CHAPTER 33

INTRAMEDULLARY NAIL IN FOOT AND ANKLE ARTHRODESIS

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The intramedullary nail has been successfully used in the treatment of fractures of the long bones of the upper and lower extremity. It has now been modified for use in arthrodesis of the ankle and subtalar joint.

Tibio-talocalcaneal arthrodesis is a salvage procedure for treatment of severe pain or deformity in the lower extremity. Many types of fixation have been utilized to achieve this goal, commonly, screw fixation. Screw fixation, like other forms of fixation has its advantages and disadvantages. The most notable advantage is the ability to obtain compression at the arthrodesis site. Another advantage is the size and ease of application of this means. A disadvantage of screw fixation is the prolonged period of non-weight bearing necessary to achieve bony union.

In the young, healthy patient non-weight bearing is less of a concern. However, in the elderly patient, decreased periods of non-weight bearing is optimal to reduce the risk of deep vein thrombosis that occurs with prolonged immobilization. Also, it is difficult for the elderly patient to function in daily activities with limited use of a limb.

In order to avoid these pitfalls, and still achieve bony union as successfully as with screw fixation, other methods of fixation have been pursued including various external fixators. One such external fixator that has been used with success at the Podiatry Institute is the Ilizarov external frame. Although this frame does allow weight bearing and achieves compression, it is bulky and cumbersome, and carries the risk of pin tract infections. Therefore, the search continues.

In 1948, Adams described his experiences using a trifin nail for ankle arthrodeses in patients who would not suffer from loss of subtalar joint motion.[1] His method was performed by refreshing the joint surfaces, and inserting a long, three-flanged nail up through the calcaneus and talus into the tibial shaft, followed by 14 weeks of immobilization in plaster. He reported two failures in 30 operations utilizing this method.

His method of ankle stabilization was repeated in 1990 by Stone and Helal on a total of 20 ankles through an anterior approach.[2] Their patients were treated with two weeks of immobilization, followed by encouraged weight bearing in a plaster cast for the next three months. They reported bony fusion in an acceptable position in 19 of the 20 ankles. The single nonunion was in a 69-year-old diabetic male with prior Charcot degeneration. Following the surgery, his talus progressed to almost complete dissolution.

In 1988, Johnson designed an intramedullary rod for use in ankle and subtalar arthrodesis, based on this early idea.[3] His rod was modified to fit the tibia better, and had the ability to be stabilized with interlocking screws. Johnson used a posterior approach, medial to the Achilles tendon because he believed that maximal exposure and correction of significant deformities were possible through this approach. In a study of 30 cases by Kile, et al.,[4] using this posterior approach in conjunction with autogenous iliac crest graft, a total of 26 patients were satisfied with their results. Of the four dissatisfied patients, two had gone on to below-knee amputations secondary to deep infection and rod prominence. One patient was dissatisfied with skin slough, and one died of pneumonia after returning to his home state.

INDICATIONS

The intramedullary rod for arthrodesis in the foot and ankle is not useful in all cases. Since the rod traverses both the subtalar joint and ankle joint, it stands to reason that it can only be used in patients undergoing concomitant arthrodesis at both sites.

This technique is also useful in patients that have undergone a previous subtalar or ankle arthrodesis, or in patients where loss of subtalar motion is not detrimental. The application of the intramedullary rod for ankle arthrodesis is contraindicated in those patients where subtalar joint motion is present and it is desirable that it be preserved.

SURGICAL APPROACH

Different approaches have been described for resection of the joint surfaces, including a posterior-medial approach with splitting and subsequent repair of the Achilles tendon, and an antero-lateral approach. In the author's opinion, the posterior approach is useful in cases where there is a need for lengthening of the Achilles tendon, such as in a case of fixed equinus with an adaptive loss of Achilles length. The ankle joint and subtalar joint can both be easily approached from this approach. However, the surgeon must be cognizant of the vital neurovascular structures in this area.

When there is not a need to lengthen the Achilles tendon, an anterolateral approach works well. From this approach, the fibula can be easily resected and used as an onlay graft. When a pantalar arthrodesis is indicated, this anterior lateral incision can be extended to reach the calcaneocuboid joint and a separate anterior medial incision can be performed to resect the talonavicular joint and apply separate fixation.

APPLICATION

The rod is inserted plantarly through the calcaneus into the tibial shaft. It is imperative that the rod is centrally located in the tibial medullary canal. This is best accomplished by starting the guide drill plantarly through a plantar incision just distal to the heel pad with the aid of fluoroscopy. Once the guide hole is placed, the canal is subsequently reamed to one size less than the rod. This is accomplished by increasing the reamer size until the desired diameter is reached. Once the size is reached, the rod is inserted plantarly and hammered in, while the foot is held in a slightly abducted position. Once in place, the transfixation screws can be applied via fluoroscopy. Ideally, two transfixation screws should be placed above and below the arthrodesis sites, however some authors have abandoned the proximal screws to allow compression with axial loading while weight bearing.[5]

POSTOPERATIVE CARE

Several postoperative courses have been mentioned previously, ranging from encouraged weight bearing, to 14 weeks of non-weight bearing. There have been consistently good results in the studies reviewed. Upon further review of the failures, the majority of these were patients who were fused for Charcot arthropathy. Therefore, one might conclude that patients at risk for further breakdown, whatever the etiology, would be best treated with strict postoperative non-weight bearing until bony union is identified radiographically. All of the patients in the studies had an additional period of one to two months of protected weight bearing, such as a removable cast boot or walker cast.[1-5]

CASE PRESENTATION

A 74-year-old, white female was referred to the office for treatment of a plantar ulceration as well as progressive deformity of her left foot and ankle. There was a three centimeter ulceration at the plantar medial aspect of the talar head, as well as complete medial arch collapse and severe ankle valgus (Fig. 1). Radiographs showed a degenerated ankle and subtalar joint with anteriomedial dislocation of the talus (Figs. 2A, 2B).

Figure 1. Preoperative clinical view. Note the deformity and anteriomedial protuberance of the talus.

Figure 2A. Preoperative lateral radiograph. Note the breakdown at both the ankle and subtalar joint, as well as the midtarsal joint.

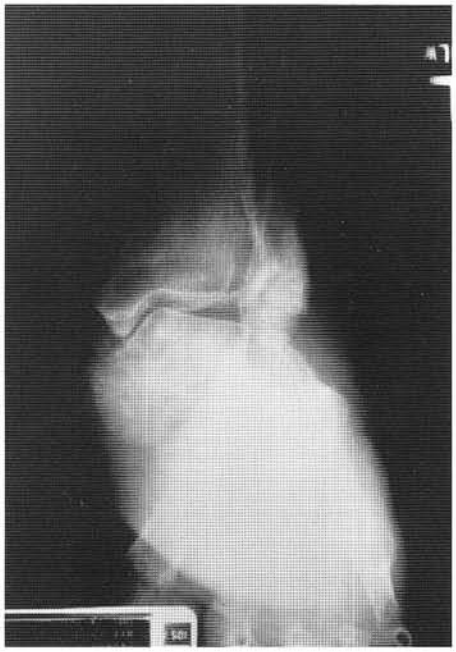

Figure 2B. Preoperative A-P radiograph. Note the medial dislocation of the talus.

The patient had a long history of Type II Diabetes Mellitus in addition to hypertension, and a past cerebrovascular accident. She was currently taking Cephalexin for the ulceration as well as her maintenance medications. After a period of two months of strict non-weight bearing and healing of the ulceration, the decision was made to perform a tibio-talocalcaneal arthrodesis.

Under spinal anesthesia, and hemostasis via a pneumatic thigh tourniquet, an anterior medial incision was made along the left ankle. The talus, which was medially dislocated, was readily accessible for excision. Once the talus was excised, the articular surfaces of the tibial plafond and dorsal calcaneus were denuded. The talus, which still had a large portion of healthy bone, was fashioned into an inlay graft (Fig. 3).

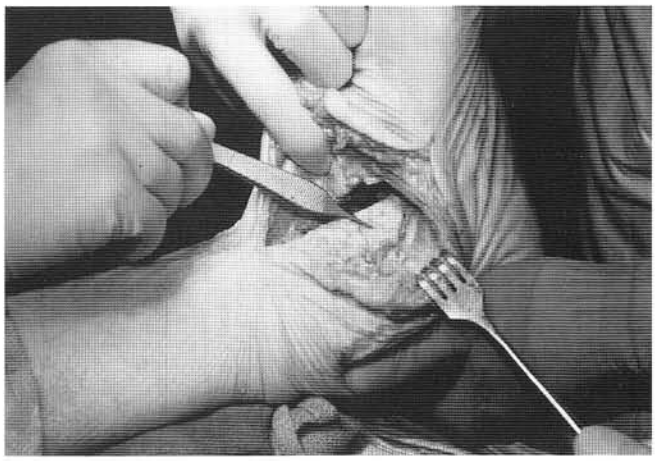

Figure 3. Intraoperative view after removal of the talus and reinsertion as an autogenous bone graft.

At this point, the pre-drill was introduced plantarly through a small incision distal to the heel pad, and after satisfactory positioning of the foot on the leg, the drill was driven into the tibial shaft with the aid of fluoroscopy. Following reaming to 10.5 millimeters, an 11 millimeter x 15 centimeter intramedullary rod was introduced. Under fluoroscopy, two transfixation screws were placed at the proximal and distal end of the rod (Figs. 4A, 4B). The wounds were closed over closed suction drainage, and the patient was subsequently discharged after a short stay in the hospital.

The postoperative course was three months of non-weight bearing in a short-leg fiberglass cast. After radiographic confirmation of consolidation, the cast was removed and protected weight bearing

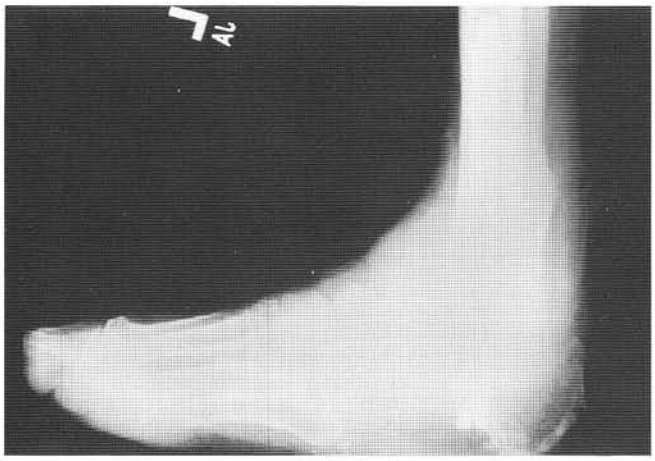

Figure 4A. Postoperative lateral radiograph showing the intramedullary rod in place.

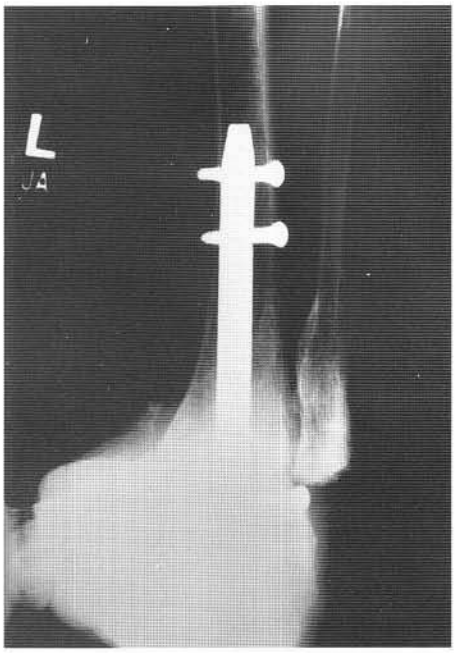

Figure 4B. Postoperative A-P radiograph showing the intramedullary rod in place. Note the proximal and distal transfixation screws.

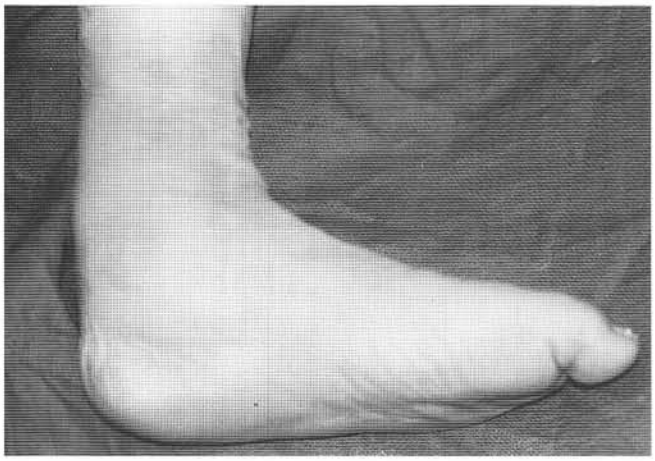

Figure 5. Clinical view, seven months postoperatively.

Figure 6. Eight months postoperative. Patient is in a molded shoe with rocker bottom to protect the midfoot.

was initiated for the next two months. After adequate healing (Fig. 5), she was placed in a pair of molded, high-top shoes with a rocker bottom to protect the midfoot from further breakdown (Fig. 6).

CONCLUSION

The modified intramedullary rod adds another dimension to lower extremity arthrodesis fixation. Its advantages include ease of application, as well as potential postoperative-weight bearing in the appropriate patients. Like all fixation, it is not without its disadvantages. However, in the properly selected patient, it can provide the necessary adequate fixation and protection during healing.

REFERENCES

1. Adams JC: Arthrodesis of the ankle joint: Experiences with the transfibular approach. *J Bone Joint Surg,* 30B:506, 1948.
2. Stone KH, Helal B: A method of ankle stabilization, *Clin Orthop:* 268:102-106, 1991.
3. Russotti GM, Johnson KA, Cass JR: Tibiocalcaneal arthrodesis for arthritis and deformity of the hind part of the foot, *J Bone Joint Surg,* 70A(9):1304-1307, 1988.
4. Kile TA, Donnelly RE, Gehrhe JC, et al.: Tibio-talocalcaneal arthrodesis with an intramedullary device, *Foot Ankle,* 15:669-673, 1994.
5. Moore TJ, Prince R, Pochatko D, et al: Retrograde intramedullary nailing for ankle arthrodesis. *Foot Ankle,* 16:433-436, 1995.