Surgical Management of Ankle Fractures in Diabetics

Evaluation and proper fixation are key.

BY NICHOLAS J. BEVILACQUA, DPM

Patients with diabetes have a higher risk of complications after sustaining an ankle fracture. Diabetes continues to be a growing problem. According to the International Diabetes Foundation (IDF), 415 million adults have diabetes, and by 2040, this will rise to 642 million. Recently, the IDF estimated that half of all adults living with diabetes are unaware of their type 2 diabetes. The increased incidence of diabetes (and its increased incidence of complications) and its sequelae are important to be aware of when treating ankle fractures.

Ankle fractures are seemingly straight-forward injuries; however, in the person with diabetes, this injury can have disastrous outcomes. Previous studies have reviewed the outcomes of ankle fractures in patients with diabetes, and increased rates of complications have been reported with both conservative and surgical management.[1] Reported surgical outcomes following open reduction and internal fixation (ORIF) of ankle fractures in this patient population include high rates of complications, including wound infection, nonunion, Charcot neuroarthropathy, loss of fixation, increased rates of revision surgery, and amputation.[2,3] Limb salvage after failed ORIF can be very challenging and often requires multiple operative procedures.[4]

In a large population-based study, SooHoo and colleagues identified 57,183 operatively managed ankle fractures, whereas 1,219 fractures were complicated diabetic ankle fractures (defined as those with end-organ damage).[2] They found significant increase in complication rates (wound infection, revision operation, and BKA) in the complicated diabetic group.

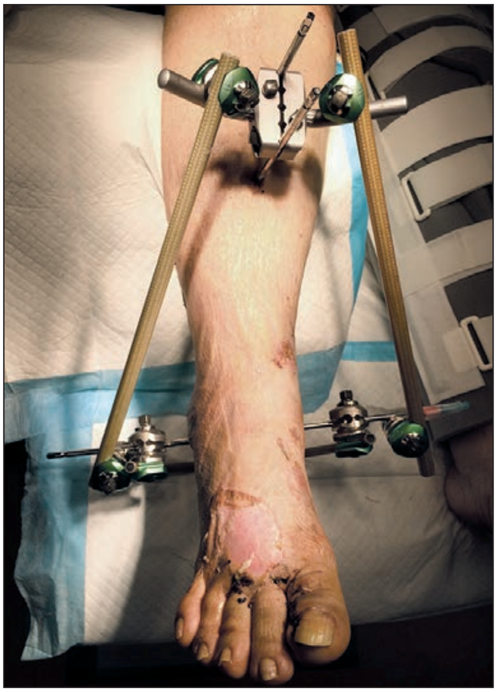

Figure 1: A spanning external fixator applied to provide skeletal stabilization and allow normalization of soft tissue.

Wukich, et al. reported on their outcomes of ankle fractures in patients with diabetes.[3] The authors found that patients with complicated diabetes had the highest rates of complications. The authors noted that it is the complications of diabetes that increase the risk of complications following ORIF of ankle fractures.

Fracture care in this patient population requires an understanding of the pathophysiology of the disease process and its inherent challenges. Accordingly, it is important to be fully aware of the treatment options available to optimize outcome. Advances in fixation techniques and technology have facilitated the evolution and complexity of procedures for diabetic ankle trauma. This article will present fixation techniques and constructs that are advantageous for the management of high-risk ankle fractures.

Is Conservative Care an Option?

One must determine whether a non-operative or surgical approach is ideal for an optimal outcome and to minimize complications.[5] Conservative therapy should be considered for non-displaced, stable ankle fractures and ideally isolated lateral malleolar fractures. Schon, et al. reported a series of 16 neuropathic diabetic patients with non-displaced ankle fractures treated with a cast or brace, and all patients went on to fracture healing.[6]

However, conservative management is not without its complications. Flynn and colleagues[3] studied 98 patients with closed ankle fractures who were treated by either surgical or non-surgical methods. Twenty-five patients had diabetes and four out of six diabetic patients treated with conservative therapy developed infections from skin ulcerations. The risk of infection appeared to correlate with a duration of diabetes of >10 years, poor medical compliance, peripheral vascular disease, peripheral

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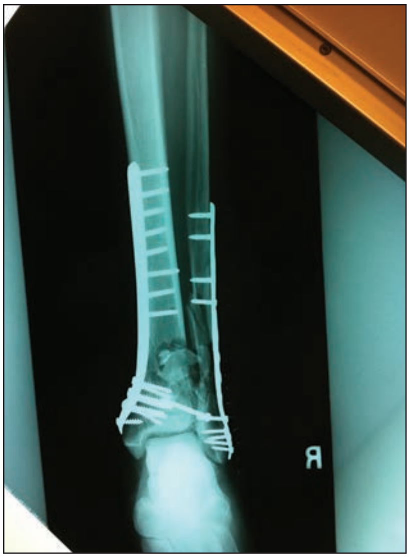

Figure 2: Bridge plating technique employed for a comminuted tibia and fibula fracture. Locking plate spans the fracture zone and provides a construct sufficiently stable to allow for osseous healing.

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neuropathy, and bimalleolar and trimalleolar ankle fracture patterns.

Recently, Bazarov, et al. examined the effects of early protected ambulation in 25 diabetic patients with stable, isolated lateral malleolar ankle fractures treated non-operatively (non-weight-bearing for 14 days and then allowed to begin weight-bearing as tolerated in a non-removable cast for an additional four to six weeks until they were ready to transition into regular shoes) and two complications occurred, one case of nonunion and one case of loss of reduction.[7]

Patients must be followed closely and require frequent follow-up visits and cast changes. The physician should inspect both the affected and unaffected limb and have a heightened index of suspicion for the development of complications, especially skin breakdown, infection, and Charcot neuroarthropathy. Patients may require an extended period of immobilization and remain non-weight-bearing until sufficient osseous healing is noted.

Figure 3: Bridge plating technique spanning a comminuted fracture; a long plate was used to increase the rigidity of the construct.

Key Pointers on Surgical Management

Displaced, unstable ankle fractures treated non-operatively will frequently go on to non-union or malunion and should only be reserved for older or lower-demand patients.[4] The primary goal of surgical management of an ankle fracture is achieving fracture reduction with restoration of ankle mortise and osseous stability. Adequate fixation constructs must be employed for fracture union. In a series by Schon and colleagues, poor outcomes after open reduction and internal fixation of ankle fractures in patients with diabetes and neuropathy were attributed to inadequate reduction, sub-optimal fixation, and an inadequate period of non-weight-bearing.[8]

Ideally, operative management should be delayed until edema is controlled, fracture blisters have resolved, and skin lines have returned.

Being mindful of the soft tissue envelope is an important management priority for ankle fractures. Ideally, operative management should be delayed until edema is controlled, fracture blisters have resolved, and skin lines have returned.[9] Any marked deformities or dislocations may be reduced and if unstable, an external fixture may be applied (Figure 1). Otherwise, patients are placed in a splint for compression and immobilization.

A biologically friendly approach for fracture reduction should be used to maintain the vascularity to the fracture fragments to create an environment that is favorable to healing. Advances in lower extremity plating designs have allowed surgeons the opportunity to use a percutaneous or a mini-open approach. This technique, combined with newer generation locking plates, may decrease complications associated with disruption of the soft tissue envelope and associated osseous complications.[10] However, often a completely percutaneous approach is not possible, and meticulous surgical technique is essential.

Poor bone quality is often noted in patients with diabetes and neuropathy. Schon and Marks recommend avoiding the use of bone-holding clamps and using either manual traction or a femoral distractor to assist with the reduction.[8] Bone fragments should be reduced with Kirschner wires, and every attempt should be made to minimize rough handling and overzealous dissection.

In patients with poor bone quality, it may be unrealistic to expect traditional fixation constructs to maintain stability; consequently, fixation failure and loss of correction may occur. Choosing the appropriate fixation construct is critical for success. Recent advances in fixation design, such as locking plate technology and external fixation, and techniques such as supplemental fixation, have effectively enhanced outcomes in this high-risk population.

Locking Plates

Locking plates provide a fixed angle construct with increased pullout strength. The locking mechanism between the plate and screw head prevents toggle and pullout, thereby having the advantage of providing improved fixation for fracture care in osteoporotic bone. One must recognize the absolute stability achieved with the locking plate; if not applied correctly, locked plates may impede bone healing. In general, locking screws should only be added after compression is obtained.

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When possible, increase the working length of the plate and bridge across the fracture zone. Bridge plating with locking plates overcome several of the disadvantages of conventional plate fixation and provide a construct sufficiently stable to allow for osseous healing (Figure 2).[11] Longer plates increase the rigidity of the construct (Figure 3).

Supplemental Fixation

Supplemental fixation is commonly used to manage osteoporotic or neuropathic diabetic ankle fractures.[12] Supplemental fixation may be achieved in numerous ways for ankle fractures: 1) syndesmostic screws with tetra-cortical purchase,[13] multiple or stacked plates, intramedullary fixation, external fixation,[12,14] and transarticular fixation.[15]

Syndesmotic fixation may be used to enhance fixation.[8,13] The bone strength of the fibula may not be sufficient to hold screws well and the use of multiple transsyndesmotic screws increases the rigidity of the entire fixation construct. The screws are placed through the fibular plate, and placed into the tibia, purchasing all four cortices. Syndesmotic screw fixation should be considered for all unstable diabetic ankle fractures, especially those with poor bone stock (Figure 4).[11]

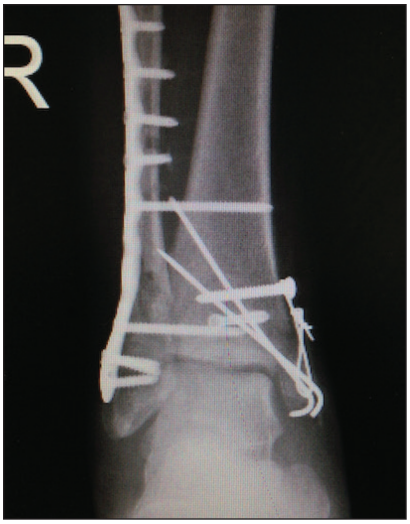

Figure 4: Multiple transsyndesmotic screws used to increase the rigidity of the entire fixation construct.

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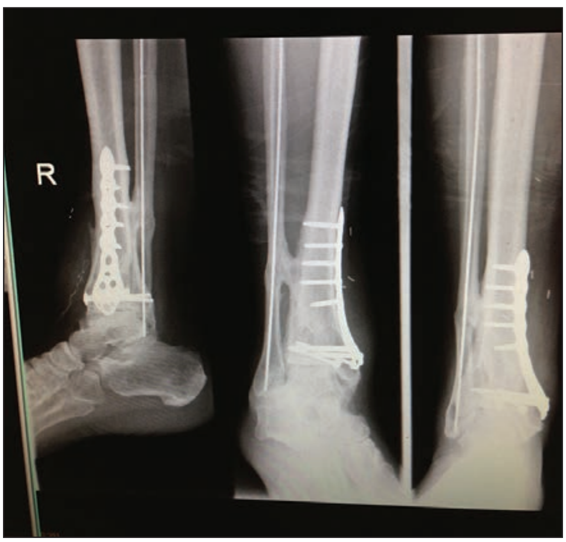

Figure 5: Intramedullary nail fixation with percutaneous reduction of the fracture has the advantage of a biologically friendly approach by limiting soft tissue disruption and preserving the soft tissue envelope around the fracture site.

Multiple or stacked plates may be used for severely comminuted distal tibia or pilon fractures. Multiple plates offer increased stability and help neutralize deforming forces that may occur over the time it takes for the bone to heal. This added stability is beneficial and helps prevent late collapse and/or malunion. One should only consider multiple plates if the soft tissue permits.

Intramedullary nail fixation with percutaneous reduction of the fracture has the advantage of a biologically friendly approach by limiting soft tissue disruption and preserving the soft tissue envelope around the fracture site (Figure 5). With the introduction of a new fibular rod system, this fixation method may be considered in select cases.

External fixation may be useful to supplement an internal fixation construct[14] or may also be considered in patients with a compromised soft tissue envelope and/or history of infection. This technique is also useful in managing ankle fractures that are associated with severe joint dislocations. The supplemental use of external fixation allows the necessary stabilization of the previously dislocated joints.[11]

Transarticular fixation is another method to stabilize an unstable diabetic ankle fracture. This technique is used to prevent late joint subluxation and to supplement the fixation construct.[15] The disadvantage of transarticular fixation is the iatrogenic injury created across the articular surface. Often, this is not a major concern, particularly among patients with diabetes and neuropathy with loss of sensation.

Post-operatively, patients are placed in a compressive splint for immobilization and are non-weight-bearing. Initially, they are seen weekly and then biweekly to monitor the incision and surrounding skin as well as the fracture position radiographically. Both the affected and unaffected extremity should be evaluated throughout the post-operative period with a heightened index of suspicion for the possible development of Charcot neuroarthropathy. These patients often require extended periods of non-weight-bearing of up to 12 weeks.

Conclusion

Diabetic ankle trauma requires a clear understanding of the pathophysiology of the disease process and its inherent challenges. One must consider patient factors, specifically peripheral neuropathy, and also factors specific to the injury.[11] Recent advances in fixation design and techniques have effectively enhanced outcomes in this high-risk population. However, despite these advances, there is still a need for further evolution and improvement to address these difficult injuries. **PM**

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