

Baker's cyst

Anatomy & Pathophysiology

BURSAE AND CYST FORMATION

- A Baker cyst is a distended bursa located in the popliteal space [5].
- Symptoms of a Baker cyst develop most often in the bursa beneath the medial head of the gastrocnemius or in the semimembranosus bursa [5].
- The semimembranosus bursa is a double bursa located between the semimembranosus tendon and the medial tibial condyle and between the semimembranosus tendon and the medial head of the gastrocnemius [5].
- A popliteal cyst can be produced by herniation of the synovial membrane through the posterior part of the capsule of the knee [5].
- A popliteal cyst can be produced by the escape of fluid through the normal communication of a bursa with the knee, specifically the semimembranosus or the medial gastrocnemius bursa [5].
- Popliteal cysts are synovial lined cysts that form in the popliteal region of the knee [4].
- Popliteal cysts develop secondarily via extravasation of joint fluid [4].
- Kim et al. described an association between the presence of capsular folds and holes in the capsule and the incidence of popliteal cysts in 194 knees treated arthroscopically [5].

IMAGING CHARACTERISTICS

- Classic popliteal cysts demonstrate low T1 and high T2 signal on MRI [4].
- Classic popliteal cysts demonstrate communication of joint fluid with the semimembranosus-gastrocnemius bursa on MRI [4].
- Popliteal cysts are not always homogenous on MRI because of debris, loose bodies, or hemorrhage that can accumulate in the cyst [4].
- The lining of a popliteal cyst will show enhancement on contrast MRI [4].
- The lining of a popliteal cyst can be quite thickened and septated because of inflammation [4].

- In cases with atypical MRI features, clear communication with the joint should be verified before the assumption of a popliteal cyst [4].
- MRI is the preferred diagnostic modality for popliteal cysts because it can also show intraarticular pathology [5].

PEDIATRIC VS. ADULT PATHOPHYSIOLOGY

- One third to one half of patients with popliteal cysts are children [5].
- In children, popliteal cysts infrequently communicate with the joint [5].
- Intraarticular pathologic findings are rare in children with popliteal cysts [5].
- Popliteal cysts in children typically are not associated with intra-articular pathology [4].
- Popliteal cysts in children may not always communicate with the joint [4].
- The fluid in pediatric popliteal cysts may involve the semimembranosus-gastrocnemius or subgastrocnemius bursa [4].
- Pediatric popliteal cysts usually resolve spontaneously without treatment [4].
- In adults, intraarticular pathologic findings are common with popliteal cysts [5].
- Patients with adult popliteal cysts typically have symptoms of intra-articular pathology such as degenerative joint disease or meniscal tear [4].

COMPLICATIONS AND DISSECTION

- Rarely, a popliteal cyst can dissect down into the calf in an intramuscular path [5].
- Intramuscular dissection of Baker's cysts has been reported involving the medial head of the gastrocnemius [3].
- It was hypothesized that intramuscular dissection took the path of least resistance through a weakness in the medial gastrocnemius fascia [5].
- Giant synovial cysts of the calf often are associated with rheumatoid arthritis [5].
- Giant synovial cysts of the calf arise from and communicate with the knee in the popliteal area [5].
- Development of acute compartment syndrome as a result of a ruptured Baker cyst has been reported [5].
- Spontaneous venous bleeding has been reported as a complication of a ruptured Baker cyst [5].
- Patients on strong anticoagulants may bleed into popliteal cysts, leading to dissection into the calf [5].
- Popliteal vein thrombosis can occur concurrently with a dissecting popliteal cyst [5].
- Venous thrombosis should be excluded as part of the evaluation of suspected pseudothrombophlebitis caused by a dissecting or ruptured popliteal cyst [5].

ASSOCIATED KNEE ANATOMY

- The medial femoral condyle is larger and projects farther posteriorly and distally than the lateral condyle [6].
- The adductor tubercle is proximal and posterior to the medial epicondyle [6].

CQ HAND + UPPER LIMB

- The gastrocnemius tubercle is slightly distal and posterior to the adductor tubercle [6].
- The posteromedial corner of the knee has five major components: the posterior oblique ligament (POL), the semimembranosus tendon and its expansions, the OPL, the posteromedial joint capsule, and the posterior horn of the medial meniscus [15].
- The posterior oblique ligament (POL) is attached proximally to the adductor tubercle of the femur and distally to the tibia and posterior aspect of the capsule [15].
- The semimembranosus tendon has five expansions: the direct arm, the anterior or deep arm, the arm to the POL or capsular arm, the arm to the OPL, and the expansion to the popliteus aponeurosis or the inferior arm [15].
- The oblique popliteal ligament (OPL) is a broad fascial band originating from the capsular arm of the POL and the lateral expansion of the semimembranosus [15].
- The OPL crosses the posterior aspect of the knee and attaches laterally to the meniscomfemoral portion of the posterior capsule and to the fabella [15].
- The medial meniscus is firmly attached to the joint capsule along its entire peripheral edge [1].
- The lateral meniscus is attached to the anterior and posterior capsule, but there is a region posterolaterally where it is not firmly attached [1].
- The popliteal artery travels through the adductor hiatus, where it is relatively immobile, and distally through the fibrous arch deep to the soleus muscle [26].
- The tibial nerve courses distally through the center of the popliteus fossa [26].

Clinical Presentation

- Numerous bursae are located in the popliteal space between the hamstring tendons and the collateral ligaments or condyles of the tibia [5].
- A bursa is located deep to each head of the gastrocnemius muscle [5].
- Symptoms develop most often in the bursa beneath the medial head of the gastrocnemius [5].
- Symptoms develop most often in the semimembranosus bursa [5].
- The semimembranosus bursa is a double bursa located between the semimembranosus tendon and the medial tibial condyle [5].
- The semimembranosus bursa is also located between the semimembranosus tendon and the medial head of the gastrocnemius [5].
- A popliteal cyst can be produced by the escape of fluid through the normal communication of a bursa with the knee [5].
- A popliteal cyst must be distinguished from a lipoma, xanthoma, vascular tumor, fibrosarcoma, and other tumors [5].
- A popliteal cyst may occasionally be confused with an aneurysm [5].
- A pyogenic abscess may sometimes be located in the popliteal space [5].

- The diagnosis of a popliteal cyst can usually be made by transilluminating the cyst [5].
- Arthrography, MRI, and ultrasound can be helpful in establishing the diagnosis of a popliteal cyst [5].
- MRI is the preferred diagnostic modality because it can also show intraarticular pathology [5].
- In children, a popliteal cyst infrequently communicates with the joint [5].
- A popliteal cyst can rarely dissect down into the calf in an intramuscular path [5].
- Dissection of a popliteal cyst into the medial head of the gastrocnemius has been reported [5].
- Giant synovial cysts of the calf are often associated with rheumatoid arthritis [5].
- Acute compartment syndrome has been reported as a result of a ruptured Baker cyst [5].
- Spontaneous venous bleeding has been reported as a result of a ruptured Baker cyst [5].
- Patients on strong anticoagulants have been observed to bleed into popliteal cysts, leading to dissection into the calf [5].

Investigations

PLAIN RADIOGRAPHY

- Plain radiographs are appropriate initial imaging studies for most knee conditions because they allow the assessment of traumatic injury, arthritis, patellofemoral alignment, osteochondral injury, bone neoplasm, and surgical implants [24].
- Radiographic studies help confirm the clinical diagnosis of a joint disorder determined using the patient's history and physical examination [24].
- Imaging studies should include at least two perpendicular views: AP and lateral [24].
- Weight-bearing AP (extension) views are used to assess cartilage loss from the distal femur and tibial plateau [24].
- Weight-bearing PA (Rosenberg; flexion) views are used to assess cartilage loss from the posterior femur and tibial plateau [24].
- Patellofemoral views are used to assess patellofemoral alignment (tilt/subluxation), patellar and trochlear morphology, osteochondral injury, and patellofemoral arthritis [24].
- A notch view is used to assess posterior femoral cartilage, notch width, and osteophytes [24].
- Radiographs can underestimate isolated chondral lesions but may demonstrate joint space narrowing, osteophytes, sclerosis, and cysts [28].
- Weight-bearing AP and lateral views and an axial view of the patellofemoral joint should be reviewed for articular cartilage evaluation [28].
- The ability to detect subtle narrowing or an isolated chondral defect on the flexion surface may be improved with a semiflexed PA view [28].
- Long leg alignment views are used to determine the mechanical axis [28].

- If the mechanical axis traverses the involved compartment (varus knees with medial compartment lesions or valgus knees with lateral compartment lesions), realignment may need to be considered as an initial procedure or as an adjunct to a cartilage restorative procedure [28].
- Radiographs should be inspected for acute fracture, lateral capsular avulsion (Segond fracture), loose bodies, Pellegrini-Stieda lesion (MCL calcification), and evidence of patellar dislocation in patients with suspected significant knee injury [12].
- Stress radiographs should be obtained in patients prior to skeletal maturity to rule out an epiphyseal fracture [12].
- Radiographs may identify subchondral sclerosis, joint space narrowing, subchondral cysts (variable), osteophytes (variable), and joint subluxation in osteoarthritis [24].
- Radiographs may identify joint space loss and peripheral bone erosion in inflammatory arthropathy [24].
- Radiographs may identify subchondral radiolucency, most common in the medial femoral condyle, in osteochondral defects [24].
- Radiographs may identify linear radiolucency or radiodensity, most common in the proximal medial tibia, in stress fractures [24].
- Radiographs may identify a mixed sclerotic pattern with a subchondral, epiphyseal, or metaphyseal location in osteonecrosis [24].
- Radiographs may identify malalignment, osteophytes, cysts, and joint space loss in patellofemoral disease [24].
- Radiographs should be inspected for acute fractures, lateral capsular avulsion (Segond fracture), loose bodies, fibular head avulsions, and evidence of patellar dislocation in patients with suspected LCL injury [33].
- With chronic posterolateral instability, degenerative changes of the lateral compartment are often noted on radiographs, including lateral joint space narrowing with osteophytes and subchondral sclerosis [33].
- Stress radiographs can help to better quantify the amount of varus angulation present in LCL injuries [33].

COMPUTED TOMOGRAPHY

- Computed tomography is a three-dimensional study performed with ionizing radiation that provides enhanced bone detail [24].
- Imaging in the axial, sagittal, and coronal planes may help visualize fracture lines and displacement, osteolytic lesions around joint arthroplasty, and cortical disruption in cases of infection or neoplasia [24].
- Three-dimensional reconstructions may help with preoperative planning for complex intra-articular fractures, multiplanar osteotomy for limb malalignment, and reconstitution of bone loss in joint arthroplasty [24].
- Axial plane imaging of the hip and knee can help assess the rotational alignment of components of a total knee arthroplasty in cases of patellar maltracking [24].
- Three-dimensional CT with remodeling is used for preoperative planning for reconstruction associated with dysplasia, post-trauma planning, and complex total knee arthroplasty (TKA) planning [32].

MAGNETIC RESONANCE IMAGING

- Increasing strength of the magnetic field (measured in Tesla units) increases the resolution of images [24].
- An injected contrast agent (intravenous or intra-articular) may help delineate specific tissues of interest in MRI [24].
- MRI may identify the degree of articular cartilage injury (chondrosis, full-thickness cartilage loss), the presence of associated bone marrow edema, and the location (medial condyle, lateral condyle, trochlea, patella; anterior, posterior) [24].
- MRI can be used to evaluate articular cartilage morphology [28].
- MRI is useful for confirming MCL injury and identifying the site of injury [12].
- MRI is useful to detect the presence of meniscal and other injuries to the knee in MCL injuries [12].
- Relative indications for an MRI in MCL injuries include an uncertain ACL status despite multiple examinations, evaluation of a suspected meniscal tear, or preoperative evaluation for a planned MCL reconstruction or repair [12].
- MRI is often a useful adjunct for diagnosing posterolateral corner and LCL injuries in the severely injured knee [33].
- MRI findings can refocus the examination to the posterolateral structures when posterolateral injury can often go unnoticed during an initial evaluation [33].
- MRI should be obtained as a useful adjunct to help diagnose posterolateral corner injuries in LCL injuries [33].
- The presence of edema, intra-articular fluid, disruption of ligament fibers, and an atypical ligament contour may suggest cruciate ligament injury on MRI [24].
- Patterns of meniscal injury can be identified by location (anterior, midbody, posterior, peripheral, articular), pattern (horizontal, longitudinal, radial, complex), and displacement on MRI [24].
- Edema, avulsion, or discontinuity may be identified for the MCL/lateral collateral ligament (LCL) or associated posteromedial and posterolateral ligamentous complexes on MRI [24].
- MRI may be used to assess the continuity of the quadriceps or patellar tendon [24].
- MRI may be used to assess the margin of resection for a neoplasm, identify vascular malformation, or define the location of nerves or vessels relative to popliteal cysts [24].
- MRI is grossly overused in the arthritic patient population [32].
- If the joint space is significantly narrowed on radiograph, then MRI is not indicated [32].
- MRI is used when osteonecrosis is suspected in the arthritic patient population [32].

NUCLEAR MEDICINE

- Nuclear medicine involves labeled radionuclide injection followed by delayed imaging of gamma radiation [24].
- Areas of increased radionuclide concentration appear bright or “hot” on nuclear medicine imaging [24].

- Nuclear medicine provides a nonspecific study that does not define the etiology of an abnormality but rather the presence of an abnormality that may correlate with a clinical concern [24].
- Increased radionuclide activity in bone may be a normal postoperative finding for up to 6 to 12 months after a fracture repair or arthroplasty [24].
- Technetium-99 (Tc-99) is a radionuclide that may help identify infection, neoplasia, occult fracture, bone healing, active phases of heterotopic ossification, implant loosening, or failure of osseointegration [24].
- Gallium-67 (Ga-67) is a radionuclide that may help differentiate between aseptic and septic prosthetic loosening; 24 to 72 hours are needed for a complete study [24].

PHYSICAL EXAMINATION

- The physical examination begins with observation of the patient's gait [1].
- The uninjured knee is examined as a basis of comparison with the injured knee [1].
- Any swelling or effusion should be noted during physical examination [1].
- A small effusion will cause obliteration of the recesses on the medial and lateral aspects of the patellar tendon [1].
- With a larger effusion, diffuse swelling is present in the region of the suprapatellar pouch [1].
- A fluid wave can be palpated on the sides of the patella with a larger effusion [1].
- Active and then passive range of motion is tested carefully during physical examination [1].
- The knee is palpated to define areas of localized tenderness [1].
- The joint lines are located at the level of the inferior pole of the patella when the knee is flexed to 90 degrees [1].
- Patients commonly present with a history of a precipitating traumatic event or previous surgery for articular cartilage injuries [28].
- An effusion, motion deficits, or limb malalignment may be observed in articular cartilage injuries [28].
- Knee stability should be compared with the normal side in articular cartilage injuries [28].
- Medial joint line tenderness along the course of the MCL is typical at the location of the tear [12].
- Laxity to valgus stresses is assessed by the amount of medial joint space opening that occurs at 30 degrees of flexion [12].
- It is important to stress the knee at 30 degrees of flexion because with the knee in full extension the posterior capsule and PCL will stabilize the knee to valgus stress [12].
- Zero opening is considered normal, with 1-4 mm indicating a grade I injury, 5-9 mm indicating a grade II injury, and 10-15 mm indicating a complete or grade III injury for MCL injuries [12].
- Grade I and II MCL injuries typically have a firm end point, whereas a grade III injury tends to have a soft end point to valgus stress [12].
- The integrity of the LCL is assessed by placing a varus stress, with the knee in full extension and 30 degrees of flexion [33].
- Baseline varus opening is widely variable and should be compared to the contralateral leg [33].

- The average baseline for varus opening is 7 degrees [33].
- Exam findings with an isolated LCL injury should include varus laxity at 30 degrees of flexion and no instability in full extension [33].
- The most useful test to evaluate for posterolateral instability is the dial test [33].
- The dial test is performed at 30 and 90 degrees of flexion with a significant difference being an angle 5 degrees or greater than the contralateral leg [33].
- Injury to the posterolateral capsule alone is confirmed with greater external rotation at 30 degrees, an isolated PCL at 90 degrees, and to both structures when there is greater rotation at 30 and 90 degrees compared to the uninjured leg [33].
- A careful neurovascular examination should be performed as the incidence of neurovascular injury, particularly peroneal nerve injury, has been reported in 12–29% of posterolateral knee injuries [33].
- An examination under anesthesia can be valuable when physical examination is unreliable because of the patient guarding the knee [12].
- Diagnostic arthroscopy can also be used to evaluate for coexisting pathology [12].
- Both examination under anesthesia and diagnostic arthroscopy have largely been replaced by MRI [12].
- The reverse pivot shift test involves starting with the knee flexed to 90 degrees, extending the knee while loading it axially with a valgus stress applied and the foot held in external rotation, and noting a palpable shift as the tibia reduces from its posteriorly subluxed position [33].
- The external rotation recurvatum test is performed with the patient supine and the hip and knee fully extended, lifting the leg off the bed by the toes, and observing hyperextension, varus instability, and external rotation of the tibial tubercle with adequate quadriceps relaxation in a patient with posterolateral instability [33].
- The posterolateral drawer test is performed with the tibia in internal rotation, neutral, and externally rotated positions, with the magnitude of posterior drawer displacement being greatest with external tibial rotation in posterolateral injury [33].

Treatment

NON-OPERATIVE

- The primary treatment of popliteal cysts requires management of the underlying intra-articular pathology [4].
- Following appropriate management of the underlying pathology, popliteal cysts may resolve without excision [4].
- Popliteal cysts in children usually resolve spontaneously without treatment [4].

OPERATIVE

- For larger cysts that are causing symptoms in the popliteal fossa, excision through a posterior or posteromedial approach may be performed [4].
- Arthroscopic treatment of popliteal cyst and associated intraarticular knee disorders in adults has been described [3].
- Arthroscopic treatment of popliteal cyst and visualization of its cavity through the posterior portal of the knee has been described [3].
- Popliteal cystoscopic excisional débridement and removal of capsular fold of valvular mechanism of large recurrent popliteal cyst has been described [3].
- A surgical approach for popliteal cyst has been described [3].

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