# Surgical Treatment Approach for Pilon and Talar Dome Fracture

## *A Case Report*

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Talar injuries that are associated with pilon fractures include talar body fractures, osteochondral defects, and posterior process talar fractures. Pilon fractures, in combination with talar dome fractures, have not yet been reported in the scientific literature. We report the case of a 15-year-old boy who sustained a pilon fracture with a lateral talar dome fracture. The pilon fracture was initially fixed using a temporary external fixator for soft-tissue care. After the swelling subsided, definitive internal fixation was performed. First, the lateral talar dome fracture was directly reduced and fixed using a small anterolateral approach of the ankle. Then, the intra-articular portion of the pilon fracture was directly reduced using the same anterolateral approach and an additional small anteromedial approach, and the extra-articular metaphyseal portion of the pilon fracture was indirectly reduced. The pilon fracture was finally fixed with an anterolateral distal tibia plate, using a submuscular plating technique through the anterolateral approach and a separate proximal skin incision. A medial distal tibia plate was later added using a subcutaneous plating technique through the anteromedial approach and another proximal skin incision. Both the pilon fracture and the lateral talar dome fracture were addressed simultaneously through a combination of the small anterolateral and anteromedial approaches. (J Am Podiatr Med Assoc 110(4): 1-6, 2020)

Pilon fractures of the distal tibia account for 10% of lower limb fractures, and usually result from high-impact injuries.[1] Associated talar injuries include talar body fractures,[2] osteochondral defects, and posterior process talar fractures[3]; however, these fractures are likely underreported. To our knowledge, pilon fracture, in combination with talar dome fracture, has not been reported yet in the scientific literature.

The treatment of pilon fractures remains challenging, particularly in cases with associated talar fractures. Surgical approaches that allow access to both the pilon and talar fractures are necessary for these injuries. However, to our knowledge, there have been no reports of a combined approach for the management of a pilon fracture with a talar dome fracture.

Instead of using the many approaches that are available for pilon fractures such as the anterolateral,[4] anteromedial,[5] modified anteromedial,[6] straight anterior,[7] and straight lateral approaches,[8] we used a combination of small anterolateral and anteromedial approaches for the simultaneous management of both pilon fractures and their associated lateral talar dome fractures. This method allowed for the concurrent exposure of both the pilon and lateral talar dome fractures so that they can be treated simultaneously.

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## Case Report

The patient provided informed consent and institutional review board approval was obtained. A 15-year-old boy fell from an 8-m height and sustained a pilon fracture and lateral talar dome fracture. He presented with severe swelling around the ankle

and the lower leg but without signs of a compartment syndrome. There were no open wounds. He had no medical history. Laboratory findings including complete blood count, erythrocyte sedimentation rate, and C-reactive protein level were normal.

Initial radiographs demonstrated that the distal tibia followed a 43-C3 fracture pattern, according to the Orthopedic Trauma Association classification, with a simple one-third fibula fracture distally (Fig. 1). The talar fracture was not evident on radiographs; however, computed tomography revealed an associated talar dome fracture that was located at the anterolateral aspect of the talar dome (Fig. 2).

The pilon fracture was initially fixed on the day of injury using a temporary unilateral external fixator for soft-tissue care, according to a staged treatment protocol.[1] An associated fibular fracture was simultaneously fixed with a distal fibula locking plate (Zimmer, Warsaw, Indiana), using the minimally invasive plate osteosynthesis (MIPO) technique through the posterolateral approach and a separate proximal skin incision.

After the swelling reduced approximately 2 weeks after the injury, a definitive internal fixation was planned. We selected the small anterolateral approach to simultaneously access both the pilon fracture and the lateral talar dome fracture. An anterolateral skin incision 5 cm in length was made along the lateral border of the extensor digitorum longus and peroneus tertius around the ankle joint. Deep dissection was also performed along the lateral border of the extensor digitorum longus and peroneus tertius.

We accessed the lateral talar dome fracture using an anterolateral approach of the ankle. The fragment of the talar dome that had been fractured was impacted into the fractured tibial plafond, leaving a bony defect of the talar dome (Fig. 3). This fragment was reduced directly and fixed using two bioabsorbable compression screws 3 mm in diameter (Arthrex, Naples, Florida) (Fig. 3). The intra-articular fracture of the pilon fracture was reduced directly using the same anterolateral approach used for the treatment of the talar dome fracture, with the addition of a small anteromedial approach.

The anteromedial skin incision was 5 cm in length, and was made at the level of the ankle joint, directly along the medial border of the anterior tibial tendon. The skin bridge between the two approaches was 6 cm.[9] Deep dissection was also performed along the medial border of the anterior tibial tendon. Both the anterolateral and the anteromedial approaches made skin incisions in line with the deep dissection plane, and made a full-thickness flap. This combined approach minimized damage to the soft tissue that may already have been jeopardized from the injury. This flap could also reduce damage to the contents of the anterior compartment such as the tibialis anterior, extensor hallucis longus, extensor digitorum longus, peroneus tertius muscles, and neurovascular structures.

The extra-articular metaphyseal aspect of the




**Figure 1.** Anteroposterior (A) and lateral (B) radiographs show a comminuted pilon fracture combined with a simple distal one-third fibula fracture. The combined talar fracture was not found on radiographs.

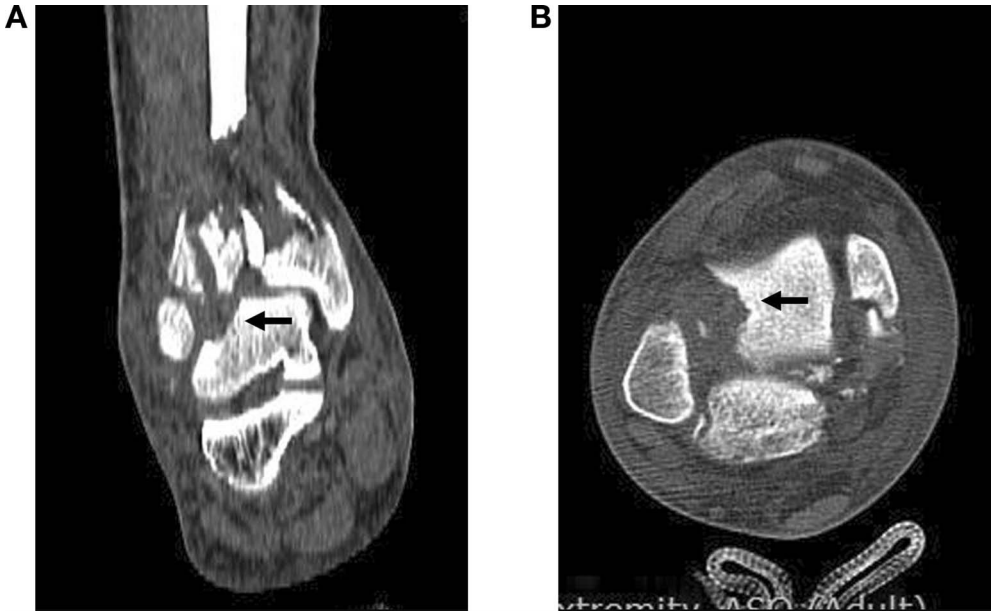



**Figure 2.** Coronal (A) and axial (B) computed tomographic views demonstrate a bone defect (arrow) of the lateral talar dome.

pilon fracture was indirectly reduced. An anterolateral distal tibia plate (Zimmer) was inserted and fixed submuscularly through the small anterolateral approach and a separate proximal skin incision (Fig. 4). A medial distal tibia plate (Zimmer) was also inserted and fixed using the subcutaneous plating technique, through the small anteromedial approach and another proximal skin incision (Fig. 4). Bone grafting was not performed.

Range-of-motion exercises started 2 weeks after the period of ankle immobilization for wound care. The patient was allowed to perform partial weight-bearing as tolerated with an ankle boot 8 weeks postoperatively, and progressed to full weight-

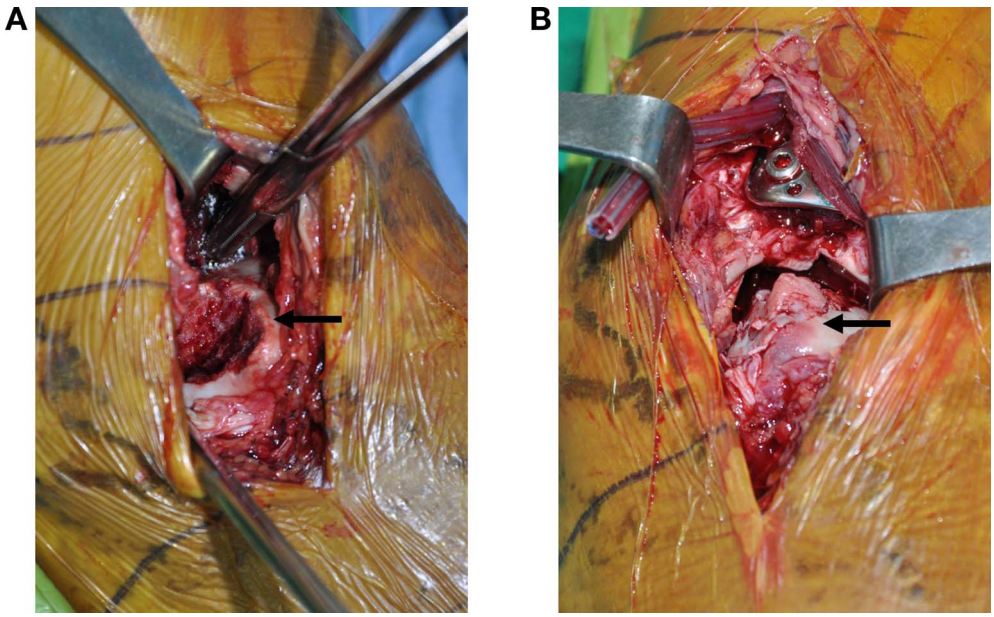



**Figure 3.** A bone defect (A) (arrow) of the lateral talar dome was found during surgery, and was fixed (B) (arrow) using two bioabsorbable compression screws (Arthrex, Inc, Naples, Florida) through an anterolateral approach of the ankle.



**Figure 4.** An anterolateral distal tibia plate was slid submuscularly through an anterolateral skin incision and a separate proximal skin incision (arrows), and a medial distal tibia plate was inserted subcutaneously through an anteromedial skin incision and another proximal skin incision (arrowheads).

bearing 3 months postoperatively, with no pain at either the pilon or the talar dome.

At 6 months postoperatively, nonunion of the metaphyseal area of the distal tibia was suspected with the onset of walking pain, and one distal screw of the medial plate was found to be loose. The patient then underwent revision surgery. The medial plate was revised with an autogenous iliac bone graft using the previous anteromedial approach. This approach was slightly enlarged proximally (Fig. 4). A distal fibula locking plate that was previously secured for a fibular fracture was removed simultaneously.

Radiographic union (Fig. 5) was achieved at 3 months after the plate revision, as evidenced by the formation of bridging calluses in at least three cortices. The ankle joint range of motion was between 5° of dorsiflexion and 30° of plantar flexion at 3 months after the plate revision, and remained unchanged at 1 year after the plate revision. The American Orthopaedic Foot and Ankle Society ankle-hindfoot scores at 3 and 12 months of follow-up after the plate revision procedure were 84 and 81, respectively. There was no evidence of osteoarthritis in the ankle joint at 1-year follow-up (Fig. 6). Compared with the contralateral tibia, there was no malrotation or discrepancy in the length of the leg.

## Discussion

Ipsilateral talar injuries that are associated with pilon fractures are difficult to detect using solely radiographs and thus have been underreported. Computed tomography is a very useful method with which to assess these injuries. Complete articular pilon fractures in combination with talar dome fractures have not yet been reported. One study[10] reported a partial articular pilon fracture combined with talar body and calcaneus fractures.

Although the definitive impact of associated talar injuries remains unknown, it is possible that they will negatively affect long-term outcomes if treated inappropriately. Many surgical approaches for the treatment of pilon fractures such as the anteromedial,[5] modified anteromedial,[6] straight anterior,[7] and straight lateral[8] approaches have been reported. However, to our knowledge, no surgical approach that combines the management of pilon fractures and talar dome fractures has been reported.

We used a combination of the small anterolateral and anteromedial approaches of the ankle to treat both pilon and talar dome fractures. The small anterolateral approach was mainly used for the open reduction and internal fixation (ORIF) of the talar dome fracture and the intra-articular portion of the pilon fracture. A small anteromedial approach was added because the anterolateral approach alone was insufficient to reduce the medial aspect of the intra-articular portion of the pilon fracture. In addition, this anteromedial approach was also necessary for insertion of a medial distal tibia plate with a separate proximal incision. We think an anteromedial approach can be replaced with a direct medial approach to retain the skin bridge between the anterolateral and anteromedial approaches as much as possible, if the intra-articular portion of pilon fracture can be easily reduced with an anterolateral approach alone.

The extra-articular portion (metaphyseal or metaphyseal-diaphyseal fractures) of the pilon fracture was reduced indirectly and fixed using the MIPO technique and by placing anterolateral and medial locking plates in the distal tibia. The anterolateral plate was slid submuscularly through the anterolateral approach and a separate proximal skin incision. The medial plate was inserted subcutaneously through the anteromedial incision and another proximal skin incision (Fig. 4).[11,12] We do not recommend our combined approach if the open

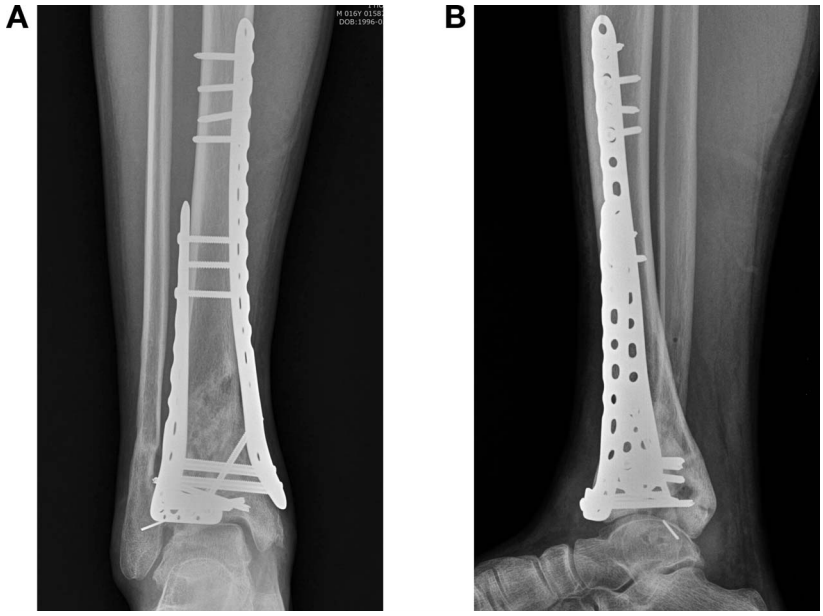



**Figure 5.** Anteroposterior (A) and lateral (B) radiographs show bony union at 3 months after plate revision, as evidenced by the formation of bridging calluses in at least three cortices.

plating technique is used for both the intra- and extra-articular portions of the pilon fracture, because of the high risk of soft-tissue necrosis. Our approach should be used in conjunction with the ORIF for the intra-articular portion of the pilon fracture and in conjunction with the MIPO technique for the extra-articular portion of the pilon fracture.[11,12]

In our case, the anterolateral approach was mainly used with an additional minor anteromedial approach to treat both fractures simultaneously. However, we believe that the anteromedial approach can be used as the primary procedure with a supplementary minor anterolateral approach for cases in which a medial talar dome fracture, though rare, is present, instead of a lateral talar dome

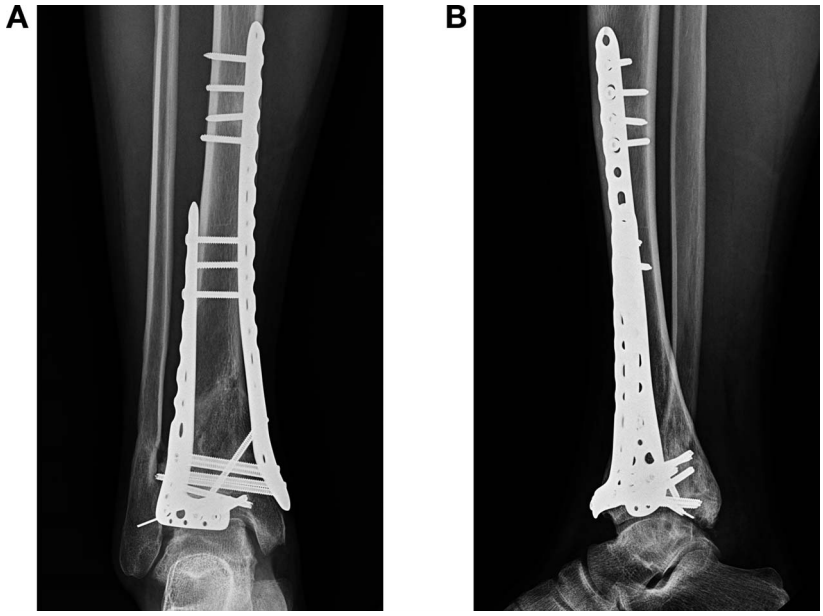



**Figure 6.** Anteroposterior (A) and lateral (B) radiographs show bony consolidation and no evidence of osteoarthritis in the ankle joint at 1 year after plate revision.

fracture. Therefore, the amount of skin incision and deep dissection of the small combined anterolateral and anteromedial approaches should be adjusted based on the pilon fracture pattern and the location of the talar dome fracture, while retaining the skin bridge as much as possible.

## Conclusions

In conclusion, a combination of the small anterolateral and anteromedial approaches in association with ORIF for the intra-articular portion of pilon fractures and the MIPO technique for the extra-articular portion of pilon fractures appear useful in the simultaneous treatment of this particular case of pilon and talar dome fractures. Further studies with a larger patient sample are necessary to assess for proper indications and techniques.

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**Conflict of Interest:** None reported.

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