Cystic and Cyst-Like Lesions of the Knee

12

12.1 Intra-articular Ganglion

- The lesion has a well-defined border, and its wall is lined by spindle shaped cells.
- Contains clear fluid similar to synovial fluid or mucoid material.
- Commonly has multiple cystic chambers due to the presence of septa.
- May cause pain and disorder of knee flexion and extension.
- Commonly seen in the intercondylar space as an ACL ganglion (Fig. 12.1) or a PCL ganglion (Figs. 12.2 and 12.3).

References

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Ganglia and Bursae

A ganglion is a benign, unilocular, or multilocular cystic mass containing clear and highly viscous fluid within a dense fibrous connective tissue wall without a synovial lining. It does not communicate with the joint capsule. The pathogenesis of ganglia remains controversial. Proposed theories include mucoid cystic degeneration in a collagenous structure near areas under continuous stress and herniation of synovial tissue.

A bursa is lined by synovium and contains synovial fluid, usually representing normal physiologic fluid accumulation. Numerous bursae are present around the knee and have names according their anatomical location.

Ganglia and fluid-filled bursae are commonly seen around the joint and tendon sheath. They are often incidentally found on MRI in asymptomatic persons,

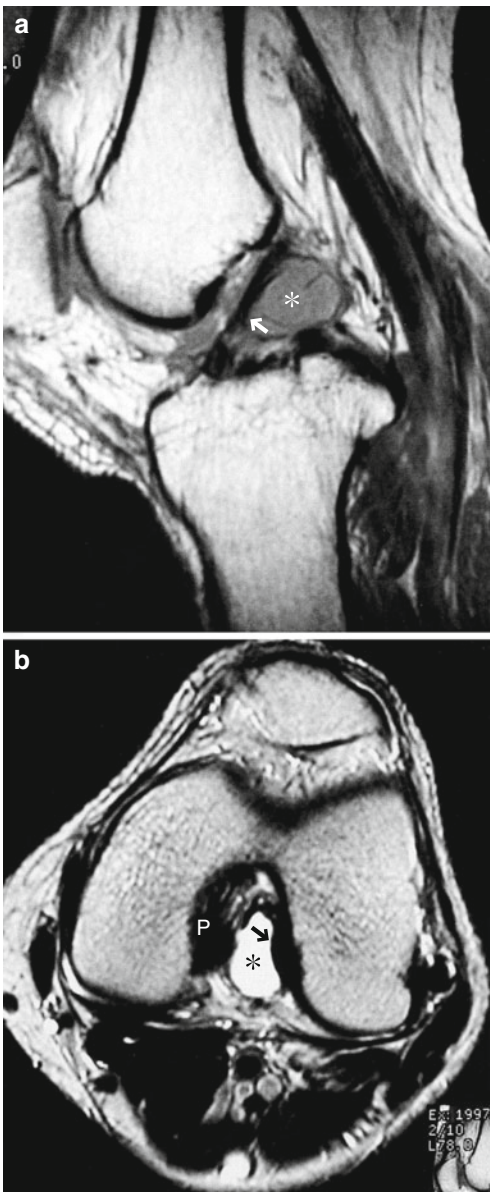

Fig. 12.1 **ACL ganglion**. A man in his 30s. (**a**) PDWI and (**b**) axial T2WI. There is an ACL ganglion (*) which is septated and compresses the ACL from below (*arrow*). *P* PCL

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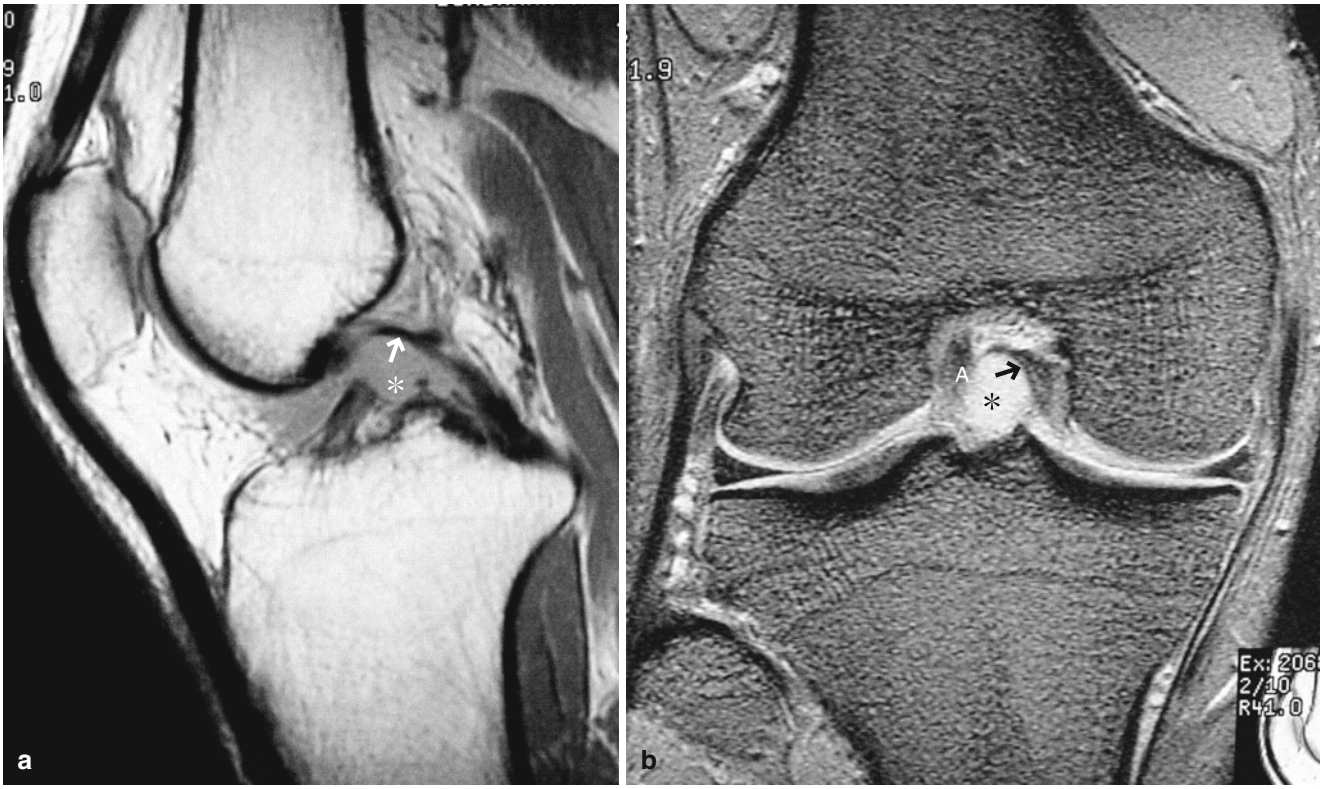

Fig. 12.2 PCL ganglion. A man in his 40s. (**a**) PDWI and (**b**) coronal T2*WI. There is a PCL ganglion (*). PCL shows an arc-like shape due to compression by the PCL ganglion (*arrow*). *A* ACL

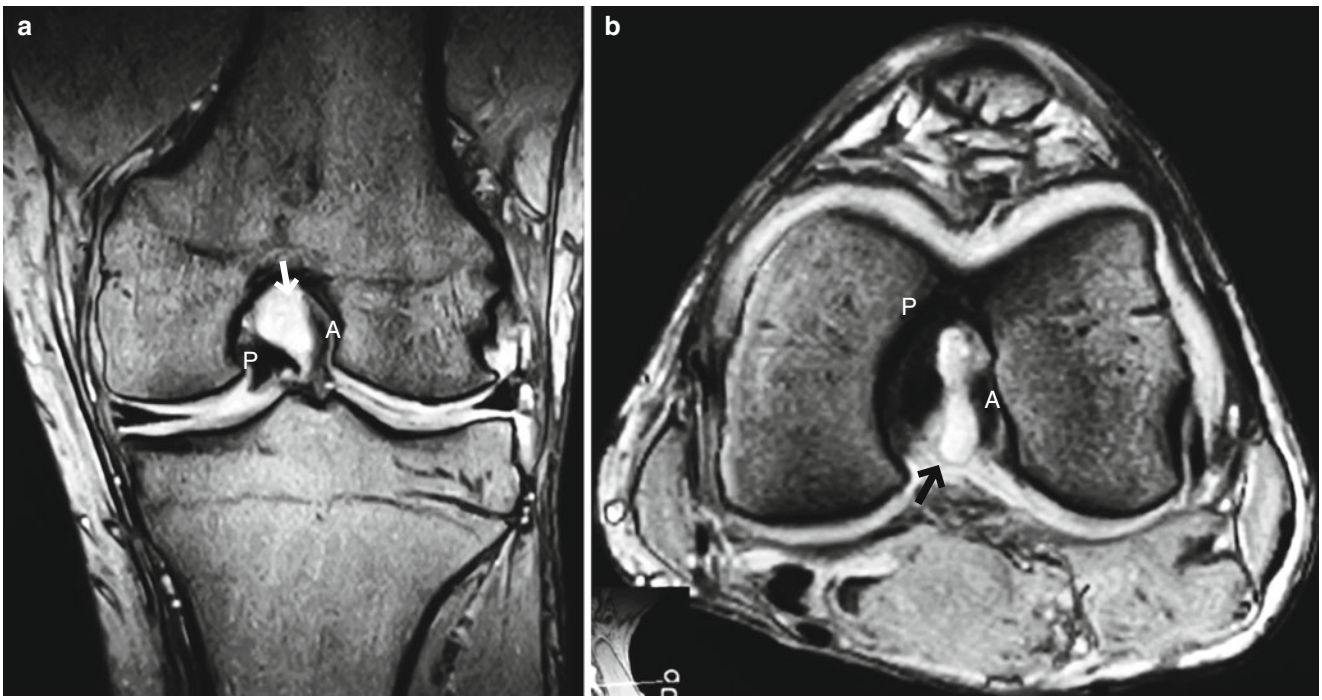

Fig. 12.3 ACL and PCL ganglion. A man in his 40s. (**a**) Coronal T2*WI, (**b**) axial T2*WI, and (**c**) arthroscopic image. There is a cystic lesion (*arrow*) sandwiched between ACL (*A*) and PCL (*P*), both of which are compressed by this lesion. Arthroscopic puncture of the cystic lesions revealed it was filled with yellow jellylike material

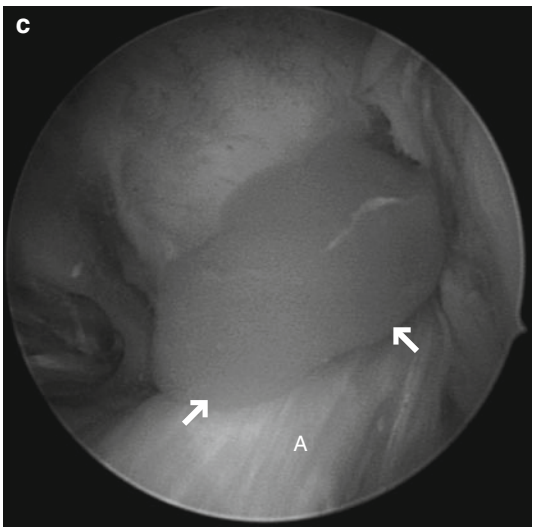

Fig. 12.3 (continued)

but can cause pain and swelling. Ganglia tend to be multilocular, but differentiating between these two entities may be difficult at times on the basis of MRI alone.

12.2 Meniscal Cyst

- It is a focal collection of synovial fluid located within or adjacent to the meniscus.
- Parameniscal cysts are thought to form when there is fluid extravasation through a meniscal tear into the parameniscal soft tissue.
- Large meniscal cysts may protrude laterally and may become palpable at the level of knee joint space as a subcutaneous mass (especially on the lateral side of the knee). Meniscal cysts may cause pain, tenderness, and swelling. Medial meniscal cysts are more likely to be painless.
- Prevalence of the lateral meniscal cysts is 3–4 times higher than that of the medial meniscal cysts (Fig. 12.4). Meniscal cysts are particularly common around the anterior horn.
- Medical meniscal cysts tend to enlarge into the posterior direction (Fig. 12.5).
- Because the bond between the superficial layer of the MCL and the joint capsule is strong, it is rare for a cystic lesion to form at this location (see Fig. 5.3). However, in the event that fluid accumulates here, it may cause symptoms.
- Meniscal cysts can be treated by surgical excision, but to prevent recurrence, meniscectomy may be necessary if the meniscal tear is present (Fig. 12.6).

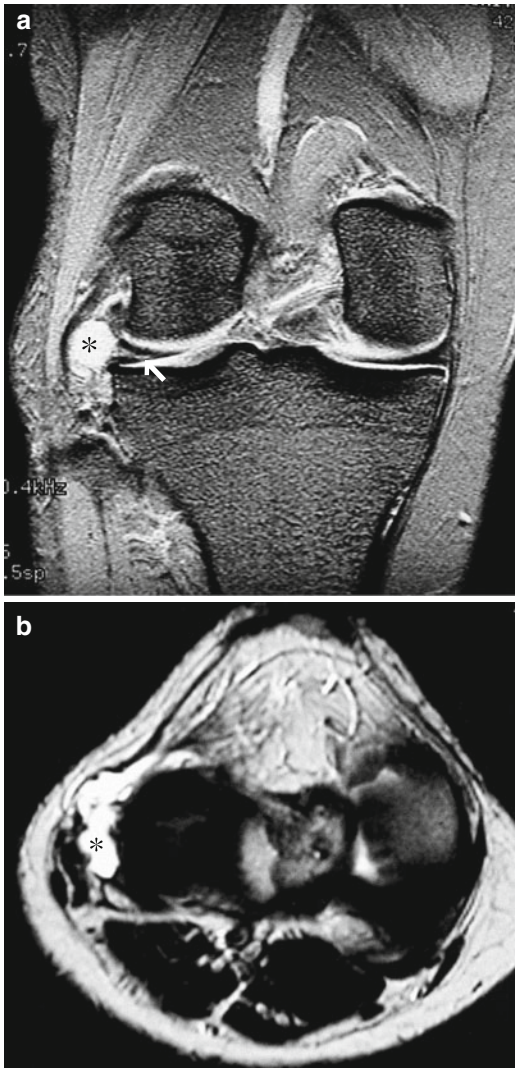

Fig. 12.4 Lateral meniscal cyst. A woman in her 40s. (**a**) Coronal T2*WI and (**b**) axial T2WI. There is a degenerative horizontal tear of the middle segment of the lateral meniscus (*arrow*) and a cystic lesion that is continuous with the tear (*)

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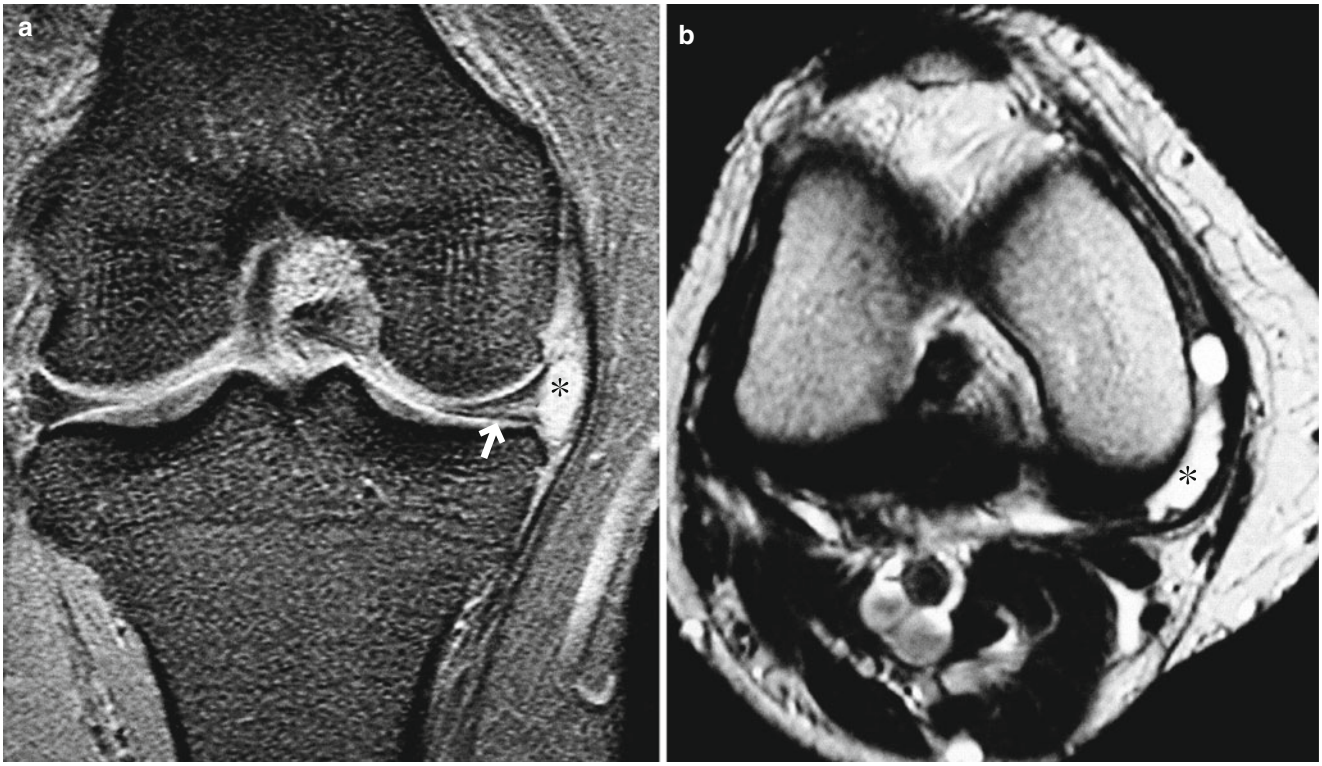

Fig. 12.5 Medial meniscal cyst. A woman in her 50s. (**a**) Coronal T2*WI and (**b**) axial T2WI. There is a degenerative horizontal tear of the medial meniscus (*arrow*) and a cystic lesion that is continuous with the tear and extends posteriorly (*)

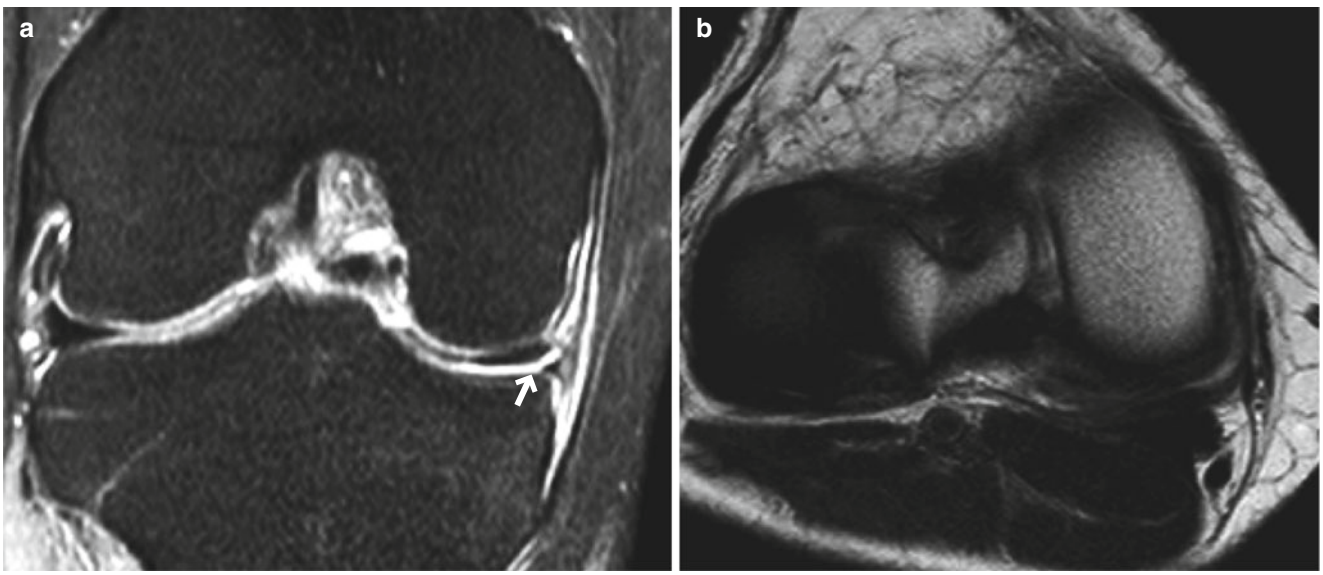

Fig. 12.6 Medial meniscal cyst that occurred 2 years after meniscal tear. A woman in her 40s. (**a**) Coronal T2*WI and (**b**) axial T2WI at the time of meniscal tear. (**c**, **d**) Respective sequences taken 2 years later. A medial meniscal tear is noted (*arrow*, **a**), but no cysts are seen. Two years later, there is a cystic lesion connected to the medial meniscal tear (*arrows*, **c**, **d**). This lesion was palpable

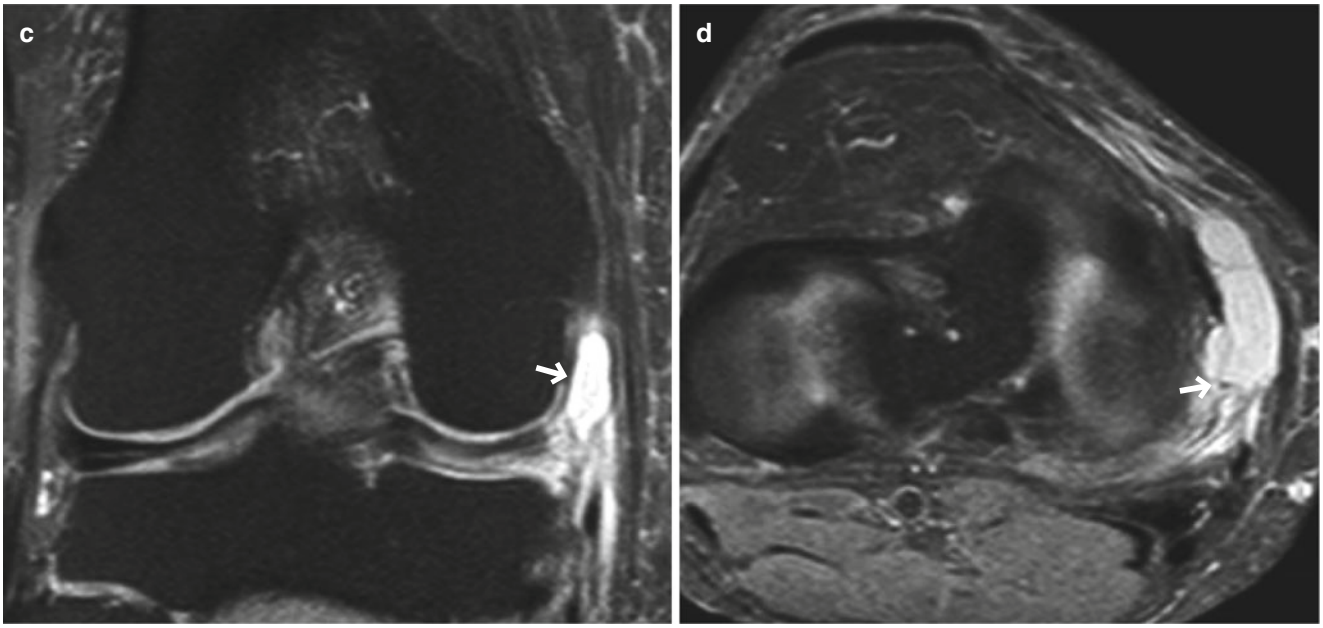

Fig. 12.6 (continued)

12.3 Popliteal Cyst (Baker's Cyst)

- Popliteal cysts are not true cysts and represent fluid accumulation in the semimembranosus-medial gastrocnemius bursa (Figs. 12.7 and 12.8).
- It commonly communicates with the joint capsule.
- Most commonly seen cystic lesion in the whole body and the knee (about 40%).
- On T2-weighted MRI, it shows homogeneous hyperintensity, but rarely it may appear heterogeneous if it contains hemorrhagic components or debris.
- Increased intra-articular pressure due to joint effusion or other factors (e.g., meniscal tear, ACL tear, inflammatory arthritis) causes the extravasation of joint fluid through the posteromedial joint capsule posteriorly into the bursa, leading to gradual formation of an enlarging popliteal cyst.
- It has a teardrop shape between the medial head of gastrocnemius and the semimembranosus tendon.
- Rarely seen in children and becomes more common as the age increases.
- Commonly painless if the size is less than 30 mm.
- Rarely it can rupture (Fig. 12.9), causing extravasation of fluid into muscle interstitium and symptoms that are similar to those of thrombophlebitis.

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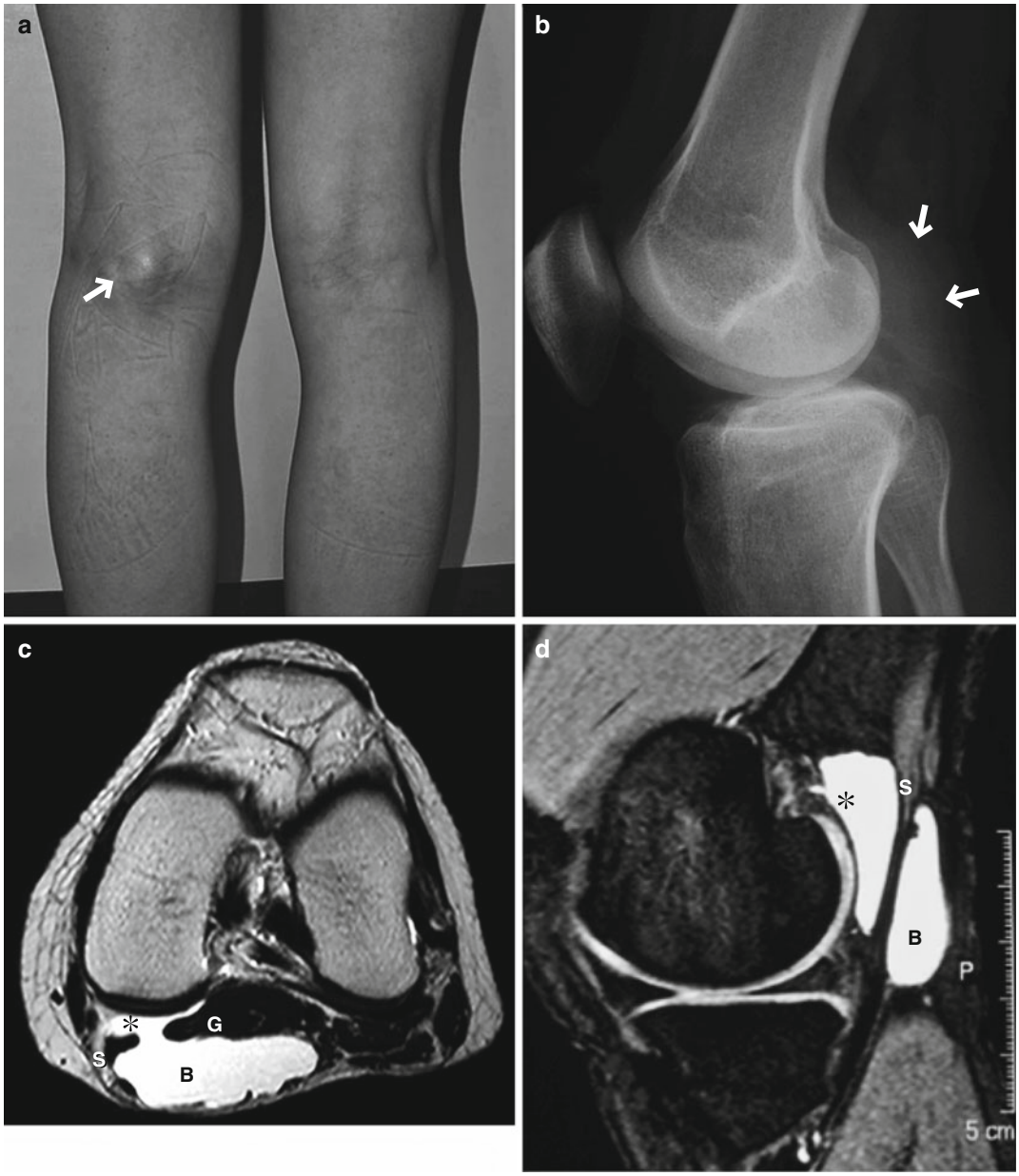

Fig. 12.7 **Popliteal cyst**. A man in her 20s. (**a**) Posterior view of the knee, (**b**) lateral radiograph, (**c**) axial T2WI, and (**d**) FS T2*WI. A swelling in the popliteal fossa (*arrow*, **a**) is noted. On radiograph, there is a soft tissue density in the corresponding location of the posterior knee (*arrows*, **b**). MRI shows the subgastrocnemius bursa (*) extending posteriorly between the medial head of gastrocnemius (*G*) and semimembranosus tendon (*S*) into the Baker's cyst (*B*). The subgastrocnemius bursa and the Baker's cyst are connected by a communication, and thus the entire lesion is generally considered to be a popliteal cyst, or simply "the Baker's cyst". (also see Sect. 12.4)

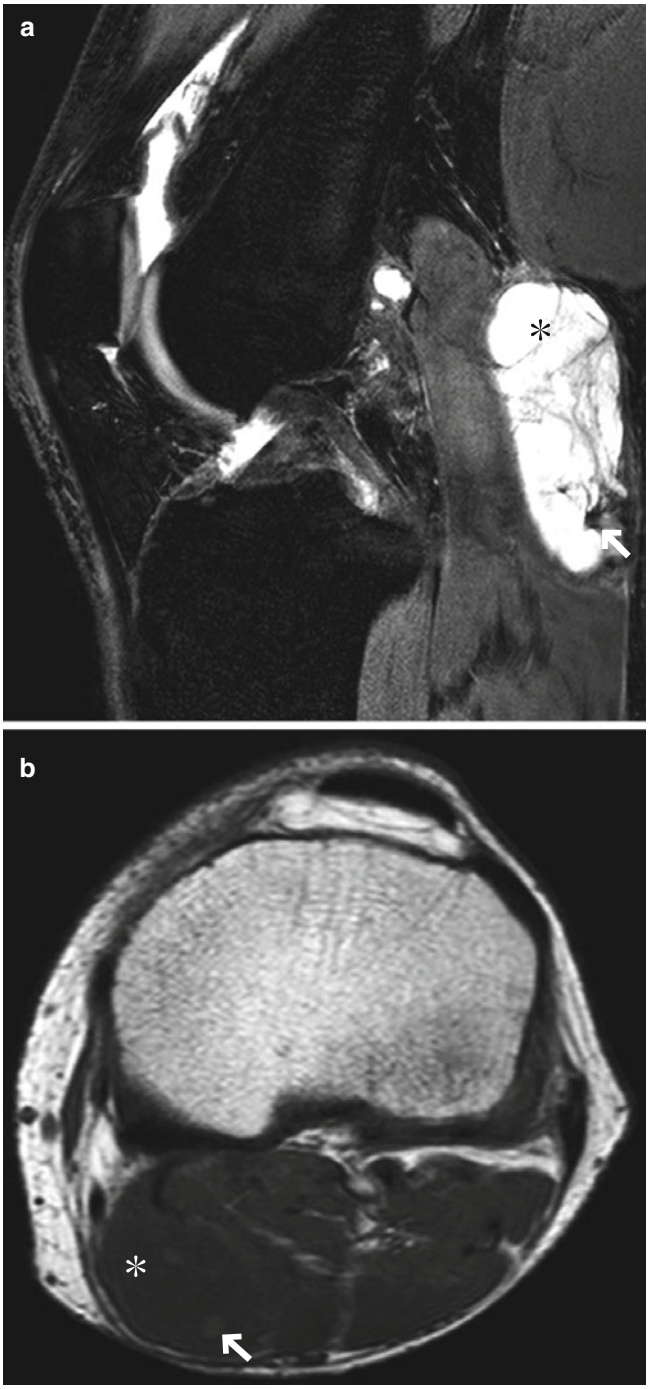

Fig. 12.8 Popliteal cyst showing heterogeneous MR signal intensity. A man in his thirties. (**a**) FS T2*WI and (**b**) axial T1WI. Popliteal cyst (*) shows heterogeneous signal intensity due to the presence of septum-like structures and small amount of bleeding (*arrow*)

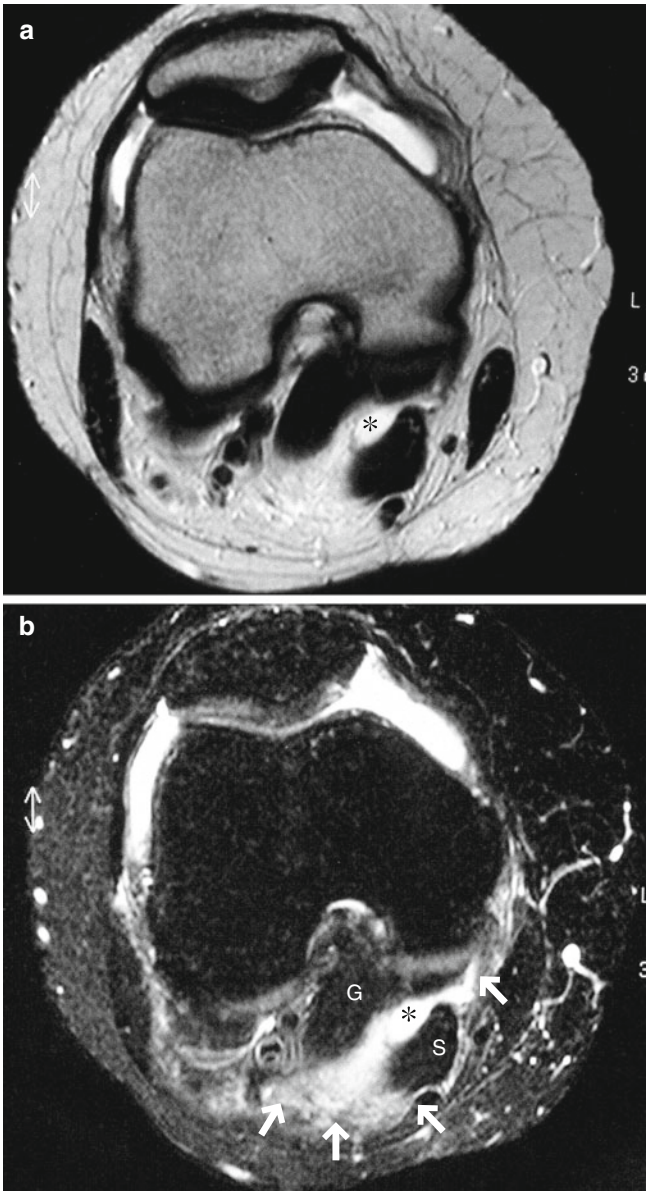

Fig. 12.9 Ruptured popliteal cyst. A woman in her 40s. (**a**) Axial T2WI and (**b**) axial FS T2*WI. The popliteal cyst (*) has ruptured and extensive edema is seen in the surrounding interstitium (*arrows*). *G* medial head of gastrocnemius, *S* semimembranosus tendon

12.4 Posterior Capsular Area of the Knee

- Posterior capsular area of the knee can be separated into medial, middle, and lateral compartments. In this section, mainly the medial posterior capsule is described in relation to the popliteal cyst.
- Medial posterior capsule extends above and below the posterior root/segment of the medial meniscus (Fig. 12.10). It extends superiorly by more than several centimeters.
- Medial posterior capsule runs below the tendon sheath of the medial head of gastrocnemius (this space is called subgastrocnemius bursa), fuses with the tendon sheath, and eventually attaches to the cortical bone of the medial femoral condyle.
- Semimembranosus tendon runs immediately posterior to these structures, which can be confirmed on axial MRI.
- Accumulation of fluid will make it easier to visualize these structures on MRI.
- Injury of medial posterior capsule commonly leads to its separation from the gastrocnemius (Fig. 12.11).
- Joint capsule and subgastrocnemius bursa communicate through a small opening at the site where the medial posterior capsule and gastrocnemius fuse together, even in

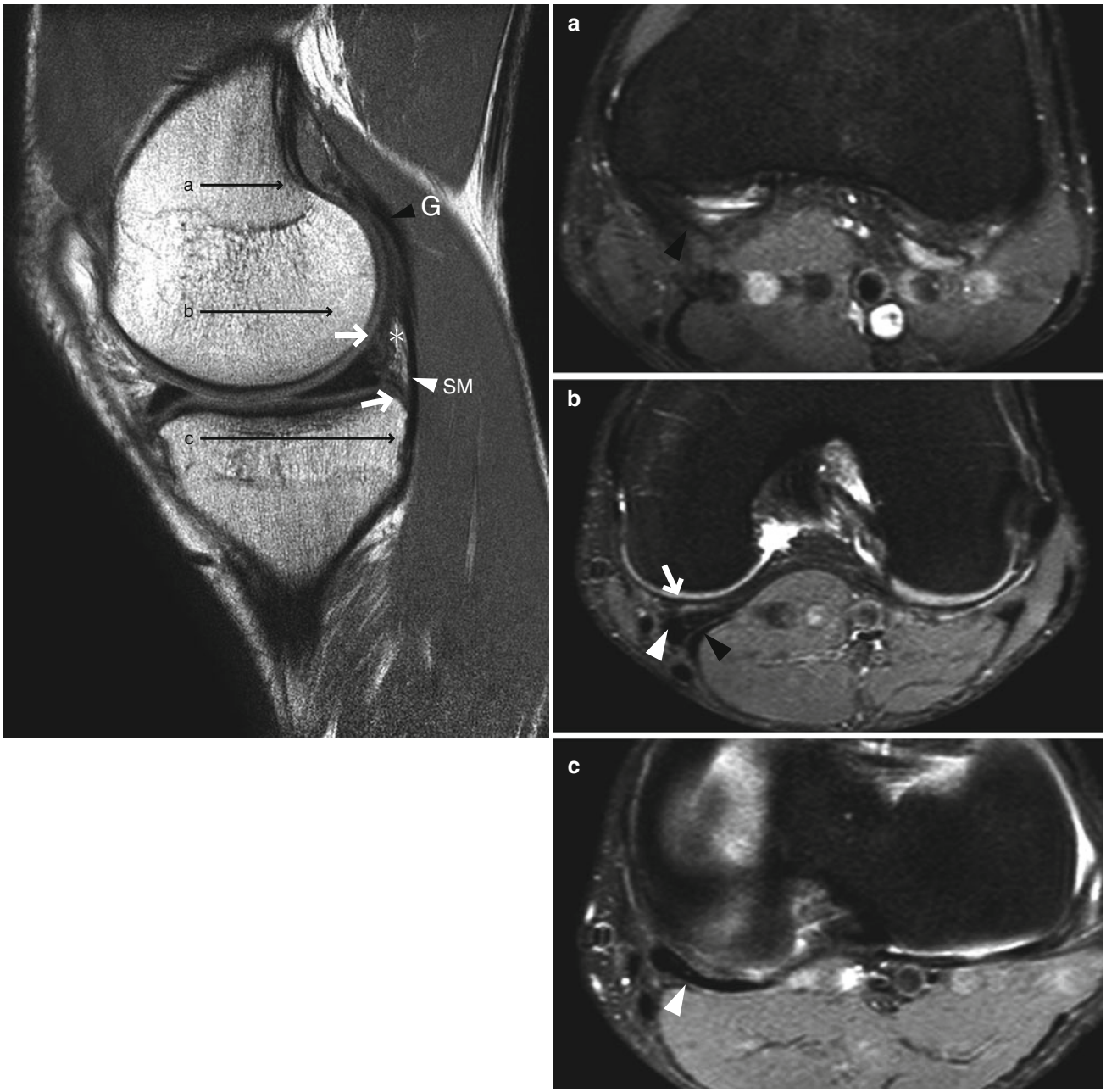

Fig. 12.10 Normal anatomy of the medial posterior capsule. Sagittal image (*left*) and axial images through the horizontal levels annotated in the sagittal image (**a–c**). Please refer to the texts for detailed explanation of the anatomy. Medial posterior capsule: arrow, medial head of gastrocnemius (*G*): *black arrowhead*, semimembranosus tendon (*SM*): *white arrowhead*, subgastrocnemius bursa: *

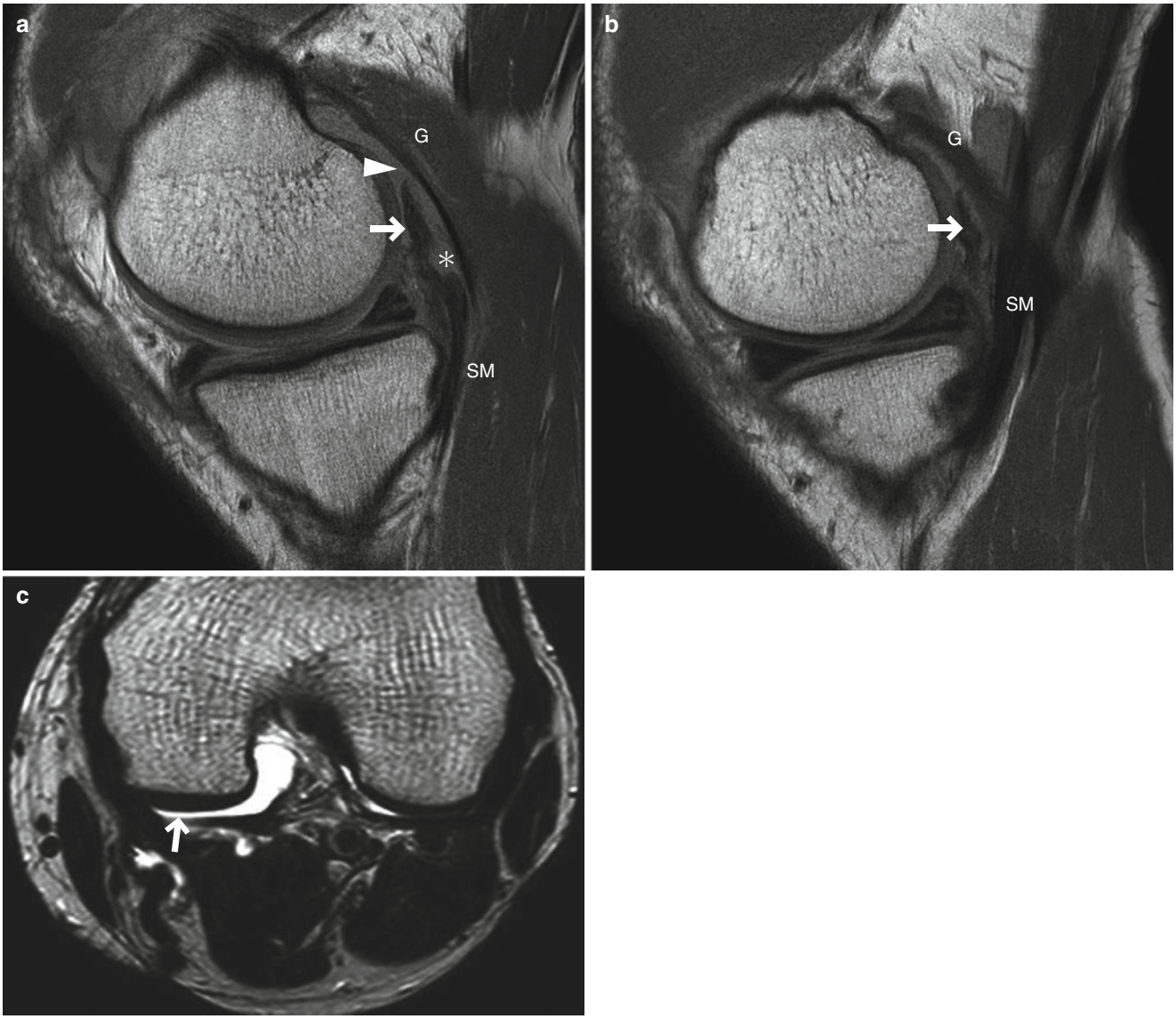

Fig. 12.11 Injury to medial posterior capsule. A man in his 50s with PCL tear. (**a**, **b**) PDWI and (**c**) axial T2WI. There is an injury to the medial posterior capsule (*arrow*), showing abnormal hyperintensity, kinky appearance of fibers, and separation of the fusion site with the gastrocnemius (*arrowheads*, **a**). There is also fluid accumulation within the subgastrocnemius bursa (*). *G* medial head of gastrocnemius, *SM* semimembranosus tendon

a normal state. Because subgastrocnemius bursa communicates with the popliteal cyst through an opening between the medial head of gastrocnemius and the semimembranosus tendon (Fig. 12.7c), consequently the joint capsule itself communicates with the popliteal cyst.

- Popliteal cyst becomes enlarged if there is pathologic accumulation of fluid.
- If there are loose bodies or hemorrhagic component in the joint capsule, they may move into the popliteal cyst through the communication (Fig. 12.12).
- Posterior capsule has a gap at the middle portion, and lymphatic vessels and nerves enter from the popliteal fossa into the intra-articular space through this opening (Fig. 12.13).

Reference

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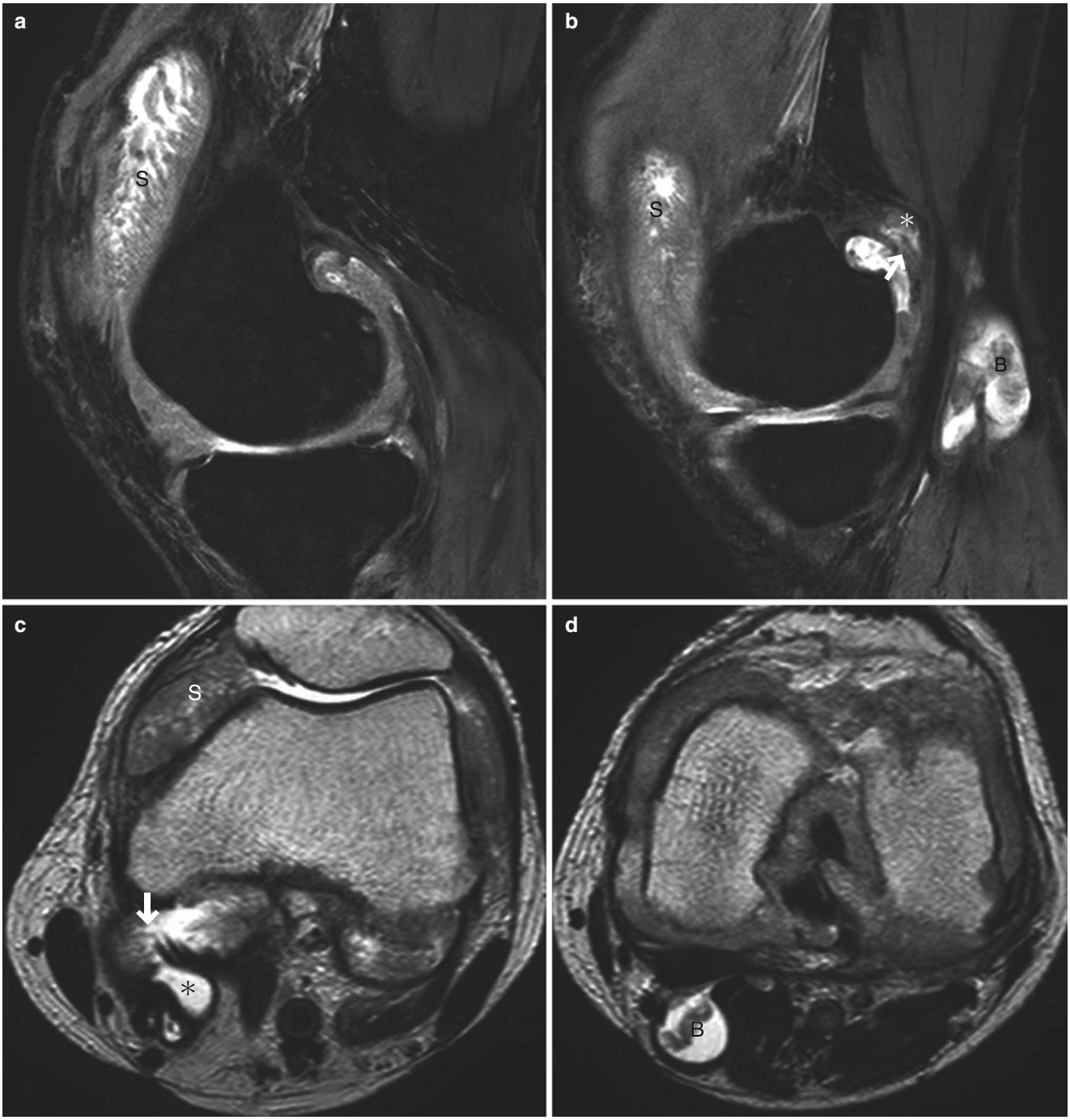

Fig. 12.12 **Synovial osteochondromatosis and the popliteal cyst**. A man in his 60s. (**a**, **b**) FS T2*WI and (**c**, **d**) axial T2WI. The patient has synovial osteochondromatosis, which is mainly seen in the suprapatellar bursa (S). Proliferated synovium and chondromas are also seen in the suprapatellar bursa (**S**). and the popliteal cyst (**b**) (In this study alone, it is impossible to tell if these lesions arose within these locations from the beginning or they moved from other locations.) Knee joint space communicates with the subgastrocnemius bursa through the opening (*arrow*) between the joint capsule and the gastrocnemius (*arrow*)

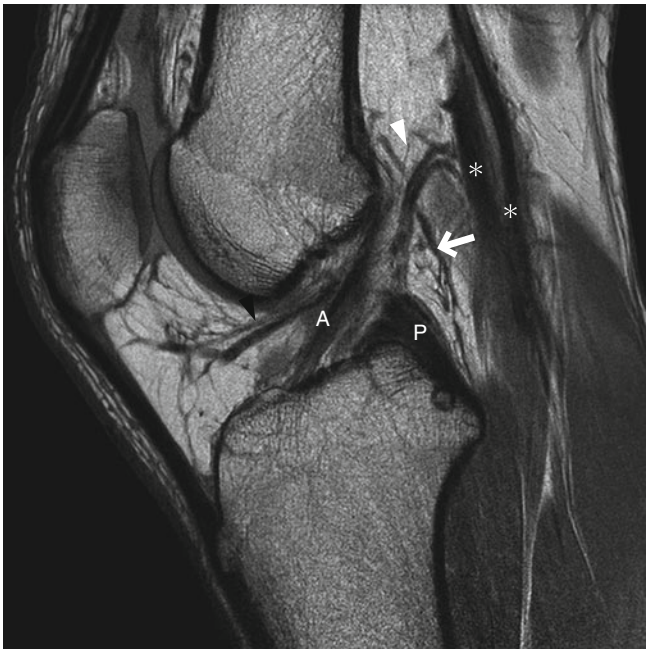

Fig. 12.13 Entry of the vessels through the gap at the middle portion of the posterior capsule. Vessels from the popliteal artery/vein (*white arrowhead*) enter into the intra-articular space piercing through the gap of the posterior capsule. A hypointense linear structure running in front of ACL is a blood vessel (*black arrowhead*), not an infrapatellar plica (see Sect. 11.8.3)

12.5 Bursa and Bursitis

- Naming of bursae is variable, and details can be found in anatomical textbooks. In this book, we will focus on major bursae that are relevant to our clinical practice (Fig. 12.14). If the bursae are subjected to repetitive mechanical stress, infection, or bleeding, the amount of fluid inside them increases, causing swelling and pain (bursitis).

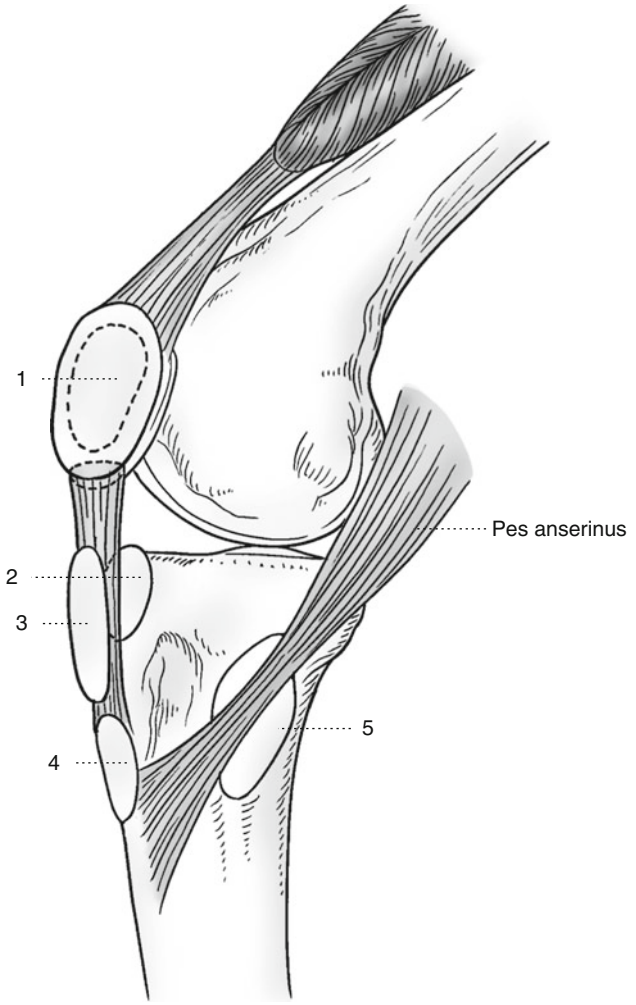

Fig. 12.14 Major bursae around the knee. (*1*) Prepatellar bursa. (*2*) Deep infrapatellar bursa. (*3*) Superficial infrapatellar bursa. (*4*) Pretibial bursa. (*5*) Pes anserine bursa

Reference

Tschirch FTC, Schmid MR, Pfirrmann CWA, Romero J, Hodler J, Zanetti M. Prevalence and size of meniscal cysts, ganglionic cysts, synovial cysts of the popliteal space, fluid-filled bursae, and other fluid collections in asymptomatic knees on MR imaging. AJR. 2003;180:1431–6.

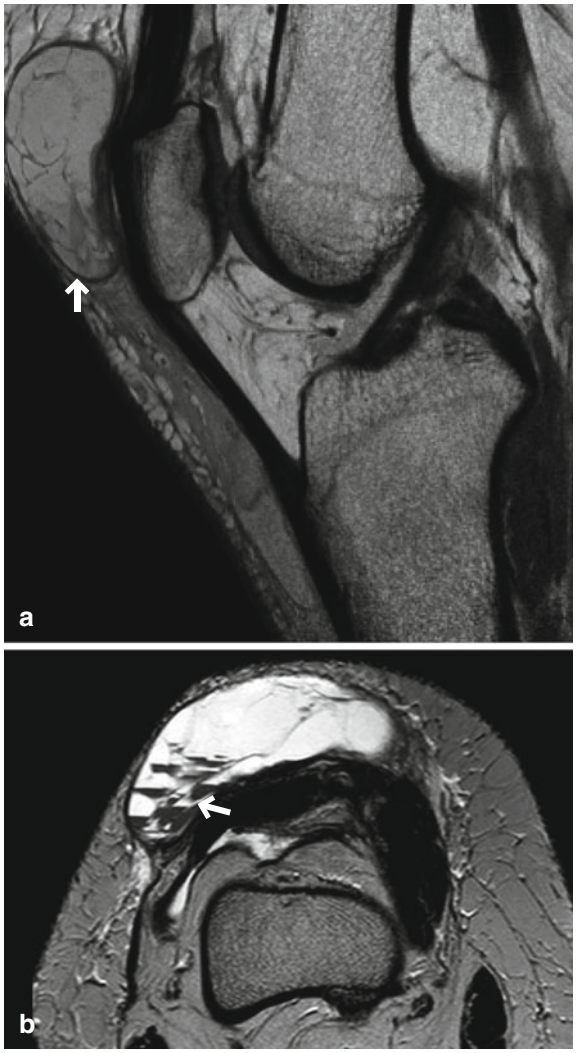

Fig. 12.15 Prepatellar bursitis with bleeding. A woman in her 40s. (**a**) PDWI and (**b**) axial FS T2WI. There is a cystic lesion showing fluid-fluid levels (*arrows*) within the subcutaneous tissue anterior to the patella. These are suggestive of prepatellar bursitis with associated bleeding

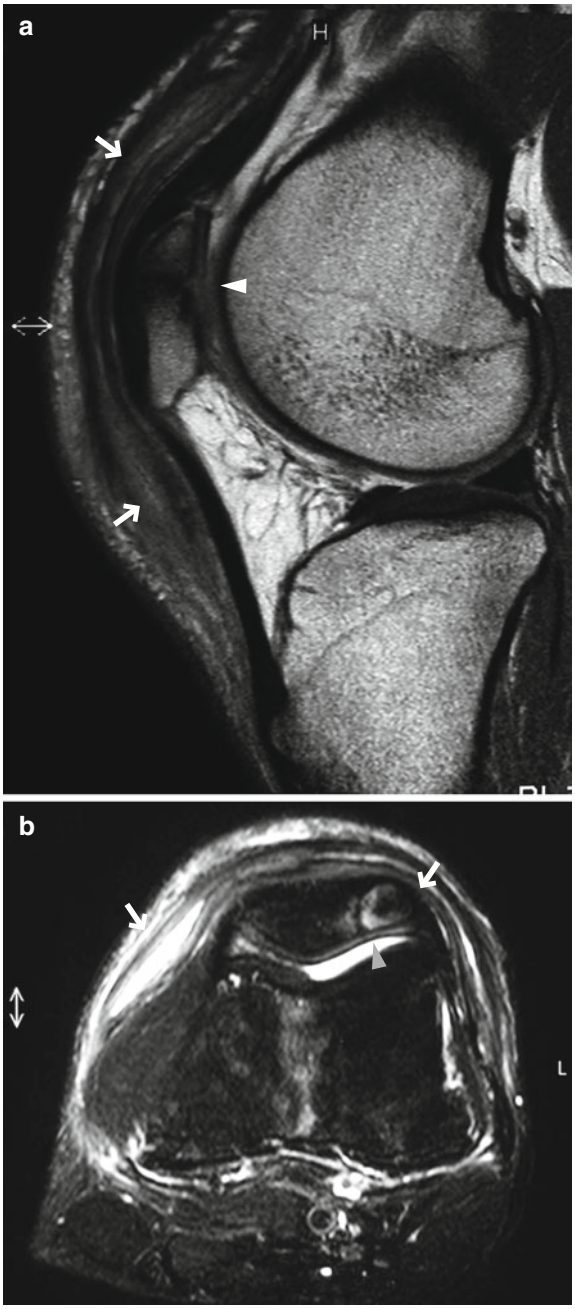

Fig. 12.16 Extensive prepatellar bursitis. A male wrestler in his late teens. (**a**) PDWl and (**b**) axial FS PDWl. There is an extensive fluid-containing space (*arrows*) within the subcutaneous tissue anterior to the patella. Note the patella bipartita (*arrowheads*)

12.5.1 Prepatellar Bursa

- Located anteriorly between the patella and the subcutaneous tissues.
- Bursitis results from overuse injury or chronic trauma, often due to frequent kneeling and crawling, and is usually referred to as "housemaid's knee" or "carpet-layer's knee." Also common in sports such as judo and wrestling.
- Effusion and hematoma are common (Fig. 12.15).
- Effusion and the surrounding edematous swelling may spread extensively. It may later form a scar tissue (Figs. 12.16 and 12.17).
- It may communicate with superficial infrapatellar bursa or pretibial bursa.

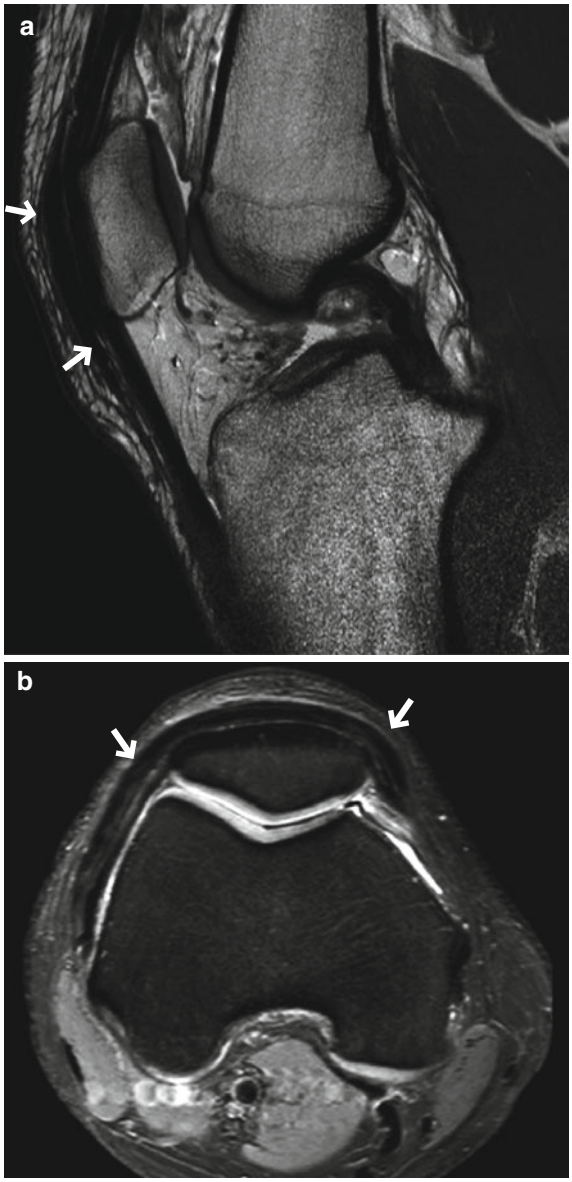

Fig. 12.17 Scar tissue following prepatellar bursitis. A male judo wrestler in his 20s. (**a**) PDWl and (**b**) axial FS PDWl. There is an extensive hypointense band (*arrows*) within the subcutaneous tissue anterior to the patella, suggestive of scar tissue following prepatellar bursitis

12.5.2 Superficial Infrapatellar Bursa

- Located between the patellar tendon and the overlying skin (Fig. 12.18).
- It may communicate with prepatellar bursa superiorly and with pretibial bursa inferiorly.

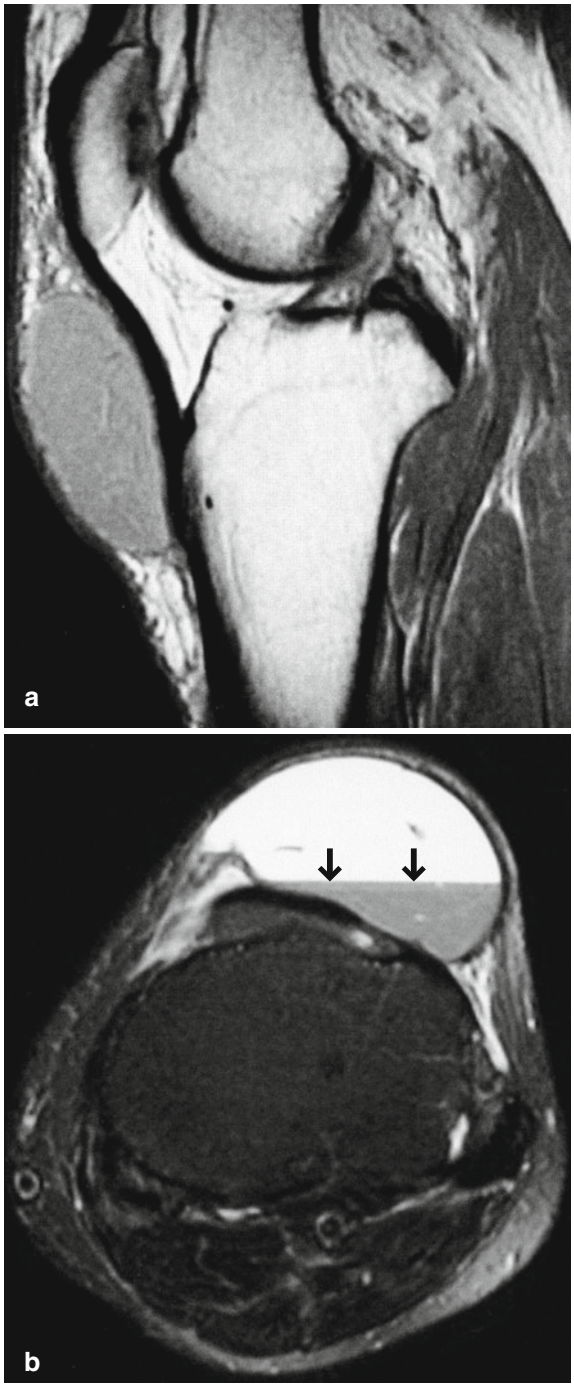

Fig. 12.18 Superficial infrapatellar bursa. A woman in her 50s. (**a**) PDWI and (**b**) axial FS T2WI. There is a fluid-containing space within the subcutaneous tissue below the patella. Bleeding inside the lesion creates the fluid-fluid level (*arrows*)

Fig. 12.19 Deep infrapatellar bursa (nonpathologic). A man in his 60s. T2*WI shows a small bursa between the patellar tendon and the tibial tuberosity (*arrow*). This is a common finding in a normal knee

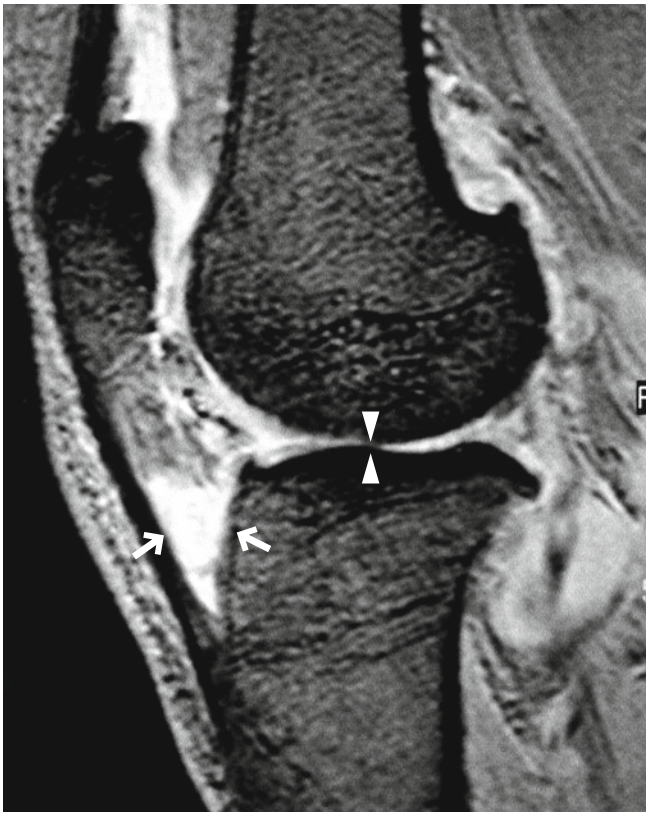

Fig. 12.20 Deep infrapatellar bursitis. A woman in her 70s with knee osteoarthritis. T2*WI. A large amount of fluid is seen in the deep infrapatellar bursa (*arrows*), suggesting bursitis. The lateral tibiofemoral joint space is narrowed (*arrowhead*). There is extensive joint effusion

12.5.3 Deep Infrapatellar Bursa

- Located between the posterior margin of the distal part of the patellar tendon and the anterior tibia.
- Commonly seen in normal knees on MRI (Fig. 12.19).
- Deep infrapatellar bursitis may be part of overuse syndrome seen in jumpers and runners.

12.5.4 Pretibial Bursa (Fig. 12.21)

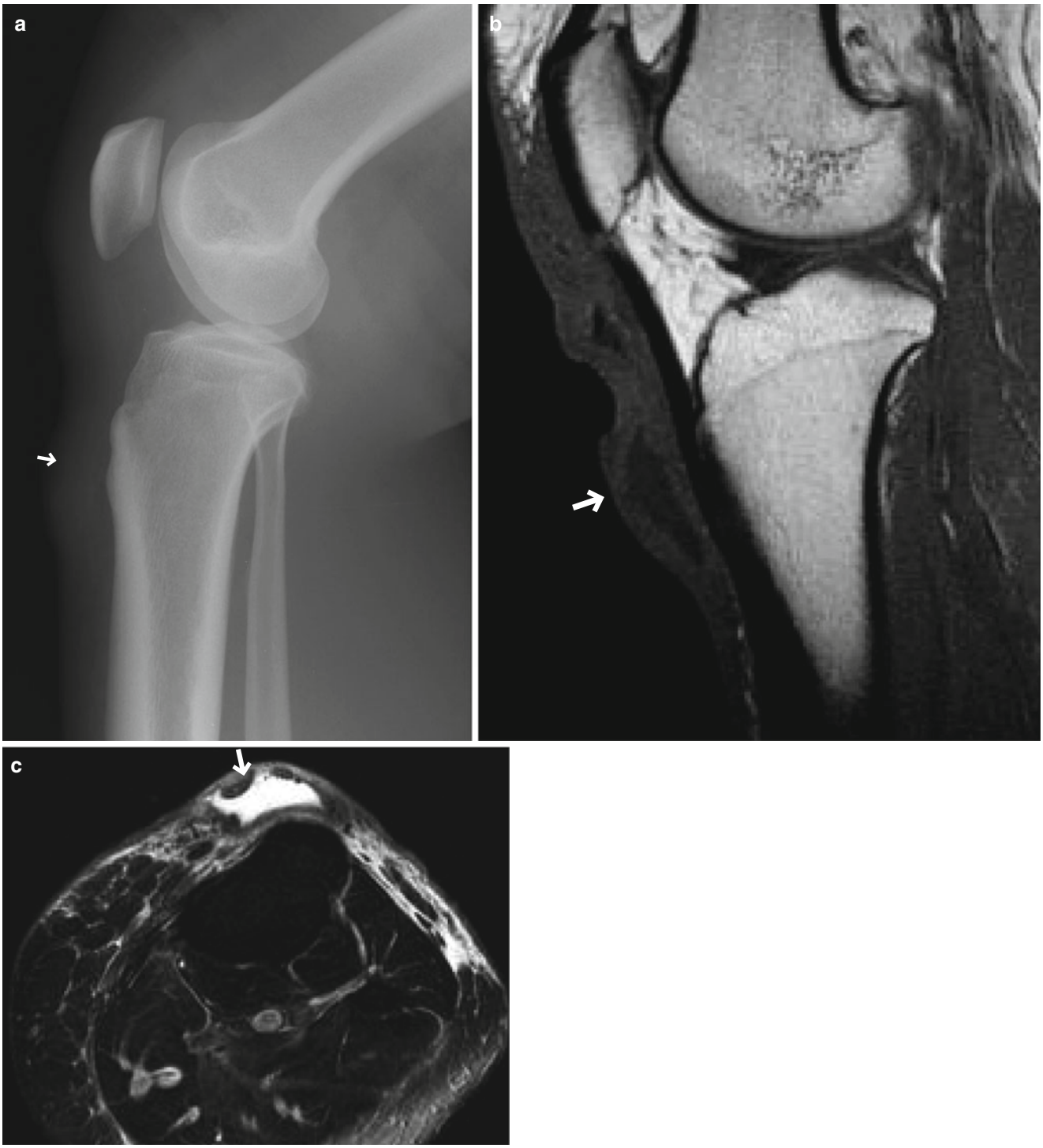

Fig. 12.21 **Pretibial bursitis**. A woman in her 30s. (**a**) Lateral radiograph, (**b**) PDWI, and (**c**) axial FS T2WI. There is extensive swelling and fluid accumulation (*arrows*) within the subcutaneous tissue anterior to the tibia

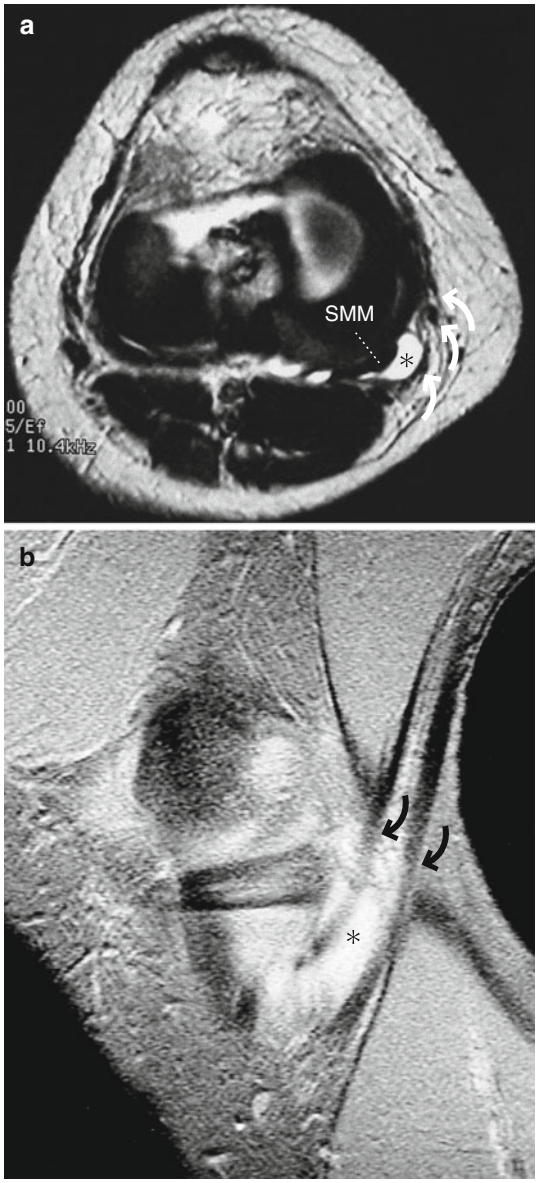

Fig. 12.22 Pes anserine bursa (nonpathologic). A woman in her 40s. Axial T2WI (**a**) and (**b**) T2*WI. There is a small bursa (*) deep to the pes anserinus (*curved arrows*). *SMM* semimembranosus tendon

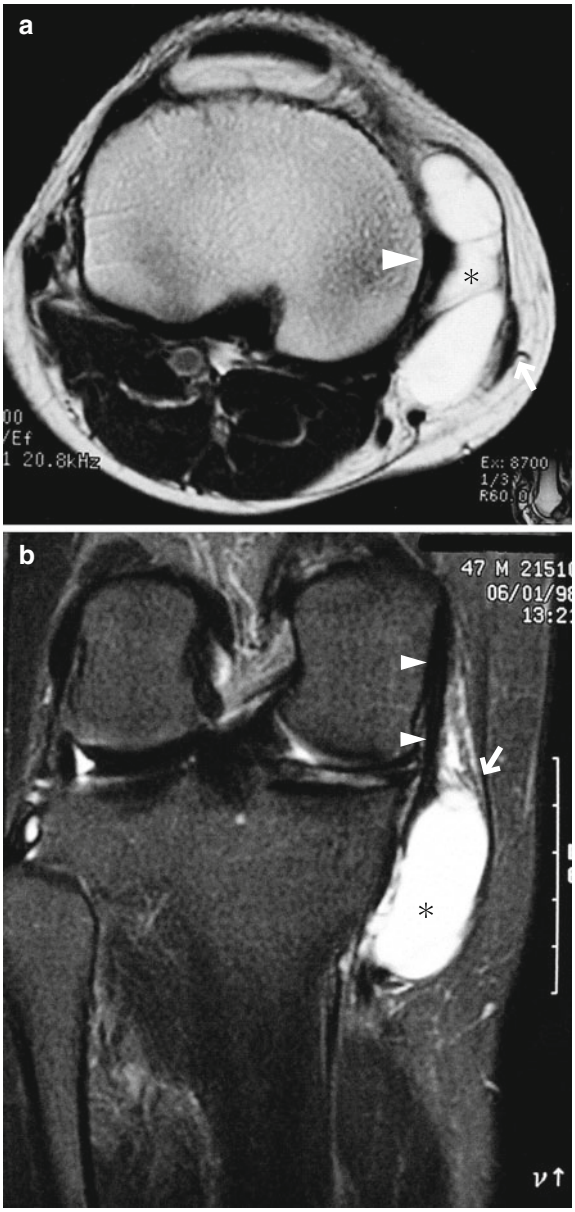

Fig. 12.23 Pes anserine bursitis. A man in his 40s. (**a**) Axial T2WI and (**b**) coronal FS T2WI. There is a multiloculated cystic lesion (*) between the pes anserinus (*arrow*) and MCL (*arrowheads*)

12.5.5 Pes Anserine Bursa

- Located along the medial aspect of the tibia separating the pes anserinus from the tibial insertion of the medial collateral ligament and the bony surface of the medial tibial condyle (Fig. 12.22). The pes anserinus is formed by the conjoined tendons of the sartorius, gracilis, and semitendinosus muscle and inserts along the anteromedial surface of the tibia. (Also see Chap. 5.)
- Relatively common in obese persons and athletes.
- If traumatized or inflamed, it becomes swollen and palpable (Fig. 12.23).
- May occur following a MCL injury.
- Posterior to the pes anserine bursa lies semimembranosus-MCL bursa, which wraps the semimembranosus from anterior direction showing a "reverse U" shape.

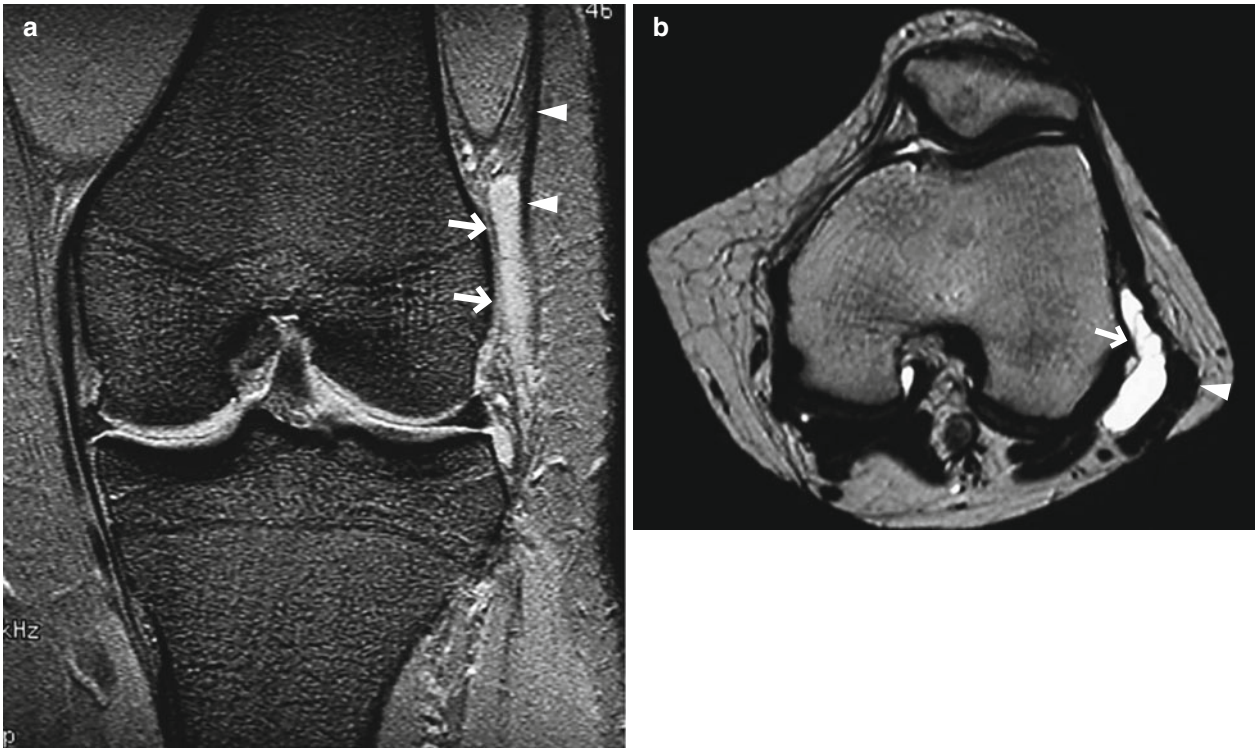

Fig. 12.24 Iliotibial bursitis. A woman in her 40s. (**a**) Axial T2*WI and (**b**) axial T2WI. There is a cystic lesion (*arrows*) between the iliotibial band (*arrowhead*) and the lateral femoral condyle

12.5.6 Iliotibial Bursa

- Located between the distal part of the iliotibial band proximal to its insertion on Gerdy's tubercle and the adjacent tibial surface.
- Iliotibial bursitis (Fig. 12.24) is usually caused by overuse injury and varus stress of the knee, commonly in the long-distance runners. Pathogenesis is similar to that of iliotibial band friction syndrome (see Chap. 6).

12.6 Periarticular Ganglion

- Ganglionic cysts may be present within periarticular muscles and the surrounding interstitium (Fig. 12.25). Unlike the aforementioned bursae, these ganglionic cysts usually show multiloculated appearance, but it is difficult to differentiate them from fluid-containing bursae on the basis of MRI alone. Moreover, there is little clinical significance in doing so.

References

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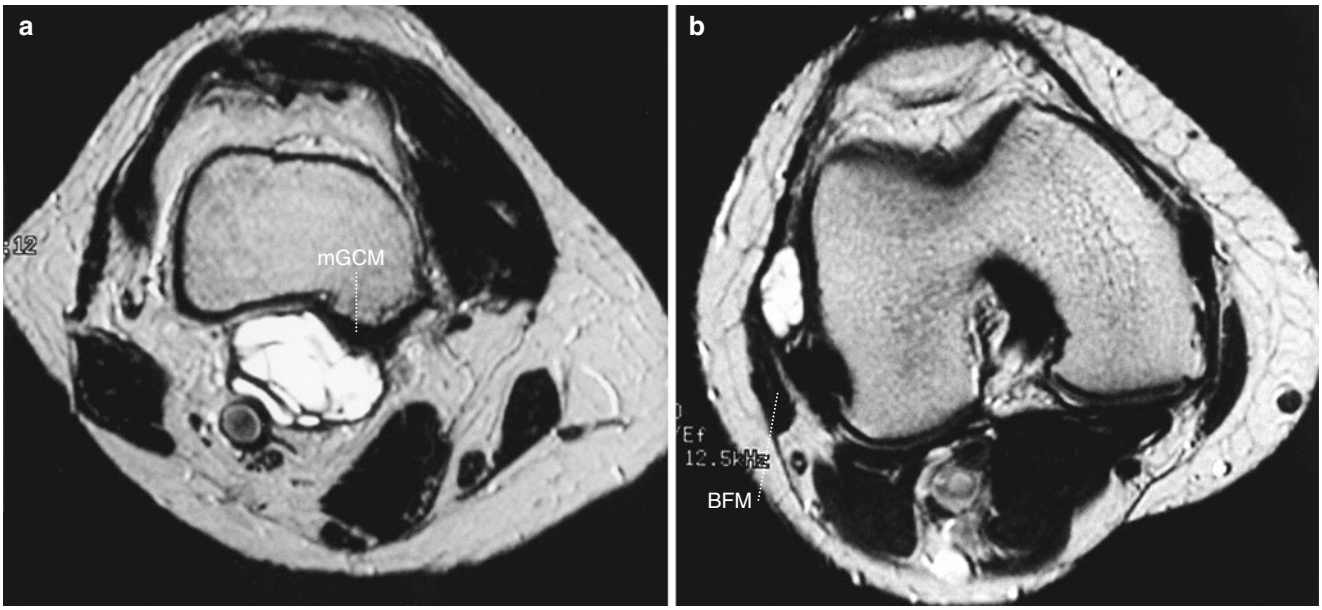

Fig. 12.25 Periarticular ganglion. (**a**) A woman in her 50s. There is a multiloculated cystic lesion behind the distal femur. (**b**) A woman in her 30s. There is a multiloculated cystic lesion deep to the biceps femoris tendon. *mGCM* medial head of gastrocnemius, *BFM* biceps femoris muscle