Use of a Pin Distractor as an Aid for Fixation of Pronation-External Rotation Fibular Fractures

Joey P. Johnson, MD; Bryan G. Vopat, MD; Brad Blankenhorn, MD

Abstract: Restoration of fibular length in pronation and other comminuted ankle fractures is key to good clinical outcomes and is often a challenging aspect of open reduction and internal fixation of the fibula. This article reports the use of a pin distractor to achieve appropriate fibular reduction in otherwise challenging ankle fractures. The authors describe the use of a pin distractor to obtain length and minimize the number of surgical assistants needed for these challenging ankle fractures. The authors find this technique particularly useful with pronation type and subacute ankle fractures. [Orthopedics. 2017; 40(1):e192-e194.]

Lauge-Hansen originally described ankle fractures based on foot position and position of direction of force at the time of injury. This classification, based off a biomechanical loading model, is frequently used to describe common fracture patterns. Proper restoration of fibular length is critical with fibular fracture fixation. Fibular malreduction is often a challenge in reducing comminuted pronation-external rotation (PER) and pronation-abduction (PA) injuries, and can necessitate reoperation. Additionally, most subacute supination-external rotation (SER) fractures will have some provisional fracture hematoma and healing, making proper restoration of length challenging.

Pronation injuries have increased comminution of the fibula associated with a higher energy mechanism of injury. Several studies have sought to establish short- and long-term outcomes of these fractures and if there is a difference in outcomes related to these fractures (PER and PA) when compared with more common (SER) ankle injuries. Early studies showed poor outcomes of PER injuries when compared with other fracture patterns; however, more recent studies have shown PER injuries to have good to excellent results in long-term follow-up when treated with open reduction and internal fixation. When compared postoperatively, SER IV and PER IV injuries have similar short-term outcomes; however, in one study, a greater number of syndesmotic malreductions were noted in the pronation group.

Pronation type injuries also have a fibular fracture proximal to the syndesmosis, which makes reestablishing fibular length by manual distraction difficult.

Given these challenges, many reduction techniques have been devised to help reestablish the length and rotation of fibulae in ankle fractures with significant comminution or shortening. This article describes a new technique to aid in fibular reduction of PER ankle fractures (Figure 1) by using a pin distractor.

Surgical Technique

Surgery is performed through the standard lateral approach to the fibula, with the patient positioned supine and the operative hip bumped to ease access to the fibula. Once the fibula is exposed, the fracture ends are identified and early calluses or clots are

---

The authors are from the Department of Orthopaedic Surgery (JPJ, BB), The Warren Alpert Medical School of Brown University and Rhode Island Hospital, Providence, Rhode Island; and the Department of Orthopaedic Surgery (BGV), University of Kansas Medical Center, Kansas City, Kansas.

The authors have no relevant financial relationships to disclose.

Correspondence should be addressed to: Joey P. Johnson, MD, Department of Orthopaedic Surgery, The Warren Alpert Medical School of Brown University and Rhode Island Hospital, 593 Eddy St, Providence, RI 02903 (joey.johnson12@gmail.com).

Received: November 20, 2014; Accepted: March 10, 2016. doi: 10.3928/01477447-20160901-04
debrided from the fracture site (Figure 2). Once the fracture site is identified and cleared, the pin distractor (Hintermann calcaneal distractor; Integra Life Sciences, Plainsboro, New Jersey) is positioned so that a hole for a 2.0-mm K-wire is placed over the most proximal fracture fragment and over the most distal fracture fragment. Then K-wires are placed through the pin distractor in the anterior to posterior plane, with bicortical purchase (Figure 3). These K-wires are typically placed 5 mm from the fracture site to avoid fracture propagation. Careful intraoperative and preoperative evaluation of the fracture is important to prevent displacement of additional nondisplaced fracture lines that are adjacent to the operative fracture. Once appropriate placement of the pins is ensured, the K-wires can be cut to the length desired by the operative surgeon (Figure 3). The anterior to posterior direction for pin placement was chosen to allow for lateral placement of a bridge plate while the pin distractor is in place.

If needed, fluoroscopy can be used to confirm that K-wire placement occurs outside the fracture plane. Once the K-wires are placed through the pin distractor, the handle can be squeezed to distract the fracture fragments and bring an otherwise challenging amount of fibular shortening out to length. Once the fracture is out to length, the handle can be locked into place with the toothed crossbar of the calcaneal distractor, allowing the surgeon’s hands to remain free. Coronal plane deformities can also be corrected by rotation of the pin distractor’s handle. Care must be used to ensure that there is no sagittal plane angulation created by the distraction. In the case of a comminuted fracture where a bridge plate is desired, once the fracture is distracted, a plate of appropriate length can be selected, situated across the fracture site, and fixated with the pin distractor in place (Figure 4). Alternatively, a reduction clamp can be used with or without the pin distractor to reduce the fracture once the length is restored (Figure 5).

If the fracture pattern is amenable to lag screw fixation, at this point a lag screw of appropriate length could be selected, drilled, and placed. After fracture fixation has been performed (Figure 6), the K-wires can be removed and the syndesmosis stressed.
to evaluate the need for syndesmotic fixation. If needed, syndesmotic fixation can be performed in the operative surgeon’s preferred manner. Once completed, the K-wires may be removed and the incision closed per the operative surgeon’s preference.

**DISCUSSION**

Comminuted and shortened fibular fractures present a unique challenge to surgical fixation. These fractures often require two sets of operator hands—one to hold the fracture out to length and one to perform other reduction maneuvers and select a plate. This technique provides an alternative to that method by allowing the surgeon’s hands to be free of the demands of keeping the fibula out to length and often aiding in reduction. This is also helpful because the operative field is often limited in size and too many hands can make visualization difficult.

Additionally, this technique is beneficial for surgeons who are in practice by themselves and have difficulty restoring appropriate fibular length. Furthermore, it is also a useful technique at teaching institutions, as the assistant and surgeon can be more involved in the case because one person will not be tasked solely with keeping the fracture out to length. The authors consider this a useful technique for treating otherwise challenging fibular fractures that can be easily applied to an orthopedic surgeon’s practice with instruments that are readily available.

**Limitations**

Although useful, this technique does have some pitfalls that need to be identified and avoided. Pin placement can displace an otherwise nondisplaced fracture associated with the operative fracture of interest, and placement of the pins should be carefully scrutinized. It is also important to ensure that there is no inadvertent out-of-plane angulation or displacement created with the distraction. Failure to recognize out-of-plane angulation prior to application of the pin distractor can lead to rotational malalignment, which can in turn prevent anatomic syndesmotic reduction if syndesmotic fixation is needed. As always, careful syndesmotic evaluation is required to determine whether fixation is necessary. Care should be exercised with the use of the pin distractor in osteopenic bone, as a large amount of force can be generated with the pin distractor and could cause inadvertent pin pullout or injury to poor quality bone.

**CONCLUSION**

Fibula fractures with significant shortening can be a challenging operative dilemma. The authors have described the use of a calcaneal distractor in the treatment of these fractures. They find that this technique aids reduction, improves visualization, and limits the number of surgeons needed for these cases.

**REFERENCES**


