CHAPTER 31

ROTATIONAL PILON FRACTURES

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Pilon injuries represent peri-articular fractures involving the distal tibia. There have been multiple classifications schemes proposed (1-6). The Ruedi-Allowger and AO Classifications are commonly known. However, the description by Kallum and Waddell is easy to understand, which distinguishes two specific fracture patterns that include the axial compression and rotational fractures (7).

The axial compression injuries are high velocity in nature producing a significantly comminuted fracture of the distal tibial plafond containing multiple fragments, extensive intra-articular damage, metaphyseal bone loss, and significant soft tissue damage. There is an associated fibular fracture 80% of the time. It is normally managed in a two-stage technique because of the highly compromised soft tissue envelope (8-11). Stage I involves application of an external fixator with or without open reduction and internal fixation (ORIF) of the fibula. Stage II involves removal of the external fixator with the definitive reduction and stabilization of the tibia through minimally invasive surgical approaches. If the fibula was not addressed initially then it is reduced and stabilized in stage II. This is performed in about 10-21 days post injury when the soft tissue envelope has recovered. The long term prognosis for this type of injury is extremely guarded as most will develop some degree of traumatic arthritis (12).

Rotational pilon fractures present an entirely different fracture configuration and long term prognosis. These injuries are low-velocity in nature that create an oblique or spiral fracture pattern of the distal tibia that may or may not enter the ankle joint. When it does enter the ankle joint, it normally does so posteriorly or medially. There is normally an associated Weber type B or type C fibular fracture but not always. In contrast to axial compression pilon fractures, important differences include a less complex fracture configuration without comminution, little or no articular damage, and significantly less soft tissue damage. Therefore, the management strategy applied to these fractures can be different. Personal experience has demonstrated that rotational pilon fractures can be managed acutely in a one-stage manner normally in a percutaneous fashion (Figures 1, 2, 3). Consequently, these fractures need to be approached as soon as possible after the injury, usually within 24 to 72 hours. A significant delay in the timing of surgery can result in more difficulty in manipulating the fracture as it begins to consolidate.

The tibial component of the fracture is normally addressed first and in a percutaneous technique. The reason is that if the fibula is fixated first, it significantly limits the surgeon's ability to manipulate and reduce the tibial fracture. It is necessary to comprehend that a rotational pilon fracture is really a distal tibial fracture and not an ankle fracture. The surgery can be performed without the aid of a tourniquet. This percutaneous technique requires two people. One person needs to apply longitudinal traction and rotation of the distal segment while the other person reduces the fracture percutaneously employing a large pointed reduction forceps. A preoperative computerized tomography (CT) scan is most helpful in understanding the fracture configuration and the direction in which to apply the reduction forceps. Normally, the reduction forceps are applied and compressed in the frontal plane from medial to lateral. On occasion, an additional reduction forceps needs to be applied in the sagittal plane from anterior to posterior. After checking with fluoroscopy to confirm an anatomic reduction, place several 0.062 Kirschner wires (K-wires) from the lateral side for additional provisional stabilization. This is done because the reduction forceps will need to be released temporarily in order to create a soft tissue tunnel and deliver the plate along the medial aspect of the tibia.

A small vertical or transverse incision is now made bisecting the medial malleolus. A large periosteal elevator is placed through the incision to create an extra-periosteal soft tissue tunnel in a proximal direction along the medial cortex of the tibia. The placement of one's thumb and index finger along the posterior and anterior aspects of the tibial cortex helps control the superior progress of the elevator. Try not to sweep the periosteal elevator as this widens the soft tissue tunnel. The goal is to create a straight extra-periosteal tunnel so that the plate follows the tibial cortex. There can sometimes be a tendency for the plate to deviate anteriorly or posteriorly as it slides superiorly. Choose an appropriate length precontoured distal tibial plate. Through the distal incision, deliver the plate and push it proximally. Again, place fingers along the anterior and posterior cortex to help guide the plate. Re-apply the reduction forceps and check fluoroscopically the position of the plate. The reduction forceps can be used to maintain the position of the plate. The plate may also be provisionally stabilized by a K-wire placed at each end. The distal end of the plate can be fixated to the tibia directly through the incision with positional screws or percutaneously. If the fracture extends inferiorly into the ankle joint, lag screws can be employed through the distal end of the plate.

Although the plate is usually precontoured, it normally is still elevated off the bone located at the curve of the tibial metaphyseal/shaft junction. Percutaneously, a positional cortical screw is placed at this location to further contour the plate. Based on the configuration of the tibial fracture, one or more cortical lag screws are placed percutaneously through the plate. On some occasions, one or more additional lag screws can be placed percutaneously outside the plate if indicated by the fracture pattern. The proximal aspect of the plate is now secured to the tibial shaft with percutaneously delivered positional cortical screws. Locking screws can be utilized in osteoporotic bone but experience has indicated that this is normally not necessary. The delivery of internal fixation is guided by fluoroscopic control. If the tibial component defies percutaneous reduction, there are two other solutions to this problem. The first is to make a small incision at a location directly over the fracture line and once exposed to directly manipulate the fracture with instrumention. The second option is to perform an ORIF of the fibula and then attempt to reduce and stabilize the tibia.

The associated fibular fracture is either a Weber type B or type C. If the fibular fracture is a Weber type B, it is routinely reduced and stabilized. This is normally performed employing a traditional ORIF technique. However, on some occasions, it can be managed in a minimally invasive or percutaneous fashion. If the fibular fracture is a Weber type C, it normally occurs in the distal one-third. It is most commonly addressed in the same fashion as a Weber B fracture. However, some thought can be given as to whether or not it always needs to be reduced and stabilized. If the tibial fracture is confined to the distal one-third, does not enter the ankle joint, and the syndesmosis is stable, then the fibular fracture may not need to be addressed.

The postoperative course involves suture removal in 10-14 days. The patient is immobilized for approximately 12 weeks with non-weightbearing for about 8 weeks depending on osseous consolidation. If the patient is reliable, then immobilization can be in a fracture brace with initiation of early functional rehabilitation. Otherwise, immobilization should be with a short leg cast.

Figure 1A. Anteroposterior view of rotational pilon fracture with associated Weber type B fracture of the fibula.

Figure 1B. Lateral view.

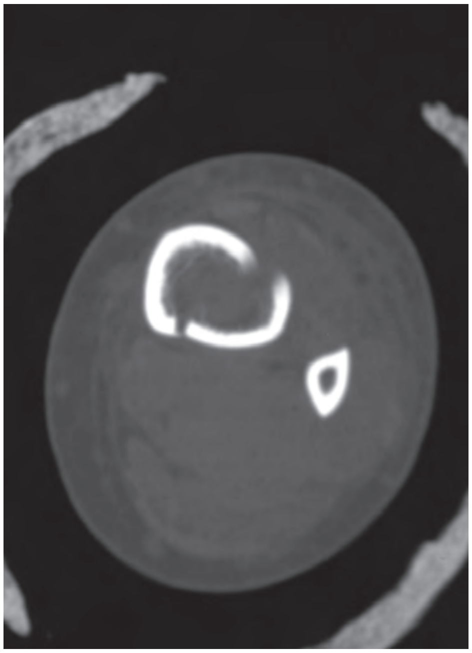

Figure 1C. Computed tomography image revealing fracture configuration.

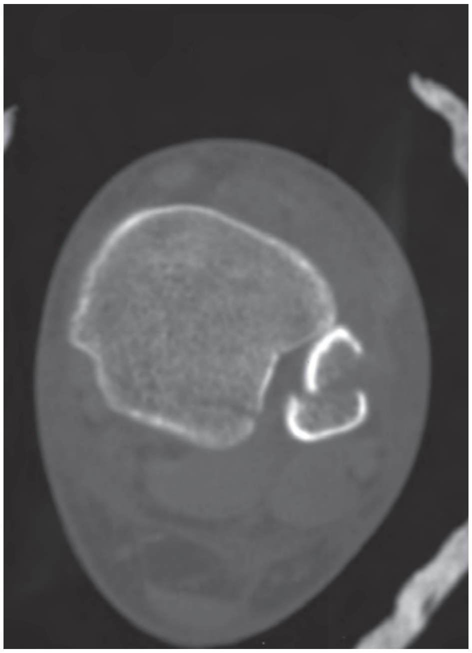

Figure 1D. Computed tomography image.

Figure 1E. Fluoroscopic image of anatomic reduction of the tibia.

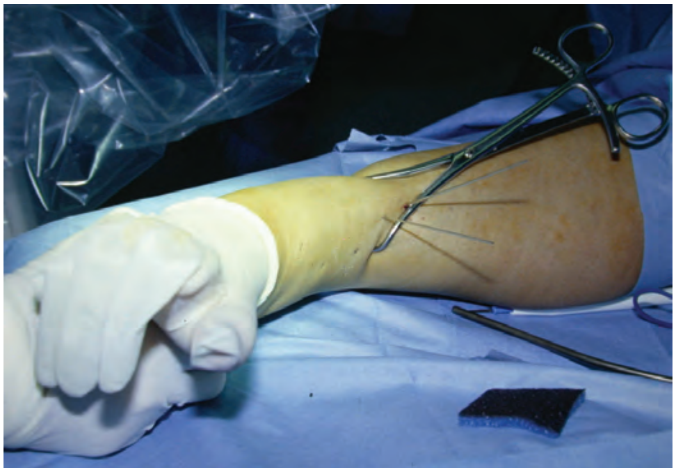

Figure 1F. Percutaneous reduction with pointed reduction forceps supplemented with two Kirschner wires.

Figure 1G. Small incision over the medial malleolus for placing the plate along the medial aspect of the tibia.

Figure 1H. Closed incisions used for percutaneous delivery of the screws.

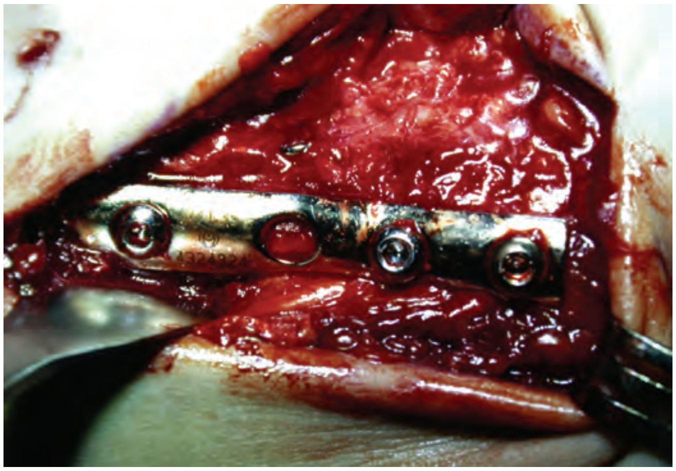

Figure 1I. Open reduction internal fixtion of the fibula.

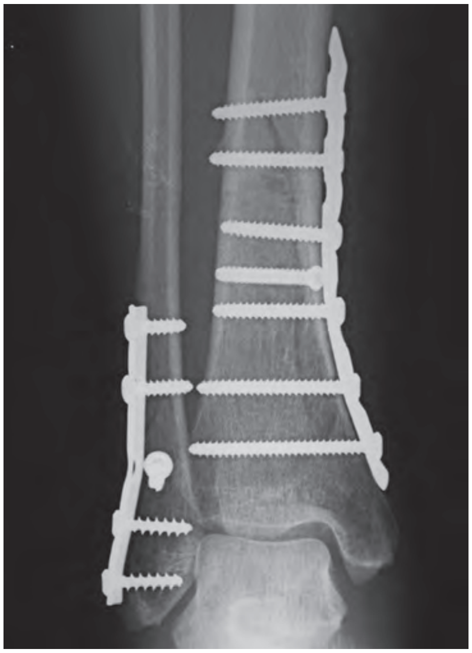

Figure 1J. Anteroposterior view demonstrating an anatomic reduction with internal fixation. The fibular fracture was managed with traditional open reduction internal fixation.

Figure 1K. Lateral view.

Figure 2A. Anteroposterior view of rotational pilon fracture without fibular fracture.

Figure 2B. Lateral view.

Figure 2C. Percutaneous reduction and provisional stabilization with pointed reduction forceps and K-wires.

Figure 2D. Fluoroscopic imaging demonstrating anatomic reduction of the tibia with provisional stabilization and periosteal elevator creating a soft tissue tunnel.

Figure 2E. Through small incision along medial malleolus an extra-periosteal soft tissue tunnel is created with an elevator.

Figure 2F. Percutaneous delivery of precontoured distal tibial plate. The tab with the distal screw hole was removed prior to final positioning of the plate.

Figure 2G. Fluoroscopic image establishing plate position.

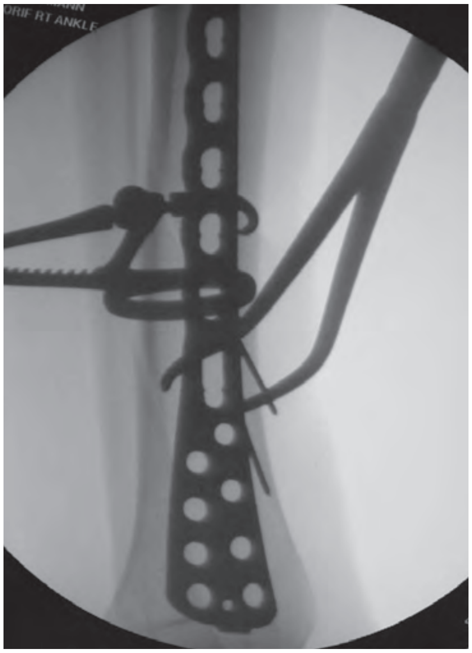

Figure 2H. Fluoroscopic image establishing plate position.

Figure 2J. multiple small incisions created to deliver screws into the plate.

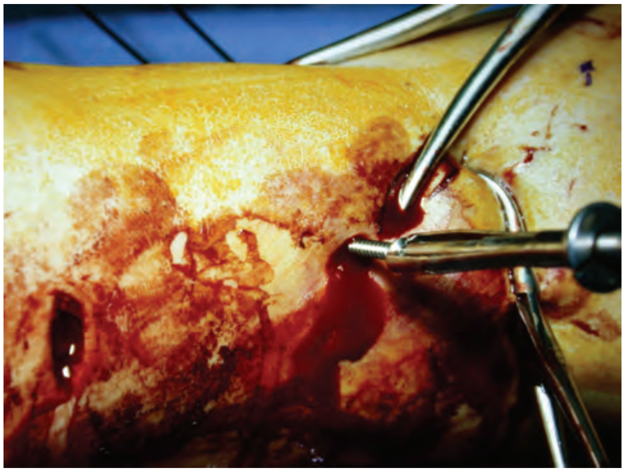

Figure 2I. Percutaneous delivery of screws.

Figure 2K. View demonstrating anatonic reduction and good position of internal fixation.

Figure 2L. Lateral views demonstrating anatomic reduction and internal fixation.

Figure 3A. Anteroposterior view of distal tibial fracture with associated Weber type C fibular fracture.

Figure 3B. Lateral view.

Figure 3C. Radiographic view of closed reduction and immobilization with a compressive dressing and splint.

Figure 3D. Radiographic view.

Figure 3E. Three-dimensional CT image revealing fracture configuration.

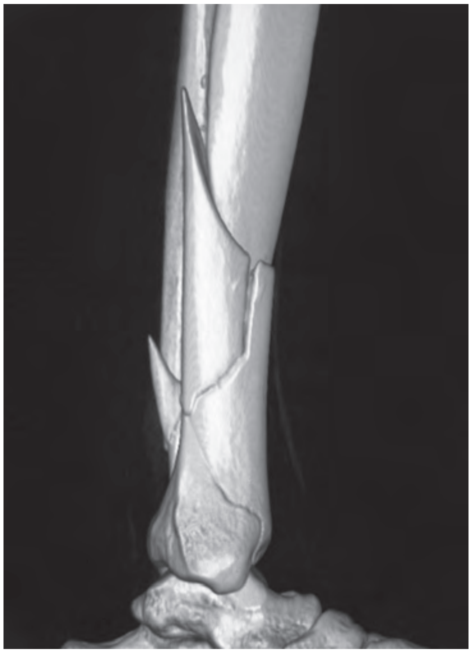

Figure 3F. Three-dimensional CT image.

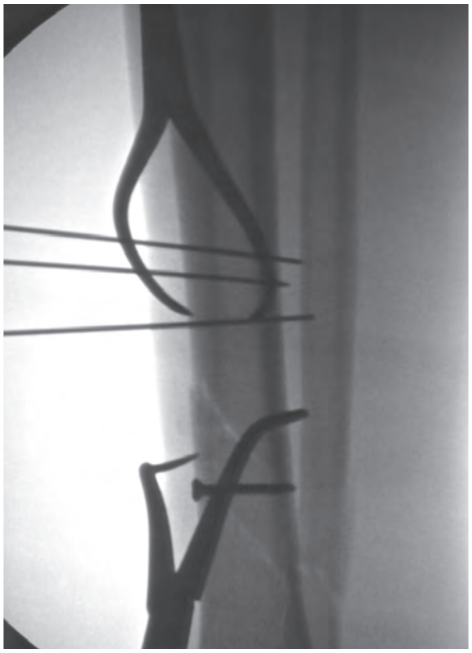

Figure 3G. Fluoroscopic image of anatomic reduction of the tibia with initial stabilization with cortical lag screw and K-wires.

Figure 3H. Percutaneous delivery of precontoured tibial plate.

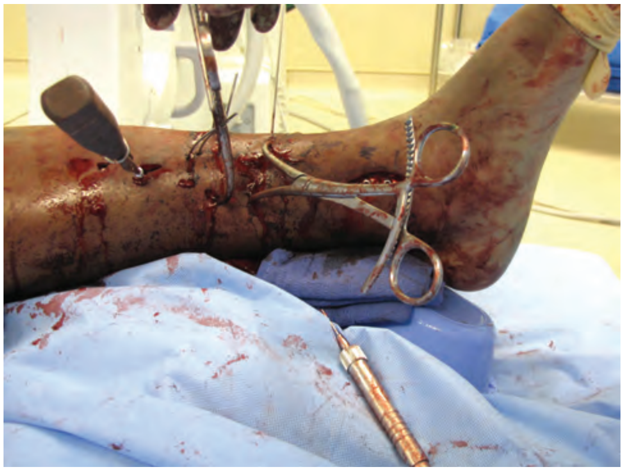

Figure 3I. Percutaneous delivery of screws.

Figure 3J. Mortise view demonstrating anatomic reduction and internal fixation. The fibular fracture was managed with traditional ORIF.

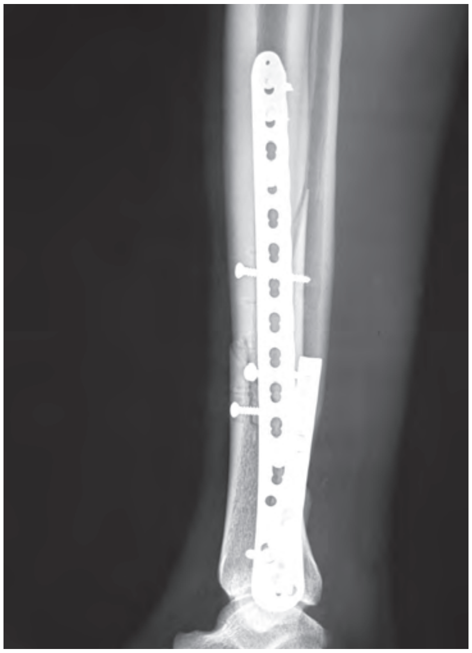

Figure 3K. Lateral view.

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