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A Current Concepts Update in Pilon Fracture Management

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Abstract

A review of the existing literature, related to treatment options and management principles of pilon fractures, was performed, and its results are presented. Pilon fractures have a very diverse pattern, but there are general characteristics to help diagnose and plan therapy. The choice of therapy is highly dependent on the surrounding soft-tissue environment. Different methods of treatment, lack of standard management protocols, and the high risk of complications make this injury one of the biggest challenges that an orthopedic surgeon can face. This review focuses on the general aspects of the pilon fracture management as well as its complications and possible solutions.

Introduction

Pilon fracture was first proposed by Destot in 1911 and Bonin in 1950 using the French, pilon, because the surface of the distal tibia joints resembles the ceiling [1]. The term pilon is appropriate because the mechanism of this fracture is the collision of the talus bone into the tibial plafond [2]. Pilon fractures are all distal tibial fractures involving the joint surface, except lateral and medial malleolus fractures, trimalleolar fractures involving <1/3 of the joint surface in the posterior malleolus [3]. The incidence of these fractures is 1%–10% of all lower extremity fractures and 5–7% of all tibia fractures that generally occur in men in the age range of 35–40 years [4], [5].

The mechanism of injury is important for predicting the severity and choice of treatment. High-energy trauma usually causes severe comminutive fractures and involves surrounding soft tissue. Therefore, to prevent complications such as sepsis, osteomyelitis, a good understanding of these fractures is needed by an orthopedic surgeon [6]. In these fractures, there is usually a severe soft-tissue injury and frequent surgical wound complications due to wide incisions, so external fixation is usually become an option [7].

According to the preceding article, more radiography and imaging should be done for correct diagnosis and pre-operative planning. The previous concept of pylon fracture management was when feasible, careful soft-tissue treatment and restoration of the articular surface architecture, length, rotation, and axial alignment with secure diaphysis fixation should be established. Intramedullary implants with percutaneous articular fixation yield good outcomes with minimum soft-tissue damage in the injury zone for simple or extra-articular patterns. Minimally invasive plate osteosynthesis (MIPO) procedures can help alleviate some of the issues associated with soft-tissue compromise while maintaining adequate articular alignment. For complicated articular injuries with or without fibular fixation, conventional locking or sealing with lag screw fixation is employed. External fixators are often used for interim measures, although they can also be utilized for permanent fixation when necessary [8].

Pilon fractures are among the most difficult to treat because they are frequently linked with high-energy trauma, both soft-tissue involvement and the comminute fracture pattern present fixing issues.

Furthermore, pilon fractures are predisposed to poor functional results and high incidence of post-traumatic arthritis due to their complicated architecture and stress to the cartilage at the time of injury. This study will discuss the current updates in the treatment of tibial pilon fractures.

This review article was carried out by searching for articles published in the PubMed and EMBASE database, from 2010 to 2020. Keywords used for this study is "Pilon fracture" AND "Management." Criteria for articles included in this review were randomized controlled trials, retrospective, observational studies, case studies, reviews, systemic reviews, and meta-analysis. The articles excluded in this study were non full-text article and paid article. A total of 424 articles were identified during the initial search of the entire database. After eliminating applying selection, 43 articles will be analyzed for further qualitative discussion (Figure 1).

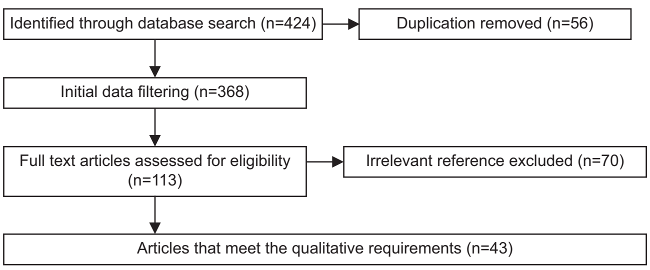
This article aims to help gather references regarding pilon fracture management. Pilon fractures have a very diverse pattern, but there are general characteristics to help diagnose and plan therapy. It is important for orthopedic surgeon to understand and carry out the most appropriate management for each patient with a fracture pill so that complications can be minimized.

Anatomy and Biomechanics

Destot also explained that the pilon in the ankle acts as a load support, in the medial portion, allowing for axial support, and the malleolus at the edges functions as a stabilization in transverse motion [3].

Pilon vascularization in the metaphysical region is derived from three main branches of blood vessels, a direct branch of the posterior tibial artery, hemp branches anterior and posterior perforans of the fibularis artery, and branch of the posterior tibial artery that runs through the extensor retinaculum. Vascularity in the epiphyseal region of the anterior capsular originates from the fibularis artery anastomosis and the anterior tibial artery (Figure 2).

Pilon fractures have a very diverse pattern, but there are general characteristics to help diagnose and



AQ10 *Figure 1: The flow of discussion based on the suitability of the topic*

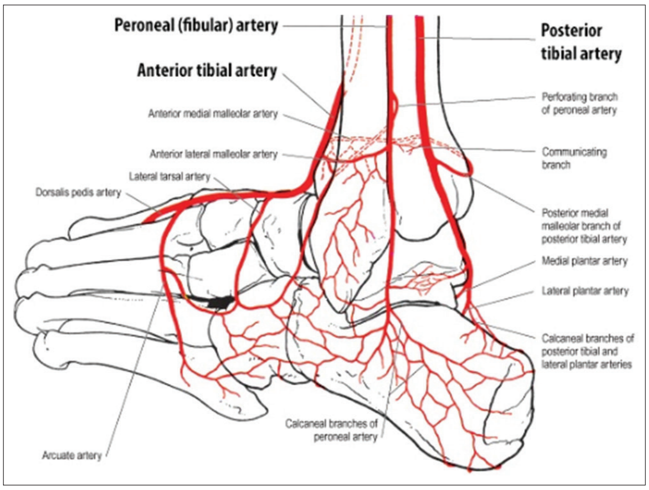


Figure 2: Vascularity of distal tibia [9]

plan therapy. Pilon fractures are rarely accompanied by ligament injuries, and this is what forms the fracture pattern consisting of three main bone fragments that have been mapped by computed tomography (CT) scanning are medial malleolus fragments, anterolateral fragments (Chaput), and posterolateral fragments (Volkmann) (Figure 3) [1].

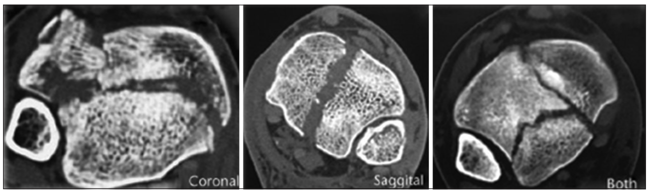


Figure 3: Fracture patterns: Coronal, sagittal, and both [5]

Most pilon fractures are caused by trauma with high-energy mechanisms that occur due to vehicle accidents, falls from heights, and work accidents, where the talus is forced proximally and masses distal tibia resulting in fracture. Viscoelastic bones make a lot of energy absorbed before reaching the peak point when the peak point is reached, energy is released and distributed to the surrounding soft tissue [10], [11].

Fracture pattern depends on the direction, level of application of force, and position of the foot in the event of trauma. The pattern of fractures that develop is determined by the direction and position of the foot at the time of injury (Figure 4) [2], [12].

Diagnostic Work Up

History related to injury mechanism, involvement of other injuries, drug use, work, daily habits, and proven to affect prognosis [13], [14].

Radiological examination to establish the diagnosis of pilon fracture can use plain photographs according to anteroposterior (AP), lateral, and mortise view (Figure 5). Plain radiographs can be

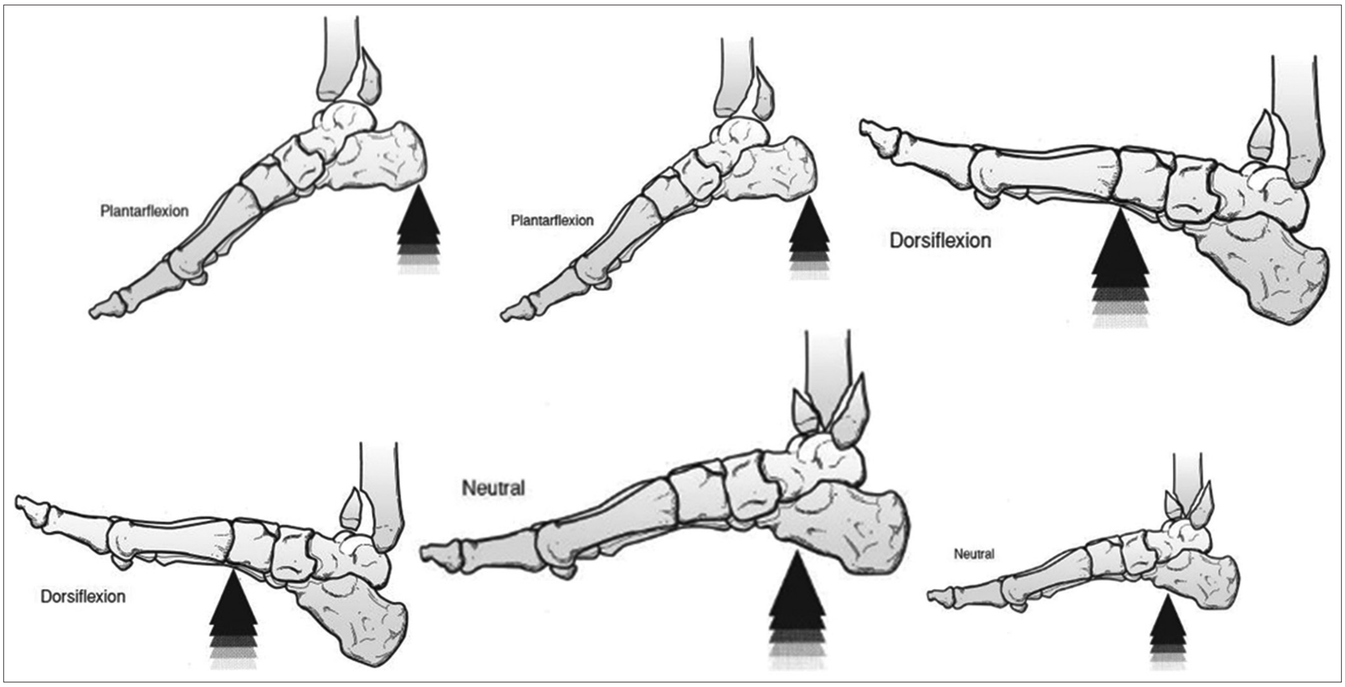


Figure 4: Pilon fracture pattern based on the position of the foot during trauma [5]

used to measure the direction and enlarge the talus subluxation, fibular fracture, articular commutative rate, articular impaction, and correct distal tibiofibular syndesmosis [15].

Figure 5: Anteroposterior (a) and lateral (b) radiographs of the left ankle showing a closed, comminuted, complete articular pilon fracture with anterior cortex bone loss and anteromedial dislocation of the talus in the tibiotalar joint [16]

Palpation or Doppler ultrasonography evaluation of the pedis pulse, as well as recording the color and temperature of the foot, are used to assess vascularity and inspect the plantar back and leg for sensational changes [17], [18].

Radiography, which is essentially an imageology examination, is inexpensive, quick, and low radiation, making it the primary choice for first diagnosis once a patient has been harmed. If the radiographic diagnosis is soft-tissue contusion with no ankle fracture, we do not require a CT scan, which saves patients money. If an ankle fracture is discovered by radiography, we can make a preliminary judgment on the kind of ankle fracture based on the necessary measurement data from the radiographs, which allows for the early formation of a treatment strategy. Radiographic diagnosis in conjunction with CT analysis is a viable tool for distinguishing posterior pilon fracture from posterior malleolus fracture and thoroughly assessing the morphological differences between the two types of fractures. Pre-operative CT evaluation is recommended in all patients with trimalleolar fractures, independent of the size of the posterior fragment [19]. A CT scan of a pilon fracture can show the location of the fracture, and its displacement from the articular surface is very helpful for determining the location and orientation of the articular fixation, especially in percutaneous techniques [20].

Classifications

Pilon fractures are classified according to the Ruedi and Allgower system and the OTA/AO fracture classification system. Ruedi and Allgower split the tibial ceiling fracture into three types based on their displacement and comminution level from the articular surface (Figure 6) [1], [21], [22].

A more comprehensive OTA/AO classification system combines all distal tibial fractures including extra-articular fractures from the distal tibia metaphysis then divided into three groups depending on the number of comminuted fractures (Figure 7) [23].

Soft-tissue injury by Tscherne and Goetzen which divides soft tissue in closed fractures into four categories, which are given a numeric code of 0 to

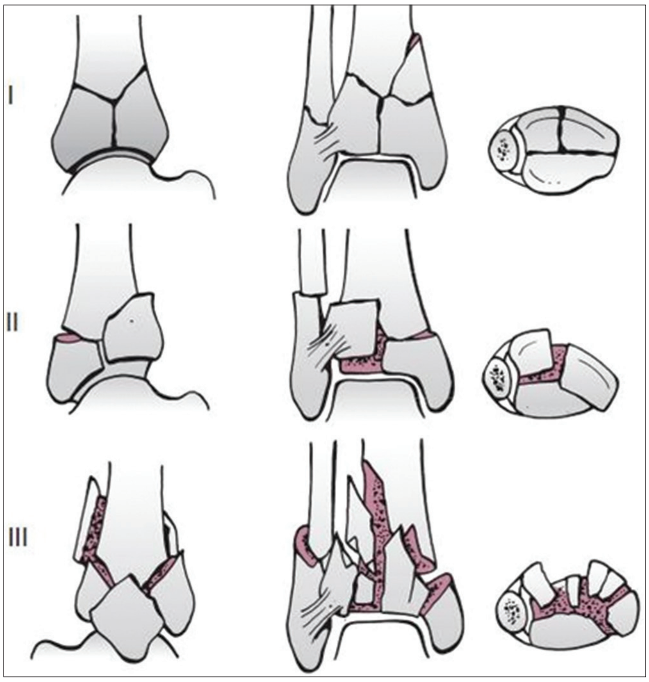


Figure 6: The classification system is based on Ruedi and Allgower [22]

3. Closed fractures without soft-tissue protection are category 0, then fractures with indirect force with a simple pattern. Category 1 is split tissue that has an abrasion or superficial skin contusions, simple fracture patterns with shifting fragments. Category 2 has deep abrasions and local skin contusions, medium to severe fracture patterns. Category 2 also shows the risk of compartment syndrome. Category 3 is damaged with extensive bruises or injuries that damage the underlying tissue and muscle damage. Extensive bruising or injuries that harm the underlying tissue and muscle damage, including compartment syndrome, vascular damage, comminuted fractures, and frequent energy changes, characterize Category 3 [24].

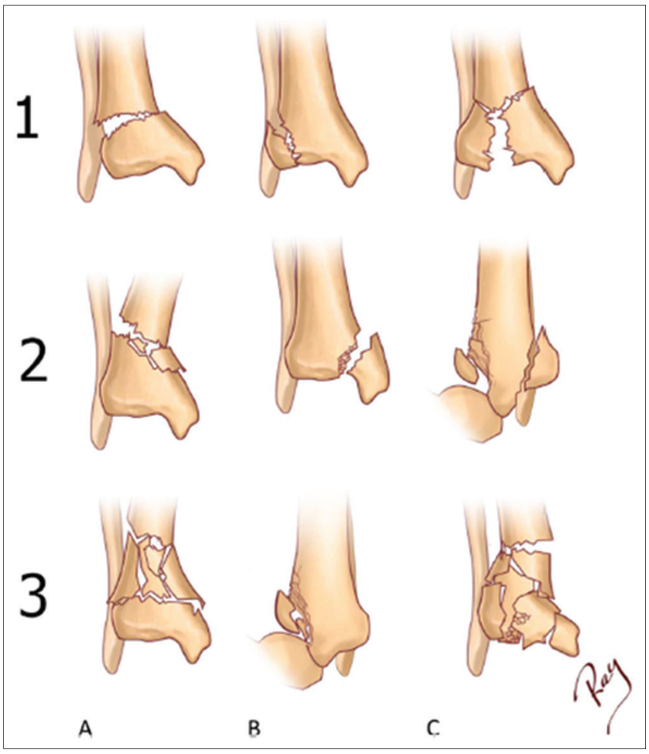


Figure 7: AO/OTA classification for end segment distal tibia fractures: (A) Extra-articular, (B) partial articular, and (C) complete articular [23]

Topliss in 2005 introduced a more advanced classification system using an axial CT scan to identify the six typical fragments: An anterolateral, anterior, posterior, posterolateral, medial, and central die-punch fragment (Figure 8). They are present with varying frequency and need to be analyzed carefully to choose the appropriate approach and plate position [25].

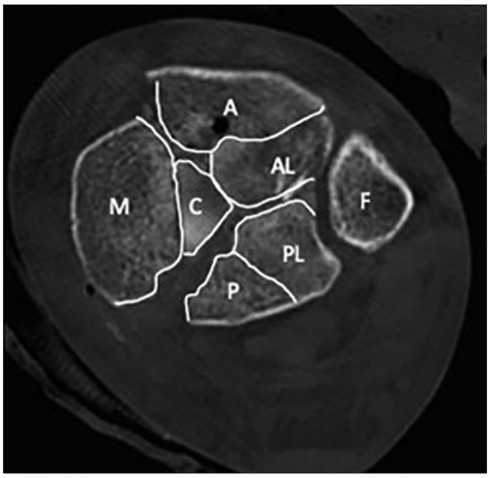


Figure 8: An axial computed tomography of the distal tibia showing the typical six fracture fragments. A, anterior fragment; AL, anterolateral fragment; P, posterior fragment; PL, posterolateral fragment; C, central die-punch fragment; M, medial fragment; and F, fibula [25]

Management

Management of tissue damage, surface correction, and restoring limb alignment are the main concepts in the treatment of pilon fractures. Treatment options for pilon fractures are conservative and operative. Non-operative management, such as cast immobilization, is reserved only for non-displaced articular fractures, patients who have surgical contraindications because of medical comorbidities, or patients with low demand such as those who are non-ambulatory. However, in an older population, surgery may not always be possible, in which case, the therapy comprises reduction as mentioned above and non-weight-bearing immobilization in a heavy cast for 6–10 weeks. Most patients will most likely be able to undergo external fixation. Definitive use of external fixation, without articular reduction or fixation, has been used in highly comminuted or open pilon fractures to maintain length, alignment, and rotation [25]. The treatment chosen is heavily influenced by the surrounding soft-tissue environment. Transcalcaneal traction or casts are conservative treatments that have been supplanted by current surgical methods. Conservative treatment can be done for pilon fractures by minimizing shifts and where the alignment of the extremities can be removed with a cast. Increased immobilization 4–6 weeks can produce a better prognosis [26].

Open wounds need to be given intravenous antibiotic initiation, evacuation of foreign bodies, sterilization with sterile saline, and cover with sterile bandages. Usually, bone fragments can pierce the skin from the inside, thus damaging the skin layer and soft tissue. This occurs when the distal part of the tibia pierces the skin from the inside through the anteromedial of the distal tibia (Figure 9) [5], [17], [18].

Figure 9: Soft-tissue condition after a high-energy pilon fracture [18]

Open Reduction and Internal Fixation

In open reduction and internal fixation, fibula is fixed first, to regain Cruris length, makes it easy to access three dimensions, and indirectly reduces fractures. The stages of reduction and fixation of each pilon fracture correspond to the pattern of the fracture, but a reduction of the articular surface is the most important aspect, and therefore, this remains a priority for surgical maintenance. Pilon fracture is one of the most challenging fracture patterns to treat. Although there are many fracture patterns, starting articular reduction of the tibial ceiling often begins with renewal, reduction, and stabilization of posterolateral fragments. It is not easy to achieve and maintain accurate articular reduction. Even though the reduction of the fibula is accurate, there is still residual, angulation, or articular impaction of the posterolateral fragment [27]. Further reduction techniques of posterolateral fragments can be done anteriorly or directly using posterolateral exposure, depending on the level of intake after initial installation (Figure 10). For example, posterolateral ceilings can alter dorsiflexion impaction supported on plain lateral radiographs and more clearly on CT scans.

Figure 10: The definitive surgical tactic consisted of a posteromedial meta-diaphyseal exposure initially to restore meta-diaphyseal alignment and begin articular reduction followed by an anterolateral exposure to complete the posterolateral and anterolateral articular reductions [3]

The subsequent reduction in the impacted posterior ceiling results in deformity on the articular surface and a tendency to anterior extrusion of the talus. Management of this residual deformity can usually be done through anterior exposure [5].

After the reduction is sufficiently agreed on, the general reduction arrangement is requested to reduce the posterior aspect from the medial malleolus fragment to the posterolateral fragment. Impaction and comminution at the center of the ceiling are then reduced and secured to the posterior ceiling. Medial malleolus fragments are then secured and followed by reducing anterolateral fragments. This stage is flexible and all strategies offered for articular and extra-articular reduction can be used. For example, techniques that are useful for the articular and meta-diaphysis segments are by approving fracture fragments involving distal articular and adding metaphysical or metaphysical communication and adding to the minimum proximal [28].

At each step of the reduction process, temporary fixation meets the use of small clamps and K-wires (0.045 inches). Subchondral bone defects are managed with a graft or bone that provides, such as calcium phosphate material. Articular visualization is very easy to use by transarticular external fixators by placing Schanz pins directly into the neck of the talus. When anteromedial exposure is performed, a pin is placed on the neck of the talus from medial to lateral, in contrast, compilation using anterolateral exposure, a pin is placed on the talus neck from lateral to medial. By connecting the newly inserted pin on the talus to the pre-existing tibia pin and being part of an external fixator proximal to the fracture line, distribution can be applied across the joints of the leg joints to aid in visualization. While visualization uses this technique, sometimes, the talus translates to the anterior and complicates the visualization and manipulation of articular fragments. One method to support this is to use a biplanar distractor

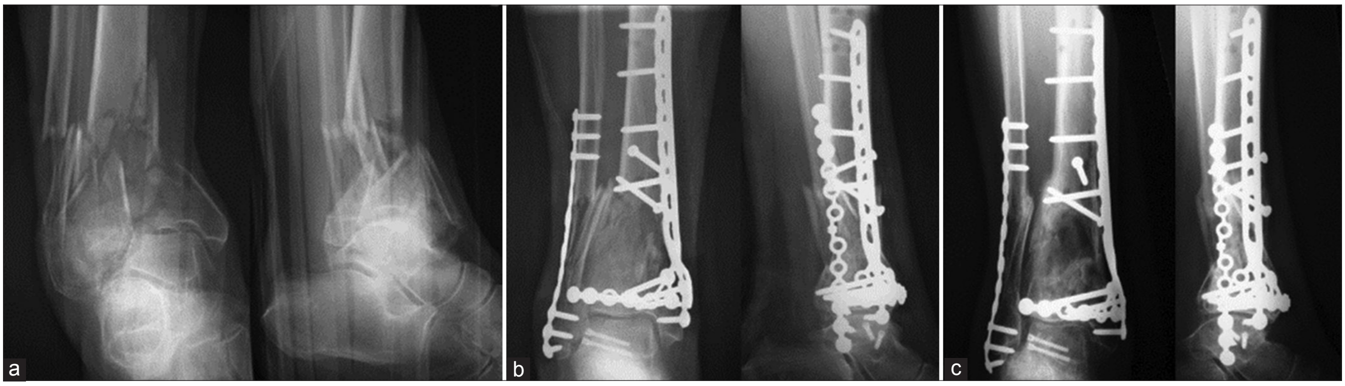


Figure 11: (a) Severely comminuted pilon fracture, with comminuted fibula and associated talar fracture. (b) Post-operative radiograph shows the bridge osteosynthesis of the tibial metaphysis and the fibula. (c) Bone healing status at 5 months. Note also that the lateral malleolus is not perfectly reduced and does not fit exactly the lateral facet of the talus [3]

through a proximal tibia pin, distal trans-calcaneal pin, and a radiolucent handle from an external fixator [17]. Some of the advantages gained with this technique: (1) The talus remains translated posteriorly so that it makes manipulation of articular fragments easier to do, (2) metaphysical alignment is obtained, and (3) the handle of external fixation is not accessible posteriorly from the operative field (Figures 11 and 12) [7].

The use of implants that provide temporary stabilization is very important for this successful procedure. The use of small diameter K-wires, clamps, plates, and mini-screws is very useful in the use of temporary reductions. This device must be placed outside of the definitive implant zone and therefore planning regarding definitive implants, the order of reduction, and surgical-related options are necessary. Historically, implants used for pilon fractures are displayed on the surface of the anteromedial tibia. The size, design limitations, and area of the screw placement limit the function of the plate and may contribute to the problem of wound surgery recovery [7].

Under ideal conditions, the distal tibia plate should be applied in a configuration that places it under tension when the tibia is loaded. If such a configuration is achieved, the plate is able to impart a maximum degree of stiffness to the tibia/plate construct. This configuration may exist when the fracture wedge is in place and the fracture gap adequately reduced. Because both the medial and posterior loading positions apply force through the tibia eccentrically, a bending moment is also generated across the tibia and the fracture wedge both absorbs compression and behaves as a fulcrum. When loaded posteriorly, the presence of the fracture wedge places each plate under tension, with some bias appearing to favor the anterolateral plate in stiffness. When loaded medially, the anterolateral plate is placed under tension, however, the medial plate shares compression with the fracture wedge, producing an overall less-stiff construct [7].

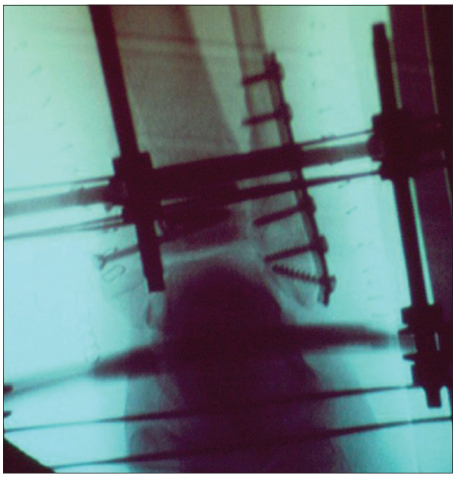


Figure 12: (a) Fracture Ovadia–Beals type IV with reducible metaphyseal portion. (b) Open reduction using minimal internal fixation completed with the fibula reduction [17]

The goal of definite internal fixation must be to establish articular segment fragment boundaries and compression, stable fixation from the articular segment to the tibia diaphysis, and correction of coronal, transverse, and sagittal field alignment. Important factors for organizing compilations to choose internal fixation for pilon fractures are comminuted levels, ability to achieve cortical contact, intrinsic fracture abilities, bone quality, the direction of spinal deformity (varus, valgus, flexion, and replacement), adjustable accessory status, and availability of accessories lost bone. Ideally, plate thickness must balance between the need for implants that have sufficient rigidity to oppose the anticipated cost and add a platinum plate and free tissue damage on the anteromedial tibial surface. Complete articular injury (AO/OTA type C) usually requires a rigid implant (for example, a 3.5 mm compression plate) to meet meta-diaphysis alignment. Partial articular injury (type B) can only be used with simpler implants that only support partial articular damage [7].

The use of plate locking is still lacking for intra-articular fractures of the distal tibia, and research in this field is currently lacking. However, poor quality, the inability to put a strain on the fracture, and long maintenance time are reasonable indications for the use of a locking plate. However, most of the pills were successfully completed with a non-locking plate [7].

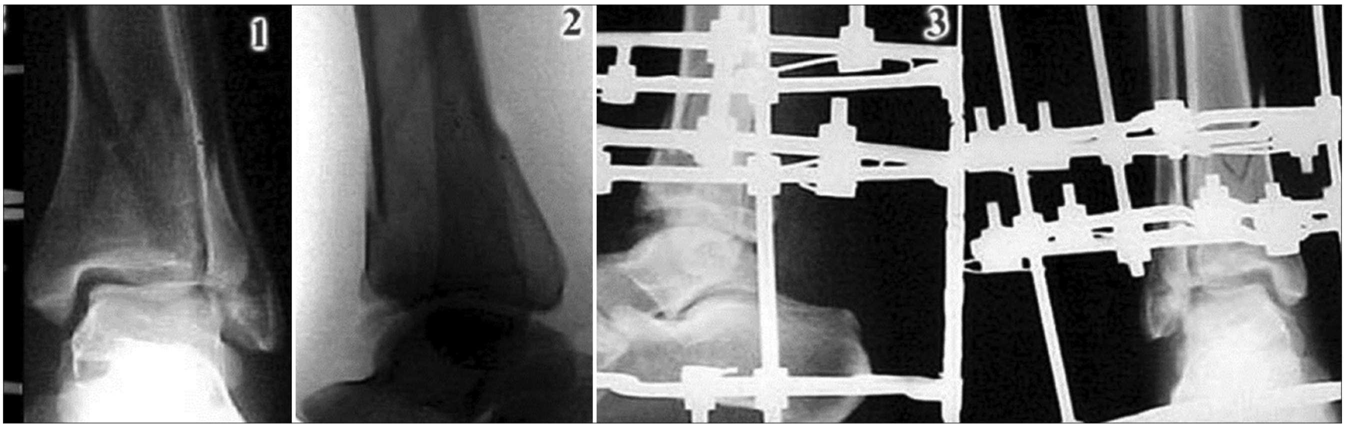


Figure 13: (1 and 2) Pre-operative radiographs of open type B pilon fracture and (3) immediate post-operative radiographs following Ilizarov treatment [29]

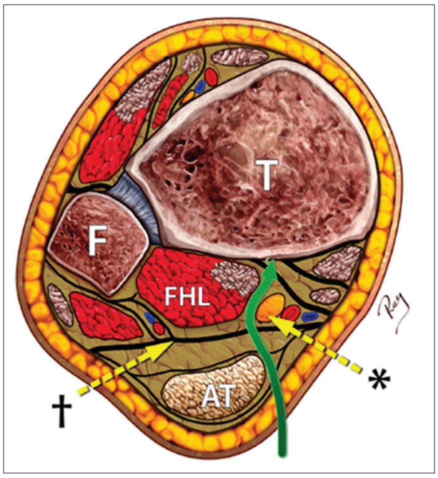


Figure 14: Cross-sectional anatomy of the pilon. T, tibia; F, fibula; AT, Achilles tendon; FHL, flexor hallucis longus tendon and muscle belly; †, floor of transverse intermuscular septum; tibial nerve; long green arrow, line of incision [32]

Tensional small-wire fixation gives good stability to reduced fracture fragments, none of the patient had loss of fixation. The use of olive wires in opposition helps compression of fracture fragments. The ILIZAROV percutaneous fixator preserves endosteal and periosteal blood supply, helps capture the small metaphyseal and subchondral bony fragments, and also helps compression of fracture fragments using the olive wires. The rigidity of fixation can be adjusted to suit stage of fracture healing. It also allows correction of deformity during the process of fracture healing. Early mobilization of the ankle joint is another advantage of the ILIZAROV device (Figure 13) [29].

Attention to wound closure is also another important component to reduce soft-tissue complications. At the end of the surgical procedure, the capsule is closed with an unbroken eight-figure pin using an absorbable thread, as well as an extensor retinaculum (using anterolateral) and a deep fascial layer (using anteromedial). The ends of the stitches are not tied until the stitches for all layers have been placed. A gentle pull is then applied to the ends of the stitches, to be supported with the strength required for deep placement. The stitches are then sequentially tied by hand and then cut. The skin is covered with nylon stitches using the Allgower-Donati technique. This paper is routinely applied over the skin incisions to help approve and replace the skin on the incision [30].

Perioperative Plan

Most surgical examinations are obtained from (1) a complete review and value of the CT scan, for the assessment of higher articular surface levels calculated from the assessment of articular surface traffic, (2) plain photographs at the time of placement to determine the optimal implant location, and (3) to determine the location of the incision. Because ligamentous structures are bound to pilon fractures, each bone fragment is usually attached to the tibiofibular anterior ligament, posterior tibiofibular ligament, and deltoid ligament (Figure 14). If ligament rupture occurs, it will usually occur anterolateral and posterolateral. This is important because the effect of ligamentotaxis on these fragments from fibula reduction will be far less than anticipated and can also be done on fixation done on posterolateral and anterolateral fracture fragments [12].

The pre-operative plan must discuss the main components and how to manipulate them to gain access to the commutative area while still paying attention to the tissue and ligament attachment (Figures 15 and 16). The implant will maintain the position of the articular fragment that has been reduced and also neutralizes the force from the metaphysical direction, a straightforward method for determining the direction of change of the move by radiography while rotating and inspecting the direction and displacement of the talus. Fibula fraction and pilon fracture will help determine the bone that failed in traction, compression, rotation, or combination [31]. This then gives an estimate of the articular impact zone and the area suitable for placing the implant that provides support, anti-displacement, or

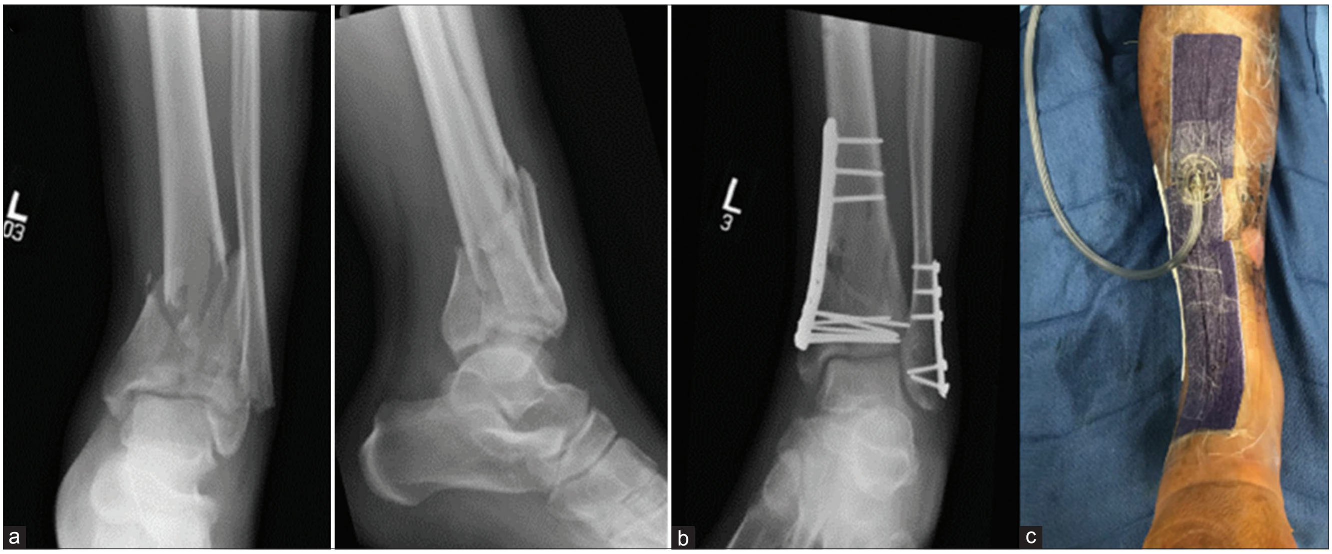


Figure 15: Left pilon fracture with primary varus deformity (a and b). Staged surgical reconstruction with ORIF of fibula and medial-based plate fixation of tibial plafond (c) vacuum-assisted closure applied over a closed wound with the goal of minimizing the risk of wound complications (d) [38]

tension-band effects (Figure 17). All this must be done with due regard to the tissue that occurs and within the limits given by the chosen surgeon.

As a result, when choosing a suitable approach for direct penetration into the joints located between the fragments, the operator must keep vascularization in mind and avoid periosteal stripping intraoperative action on the metaphysics area, as in the case of minimal invasive operations, which arises from massive involuntary rotation and/or axial compression, which occurs in areas that are slightly covered by soft tissue. This is what causes the problem for the surgeon to determine the best incision location in the open reduction internal fixation (Figure 18) [23].

Plates for distal tibia that has been contoured are very useful in the definitive management of these fractures. The anterolateral, medial, and tibial posterior distal periarticular plates are now commonly available and provide surgeons the flexibility to attach certain parts of the distal tibial epiphyseal and allow the plate to provide indirect reduction to the metaphysical component. Easier implants, such as distal radius T plates, 1/4 tubular, 1/3 tubular, and mini-fragment plates when useful, especially in partial articular constraints, where meta-diaphysis stabilization is not needed, or as additional implants combined with more rigid implants when neutralization of meta-diaphysis is needed and more implants are needed to stabilize the fracture. Additional equipment that is often needed today is a distractor, Schanz pin, a large set of external fixations, bone grafts, headlight lighting, K-wire, mini-fragment screws, osteotomes, and various Freer elevator and bone clamps [31].

Figure 16: Fractures of the distal tibia in a 47-year-old-man anterior-posterior (a), lateral (b), pre-operative radiography and 3D computerize tomography (c) [41]

Current Update

A meta-analysis of observational studies that comparing external fixation and open reduction internal fixation shows no difference in reduction, deep infection, and union time. However, external fixation shows a higher rate of superficial infection, malunion, and non-union [33], [34]. A randomized controlled trial using vascular impulse technology included tibial pilon

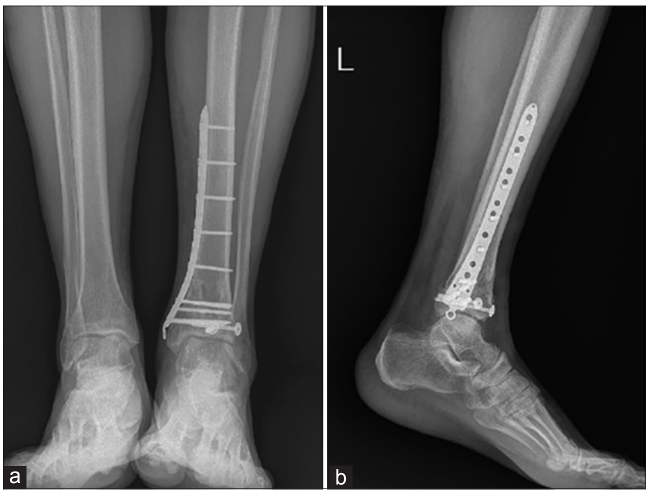


Figure 17: Patient in Figure 16 treated with a MIPO anterior-posterior (a) and lateral (b) radiography [41]

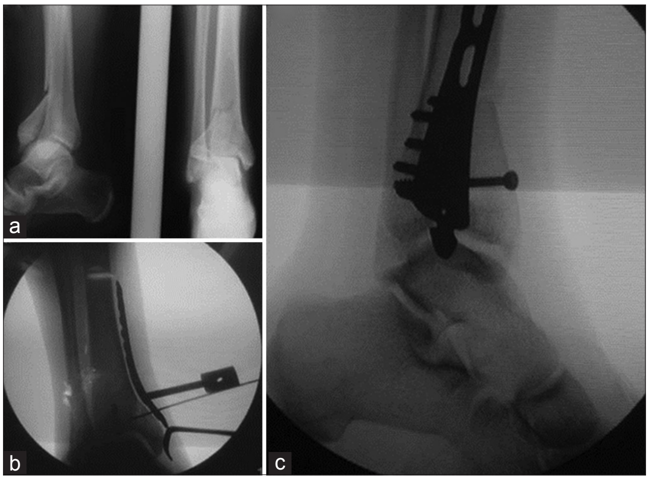


Figure 18: (a) Plain radiographs of a 19-year-old male who sustained this injury in a road traffic accident. (b) Intraoperative image of the sizing of a medial locking plate following reduction with traction and probe. An anteroposterior screw has already been inserted. (c) Final intraoperative image showing restoration of articular surface [41]

fracture as its population show a novel pre-operative treatment that significantly reduces swelling, shorter time to operability, and reduces pain [35]. Other methods for pilon fracture management were by giving supplementary perioperative oxygen with 80% oxygen inspiration concentration (FiO2) for reducing surgical site infection in pilon fracture and high-energy fracture surgery. However, it’s still at protocol level and needs further research [36].

Complications

Complications from tibial pilon fracture therapy might develop intraoperatively, as well as in the early or late post-operative phase. Pre-operative planning and thorough surgical technique can reduce perioperative problems such as malreduction, insufficient fixation, and intra-articular penetration of hardware. Wound complications can result in deep infection, which can have disastrous effects. Delaying surgery for 5–14 days, once post-traumatic edema has reduced, may reduce the risk of wound problems [25].

Complications of pilon fractures are divided into two namely septic and aseptic. Septic complications include superficial and deep surgical wound infections [37]. Deep slough or wound dehiscence is an indication of surgery. The goal is to return the contaminated part to a sterile wound and be closed again, and to get tissue culture to guide the selection of antibiotics. Irrigation and debridement must be done as soon as possible to remove all necrotic tissue and clean the wound. Open wounds help with vacuum-assisted closure (VAC) to avoid exposure to the outside environment, eliminate hematoma, and to facilitate granulation and wound contraction. Antibiotics are given according to the results of culture and after the wound is free of necrotic tissue and clean, then wound closure. If the area is larger, skin grafting can be done to speed up the settlement. In the case of acute fractures and stable fixation, the goal of treatment is to process unity until the union, and the implant can then be removed. In patients with acute infections and unstable implants, treatment strategies are similar to supported non-union cases, with the gradual agreement of the distal tibia [12], [20], [38].

When osteomyelitis occurs, the aim is to remove everything that has been canceled for contamination, including implants and dead tissue or bone, tissue culture, and good wound closure. The principles of the treatment of chronic osteomyelitis related to non-union include debridement of radical tissue that is resistant and cannot survive. Bone defects are filled with non-biodegradable drugs, such as antibiotic bags. Soft-tissue defects with local, or distant tissue, and bone stabilized by external fixation. Antibiotics are given according to culture results, with a duration of 6 and 12 weeks. If the articular surface is involved and the main function of the tibiotalar is poor, then try discussing the purpose of tibiotalar arthrodesis. In the case of recurrent infections, amputation below the knee remains the treatment of choice [39], [40].

Aseptic complications include non-union of metaphysical or metaphysical fissures, incidence between 0% and 16%. Corrections are often used using medial distractors or external fixators followed by plate fixation or intramedullary nails. Because the correction of this deformity will result in defects in the bone, the use of bone graft needs to be increased [12], [14].

Many studies have confirmed that the improvements with newer implants and MIPO techniques can reduce wound complication rates. MIPO techniques can reduce soft-tissue injury and damage to bone vascularity and further preserve the osteogenic fracture hematoma that can reduce the infection rate and improve bone healing. However, minimally invasive plating is not suited for all pilon fractures. Meta-diaphyseal comminution fractures usually do not get direct reduction without extensive exposure [41], [42].

Late complications, such as stiffness and posttraumatic arthritis, correlate with the severity of the initial injury and the accuracy of reduction [25]. Stiffness and post-traumatic arthrosis pain occur due to the narrowing of the joint space after open reduction therapy and internal fixation. Many patients can succeed with anti-inflammatory drugs, activity modification, and the use of transient orthosis. Treatment for severe end-stage posttraumatic arthritis is better done with arthrodesis in situ if the distal tibia is properly aligned and the fracture is healed. In his notes, increase arthrodesis in pilon fractures with surgical therapy from 5% to 26%, most of these data was obtained from patients taken <5 years.

Many arthrodesis techniques have succeeded with successful results, including the use of blade plates, hindfoot fusion nails, and external circular fixators [27].

Outcomes

Functional results obtained by more than two-thirds of patients meet pain every day. Although staged surgery is proven to prevent post-operative soft-tissue problems, the functional results obtained are not very significant [43], [44].

The surgeon must simultaneously address the parallel priorities of articular reconstruction and soft-tissue restoration. Damage to the soft-tissue envelope is usually more severe, which may interfere with surgical incisions, complicate primary soft-tissue healing, and place underlying hardware at increased risk for infection. Hence, in handling, it needs attention to the tissue that is easily handled by fracture, because this is the most important thing to be complicated. In most pilon series, open fractures have had a higher rate of infection than closed fractures. Use of external fixation has decreased the complication rate, but led to more variability in the metaphyseal and articular reduction compared to plate fixation [12], [45], [46].

Conclusion

Tibial pilon fractures are uncommon; this term has further been used to portray the mechanism involved in tibial pilon fractures in which the distal tibia acts as a pestle with heavy axial forces over the talus basically causing the tibia to burst. Pre-operative preparation includes CT scans and a detailed assessment of the patient's history to identify potential risk factors, which is critical to treatment success. The delicate soft-tissue envelope around tibial pilon fractures requires special study and care. Choosing the optimal method for each fracture pattern is critical for obtaining the greatest possible visualization and, as a result, anatomically reducing the articular surface of the tibial pilon. Modern surgical procedures and technology have improved results, but they are still only modest, with a high overall complication rate.

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