FLEX-THREAD™

Surgical Case Study
Ankle Fracture

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Introduction

Management of ankle fractures has evolved over the years, adding locking plates and screws to span comminuted fractures or more effectively stabilize fractures with osteoporotic bone. The success of these advancements is well-documented in the literature, and has improved patient care and outcomes.[1-5] The drawback to these modalities is the necessity of a formal open incision, with potential wound healing issues and the possibility of hardware-related complications because of a sometimes very thin soft tissue envelope laterally over the fibula.[6,7] The patient population with the highest risk factors for complications are also those likely to benefit the most from locked technology. The most recent advancement in ankle fracture treatment has evolved from long bone fracture management. Intramedullary fixation allows for limited or minimal incisions with less risk of hardware related complications.[7,8] In addition, certain intramedullary nails for fibula fracture management also allow for locking fixation both proximally and distally to span comminuted bone without disrupting the periosteal sleeve, while providing locked fixation for all bone types — including osteoporotic bone. This has created another option for providing appropriate stabilization while minimizing risks to the patient.[7,8] The fibular nails also offer an ability to place syndesmotic fixation through the nail in the event there is an associated syndesmotic disruption. The original fibula intramedullary nails were a rigid construct and also had to be hammered into place, with the inherent risks of displacing the fracture or creating an iatrogenic fracture.[9] Rigid nails require a precise starting point to prevent fracture displacement when the nail is placed.[10] The other nails also have a larger insertion jig that can be bulky and cumbersome when trying to work around reduction forceps on the fibula. A flexible intramedullary fibular nail with a smaller insertion jig has recently come to market that enables locking both proximally and distally, while allowing for a less traumatic insertion — with an inherent lower risk of displacing the fracture — which is of great importance when using this in osteoporotic bone.

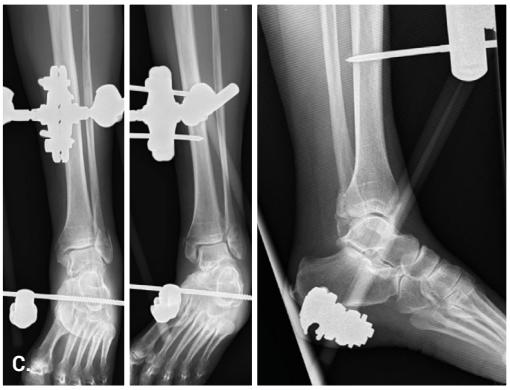
The following case is an example of an elderly female with a poor soft tissue envelope and osteoporotic bone who sustained a significant injury that required surgical stabilization. The goal was to provide an anatomic reduction with sufficient stability through minimal incisions to allow the fracture to heal and limit the surgical risks associated with the incisions.

Case Report

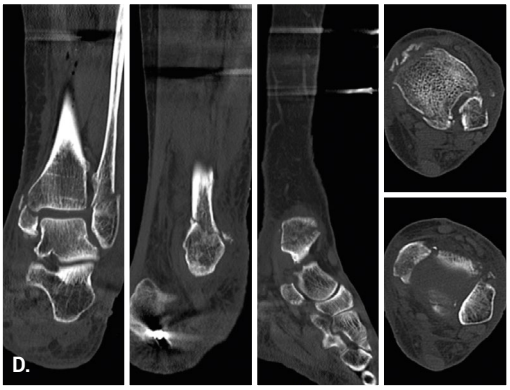
The patient is a 78-year-old female who had sustained a mechanical fall injuring her left ankle. She was seen at an outside Emergency Department and was diagnosed with a closed ankle fracture. The patient's ankle fracture was reduced, splinted, and she was instructed to follow up outpatient with an Orthopedic Surgeon. She presented to my office the following day and was diagnosed with a trimalleolar ankle fracture. The fibula appeared to be a displaced Weber B fracture[A] that would be appropriate for fixation with a fibular nail. We maintained the splint as the Emergency Department had noted a closed fracture and the patient denied any open wounds or bleeding around the ankle. To avoid the fracture displacing and requiring repeat reduction with splinting in the office, we did not want to remove the splint holding the ankle reduced. With the unstable nature of the injury, the plan was to take the patient to surgery for surgical fixation as soon as she was cleared medically.

Surgical Technique Overview

Once we had the patient in the operative suite and anesthetized, we removed the splint and noted significant fracture blisters both medially and laterally.[B] We would be unable to make any incisions medially or laterally, and we decided to place a spanning external fixator to provide stability; this would allow us to monitor the soft tissue envelope for resolution of the fracture blisters before we could return to perform formal operative reduction with internal fixation. A standard delta frame external fixator was applied, and the fracture was assessed for reduction prior to leaving the operating room.[C] A postoperative CT scan was also obtained for preoperative planning of definitive stabilization.[D]

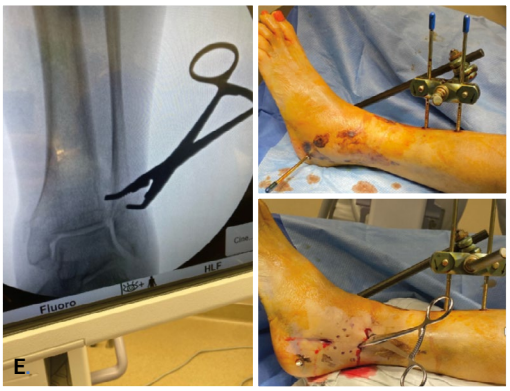


After adequate time had passed to allow the fracture blisters to resolve, the patient was taken back to the operating room for definitive fixation. The patient still had very thin skin, and I was concerned about wound healing issues even once the fracture blisters appeared to have healed sufficiently. We felt that using a fibular nail with a less traumatic insertion would serve the patient well — minimizing the incision laterally with her thin soft tissue envelope, and be less at risk of displacing the percutaneous fracture reduction while placing the flexible nail. The fibula fracture appeared to be out to length with the external fixator in place, and the goal was to leave the external fixator in place medially to maintain the length of the fibula before and during fixation with the flexible nail. The patient was anesthetized, prepped, and draped in the standard sterile fashion. The lateral pins and bars were removed, and intraoperative fluoroscopy was used to confirm maintenance of the fibular length. We then used fluoroscopy to identify the fracture site, and percutaneous stab incisions were made anterior and posterior to the fibula at the fracture site so that a reduction forceps could be inserted; a formal reduction was performed under fluoroscopic guidance.[E] We had to be very careful to



Surgical Technique Overview *continued*

not crush the soft osteoporotic bone with the reduction, but wanted to provide compression across the fracture site. We then marked out the borders of the distal fibula with a marking pen, and made a small incision centrally under the fibula to allow for identifying the starting point for our nail. We retrograded the guidewire up the fibular canal above the fracture site and ensured that we were centered on both AP/mortise and lateral fluoroscopic spot images. We then inserted the distal opening reamer for the barrel of the nail to the appropriate depth with fluoroscopy, and then used the proximal canal reamers to ream sequentially proximally to identify the correct nail diameter — as with any intramedullary nailing of a long bone. The guidewire was then removed and the appropriate length and diameter nail was prepared for placement. Due to the compact size of the insertion jig, we were able to maintain the reduction forceps maintaining compression across the reduced fracture while we placed the nail. We were then able to insert the nail with the screw in mechanism without having to impact the nail into the soft bone. We used fluoroscopy to confirm that the nail was buried to the appropriate depth. Prior to placing our distal locking screws through the nail and fibulae, we inserted a guidewire through a drill sleeve across the syndesmosis to provide further stability to the construct. We were then able to place the distal locking screws through the targeting guide through small stab incisions. The fibula was now locked out to length, with the threads proximally and the interlocking screws distally. Once the fibular hardware was confirmed to be well-positioned and the reduction was anatomic, we removed the remaining components of the external fixator to approach the remaining fractures. We kept the insertion jig in place while we moved over and fixed the medial malleolus in a standard fashion, and where then able to percutaneously fix the posterior malleolus. Once we had the fractures reduced and stabilized, we performed an external rotation stress test and felt that the syndesmosis was still unstable. The ankle was reduced in dorsiflexion to avoid overtightening of the syndesmosis, and the targeting jig was utilized to place a suture button to help reduce and stabilize the syndesmosis.[11] Final fluoroscopic images were obtained to confirm accurate reduction of the fracture and correct hardware placement.[F] The wounds were then irrigated and closed, and the patient had a sterile dressing applied followed by a walking boot.

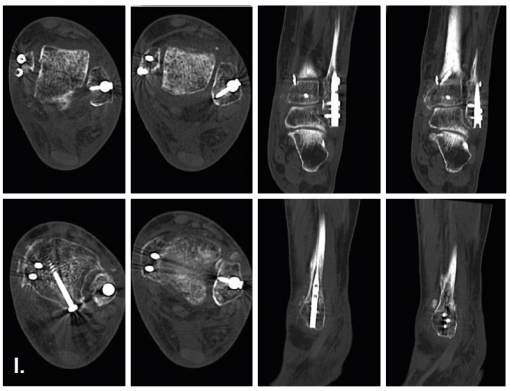


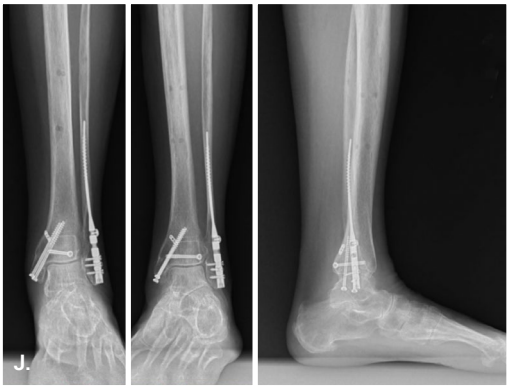
Postoperative Protocol and Outcome

Postoperatively, the patient was kept non-weight bearing to protect the medial incision and the healing fractures. The patient was seen at a two-week postoperative appointment, and the sutures were removed. Radiographs of the ankle were obtained to confirm no changes to the ankle, and the patient was placed back into a walking boot to begin partial weight bearing.[G] The patient was then seen at a six-week postoperative appointment, and repeat radiographs were performed.[H] The patient still had residual pain over the medial malleolus. We

Postoperative Protocol & Outcome *continued*

continued to protect the patient in the boot with partial weight bearing while we waited on the medial malleolus to heal. We saw the patient at eight and ten weeks postoperatively. Due to continued pain over the medial malleolus we obtained a CT scan that demonstrated healing of the fibula and posterior malleolus, but delayed healing of the medial malleolus. With the fibula and posterior malleolus healed, we allowed the patient to weight bear as tolerated in the boot until her medial symptoms resolved. Once the patient demonstrated no residual pain over the medial malleolus, we discontinued the boot and began physical therapy. The patient recently followed up eight months out from surgery, and has returned to full activity with no residual pain and completely healed fractures.[J]





Summary

When dealing with patients with osteoporotic bone and less than optimal soft tissue envelopes, this fibular nail — with its ability to be placed in a controlled and less aggressive fashion, through minimal incisions and with a smaller insertion jig, and the ability to lock the nail proximally and distally — can help minimize risks while providing adequate stability for patients most at risk for complications. This patient was a perfect example of utilizing this new technology to benefit patients and provide sufficient stability for fracture healing while minimizing surgical risks.

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