CHAPTER 31

INCISIONAL APPROACHES AND SOFT TISSUE DISSECTION FOR ANKLE ARTHRODESIS

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Arthrodesis of the ankle joint is a unique procedure in that every major soft tissue structure with distal insertion into the foot is at risk for injury during the procedure. Every aspect of the ankle arthrodesis from the first stroke of the knife to the placement of the final screw, adds to the risk of complication (Table 1). By the use of carefully planned incisions and anatomic soft tissue dissection, the risks can be significantly reduced.

Table 1

ANKLE ARTHRODESIS COMPLICATIONS

I. Complications of Union
   A. Delayed union
   B. Nonunion
   C. Malunion
II. Neurovascular Injury
   A. Painful neuroma
   B. Posterior tibial nerve injury
   C. Arterial laceration
   D. Gangrene
III. Infection
   A. Pin tract infection
   B. Sepsis
IV. Tibial fracture
V. Below Knee Amputation

Advantages to proper incision placement and dissection technique when performing an ankle arthrodesis include avoidance of neurovascular structures, minimal disruption of blood supply to the talus and tibia, adequate visualization of the ankle mortise, access for internal fixation, minimal scar formation by using skin tension lines, and can be performed in a reasonable amount of time.

The literature is full of various incision placements and dissection techniques for ankle arthrodesis. Each incision has advantages and disadvantages, and certainly some incisions have a place for unique types of ankle pathology. Presented here is a review of the most commonly used incisions for ankle arthrodesis, and a description of the incision placement and anatomic dissection of the ankle joint for arthrodesis most favored by the authors.

INCISIONAL APPROACHES

Ankle fusions have been performed using incision sites from every conceivable aspect of the ankle. These incisional approaches reviewed will be grouped into regions of the ankle, including anterior, posterior, medial/lateral, and plantar.

Anterior Approaches

Two types of anterior incisional approaches have been described in the literature, transverse and longitudinal. The longitudinal approach is the safest of the two as far as neurovascular structures are concerned, however, this approach is limited in the amount of ankle mortise that can be visualized.[2] The longitudinal incision (Fig. 1) is made between flexor digitorum longus and flexor hallucus longus,

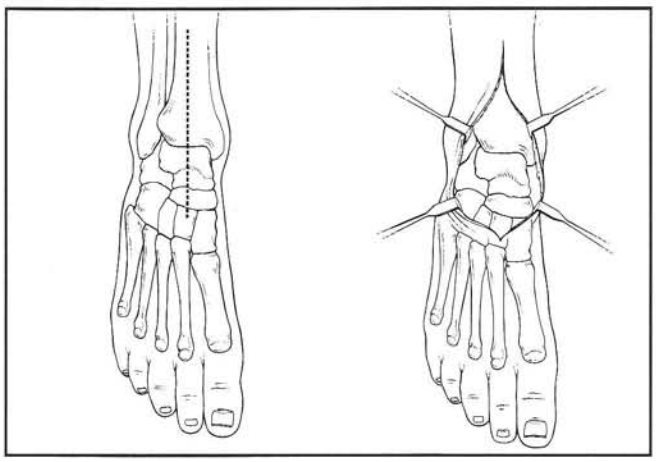

Figure 1. Anterior longitudinal ankle incision.

or tibialis anterior.[3] Care must be taken when performing this incision since the neurovascular bundle is in the immediate area. The only safeguard is that the incision is parallel to the neurovascular bundle.

The remainder of the dissection is carried down to the level of the joint capsule, which is incised, and the entire anterior aspect of the ankle joint is visualized. Unfortunately, the medial and lateral malleoli, along with the posterior aspect of the ankle mortise, are poorly visualized unless extensive soft tissue dissection is performed proximally and distally to allow for wide retraction. The longitudinal incision also severely limits the options for internal fixation unless additional incisions are made.

The transverse anterior approach is the most destructive of all the ankle incisional approaches. The incision is made from 1 cm proximal to the medial malleolus, across the ankle, to 1 cm proximal to the lateral malleolus. A variation of this incision is to start at the talonavicular joint and extend it laterally to the inferior aspect of the fibula (Fig. 2).[3] Dissection is carried through the subcutaneous tissue to the level of the deep fascia. Once the tendons and neurovascular bundle are identified, they are appropriately tagged or ligated and then sharply transected. The dissection is then carried through the joint capsule (Fig. 3)[3] Potential complications from this incisional approach include chronic swelling, numbness, and tendon adhesions.[2,4] This radical dissection allows for maximum visualization of the ankle, but sacrifices far too many important soft tissue structures in the process. Carnesale relates that it is possible to perform this incision and save the neurovascular structures by retracting them out of the way.[3] The use of internal fixation with the transverse approach requires additional incisions.

Plantar Approach

The plantar incisional approach is only used in ankle fusions for fixation purposes.[5,6] Incisions in one of the other areas must be used for resection of the ankle joint. Generally the plantar incision will be on the inferior aspect of the heel and will only be 3 cm to 4 cm in length. The dissection is carried to the level of the calcaneus and the internal fixation is inserted under fluoroscopic visualization.[6]

Posterior Approach

The posterior approach to the ankle joint for arthrodesis has two main indications. The first is the ability to perform an Achilles tendon lengthening or posterior capsule release through the same incision. The second is the superior visualization of the posterior aspect of the ankle joint. The ability to perform the soft tissue procedures through the same incision is an advantage since the position of the patient on the table does not have to be changed, and using the same incision for multiple procedures saves time.

The incision is made slightly lateral or medial to the midline of the Achilles tendon (Fig. 4). The usual technique is carried out for lengthening of the Achilles tendon, in either a frontal or sagittal plane Z fashion. Dissection into the ankle joint is performed lateral to the flexor hallucis longus muscle belly (Fig. 5).[7]

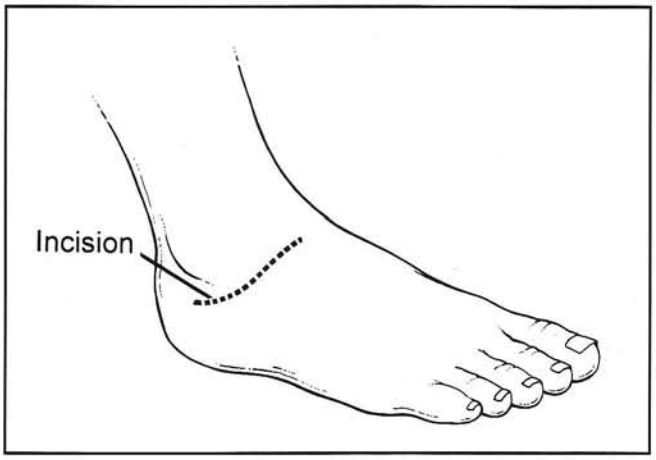

Figure 2. Anterior transverse ankle incision.

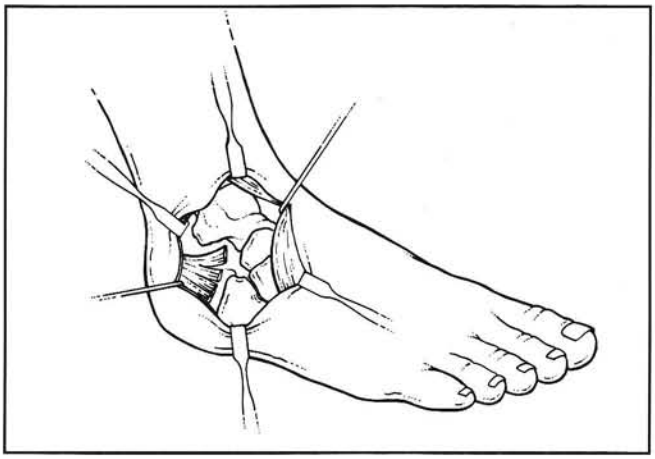

Figure 3. Exposure and dissection associated with anterior transverse ankle incision.

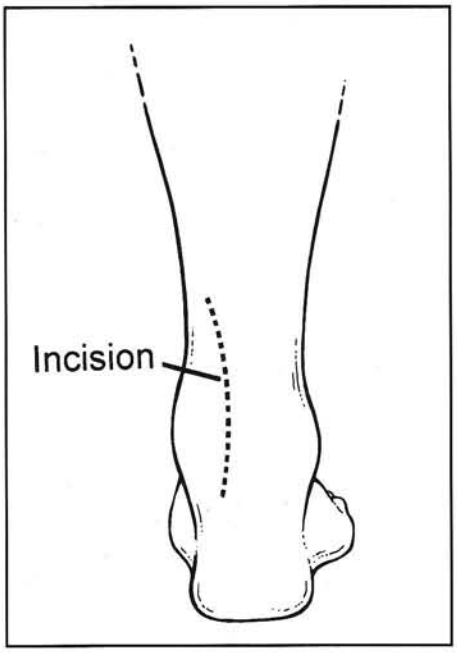

Figure 4. Posterior longitudinal ankle incision.

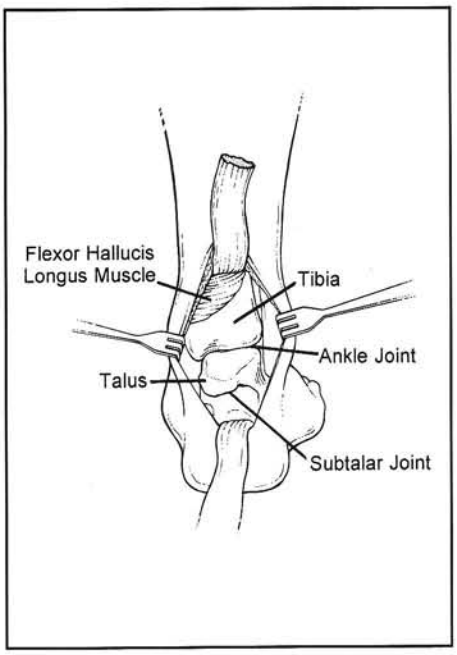

Figure 5. Exposure of the ankle through posterior longitudinal incision.

Visualization of the posterior ankle joint is good, however, the exposure of the anterior aspect, and medial and lateral malleoli, are all limited. The posterior neurovascular structures are relatively safe, and the sural nerve needs to be carefully retracted. Care must also be taken when using a posterior approach to avoid disrupting the subtalar joint, due to their close proximity in the posterior ankle area.[1] Proper fixation from the posterior approach requires additional incisions, which is another minor drawback. Although a transverse posterior incisional approach is possible, (Fig. 6) the destruction of critical neurovascular structures and limitation of exposure make it an extremely poor choice.

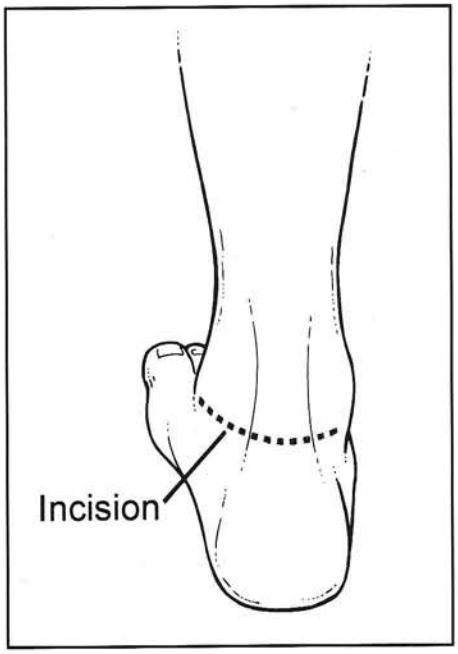

Figure 6. Horizontal posterior incision to ankle joint; should never be used.

Medial/ Lateral Approaches

The medial and lateral incisional approaches, when used together are the most common and sensible approaches to ankle surgery. The medial and lateral incisional approaches can be used either slightly anterior to the malleoli, or as transmaleolar approaches.[1,8,9] Often a combination of the two approaches are used, such as a transmaleolar fibular approach, combined with a anterior medial approach.

The transmaleolar incisional approaches are made over the fibula and medial aspect of the tibia.

The dissection is carried to the level of the malleoli, and then they are transected. The ankle joint is then entered through both the medial and lateral sides. The exposure of the ankle joint is good in all areas. Fixation can be easily accommodated through these incisions to the ankle. The resected bone can be used as an onlay graft or completely discarded.

The major drawback to the transmaleolar approach is the time and amount of soft tissue dissection required to resect the malleoli, and then to fixate them as onlay grafts. When removing the distal aspect of the fibula, caution must be used to avoid disrupting the perforating peroneal artery.

The antero-medial and antero-lateral approaches have the advantages of excellent exposure of the ankle joint and minimal disruption of important osseous and soft tissue structures. The minimal soft tissue dissection leaves the important blood supply to the tibia and talus intact. Exposure is somewhat limited in the posterior aspect of the joint, however, this can be overcome by plantarflexing the ankle and careful bone resection of the talar dome. In a joint that does not require wedging, this approach is ideal for curettage of the cartilagineous surfaces. The medial and lateral malleoli are left intact except for the cartilaginous surfaces, and can be used as supports to place bone grafts between the talus and themselves.

The only important soft tissue structure that lies near the pathway of this incisional approach is the superficial peroneal nerve as it crosses the anterior aspect of the ankle joint. With careful anatomic dissection and retraction, this nerve can be easily avoided. Fixation is also easily applied through this incision.

DESCRIPTION OF ANTERIOR MEDIAL AND LATERAL APPROACH

The initial stage of any surgical procedure is becoming familiar with the bony landmarks. The tibia, fibula, talus, and ankle joint should all be palpated and clearly identified (Fig. 7). In this case, the incision was started medially, approximately 8 cm proximal to the ankle joint. The incision is carried distally over the ankle joint to the level of the talar neck (Fig. 8). A controlled depth incisional technique allows for dissection through the skin without blindly entering the subcutaneous tissue.

When entering the subcutaneous layer, care must be used to avoid the saphenous nerve and the medial dorsal cutaneous nerve. After dissecting through the subcutaneous layer, a gauze sponge should be used to reflect the layer both medially and laterally. The deep fascia will then be clearly visible (Fig. 9).

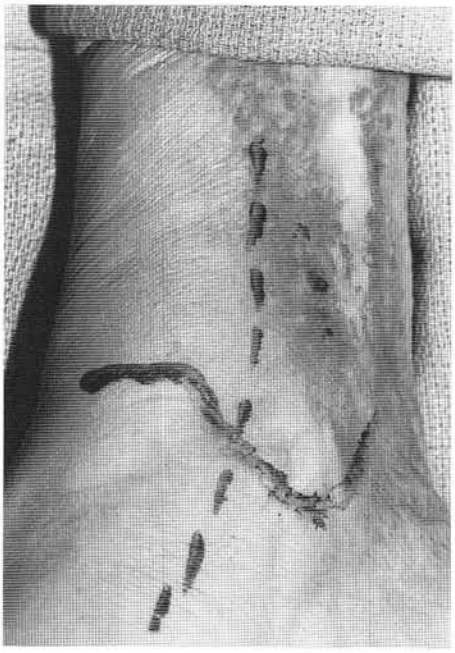

Figure 7. Anterior medial incision line drawn on ankle.

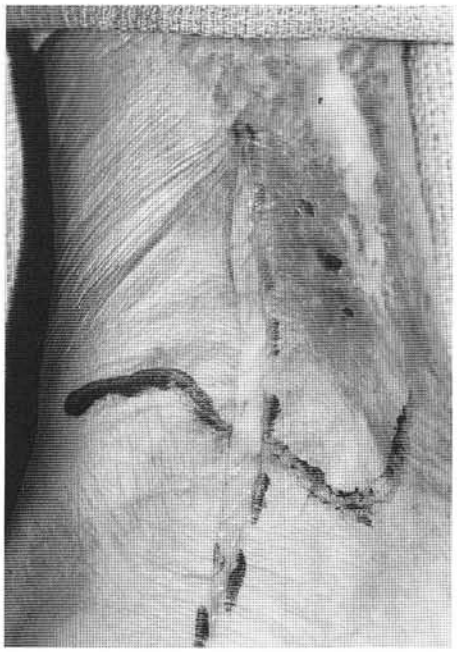

Figure 8. Subcutaneous tissue visualized through skin incision.

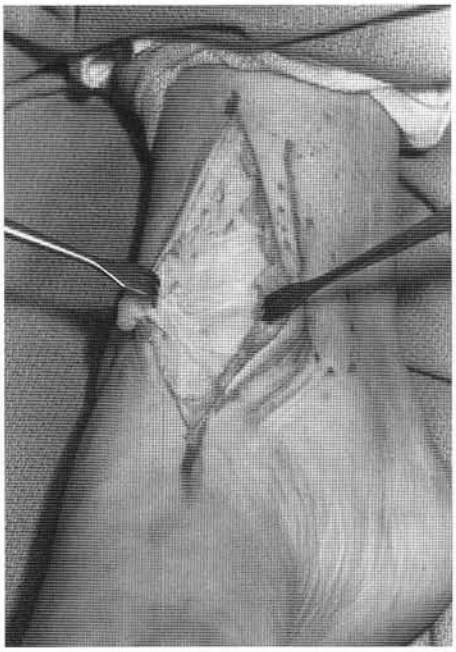

Figure 9. Deep fascia and joint capsule of ankle should be clearly visualized.

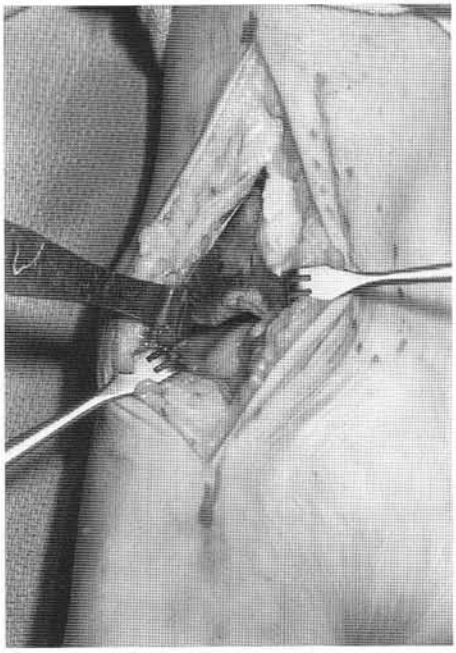

Figure 10. Exposure of ankle through the capsular incision. Note the amount of periosteal dissection.

The deep fascial layer over the ankle joint adheres tightly to the joint capsule, and should be incised sharply at the same time that the capsular incision is made. Prior to the capsular incision, the area should be carefully palpated to be sure of the landmark orientation. Once sure of the joint line and adjacent bony structures, the capsular incision is made in the orientation of the skin incision. The capsular incision should only extend from the area on the tibia just proximal to the joint down to the talar neck. The talonavicular joint should not be entered. As the soft tissues are then dissected from the tibia and the talus, a periosteal elevator should be used to start the dissection. The use of the elevator will assist in keeping the joint tissue and adjoining periosteum intact.

The soft tissues around the medial malleolus need to be adequately reflected so that the articular surface can be easily reached. Minimal dissection of the periosteal layer around the ankle preserves the blood supply to these bones that is so important in preventing complications such as nonunion. Once the soft tissue dissection on the medial side of the ankle is completed, the anterior, medial, and posterior (with some manipulation of the foot) aspects of the ankle joint should be seen (Fig. 10).

The lateral side of the ankle is now palpated and the anterior aspect of the fibula should be carefully identified (Fig. 11). The incision is made using the same techniques as before. The incision should course along the leg just anterior and medial to the fibula (Fig. 12). The subcutaneous layer is carefully dissected with the same technique as the medial side. Once the joint capsule is identified (Fig. 13), the area must be carefully palpated to identify the talus, fibula, and tibia. The capsular incision is made on the lateral aspect of the tibia. The capsular incision should be only long enough to expose the joint and enough bone on the tibia and fibula to allow for curettage of the joint surfaces (Fig. 14). Use of the periosteal elevator when beginning the periosteal dissection will aid in keeping the tissue layer intact. After completing the soft tissue dissection on the lateral aspect of the joint, the articular surface of the tibia, fibula, and remaining surfaces of the talus should all be visible.

Following the joint resection and fixation, the layers can be closed anatomically using the appropriate sized absorbable suture. Capsule and deep fascia are closed using 2-0 absorbable suture with drains also being inserted at this point (Fig. 15). The subcutaneous layer is closed using 3-0 absorbable suture (Fig. 16). The skin is reapproximated using 5-0 absorbable suture in a subcuticular fashion (Figs. 17A, 17B).

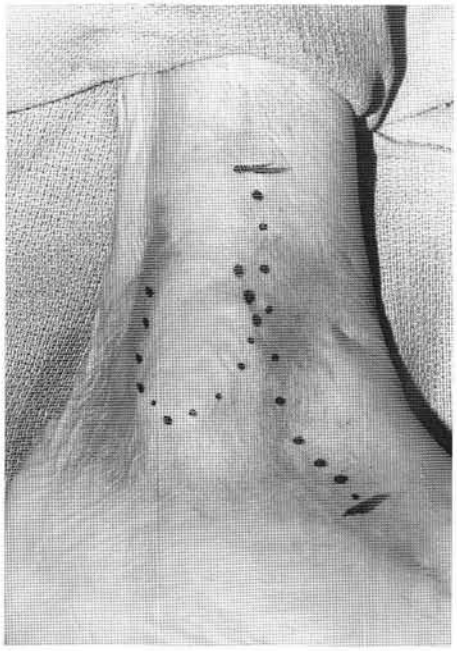

Figure 11. Anterior lateral incision line drawn on the ankle.

Figure 12. Subcutaneous tissue visualized through incision line.

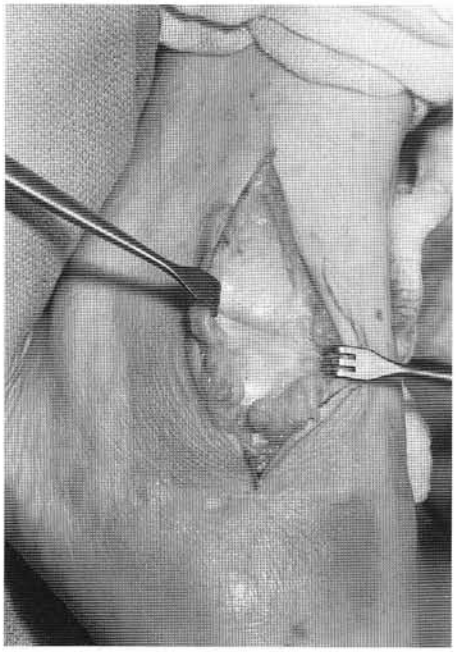

Figure 13. Deep fascia and joint capsule should be clearly visualized.

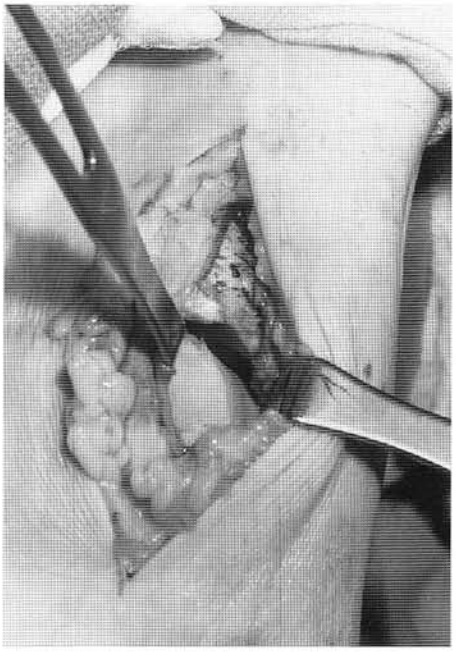

Figure 14. Exposure of ankle joint through the capsular incision. Note the amount of periosteal dissection.

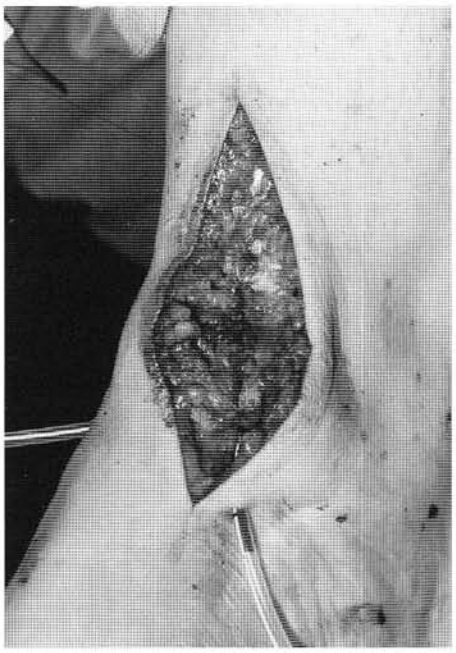

Figure 15. Capsular closure of the medial incision with 2-0 absorbable suture with a drain in place.

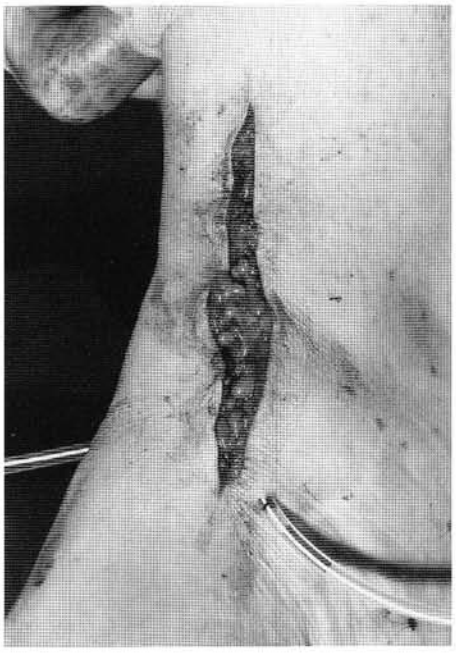

Figure 16. Subcutaneous closure of the medial side with 3-0 absorbable suture.

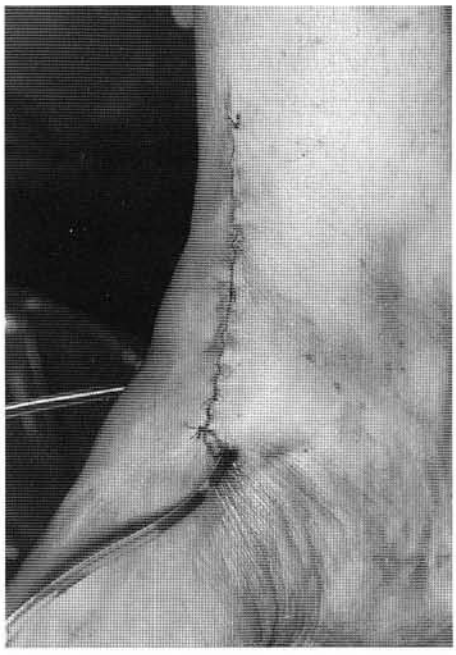

Figure 17A. Skin closure of the medial side with 5-0 absorbable suture.

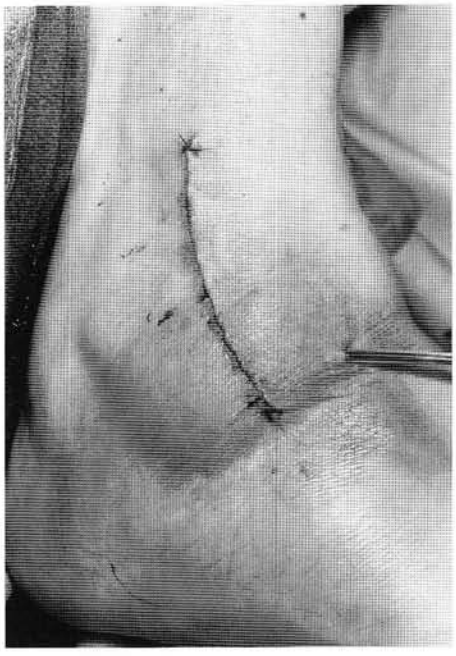

Figure 17B. Skin closure of the lateral side.

CONCLUSION

The first step to avoiding complications and achieving a successful fusion of the ankle joint is in careful planning of the incision and anatomic dissection. Use of the anterior medial and lateral approach minimizes periosteal disruption, and therefore blood supply to the tibia and talus. This approach also provides good visualization of the ankle joint without compromising neurovascular structures.

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