7 Anterior Ankle Impingement

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7.1 Introduction

Anterior ankle impingement with and without ankle osteoarthritis (OA) is a common condition. It occurs when bone spurs, or osteophytes, develop on the anterior aspect of the bones of the ankle. Due to its prevalence as a source of chronic ankle pain seen in athletes, anterior ankle impingement has been nicknamed “footballer’s ankle” or “athlete’s ankle.” Symptoms develop from the osteophytes impinging against each other or the pinching of soft tissues between them, which also leads to surrounding inflammation. The impingement of the bone spur may damage the cartilage of the talus and may be a precursor to ankle arthritis. Other sources of anterior ankle pain may be related to soft tissue impingement including posttraumatic scar tissue, loose bodies, and Bassett’s ligament. CAM deformities of the talus have also been found to be a source of ankle impingement.

The conservative treatment includes rest, oral anti-inflammatory medications, calf stretching, heel wedges in shoes, ankle bracing, and steroid injections. If symptoms are refractory to these treatments, then a surgical procedure may be considered to remove the bone and soft tissue impingement. Ankle arthroscopy is often utilized in the treatment of anterior ankle impingement. Arthroscopic debridement of bony and soft tissue impingement has a good success rate. When compared to open debridement, there is a shorter recovery time and earlier return to sports activities with arthroscopic approaches.

7.2 Clinical Anatomy of the Anterior Ankle

The distal tibia has five separate facets: medial, inferior, anterior, lateral, and posterior. It is prolonged downward on its medial side as a strong pyramidal process, the medial malleolus. The inferior articular surface is quadrilateral and smooth for articulation with the talus (Fig. 7.1). It is concave and broader anteriorly than posteriorly and is continuous with the medial malleolus. The anterior surface of the tibia is smooth, and the extensor tendons of the lower extremity course over it. The distal margin of the anterior surface of the tibia presents a rough transverse depression for the attachment of the articular capsule of the ankle joint (Fig. 7.2a, b). The anterior joint capsule attaches onto the tibia on average 6 mm proximal to the joint level and on the talar side 3 mm from the distal cartilage border (Fig. 7.2c). The lateral surface of the lower extremity of tibia presents a triangular rough depression, also named fibular notch, which is bounded by two prominent borders which are attachment points to the anterior and posterior ligaments of the lateral malleolus (Fig. 7.3). The anatomy of the posterior surface can be seen in Chap. 8.

If there is an osteophyte on the anterior lower margin, the osteophyte can damage the cartilage of the talus. This can cause synovitis of the ankle capsule or impinge the talar neck during dorsiflexion of the ankle joint (Fig. 7.4).

The distal tibia and fibula are linked by the antero-inferior tibiofibular ligament, the posteroinferior tibiofibular ligament, the transverse ligament, and the interosseous ligament and form the ankle mortise. Bassett’s ligament is an accessory antero-inferior tibiofibular ligament and runs inferior and parallel to the AITFL (Fig. 7.5). This accessory ligament can be identified in 21–92% of the dissected ankles of human anatomic specimen or MRI studies. The fascicle has an average width of 3–5 mm, length of 17–22 mm, and thickness of 1–2 mm that is separated from the AITFL by a fibrofatty septum. A thickened Bassett’s ligament can cause anterolateral ankle impingement and pain in the presence of a normal AITFL due to synovitis and scarring tissue in the anterolateral groove and cartilage abnormalities in the anterolateral talar dome (Fig. 7.6). In the study of Subhas et al., a Bassett’s ligament thickness of greater than 3 mm was 89% specific for subsequent arthroscopic pathology. Resection of the accessory ligament does not lead to instability and relieves pain in patients with chronic ankle complaints after ankle sprain.

Amendola et al. (2012) introduced the concept of cam-type impingement in the ankle. The sagittal contour of the

B. Wei et al., *Arthroscopic Techniques and Anatomy of the Foot and Ankle*, https://doi.org/10.1007/978-3-031-05190-6_7

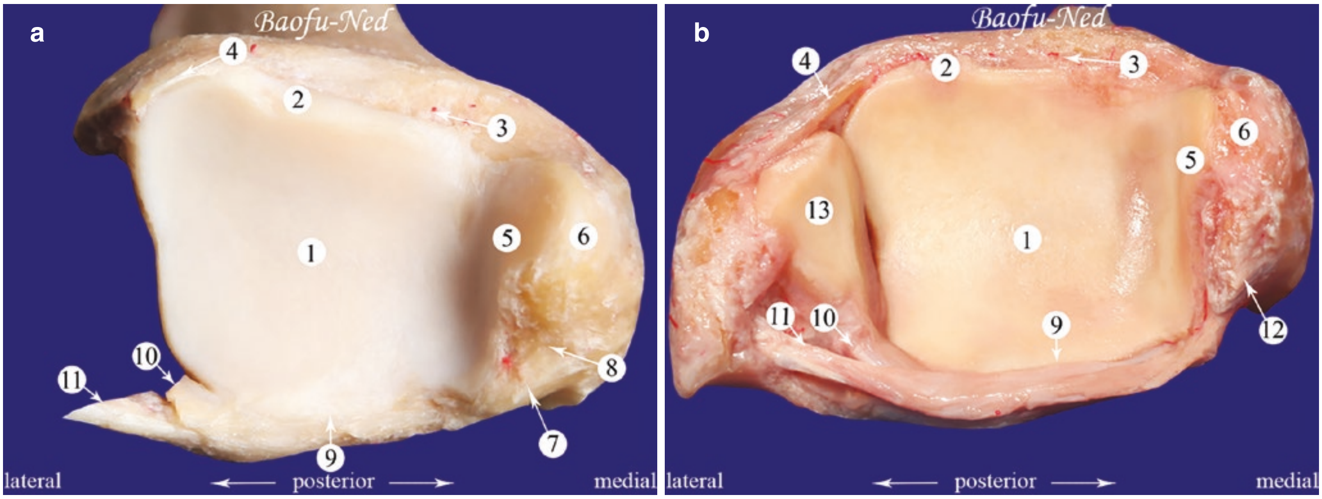

Fig. 7.1 (**a**) Normal clinical anatomy of the distal end of the tibia. (**b**) Tibial plafond in the ankle mortise. (1) Tibial plafond. (2) Anterior labrum of the tibial plafond. (3) Rough transverse depression for the attachment of the articular capsule. (4) Bassett's ligament. (5) Medial surface of the medial malleolus. (6) Anterior colliculus. (7) Posterior colliculus. (8) Intercollicular groove. (9) Posterior labium of the tibial plafond. (10) Transverse tibiofibular ligament. (11) Posterior inferior tibiofibular ligament. (12) Deep layer of the deltoid ligament. (13) Medial surface of the lateral malleolus

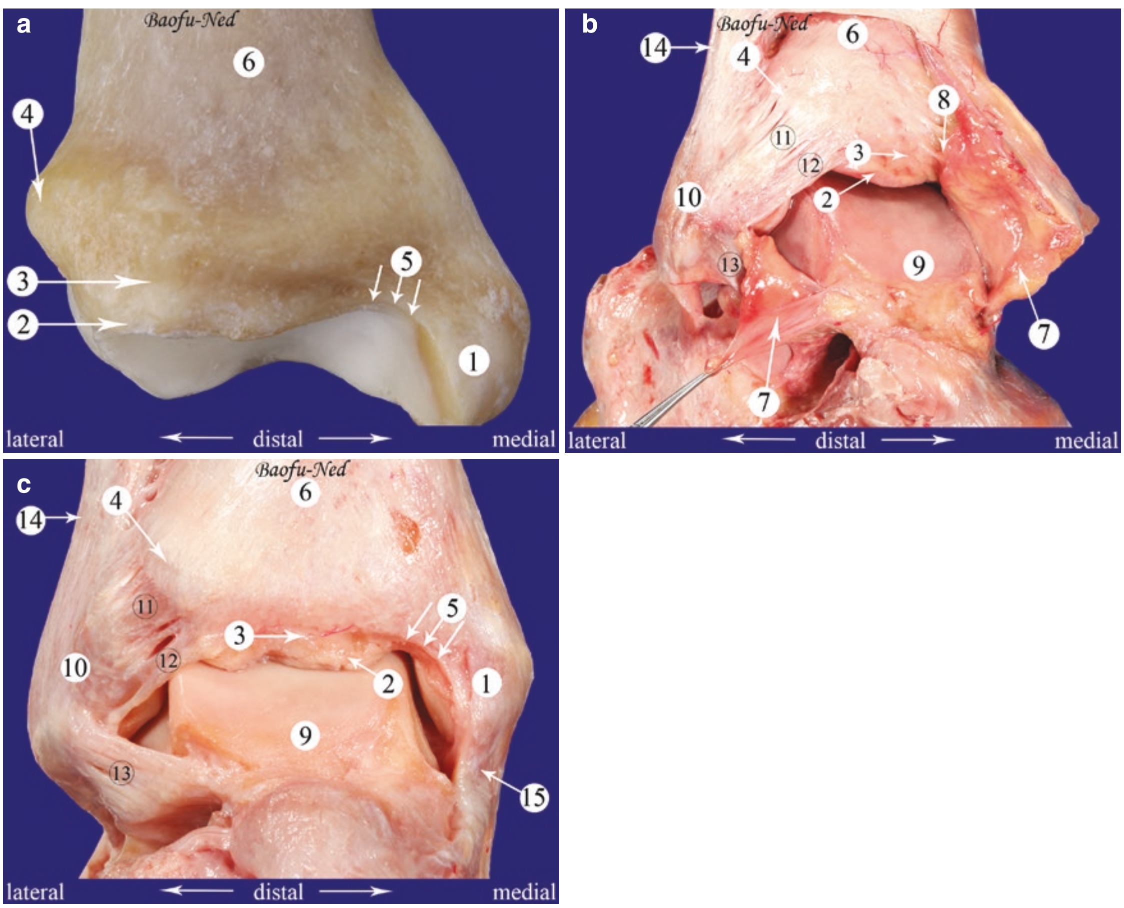

Fig. 7.2 Anterior surface of the distal end of the tibia. (**a**) Bone surfaces. (**b**) Anterior capsule. (**c**) Relationship between the anterior surface and the talus, lateral malleolus (**a**, *From Wei et al.; with permission.*) (1) Medial malleolus. (2) Anterior labrum of the tibial plafond. (3) Rough transverse depression for the attachment of the articular capsule. (4) Anterior tubercle. (5) Notch of Harty (arrows) at the anterior edge of the tibia. (6) Tibia. (7) Capsule and synovial tissue. (8) Attachment of the capsule. (9) Talus. (10) Lateral malleolus. (11) Anterior inferior tibiofibular ligament. (12) Bassett's ligament. (13) Anterior talofibular ligament. (14) Fibula. (15) Deltoid ligament

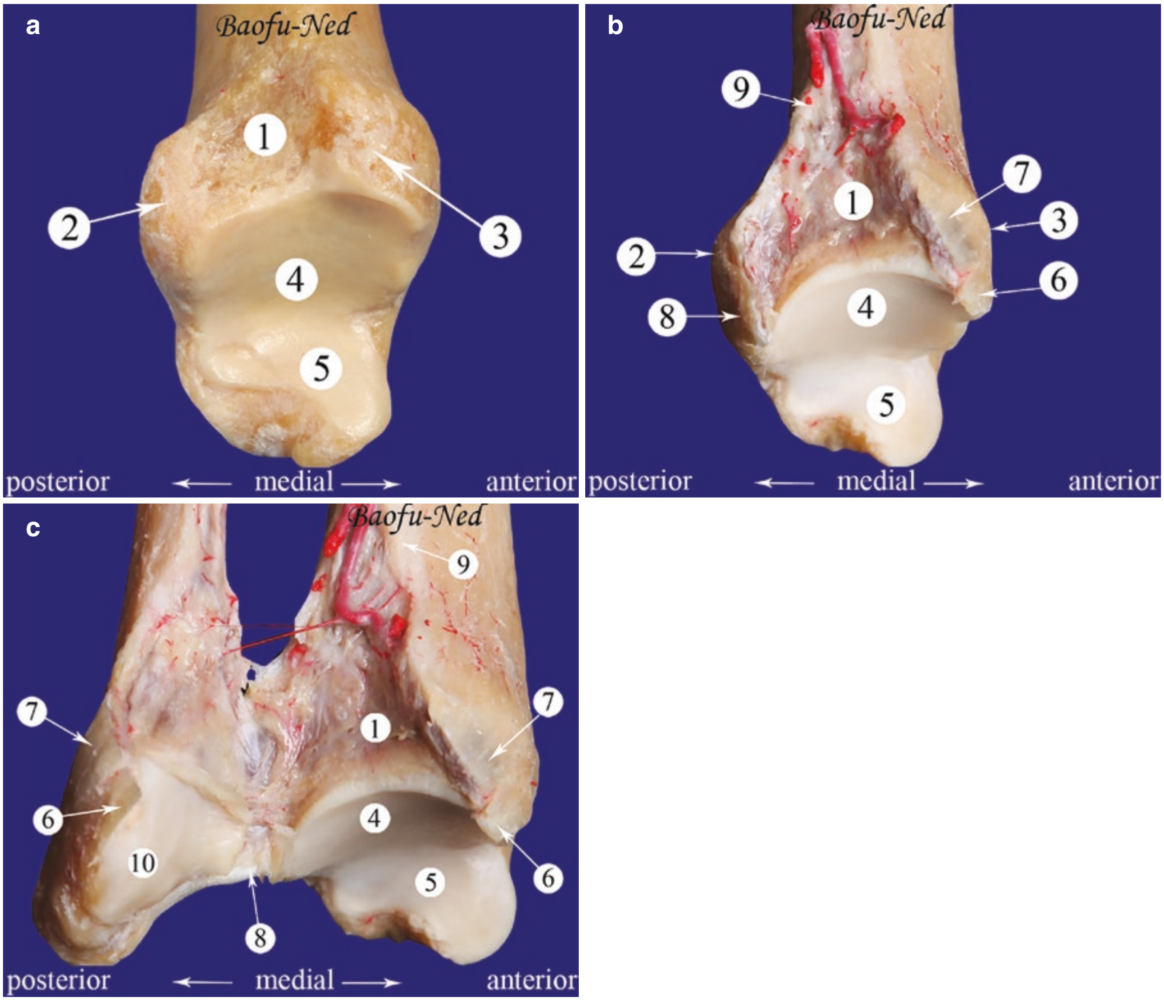

Fig. 7.3 Lateral surface of the distal end of the tibia. (**a**) Lateral bone surfaces. (**b**) Lateral surface of bone and ligament. (**c**) Syndesmosis is opened. (*From Wei et al.; with permission*.) (1) Fibular notch. (2) Posterior tubercle. (3) Anterior tubercle. (4) Tibial plafond. (5) Medial malleolus. (6) Bassett's ligament. (7) Anterior inferior tibiofibular ligament. (8) Posterior inferior tibiofibular ligament. (9) Interosseous membrane. (10) Lateral malleolus

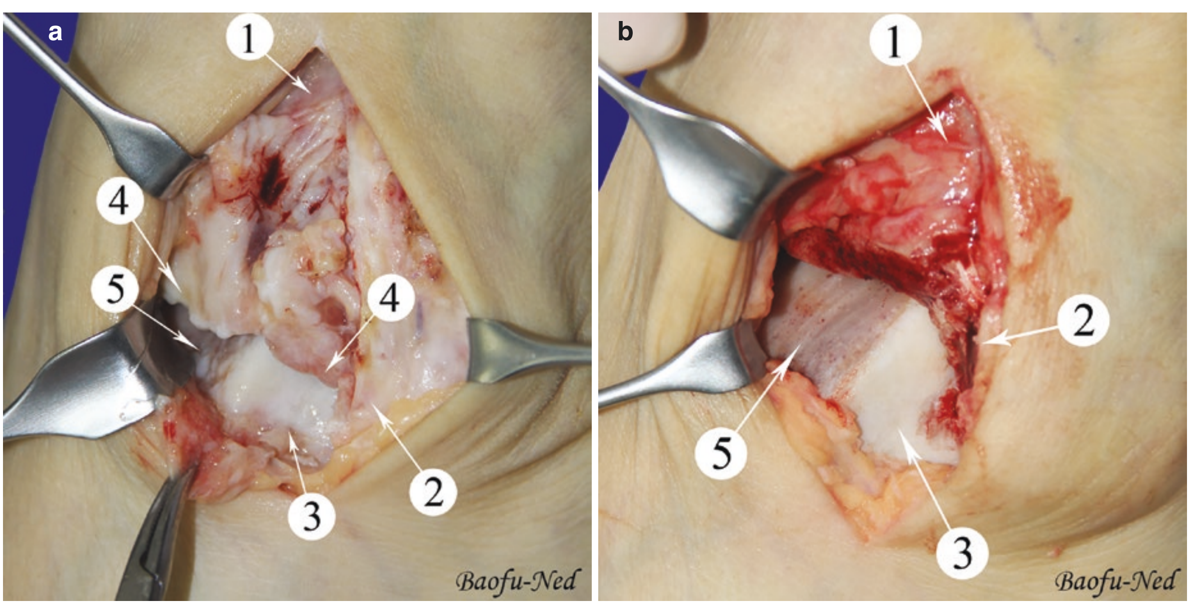

Fig. 7.4 (**a**) The osteophyte and synovitis of the capsule. (**b**) The cartilage lesion of the talus. (1) Tibia. (2) Medial malleolus. (3) Talus. (4) Osteophytes. (5) Cartilage lesions

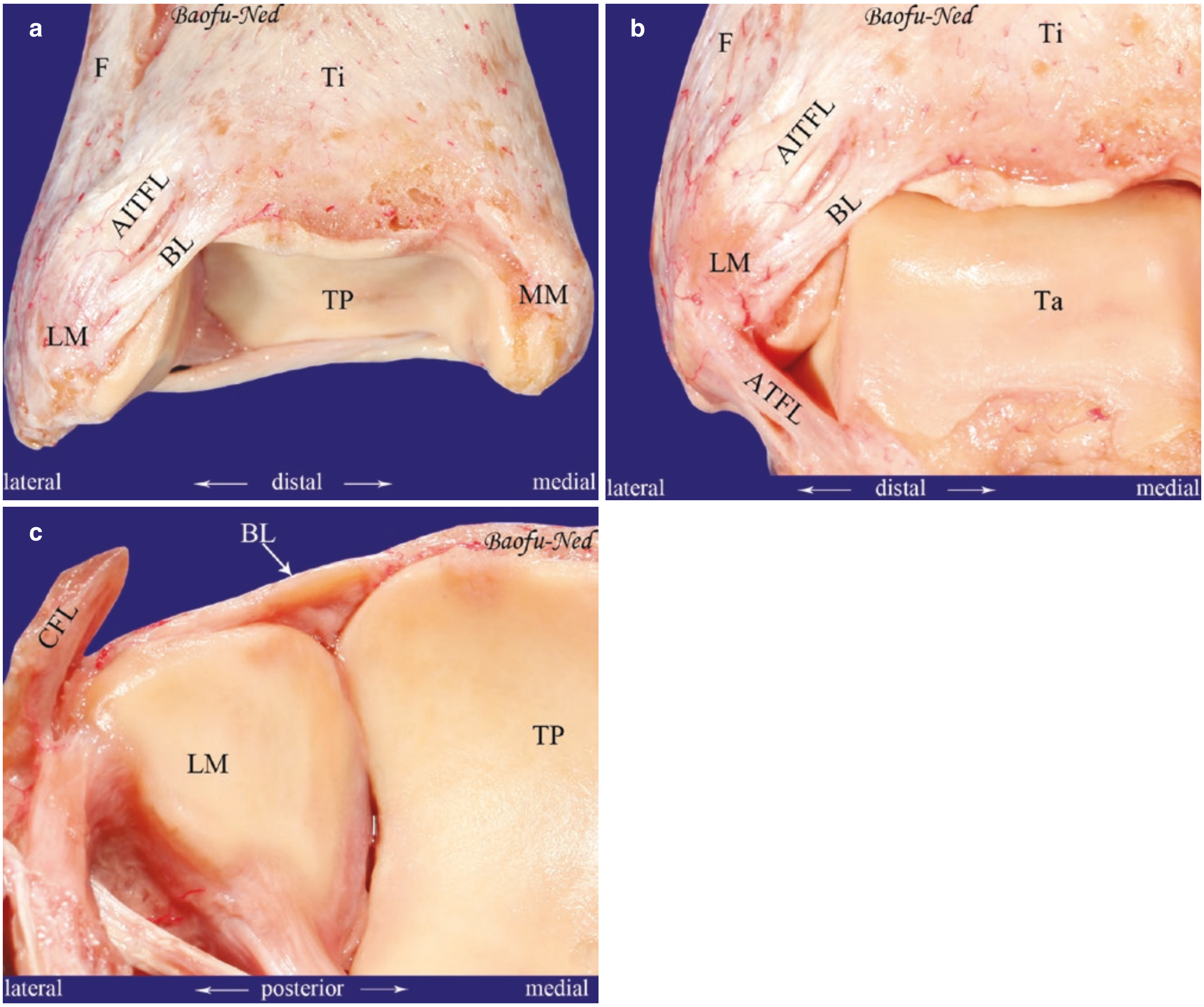

Fig. 7.5 Anatomy of Bassett's ligament. (**a**) Anterior view of Bassett's ligament. (**b**) Inferior view of Bassett's ligament. (**c**) Relationship between the talus and Bassett's ligament. *AITFL* anterior inferior tibiofibular ligament, *ATFL* anterior talofibular ligament, *BL* Bassett's ligament, *CFL* calcaneofibular ligament, *F* fibula, *LM* lateral malleolus, *MM* medial malleolus, *Ta* talus, *Ti* tibia, *TP* tibial plafond

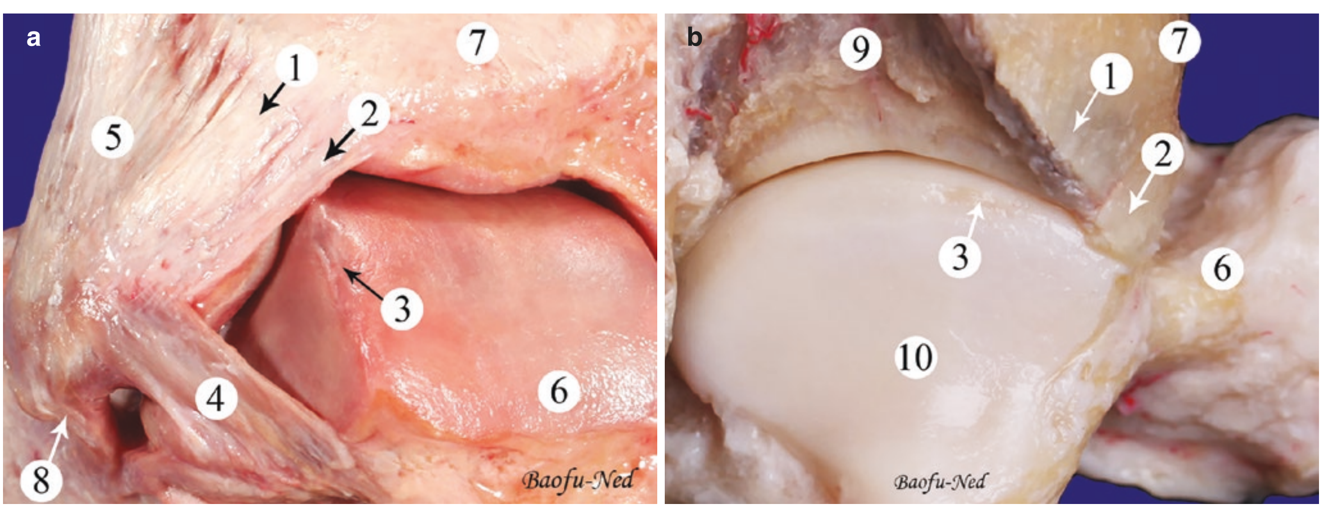

Fig. 7.6 Bassett's ligament impingement and cartilage lesions. (**a**) Anterolateral view. (**b**) Lateral view, the lateral malleolus is removed (**b**, *From Wei et al.; with permission*.) (1) AITFL. (2) Bassett's ligament. (3) Cartilage lesions of the lateral dome of the talus. (4) ATFL. (5) Fibula. (6) Talus. (7) Tibia. (8) CFL. (9) Fibular notch. (10) The articular facet for lateral malleolus

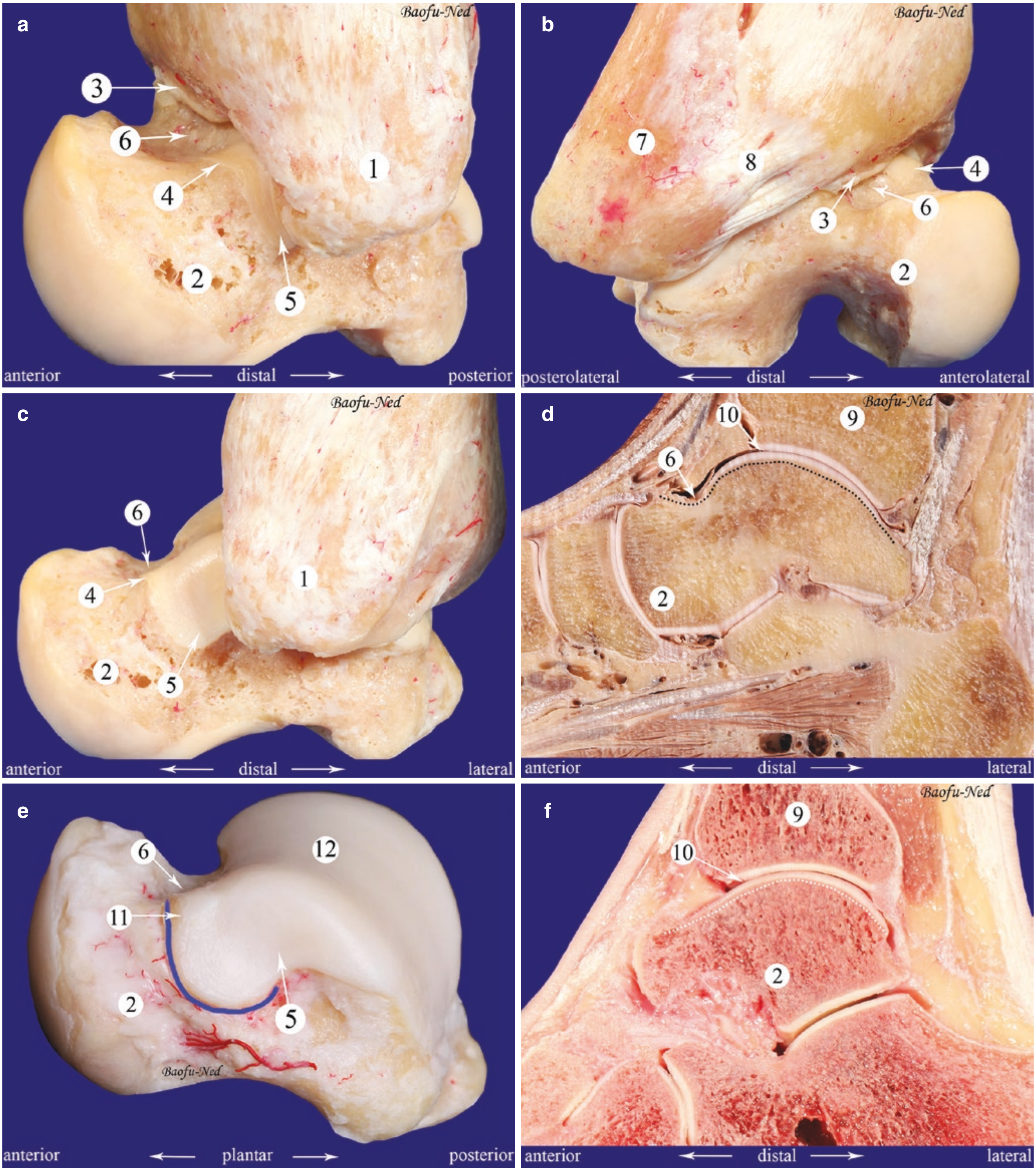

Fig. 7.7 (**a**) Relationship between the medial malleolus and the talar dome (dorsiflexion, medial view). (**b**) Dorsiflexion, lateral view. (**c**) Plantarflexion, medial view. (**d**) Normal circular arc of the talar dome (sagittal view, black dotted line). (**e**) Cam deformity of the talus (blue line, right). (**f**) Abnormal circular arc of the talar dome (sagittal view, white dotted line) (**d**, *From Wei et al.; with permission*.) (1) Medial malleolus. (2) Talus. (3) Anterior labrum of the tibial plafond. (4) Anteromedial extension of the talus. (5) Medial articular surface of the talus. (6) Shallow depression of the talar neck. (7) Lateral malleolus. (8) Anterior inferior tibiofibular ligament. (9) Tibia. (10) Talocrural joint. (11) Cam deformity of the talus. (12) Trochlea of the talus

talar dome forms a non-circular arc and impinges the anterior aspect of the tibial plafond, and this causes the loss of the normal concavity of the talar neck and pathologic contact with the anterior aspect of the tibial plafond in dorsiflexion. This may lead to abnormal ankle joint mechanics by limiting dorsiflexion (Fig. 7.7).

7.3 Symptoms, Physical Examination, and Radiographic Evaluation

7.3.1 Symptoms

Pain due to anterior ankle impingement is present in the anterior or lateral ankle. Pain is elicited when the ankle is passively or actively dorsiflexed and relieved when the ankle is plantarflexed. Patients may describe weakness and swelling following weight-bearing activities. Some patients may complain of associated ankle instability. Close examination should be performed to assess whether symptoms are indicative of one or concomitant pathology between anterior impingement and lateral ligament laxity.

7.3.2 Physical Examination

Tenderness over the anterior tibia at the level of the joint line is common, sometimes with a palpable bony prominence, usually anteromedially. There may be limitations of ankle joint dorsiflexion, and forced passive dorsiflexion can cause discomfort or severe pain. There may be a degree of swelling in the soft tissue due to the secondary joint synovitis. Complete physical examination should pay attention to the hindfoot alignment, the lateral and anterior joint laxity, and the tenosynovitis of the tibialis anterior tendon. Anterior drawer and talar tilt will help identify concomitant ankle instability.

7.3.3 Radiographic Evaluation

Patients with anterior ankle pain should have weight-bearing anteroposterior (AP) view, lateral view, and mortise view of the ankle. Most of the osteophytes on the anterior tibia or talar neck will be shown on the lateral view in the neutral position, dorsiflexion, or plantarflexion (Fig. 7.8). Lateral views in maximum dorsiflexion may demonstrate the bony impingement. The subtalar joint should be evaluated for

Fig. 7.8 Radiographs of ankle joint for the anterior impingement. (**a**) Anteroposterior view of the ankle. (**b**) Lateral view (neutral position). (**c**) Lateral view (dorsiflexion). (**d**) Lateral view (plantarflexion). *Ti* tibia, *Ta* talus, *C* calcaneus, *F* fibula. White arrow: osteophyte of the tibia. Black arrow: osteophyte of the talus. White circle: osteophytes impinge each other

abnormalities such as degenerative changes, cysts, or loose body. Niek van Dijk et al. have suggested that many of the anterior tibial osteophytes are located anteromedially.

The normal angle between the anterior distal tibia and the talus is 60° or greater and allows ankle range of motion. Osteophytes that form on the tibia and/or talus may decrease this angle to less than 60° (Fig. 7.9). The size of the bone spur can vary. The bone spurs can damage the joint cartilage and result in narrowing of the joint space. Radiographs may also demonstrate mild, moderate, or even severe ankle arthritis.

Computed tomography (CT) can delineate the size and location of the osteophyte, and it can also evaluate for further pathology of the ankle joint and subtalar joint. Similarly, MRI can also delineate the size and location of the osteophyte with the added benefit of soft tissue evaluation. MRI may demonstrate inflammation or fluid accumulation in the bones of the ankle joint (Fig. 7.10). MRI may also help differentiate the soft tissue impingement and loose body from the bone impingement and identify other concomitant pathologies such as peroneal tendon injuries or talar cartilage defects (Fig. 7.10).

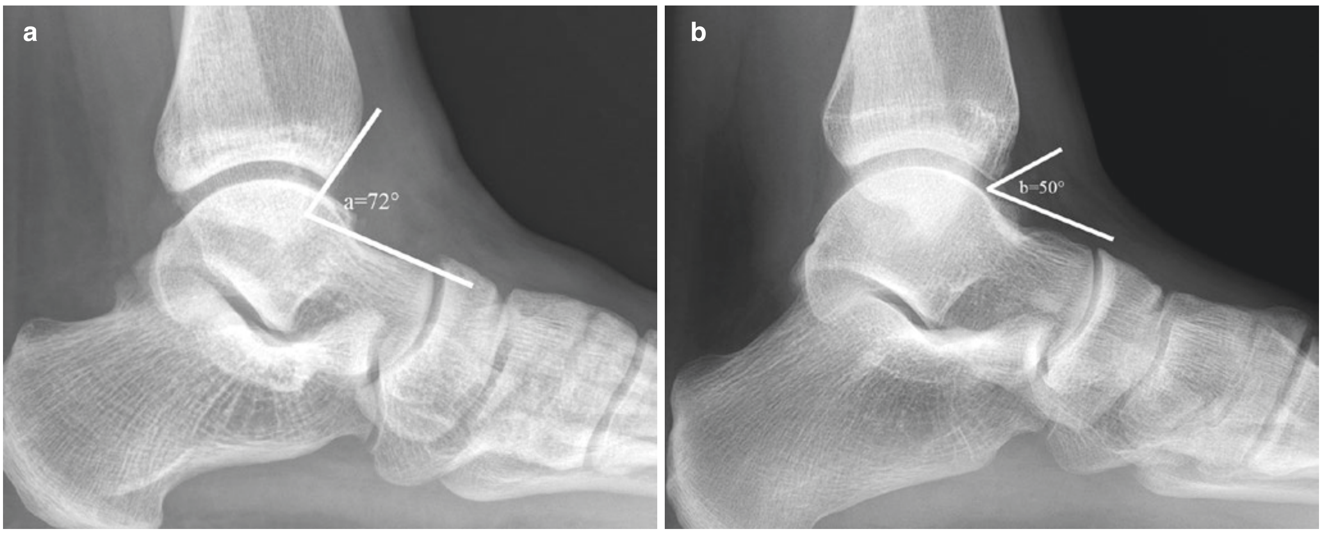

Fig. 7.9 Angle between the distal tibia and the talar neck. (**a**) The normal angle should be 60° or greater. (**b**) The osteophytes on the distal tibia and/or talus can decrease the angle to <60°

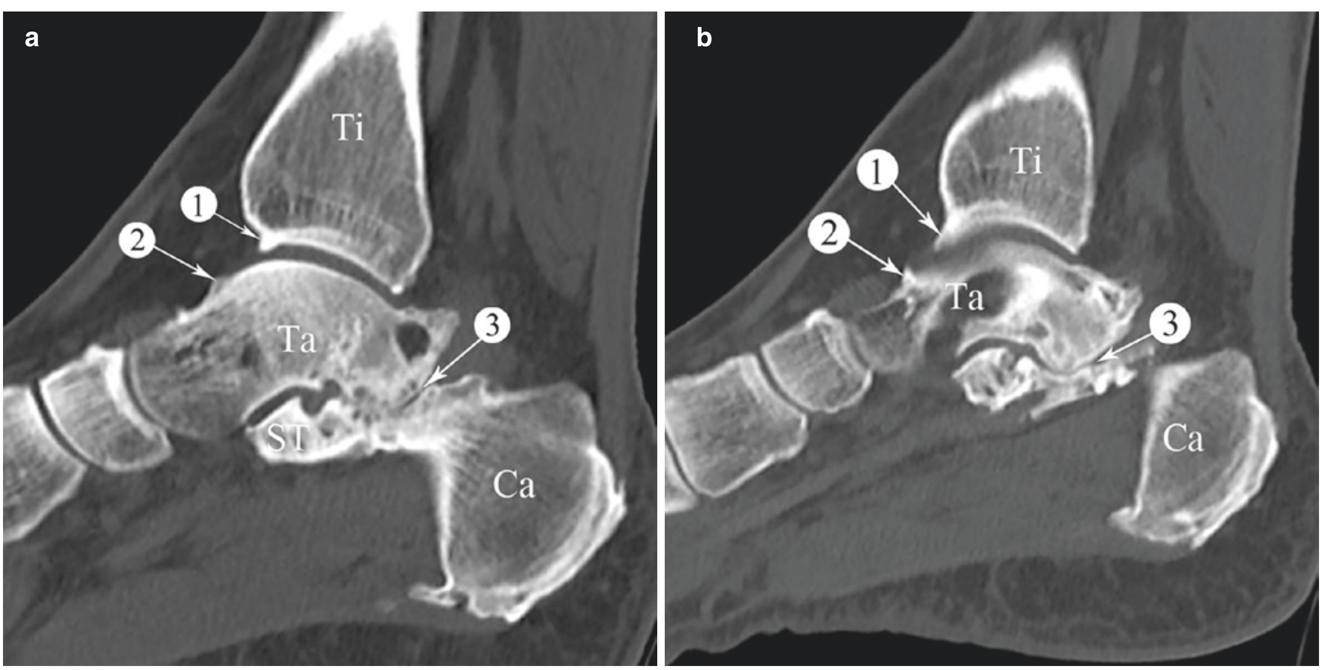

Fig. 7.10 (**a**, **b**) Sagittal view of the ankle joint (CT). (**c**) Sagittal view of the ankle joint (MRI T2WI). *Ti* tibia, *Ta* talus, *Ca* calcaneus, *ST* sustentaculum tali. (1) Osteophyte of the tibia. (2) Osteophyte of the talus. (3) Arthritis of the subtalar joint. (4) Osteophyte and fluid of the talus. (5) Tibial plafond lesion. (6) Cartilage lesions of the talus

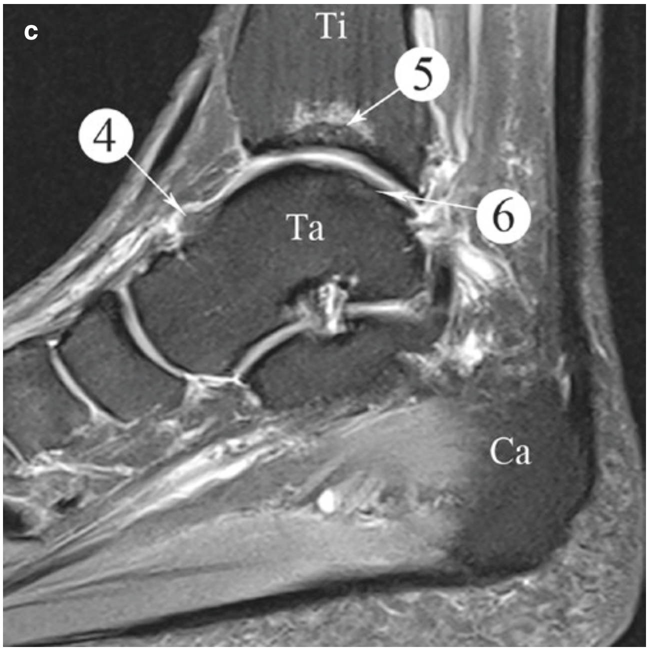

Fig. 7.10 (continued)

7.4 Indications and Contraindications for Surgical Intervention

7.4.1 Indications

Indications include osteochondral defects, osseous impingement refractory to conservative treatment, arthrofibrosis, locking, and popping.

7.4.2 Contraindications

Absolute contraindications include severe degenerative joint disease and localized infection. Relative contraindications include reduced joint space, severe edema, insufficient blood supply to the affected limb, and moderate degenerative joint disease with limited range of motion.

7.5 Anesthesia, Tourniquet, Position, Distraction, and Instruments

See Chap. 3.

7.6 Surgical Procedures for Anterior Ankle Impingement

7.6.1 Portals/Incision

See Chap. 3.

7.6.2 Creating the Pathway

See Chap. 3.

7.6.3 Ankle Impingement: Arthroscopic Debridement

The ankle joint is first evaluated through the anteromedial portal and the anterolateral portal. The large anterior osteophyte along with severe synovitis may make it difficult to visualize the joint space, and a limited anterior synovectomy should improve the visualization (Fig. 7.11). An extensive debridement at this point may elicit bleeding which may obstruct visualization. Furthermore, the shaver must be guided away from the anterior capsule to avoid the capsular penetration and the risk of the anterior neurovascular injury. Reducing the joint distraction force and dorsiflexing the ankle could improve the visualization when performing the anterior synovectomy and removing the anterior osteophyte. The anterior joint capsule, which is often adhered to the osteophyte, must be stripped off, so that the anterior tibial osteophyte could be exposed using a shaver or an electrocautery device (Fig. 7.11). When using the shaver, the blade must be directed toward the osteophyte and pointed away from the anterior capsule and the cartilage of the talus. The electrocautery device may aid in achieving hemostasis during the exposure of the osteophyte.

The osteophyte may be removed using three different methods: osteotome, burr, and rongeur. A narrow osteotome can be used to cut the osteophyte into smaller fragments which can be removed using an arthroscopic grasper or pituitary rongeur. A round burr may also be used through the medial and lateral portals to remove the osteophyte. It is important to view from both portals to ensure adequate resection (Fig. 7.12). Care must be taken when extending the resection to the lateral and margins of the tibia. The pituitary rongeur may be used to remove the smaller osteophytes and to “fine-tune” the excision (Fig. 7.12).

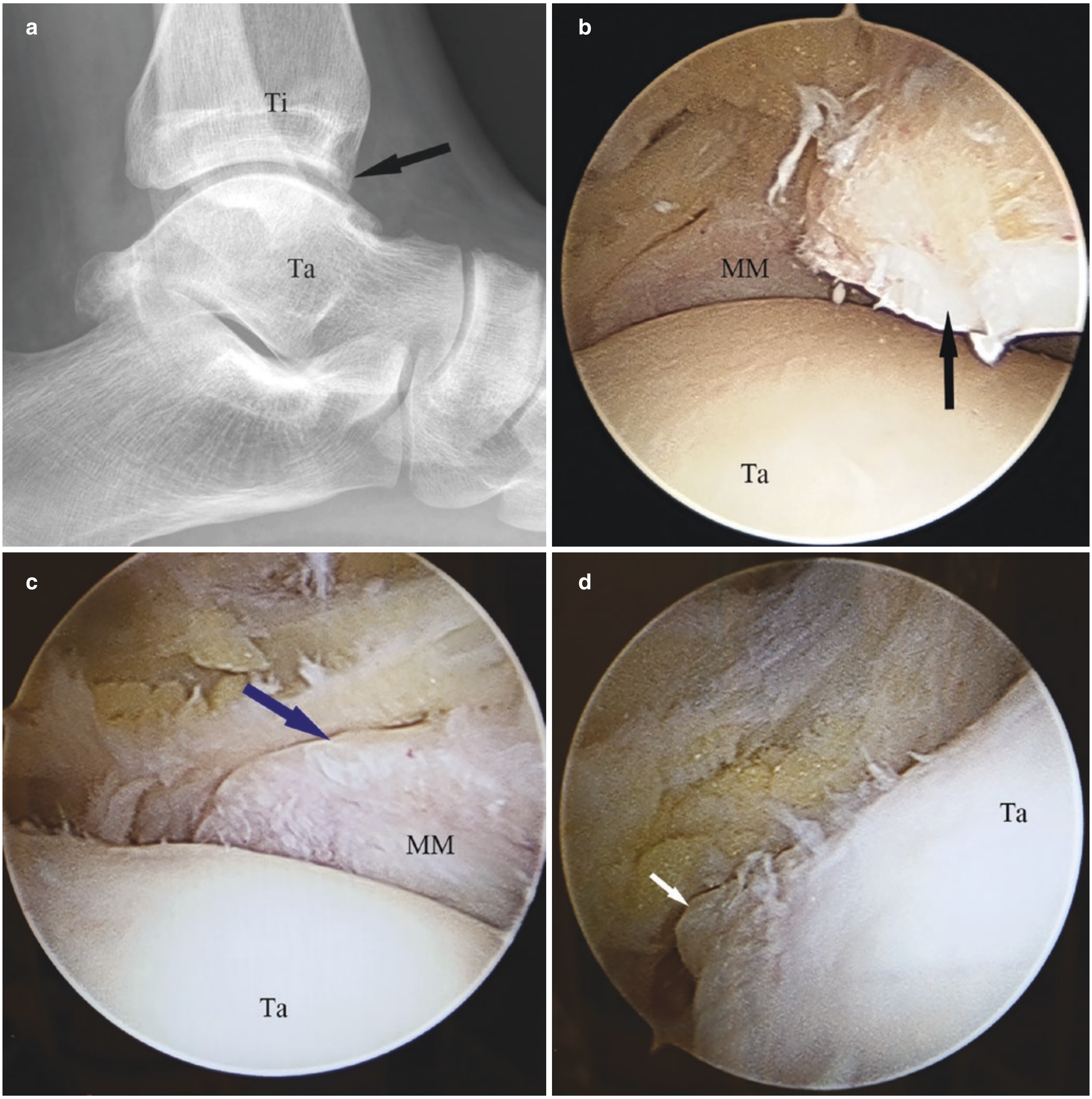

Fig. 7.11 Anteromedial osteophyte. (**a**) Lateral X-ray of the ankle. (**b**) Anteromedial osteophyte of the tibia (black thick arrow). (**c**) Hypertrophy of the medial malleolus (blue thick arrow). (**d**) Anteromedial margin of the talus (white thick arrow). *MM* medial malleolus, *Ta* talus, *Ti* tibia

It may be difficult to determine the appropriate amount of bony resection. The anterior margin should be resected until the normal thickness of articular cartilage is seen along the entire anterior margin. An intraoperative fluoroscopic lateral radiograph may also demonstrate adequate resection. After anterior tibial resection, the talar neck should be checked, and any osteophytes on the talar neck should be resected using a round burr.

Occasionally, large osteophytes can break off and form a nonunion. The osteophyte must be completely excised and cleaned from the nonunion site. An intraoperative lateral fluoroscopy or arthroscope can verify the accurate removal.

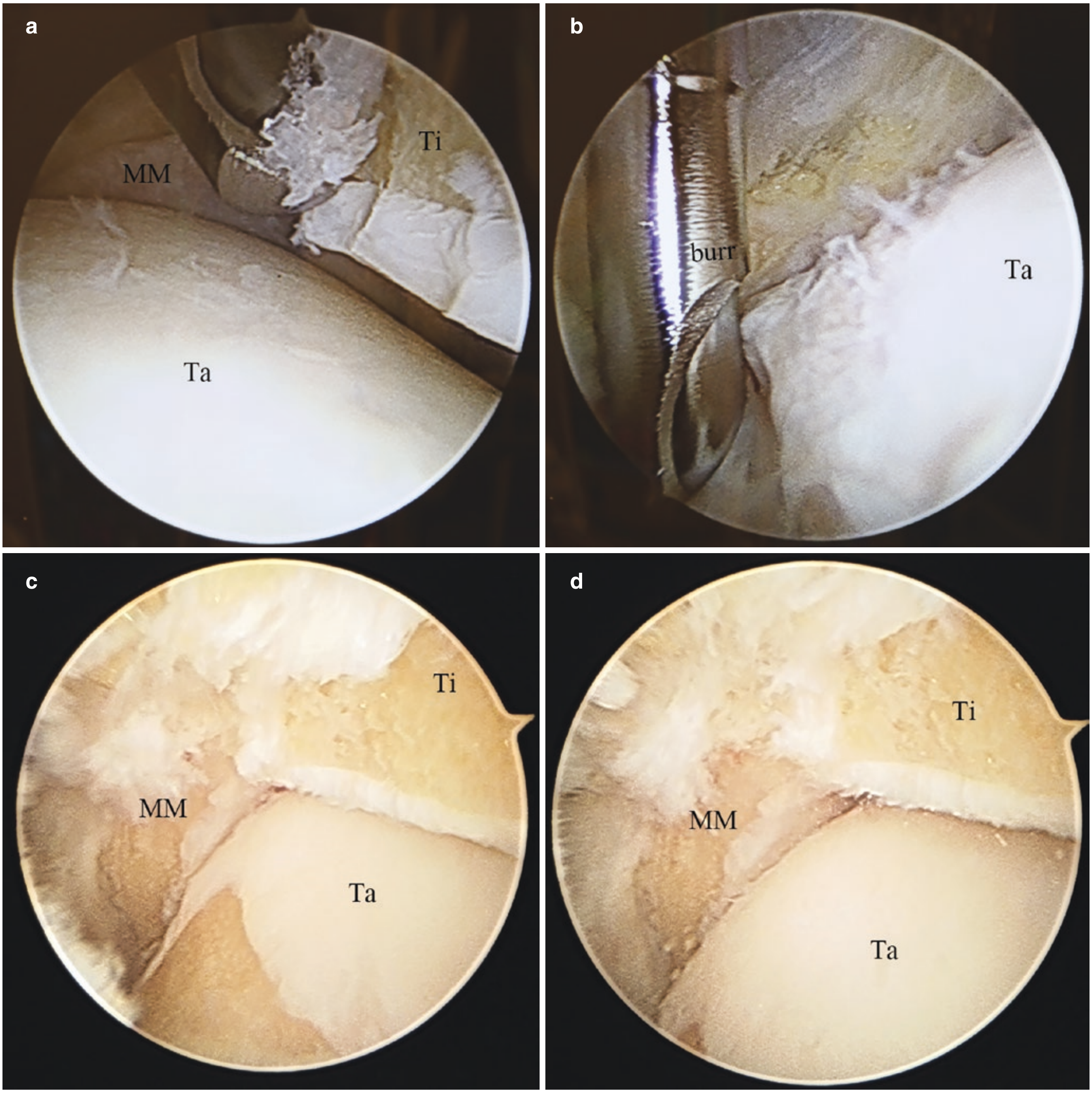

Fig. 7.12 Removal of the osteophyte. (**a**) Removal of the osteophyte on the anteromedial margin of the tibia. (**b**) Removal of the hypertrophic anteromedial margin of the talar body. (**c**, **d**) Examine the ankle motion after resection of the osteophyte (dorsiflexion/plantarflexion). *Ta* talus, *Ti* tibia, *MM* medial malleolus

7.6.4 Cam Impingement: Arthroscopic Debridement

Treatment of the cam-type impingement consists of debriding the "cam" lesion with a burr and shaver. An anteromedial and accessory anteromedial portal are used, with one used for the arthroscope and the other portal for instrumentation. Inspect the medial gutter and cam lesion in detail, and then debride the cam lesion using the burr and shaver (Fig. 7.13). Inadequate bone removal of the lesion and failure to clean the medial gutter may lead to the failure of the cam impingement treatment.

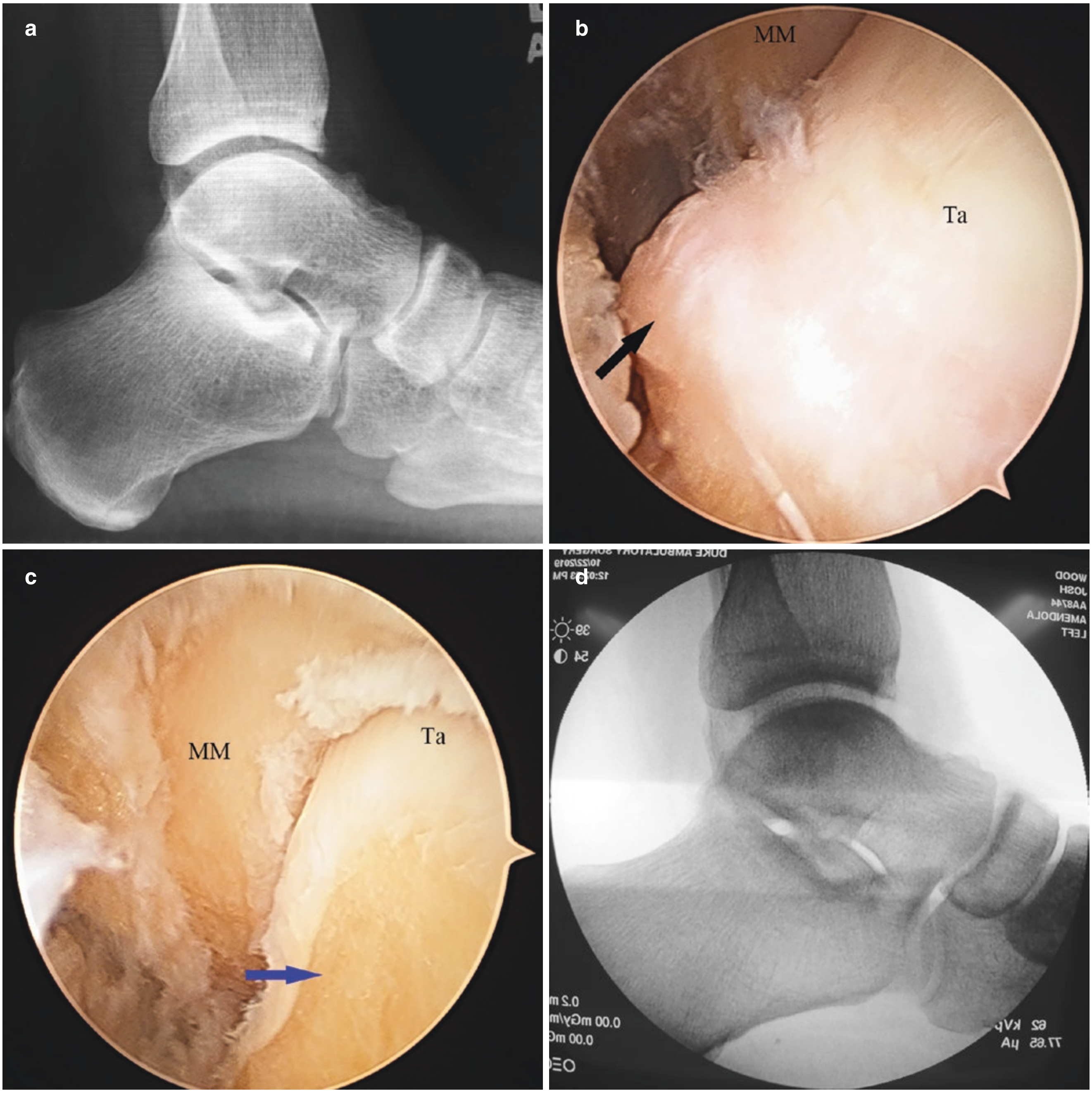

Fig. 7.13 Cam impingement. (**a**) Preoperative X-ray with non-spherical nature of the talar dome. (**b**) Cam deformity. (**c**) Removal of the cam deformity. (**d**) Postoperative X-ray with normal spherical nature of the talar dome. Black thick arrow: cam deformity. Blue thick arrow: removal of the cam deformity

7.6.5 Loose Bodies and Loose Body Removal Approaches

Loose bodies are bone or cartilage fragments that have chipped off inside the joint. They can damage the joint surface; cause pain, swelling, locking, and catching; and restrict ankle movement as they float freely within the joint. These symptoms can be intermittent because the loose bodies may become fixed to the synovium and are therefore asymptomatic. Physical examination is usually unremarkable.

Radiographs are still the modality of choice when a loose body is suspected, although some loose bodies are poorly seen on X-rays. Lesions that appear to be loose bodies on standard radiographs may be intracapsular or extra-articular in location. If additional imaging is requested, CT/MRI is the modality of choice. CT or MRI can show the amount, size, and location of the loose bodies (Fig. 7.14). CT/MRI arthrography can help distinguish between true loose bodies, fixed loose bodies, and intra-articular loose bodies.

The surgical approach for loose bodies is similar to that above for osteophytes. The anteromedial and anterolateral portals are established, and a comprehensive exam of the ankle joint is performed. Many loose bodies are found in the anterior compartment of the ankle joint (Fig. 7.14). When loose bodies are identified in the anterior recess of the joint, the anterior capsule may relax and create more space to maneuver instruments by diminishing the distraction force and dorsiflexing the ankle. In addition, this can also help prevent loose bodies from inadvertently traveling, especially from the anterior to the posterior joint space. Most loose bodies can be removed using different-sized pituitary rongeurs or a loose body grasper (Fig. 7.14).

The symptomatic fixed loose bodies may be fixed to the synovium or contained within the ligament medially or lat-

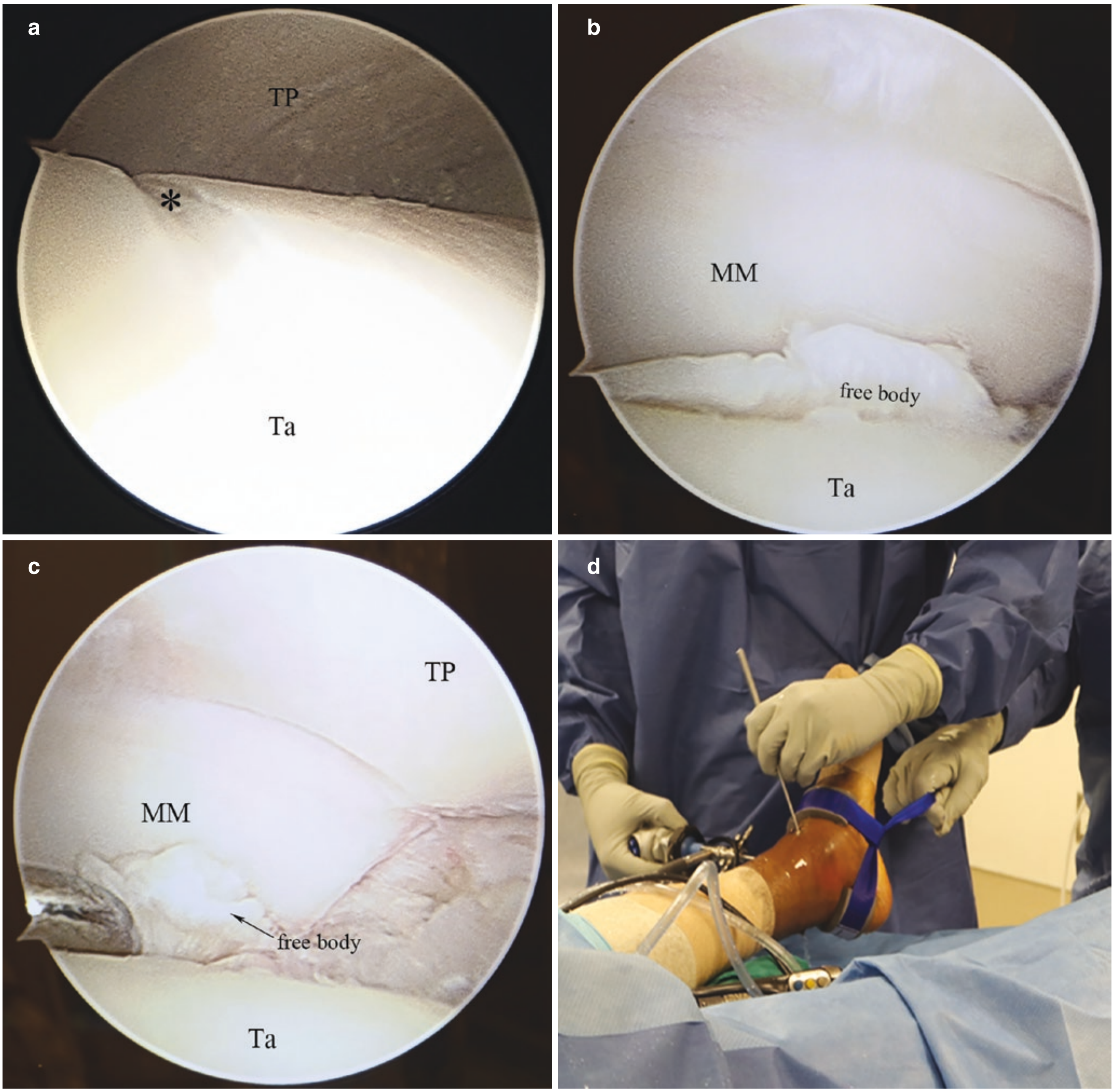

Fig. 7.14 Removal of the loose body. (**a**) The "tram tracks" lesion. (**b**) The loose body. (**c**, **d**) A hook to free the free body. (**e**) A shaver to remove the loose body. (**f**) The loose body was removed completely. *Ta* talus, *TP* tibial plafond, *MM* medial malleolus. *A "tram tracks" lesion

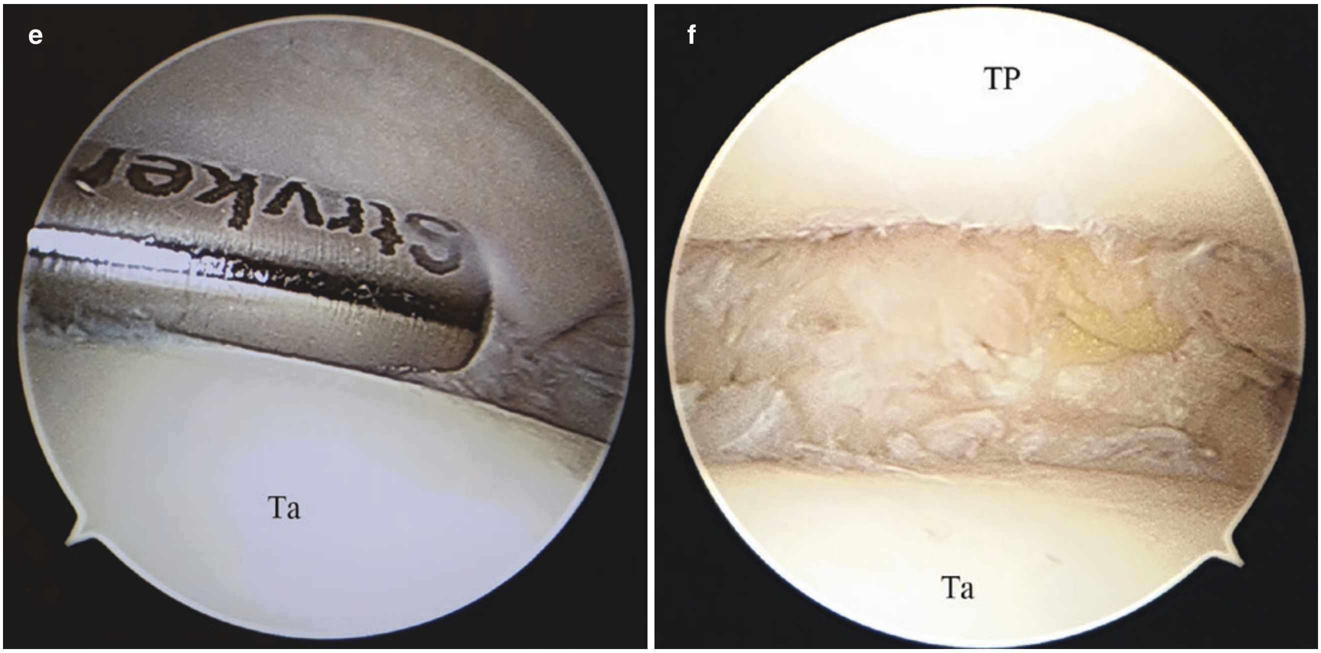

Fig. 7.14 (continued)

erally. They are usually found at the tip of the medial or lateral malleolus (Fig. 7.14). An accessory medial or lateral portal may be needed to approach these fixed loose bodies. A hypodermic needle can help locate the position of the loose body and provide the easiest access to the depth of the recess. The lateral and medial gutters should be examined carefully, and a small diameter bipolar electrocautery or shaver is used to dissect the soft tissues from the loose fragment (Fig. 7.14).

After the loose bodies are removed, a careful evaluation of the ankle joint surface should be performed. If an osteophyte is found to be the source of the loose body or cause injury to the joint, it should be debrided using an arthroscopic burr, an osteotome, or a pituitary rongeur.

7.6.6 Bassett's Ligament Impingement: Arthroscopic Debridement

Nikolopoulos originally described this distal fascicle as an accessory AITFL because of the fibrofatty space between the two ligaments in 1982. Bassett et al. (1990) reported that the distal fascicle of the AITFL could contribute to anterolateral impingement after inversion ankle sprains. The distal fascicle of the AITFL is also named Bassett's ligament.

Bassett's ligament may become thickened, which can impinge the lateral talar dome. MRI may show the edema near the anterolateral talar dome and the thickened ligament (Fig. 7.15a, b). However, the sensitivity of Bassett's ligament impingement on MRI is limited. Arthroscopy is the best tool to examine Bassett's ligament and diagnose impingement. Intraoperatively, a pathologic Bassett's ligament is thick and contacts the talus throughout the ankle range of motion (Fig. 7.15c, d).

Standard anteromedial and anterolateral portals are established. The ankle joint is evaluated, and the synovitis tissue is removed using a shaver. The thickened Bassett's ligament is further examined, and the existence of the impingement is confirmed. An arthroscopic biter or basket is used to resect Bassett's ligament, and a shaver is used to debride the stump of the ligament (Fig. 7.15e, f).

Several studies have reported good to excellent results after arthroscopic debridement of the impinging Bassett's ligament.

7.6.7 Skin Closure/Dressings

The incisions are sutured using 3-0 nylon sutures. A sterile compression dressing is applied.

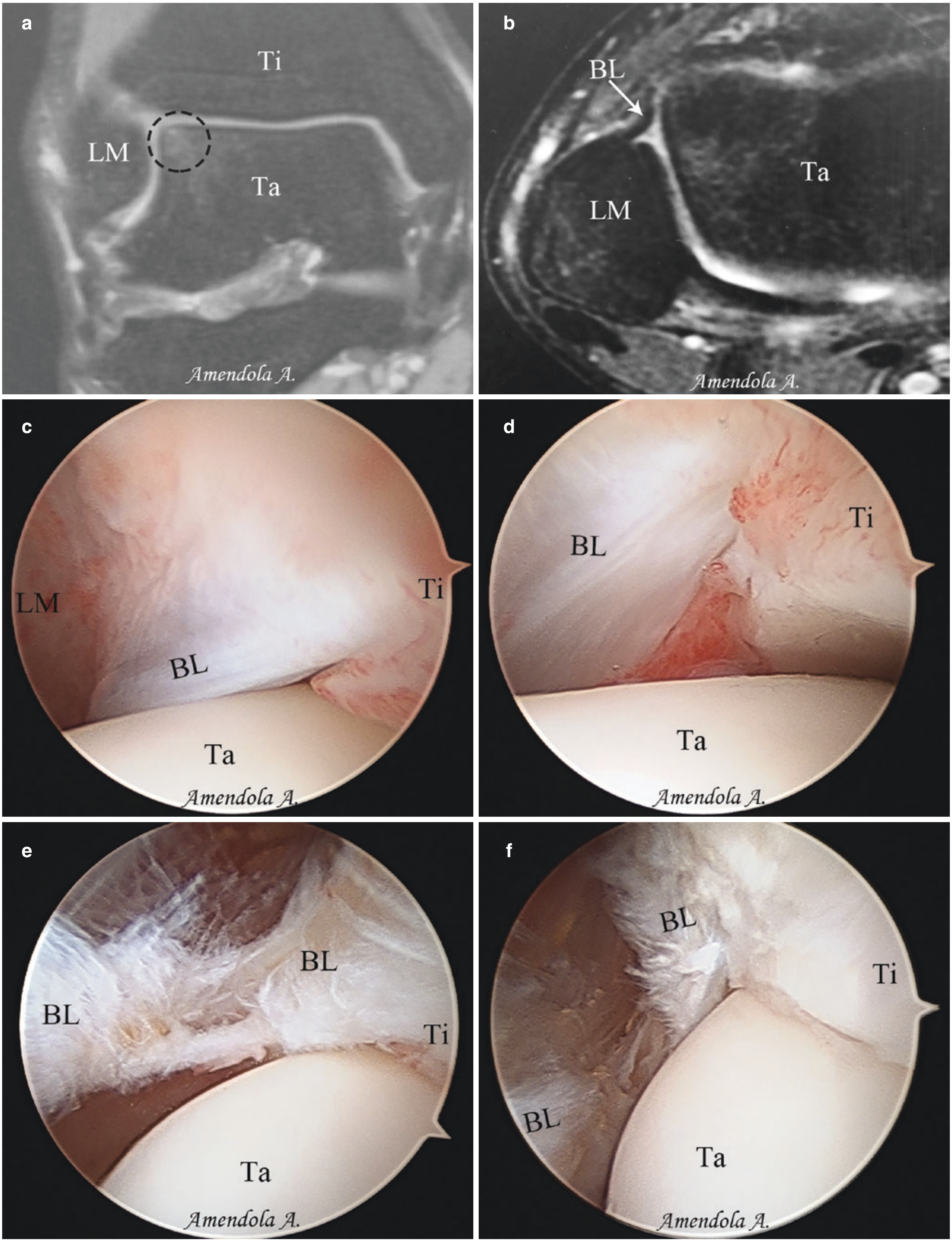

Fig. 7.15 The Bassett's ligament impingement. (**a**) MRI T2WI, coronal view, the black circle shows the edema of the lateral talar dome. (**b**) MRI T2WI, axial view, the thickened Bassett's ligament. (**c**, **d**) Arthroscopic view of Bassett's ligament. (**e**, **f**) Release of Bassett's ligament. *BL* Bassett's ligament, *LM* lateral malleolus, *Ta* talus, *Ti* tibia

7.7 Postoperative Care

A short-leg walking boot is used, and patients remain non-weight-bearing for 1 week. At 1 week postoperative, patients are encouraged to weight-bearing as tolerated in a boot. Physical therapy can help improve the range of ankle motion.

7.8 Complications

Ferkel et al. reported an overall complication rate of 10% in 518 patients with arthroscopically treated ankles. For the anterior ankle impingement, the most common complications were neurologic, involving the superficial peroneal nerve and the saphenous nerve. Superficial infection was noted as another complication. The incidence of deep infection was very low. Incomplete removal of osteophyte, residual free bodies, and hypertrophic scars may lead to recurrence of the symptoms.

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