-defined, T1-hypointense and T2-hyperintense, septated cystic mass arising from the posterior aspect of the PCL. The diagnosis of a PCL ganglion cyst was confirmed by computed tomography-guided aspiration of the cyst. Due to persistent mild knee pain, the patient eventually underwent arthroscopic decompression of the ganglion cyst. The clinical features, diagnosis and management of PCL ganglion cysts are discussed.**

**Keywords:** cruciate ligament, ganglion cyst, knee cystic masses, posterior cruciate ligament

*Singapore Med J 2009; 50(11): 1102-1109*

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**SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME**  
**Multiple Choice Questions (Code SMJ 200911B)**

	True	False
<b>Question 1.</b> Ganglion cysts:		
(a) Are benign cystic lesions.	<input type="checkbox"/>	<input type="checkbox"/>
(b) May be due to mucoid degeneration.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Are more common in the PCL than ACL.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Never arise from muscles.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 2.</b> Clinical presentation of ganglion cysts of the knee:		
(a) Are often painful.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Can cause locking in the knee.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Are always associated with previous trauma.	<input type="checkbox"/>	<input type="checkbox"/>
(d) The intra-articular location and size of the cyst are closely related to symptoms and signs.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 3.</b> Regarding MR imaging of ganglion cysts:		
(a) It is sensitive but not specific in diagnosis.	<input type="checkbox"/>	<input type="checkbox"/>
(b) It usually shows low-signal intensity on T1-weighted images and high-signal intensity on T2-weighted images.	<input type="checkbox"/>	<input type="checkbox"/>
(c) It shows avid and homogenous contrast enhancement.	<input type="checkbox"/>	<input type="checkbox"/>
(d) The cysts are always unilocular.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 4.</b> PCL ganglion cysts are differentiated from meniscal cysts by these features:		
(a) They are connected to meniscal tears.	<input type="checkbox"/>	<input type="checkbox"/>
(b) They surround the ligament.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Size.	<input type="checkbox"/>	<input type="checkbox"/>
(d) They tend to be located at the femoral or tibial insertions.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 5.</b> In the management of ganglion cysts:		
(a) MR imaging is now considered the modality of choice for diagnosis.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Treatment is not necessary if the finding is asymptomatic and incidental on MR imaging.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Imaging-guided aspiration has no role in cruciate ligament cysts.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Open surgery is required for all diagnosed ganglion cysts.	<input type="checkbox"/>	<input type="checkbox"/>

**Doctor's particulars:**

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