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Pictorial review

Articular and Juxtaarticular Cystic Lesions: Evaluation with MR Imaging

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MR imaging is the most appropriate imaging modality for the evaluation of articular or juxtaarticular cystic lesions. Most of the cystic lesions show a typical signal intensity pattern of fluid, but debris or hemorrhage within the cyst may alter the signal intensity pattern of the cyst. The location and relationship with the surrounding structure are important for the differential diagnosis of cystic lesions. Associated joint abnormalities that include meniscus or labral tears, ligamentous injury, degeneration, and inflammation should also be evaluated.

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Key Words: bursitis, ganglion cyst, synovial cyst, labral cyst, meniscal cyst, MR imaging

Introduction

Articular or juxtaarticular cystic lesions are a common clinical problem and are frequently encountered during routine imaging studies. These lesions include bursitis, synovial cysts, ganglion cysts, labral cysts and meniscal cysts. They are often asymptomatic, but occasionally cause some symptoms such as local pain, swelling, compressive neuropathy, or joint impairment. The symptoms depend on the location, size, and mass effect of the lesions. Asymptomatic cysts are usually followed up conservatively. The treatment of symptomatic cysts should be based on the underlying cause. Magnetic resonance (MR) imaging is valuable not only for demonstrating cystic nature of the lesions, but also for evaluating their extent of the lesions, relationship to the surrounding structures and associated joint disorders[1)]. The purpose of this review is to present MR imaging features of articular and juxtaarticular cystic lesions.

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Classification and Terminology

Bursitis

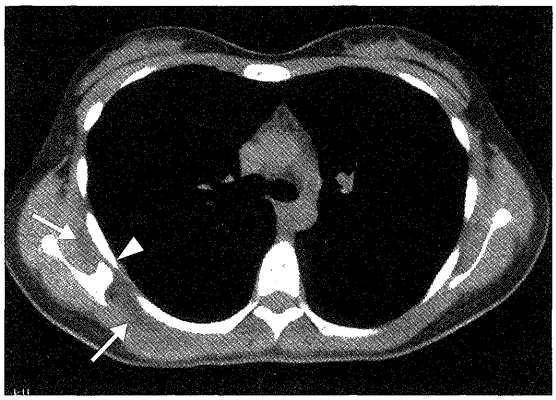
The bursa is a simple sac, which is lined by a synovial membrane and supported by the dense connective tissue. It is interposed between the adjacent moving structures, and plays a role to reduce the friction force of those structures. In general, they are classified by their location into subcutaneous, subtendinous, submuscular, and subfascial bursae. Approximately 80 bursae are present in one half of the human body[2)]. Most bursae are considered to be congenital in origin, but some may develop secondary to repetitive friction or stress (e.g. bursa formation associated with osteochondroma[3)]) (Fig. 1).

Fluid collection in the bursa can be associated with number of disorders such as trauma, infection, or articular disorders such as rheumatoid arthritis, gout, crystal deposition diseases, and osteoarthritis. Normal bursae contain little fluid, and are not usually visible on imaging studies. Bursitis can be seen as a fluid collection with or without thickening of synovium.

Ganglion cyst / Synovial cyst

Ganglion cyst is a non-neoplastic lesion, which is lined by the connective tissue and contains gelatinous fluid. It rarely communicates with the adjacent joint space, and is considered to be the consequence of either a herniation of synovial tissue or a myxoid degeneration of the periarticular connective tissue. It is commonly located adjacent to the joint capsule or tendon sheath. Intraarticular[4)], intraneural[5-7)], intraspinal[8,9)] and intramuscular ganglion cysts are rarely seen.

Synovial cysts are differentiated from ganglion



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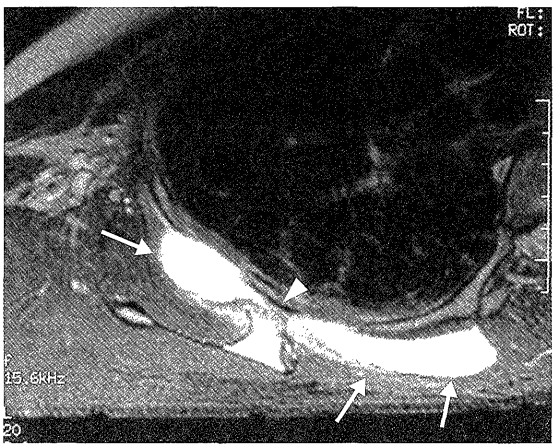

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Figure 1. Bursa formation associated with osteochondroma of the scapula
(a) CT shows an osteochondroma arising from the anterior surface of the scapula on the right (arrowhead). A low-attenuation mass appears to be present along the chest wall (arrows), but the extent and nature of the lesion is not clear.
(b) T2-weighted MR image with fat-suppression clearly shows a cystic lesion (arrows) along the chest wall as well as the osteochondroma (arrowhead).

cysts by the presence of the synovial lining on the internal surface. They may or may not communicate with the adjacent joint. The distinction between the synovial cyst and ganglion cyst is not always possible by imaging, and the both terms are often used interchangeably.

Labral / meniscal cyst

Some authors use terms of labral/meniscal cysts and ganglion cysts synonymously. We prefer to use the term labral cysts only for describing the cysts associated with a tear involving the glenoid or acetabular labrum, and a meniscal cyst associated with a tear of the meniscus. These cysts are considered to be the consequence of extrusion of joint fluid through the underlying labral or meniscal tear into the paraarticular soft tissue. The treatment of the labral/ meniscal cysts, therefore, would be repair of the labral or meniscal tear rather than removal or aspiration of the cysts.

General MR Imaging Features of Cystic Lesions

The purposes of imaging cystic lesions around joints is to confirm thier cystic nature, to assess the relationship of the lesions with the adjacent structures, and to detect associated joint disorders. Although various imaging modalities like arthrography, ultrasound, computed tomography (CT), and MR imaging can be used to achieve these goals, MR imaging is superior to others because of its high contrast and spatial resolution, multiplanar capability and non-invasiveness.

MR imaging shows a cystic lesion as an encapsulated fluid collection with lower signal intensity than muscle on T1-weighted images and markedly high signal intensity on T2-weighted images. The diagnosis is readily established in most cases, but there are some pitfalls. Hemorrhage or debris alters the signal intensity patterns of cysts. Furthermore, inflammation can cause thickening of the cyst wall as well as edematous change of the surrounding structures. These findings may simulate a solid soft tissue mass. Contrast enhanced MR imaging typically shows rim enhancement and is useful for the diagnosis of cystic lesions demonstrating atypical features (Fig. 5, 12).

A communication with meniscal or labral tear is an important feature suggesting meniscal or labral cyst. MR arthrography can be performed to confirm the finding; contrast media injected into the joint cavity dissects into the cyst through meniscal or labral tear (Fig. 3). However, it should be noted that the communication is not always visible because the tear may be sealed by a fibrous scar tissue.

Cystic Lesions in Each Joint

Shoulder

There are two main bursae around the shoulder, which often communicate to each other: the subacromial-subdeltoid bursa and subcoracoid bursa. The subacromial-subdeltoid bursa lies between the acromion and deltoid muscle and the rotator cuff tendons. The subcoracoid bursa lies between the coracoid process, the combined tendons of the short head of the biceps

brachii and coracobrachialis, and the subscapularis tendon. Fluid collection of these bursae is associated with the shoulder impingement syndrome, rotator cuff tear, rheumatoid arthritis, infection or trauma.

Ganglion cysts commonly occur along the posterosuperior aspect of the glenoid neck: suprascapular or spinoglenoid notch of the scapula[10] (Fig. 2). It leads to entrapment of the suprascapular nerve. Entrapment in the suprascapular notch causes denervation of the supraspinatus and infraspinatus muscles. Entrapment in the spinoglenoid notch causes denervation of the infraspinatus muscle. Denervated muscles show increased signal intensity on T2-weighted images or short inversion time inversion-recovery (STIR) images in acute or subacute phase, and atrophy with fatty infiltration in chronic phase[11].

Labral cysts associated with labral tear are commonly seen along the posterosuperior aspect of the glenoid neck (Fig. 3), which is also a common site of ganglion cysts. As described above, labral cysts should be differentiated from ganglion cysts based on the presence of associated labral tear. MR imaging demonstrates labral tears as an area of high signal intensity within the labrum on T2-weighted or T2*-weighted se-

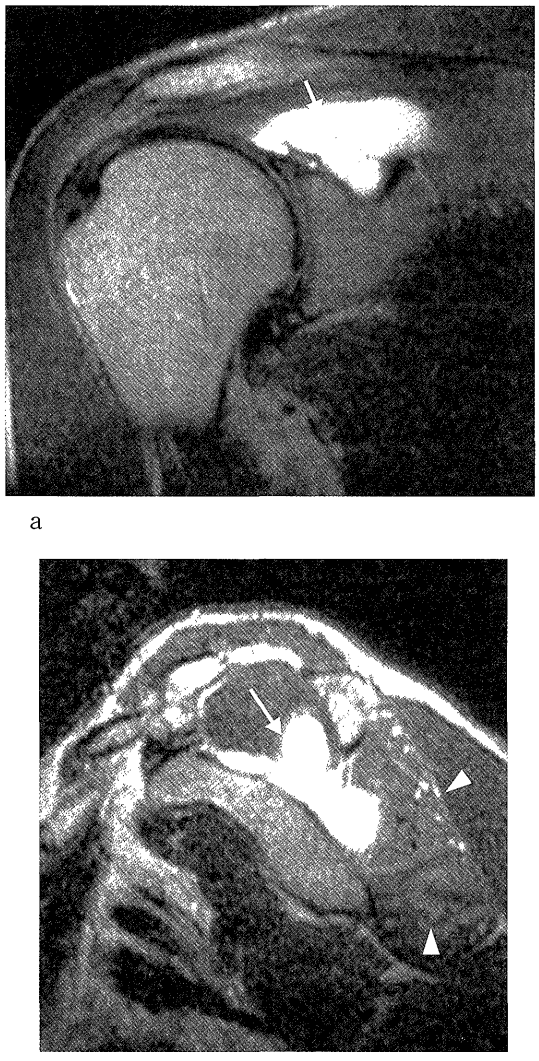


Figure 2. Ganglion cyst with suprascapular nerve entrapment
(a) Coronal T2-weighted image shows a ganglion (arrow) along the posterosuperior aspect of the scapular neck.
(b) Sagittal T2-weighted image shows the ganglion (arrow) as well as high signal intensity of the infraspinatus muscle (arrowheads) that suggests its denervation due to suprascapular nerve entrapment.

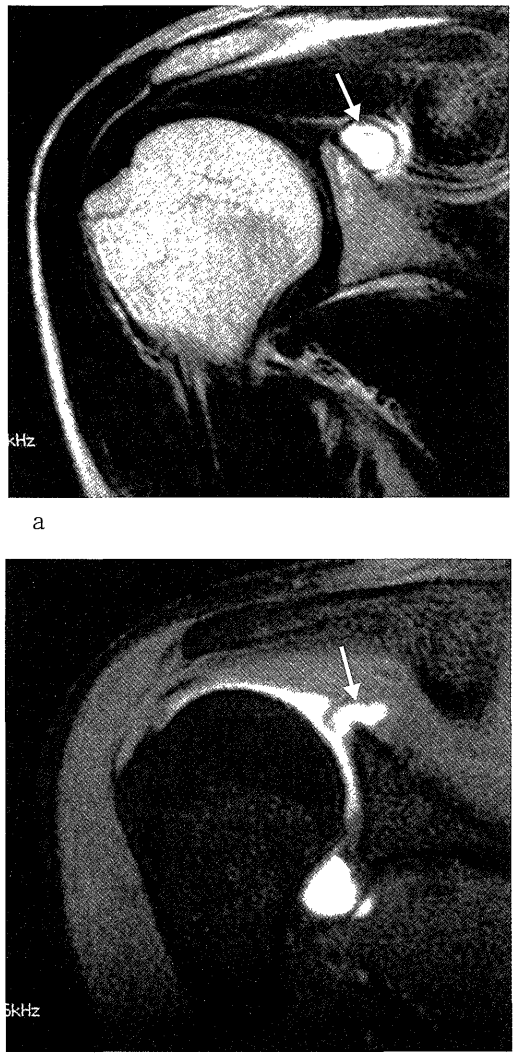
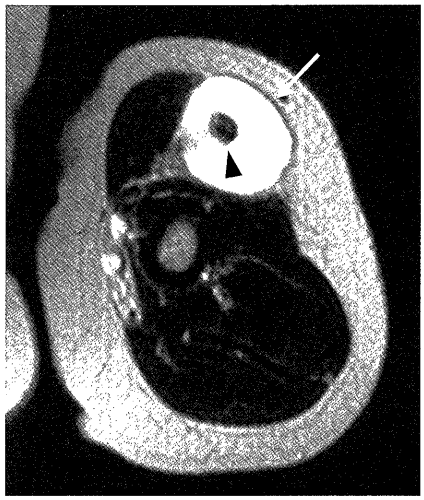


Figure 3. Labral cyst secondary to glenoid labral tear
(a) T2-weighted image shows a cystic lesion adjacent to the superior glenoid labrum (arrow). Labral tear is not demonstrated on this image.
(b) MR arthrography shows a contrast media dissecting into the cyst through the tear of the glenoid labrum (arrow).



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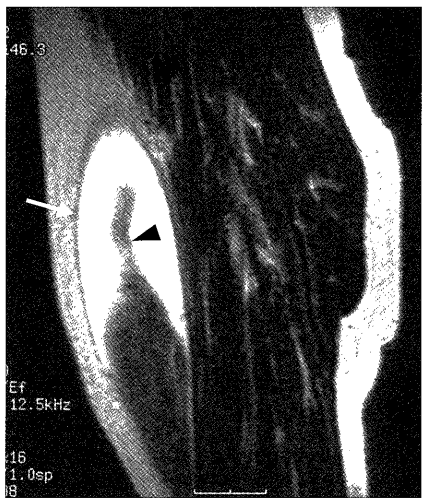

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Figure 4. Cystic lesion associated with rupture of the long head of biceps brachii tendon
(a) Axial T2-weighted image and (b) sagittal T2-weighted image through the proximal forearm show a cystic lesion (arrow) surrounding the retracted biceps tendon (arrowhead).

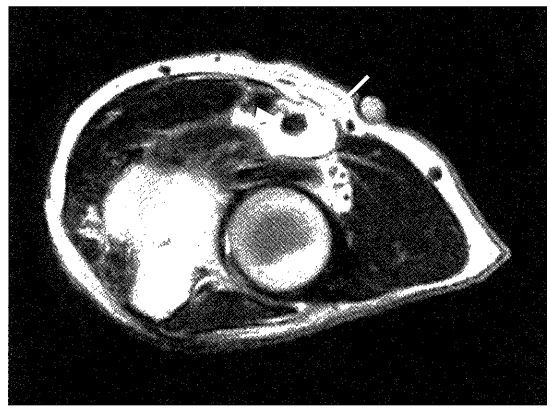
quences[12]. Communication between the cysts and joint space through the tear may be demonstrated on MR arthrography[12].

Rupture of the long head of biceps brachii tendon may cause a cystic lesion along retracted tendon in the anterior aspect of the forearm (Fig. 4). The tendon rupture is associated with degenerative change or trauma and is often accompanied by rotator cuff tear. The most common location of the rupture is the site of attachment to the glenoid labrum. The proximal tendon is absent or thin, and the distal tendon is retracted and often surrounded by a cystic lesion. This cystic lesion is thought to be either a hematoma or leakage of joint fluid associated with rupture of the glenohumeral joint capsule.

Elbow

Olecranon bursae are located posterior to the olecranon and are comprised of three bursae: subcutaneous, intratendinous, and subtendinous bursae. Superficial bursa is the largest and lies in the subcutaneous tissue. Intratendinous bursa and subtendinous bursae lie within and anterior to the triceps brachii tendon respectively. Olecranon bursitis is mainly due to direct trauma or repetitive stress, but often associated with rheumatoid arthritis, gout, or crystal deposition disease.

Cubital bursae, which consist of bicipitoradial and interosseous bursae, lie in the cubital fossa. Bicipitoradial bursa is located around the distal biceps brachii tendon near its attachment to the radial tuberosity[13] (Fig. 5). Bicipitoradial bursitis is largely



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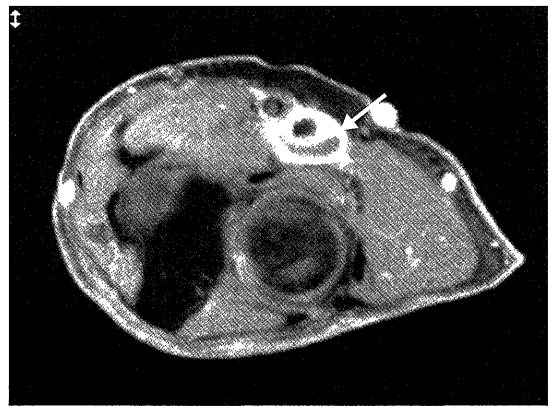

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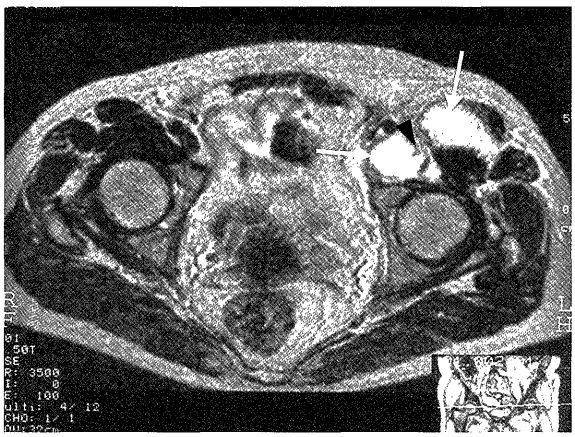
Figure 5. Bicipitoradial bursitis
(a) Axial T2-weighted image shows a cystic lesion (arrow) surrounding the distal biceps tendon (arrowhead).
(b) Axial T1-weighted image with fat saturation after intravenous contrast administration. The cyst (arrow) is outlined by the thick synovium that is enhanced by the contrast.

due to mechanical friction or stress during pronation. Interosseous bursa is situated between the proximal radius and ulna closely distal to radial insertion of biceps brachii tendon.

Medial epicondylar bursa is located adjacent to medial epicondyle and the origins of the flexor tendons of the forearm and pronator muscle. Lateral epicondylar bursa is present adjacent to lateral epicondyle and the extensor tendons of the forearm. Medial epicondylar bursitis often associated with overuse of the flexor pronator muscles of the forearm like baseball pitching. Lateral epicondylar bursitis often develops in patients with tennis elbow.

Hip

The iliopsoas or iliopectineal bursa, the largest bursa in the human body, is situated anterior to the hip joint, medial to the iliopsoas muscle, and lateral to the femoral vessels. This bursa has a communication with the hip joint in 15% of the cases[1]. Iliopsoas bursitis often presents as an inguinal mass that may extend to the pelvic cavity. It also can be a source of hip pain or limitation of hip motion. While the pathogenesis of iliopsoas bursitis is uncertain in many cases, it can be associated with many arthritides, infection, trauma, overuse and osteonecrosis. MR imaging shows a cystic lesion that is anterior to the hip joint, lateral to the femoral vessels, and posteromedial to the iliopsoas muscle[14,15] (Fig. 6). Communication of the bursa with the hip joint can be seen on MR imaging. The lesion should be distinguished from other groin masses, including hernia, lymphadenopathy, femoral artery aneurysm, or other soft tissue tumors.



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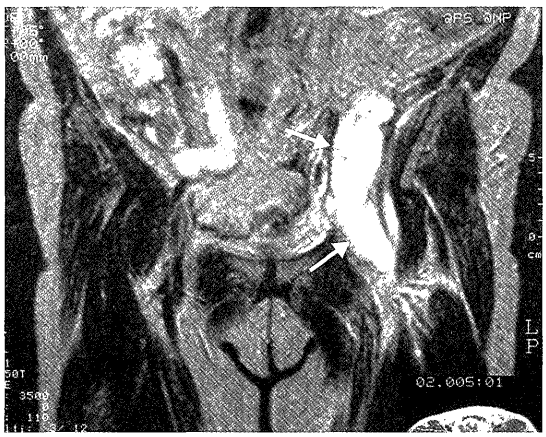

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Figure 6. Iliopsoas bursitis
(a) Axial T2-weighted image shows a cystic lesion anterior to the left hip (arrows). The cyst appears to be separated by the iliopsoas tendon (black arrowhead).
(b) Coronal T2-weighted image shows the cyst (arrows) extending into the pelvic cavity.

The trochanteric bursa lies between the greater trochanter and tensor fasciae lata. Trochanteric bursitis is due to overuse especially in runner or racquetball players, trauma, or infection. Trochanteric bursa is also known as a commonly involved site of tuberculous bursitis[16].

Labral cyst is always accompanied by acetabular labral tear, which is commonly associated with developmental dysplasia or osteoarthritis of the hip joint[17]. Posterosuperior or anterosuperior aspect of the hip joint is frequently involved.

Knee

Popliteal cysts or Baker's cysts arise from gastrocunemiosemimembranosus bursa, which commonly communicates with the knee joint space. They are associated with various knee joint disorders including osteoarthritis, rheumatoid arthritis, meniscus tear, and cruciate or collateral ligament injury[18]. Popliteal cysts are located in the medial aspect of the popliteal fossa, between the medial head of the gastrocunemius muscle and the semimembranosus muscle. The clinical presentation of the popliteal cysts is usually a painless mass along the medial side of the popliteal fossa. They are often associated with rupture or dissection into the calf, which presents as sudden onset of pain and swelling of the calf resembling thrombophlebitis. On MR imaging, popliteal cysts present as well-defined cystic lesion in the medial aspect of the popliteal fossa (Fig. 7). A tail-like projection is often seen between the medial head of the gastrocunemius muscle and the semimembranosus muscle. Loose bodies or debris within the cysts may be seen as low signal intensity areas on T2-weighted images. Ruptured or dissected

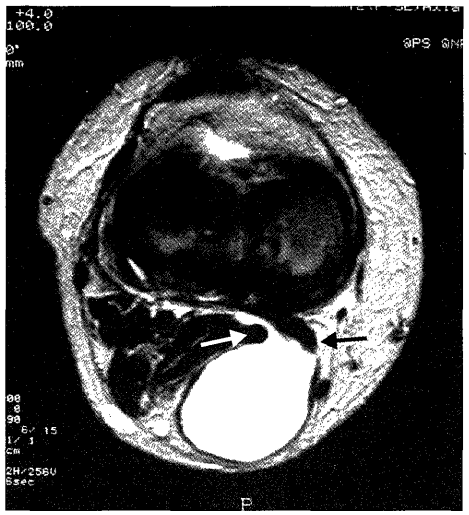

Figure 7. Popliteal cyst (Baker's cyst)
A cystic lesion is seen in the medial side of the popliteal fossa on T2-weighted axial image. Note a tail-like projection between the medial head of the gastrocunemius muscle (white arrow) and the semimembranosus tendon (black arrow).

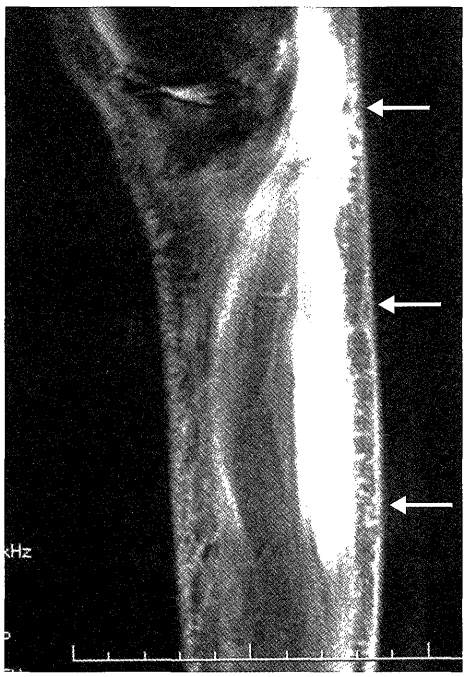

Figure 8. Ruptured popliteal cyst (Baker's cyst)
Sagittal STIR image through the proximal leg shows a cystic lesion that is continuous from the popliteal fossa (arrows). High signal intensity in the subcutaneous tissue and muscle indicates inflammatory change associated with rupture of the cyst.

popliteal cysts present as cystic lesions extending from the popliteal fossa to the posterior aspect of the thigh, which often contains hemorrhagic contents[19] (Fig. 8). Marked inflammatory changes may be seen in the surrounding muscle and subcutaneous tissues that are best appreciated in T2-weighted and fat-suppressed inversion recovery (STIR) images[19].

The prepatellar bursa is situated anterior to the patella. Prepatellar bursitis is caused by chronic or repeated trauma such as occupational kneeling (e.g., house-maid's knee, carpet layer's knee). The superficial infrapatellar bursa lies anterior to the tibial tubercle. The deep infrapatellar bursa lies between the distal patellar tendon near its insertion on the tibial tubercle and the adjacent tibial surface. Deep patellar bursitis is caused by overuse of the extensor mechanism of the knee, and is frequently observed in jumpers or runners.

The suprapatellar bursa, which is located between the distal femur and quadriceps femoris tendon, communicates with joint cavity of the knee in approximately 85% of adults. In the remaining 15%, it is completely separated from the joint by the suprapatellar plica[14]. This isolated suprapatellar bursa, which is often affected by an inflammatory process, may clinically mimic a soft tissue tumor above the knee (Fig. 9).

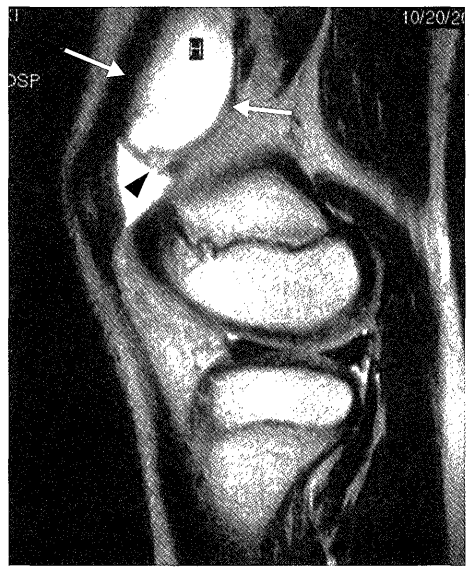

Figure 9. Isolated suprapatellar bursa
T2-weighted sagittal image shows a fluid collection in the suprapatellar bursa (arrows). The bursa is separated from the knee joint space by the persistent suprapatellar plica (arrowhead).

The tibial collateral ligament bursa is located between the superficial and deep layers of tibial collateral ligament. The pes anserine bursa lies between the distal portion of pes anserine tendon (a combined tendon of sartorius, gracilis, and semimembranosus tendons, the distal portion of tibial collateral ligament) and the medial tibial condyle. Tibial collateral

ligament bursitis and pes anserine bursitis have similar clinical manifestations of swelling and pain in the medial knee, which resemble symptoms of medial meniscus tear or tibial collateral ligament injury.

Ganglion cysts affect variable sites around the knee joint. Intraarticular ganglion cysts of the knee may arise from the posterior (Fig. 10) or anterior cruciate ligaments[4]. Intraneural ganglion cysts involving the common peroneal nerve, a rare cause of peroneal nerve palsy, may be seen near the proximal tibiofibular joint[5].

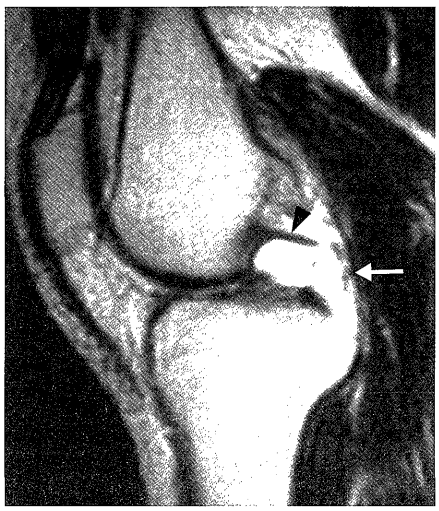

Figure 10. Intraarticular ganglion cyst adjacent to the posterior cruciate ligament
T2-weighted sagittal image shows a ganglion cyst (arrow) adjacent to the posterior cruciate ligament (arrowhead).

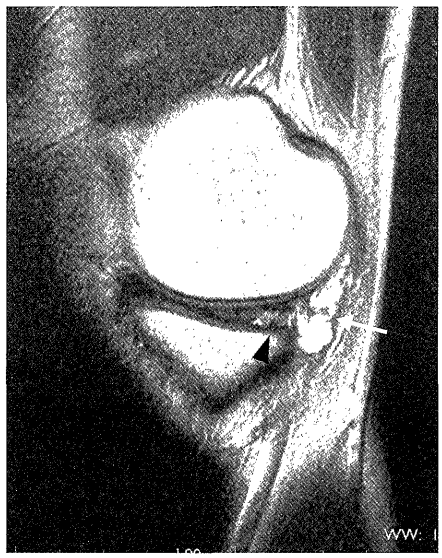

Figure 11. Meniscal cyst
(a) T2-weighted saggital image shows a cystic lesion adjacent to the posterior horn of the meniscus (arrow). A horizontal tear of the meniscus is seen as a high signal intensity area (arrowhead).

Meniscal cysts are cystic lesions associated with the meniscal tear[21,22] (Fig. 11). Lateral meniscal cysts are more common than medial meniscus cysts, but medial meniscal cysts tend to be larger and more posterior. The clinical symptoms of meniscal cysts are pain and swelling. MR imaging is useful in demonstrating associated meniscal tear.

Other joints

Ganglion cysts are the most common soft tissue mass around the wrist. They predominate in female, and are

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Figure 12. Synovial cyst associated with the degenerated right facet joint
(a) T2-weighted axial image at the level of L5/S1 shows a cystic lesion adjacent to the facet joint on the right (arrow). Small amount of fluid is seen in the right facet joint (arrowhead), suggesting degenerative change.
(b) Rim enhancement is seen along the cyst wall on post-contrast T1-weighted image (arrow).

frequently seen in third to fifth decades of life. Dorsal aspect of the wrist is the most common site of involvement in adult, while volar aspect is most frequently affected in children[23].

Bursae around the ankle include retrocalcaneal and retroachilleal bursa that lie anterior and posterior to the distal portion of the Achilles tendon near its insertion on the calcaneus. Retrocalcaneal bursitis is caused by trauma, sport activities, infection, or arthropathies like rheumatoid arthritis, ankylosing spondylitis, psoriasis, and Reiter's disease. Retroachilleal bursitis usually occurs as a result of chronic irritation by shoes or some sport activities. Ganglion cysts are frequently seen in the dorsal or dorsolateral aspect of the foot.

Intraspinal synovial or ganglion cysts commonly occur within the spinal canal in close contact to the adjacent degenerative facet joint (Fig. 12). They are thought to occur secondary to the degenerative change of the facet joint. The most common site of involvement is lumbosacral spine, particularly at the level of L4-5[24,25].

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