OBLIQUE MEDIAL MALLEOLAR OSTEOTOMY: Technique Guidance Fully Utilizing the Saw Blade

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The medial malleolar osteotomy (MMO) is frequently performed for adequate access of the medial talar dome in the surgical treatment of talar body fractures and osteochondral lesions. Talar fractures account for less than 1% of all fractures in the body and approximately 5% of fractures that occur in the foot (1). Although rare in occurrence, it is critical for the talar dome to be adequately exposed to ensure optimal anatomic reduction of the talar body and prevent arthritic sequelae.

Osteochondral lesions on the other hand are fairly common causes of ankle pain and instability within the general population. While conservative treatment tends to fair well, especially on smaller lesions, persistent pain usually warrants surgical correction. Beside arthroscopic debridement and subchondral drilling for lesions <1 cm^2, other talar procedures such as the OATS (osteochondral autograft transfer system), mosaic plasty or ACI (autologous chondrocyte implantation) needs access to the talar dome. Large medial dome lesions are best visualized and accessed through a medial malleolar cutdown.

The MMO was first described as a transverse osteotomy by Ray and Coughlin in 1947 (2). Since then, a variety of orientations of the MMO have been described in an attempt to give surgeons better field vision and exploratory room. This led to the inverted V osteotomy described by O'Farrell and Costello in 1982 (3). The crescentic osteotomy was later introduced in 1989 (4). And finally, the step-cut osteotomy by Alexander and Watson surfaced in 1991.

The oblique osteotomy was first described by Spatt in 1986 (5, 6). It is a well-established technique that offers many advantages. The orientation is straight and simple. It affords clear visualization to the medial talar dome without sacrificing anatomic structures such as the anterior ankle capsule, deltoid ligament or deltoid artery. Lastly, fixation is relatively simple with the use of two parallel screws. The senior author utilizes this technique with much success and offers the following surgical pearls.

SURGICAL TECHNIQUE

The patient is positioned in the supine position on the operating table with a contralateral hip bump to apply an external force to the surgical limb. For surgical hemostasis, either a pneumatic thigh tourniquet is applied or local anesthesia with epinephrine. The anatomical landmarks are identified as follows: the medial malleolus (anterior and posterior boundaries), the posterior tibial tendon course (including the posterior tibial tendon malleolar groove), and lastly the medial anterior and posterior ankle gutter.

The medial malleolus is bisected proximal and distal to the ankle joint. Exposure is obtained through a linear incision made approximately 5 cm above the joint line bisecting the malleolus (Figure 1). The incision extends inferior and distal to the tip of the medial malleolus in order to visualize the anterior and posterior ankle gutter without aggressive retraction. Anterior to the incision line, care must be taken to identify and protect the saphenous vein and nerve. Posterior and inferior along the incision line lies the posterior tibial tendon within its groove. The incision is made through the skin down to the level of the subcutaneous tissue. As mentioned above, visualization of the neurovascular

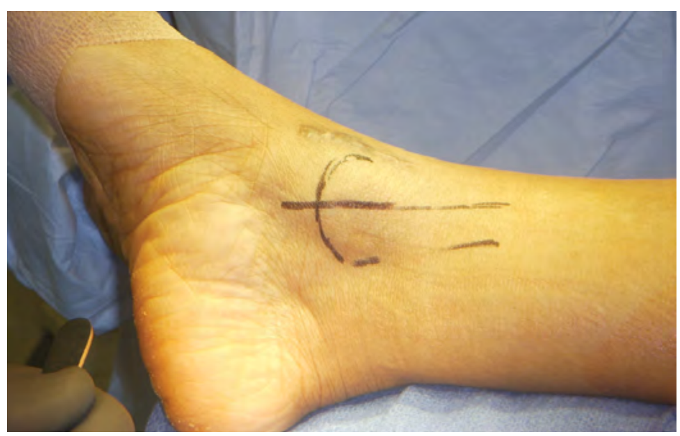

Figure 1. The medial malleolus is bisected and the skin incision commenced in a linear longitudinal orientation extending 3.5 above the medial malleolus and slightly inferior to the tip of the malleolus.

structures are critical. Upon identification of the deep fascia overlying the medial malleolus, a small arthrotomy is made anterior and posterior to expose the ankle gutter based on the target location of the talar pathology.

Utilizing intra-operative fluoroscopy, the saw blade is angled for proper entry to the ankle joint. The periosteum is reflected only along the planned osteotomy site to minimize vascular disruption. The apex of the osteotomy is 3.5 cm proximal to the distal tip of the medial malleolus and angled 35 degrees to the long axis of the tibia providing exposure to approximately 1.0 cm of perpendicular access to the medial talar surface (7). An oblique osteotomy is made utilizing a sagittal saw for three-quarters of the cut (Figure 2).

The key step to this technique is detaching the saw blade from the sagittal saw and keeping it within the osteotomy (Figure 3). The medial malleolus is over-drilled perpendicular to the saw blade within the osteotomy site. The saw blade is positioned anterior or posterior within the osteotomy in order for under drilling and placement of fixation across the far cortex (Figure 3). The saw blade is used to aid in maintaining the proper perpendicular orientation for insertion of lag fixation. This step is crucial in achieving anatomic alignment of the osteotomy on final fixation. Two 3.5 mm cortical screws are then inserted and taken out.

A flexible chisel is used to complete the osteotomy to minimize injury to the articular cartilage (Figure 4A). The posterior tibial tendon is protected and isolated posteriorly. With an osteotome used as a lever, the medial malleolus is reflected plantarward on the deep deltoid ligament (Figure 4B). Upon completion of the intra-articular procedure, the malleolus is reduced back to its original position with reinsertion of the 3.5 mm cortical screws. Intra-operative evaluation and fluoroscopy are used to confirm the final position of fixation and restoration of the ankle joint via visualization of the subchondral bone plate (Figure 5).

DISCUSSION

Anatomic reduction and stable fixation of the osteotomy is critical. Various procedures have been proposed for exposure of medial lesions, however little attention addresses the significance of fixation techniques. Osteotomies of the medial malleolus must be approached with caution. Nonunion or malunion of the osteotomy may lead to increased loads on the joint, worsening articular disruption, and arthritis. For certain large lesions and difficult to access lesions, a MMO is often indicated. We chose an oblique osteotomy, as compared to other proposed procedures, which include a chevron-type, transverse, crescentic, step-cut osteotomies and an inverted U osteotomy (7-10).

Figure 2. Intraoperative fluoroscopic guidance can be used for accurate angulation and orientation of the oblique osteotomy. Care must be taken to maintain a cortical hinge until preliminary fixation placement.

Figure 3A. The saw blade is detached from the sagittal saw. The saw blade is positioned anterior or posterior in order for under drilling.

Figure 3B. Placement of fixation across the far cortex.

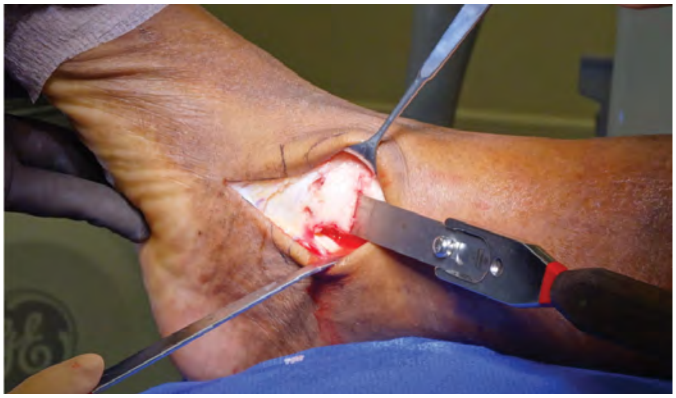

Figure 4A. The remainder of the osteotomy should be completed with an osteotome to minimize injury to the articular cartilage. The posterior tibial tendon is isolated and retracted posteriorly.

Figure 5A. Reduction of the osteotomy is assessed intra-operatively by evaluation of the articular cartilage along the anterior medial ankle gutter. Any rotation or mal-alignment can be manipulated and repositioned at this point.

In our experience, anatomic alignment and restoration of the joint line is maintained with an oblique cut. The surgical pearl in the senior author's experience is using the saw blade as a guide for the insertion of fixation. The perpendicular orientation of hardware prevents shear forces across the osteotomy site. Navid et al studied the effects of screw orientation for fixation of oblique MMOs in cadaver models. The use of a transverse screw in combination with a perpendicular point of fixation has been found to prevent shear forces (9). The fixation technique presented is analogous to oblique malleolar fracture reduction. Long-term results have proven satisfactory union rates with lag screw fixation (11). The use of the sagittal saw to visually aid the perpendicular placement of screw fixation, such as was described here, can reduce the risk of malreduction and malunion of the osteotomy site.

Figure 4B. The medial malleolus is reflected plantar ward on the deep deltoid ligament.

Figure 5B. Intra-operative fluoroscopy is utilized again to confirm position of fixation and restoration of the joint line via visualization of subchondral bone plate.

REFERENCES

1. Ziran B H, Abidi N A, Scheel MJ. Medial malleolar osteotomy for exposure of complex talar body fractures. J Orthop Trauma 2001;15:513-8.
2. Ray RB, Coughlin EJ. Osteochondritis dissecans of the talus. J Bone Joint Surg 1987;29:697-706.
3. O'Farrell TA, Costello BG. Osteochondritis dissecans of the talus: the late results of surgical treatment. J Bone Joint Surg Br 1982;64:494-7.
4. Mendicino RW, Lee MS, Grossman JP, Shromoff PJ. Oblique medial malleolar osteotomy for the management of talar dome lesions. J Foot Ankle Surg 1998;37:516-23.
5. Spatt L, Frank F, Fox NG. Transchondral fractures of the dome of the talus. J Foot Surg 1986;25:68-72.
6. Wallen EA, Fallat LM. Cresentic transmalleolar osteotomy for optimal exposure of the medial talar dome. J Foot Surg 1989; 28:389-94.
7. Eilts CL. Perpendicular talar dome access from variable chevron medial malleolar osteotomies. In: Update 2011. Tucker (GA); Podiatry Institute; 2011. p 11-4.
8. Raikin SM, Elias I, Zoga AC, Morrison WB, Besser MP. Osteochondral lesions of the talus: localization and morphologic data from 424 patients using a novel anatomical grid scheme. Foot Ankle Int 2007;28:154-61.
9. Navid DO, Myerson MS. Approach alternatives for treatment of osteochondral lesions of the talus. Foot Ankle Clin North Am 2002;7:635-49.
10. Alexander IJ, Watson JT. Step-cut osteotomy of the medial malleolus for exposure of the medial ankle joint space. Foot Ankle Int 1991;11:242-3.
11. Ebraheim NA, Ludwig T, Weston JT, Carroll T, Liu J. Comparison of surgical techniques of 111 medial malleolar fractures classified by fracture geometry. Foot Ankle Int 2014;35:471-7.