21 Fractures of the Distal Tibial Metaphysis Involving the Ankle Joint: The Pilon Fracture

D. Stephen

21.1 Introduction

The pilon fracture is a metaphyseal injury extending into the ankle joint. The complexity of this injury continues to challenge most, if not all orthopedic surgeons.

Over the past decade, there has been a shift in emphasis from the fracture as an isolated entity to an understanding that the soft tissue injury plays a large role in the outcome of treatment. This has resulted in a considerable change in the treatment, both from a perspective of timing as well as technique of fracture fixation. Coupled with this increased awareness regarding the importance of the soft tissues, there have been changes in the implants used for fracture fixation. This chapter will review these issues, as well as the results and complications of this complex injury.

The major problems affecting the natural history of the high-energy distal tibia fracture may be summarized as follows:
1. The nature of the injury
2. The state of the bone
3. The state of the soft tissues
4. Technical difficulties

21.2 Overview

21.2.1 Nature of the Injury

Fractures in cancellous bone are subject to either compressive or shearing forces, each imparting its own particular type of injury on the bone (Figs. 21.1, 21.2). Compressive forces cause severe impaction, whereas shearing or tensile forces cause marked disruption of the bone and soft tissues without impaction, resulting in gross instability. A fracture caused by a combined shear and compressive load may present with both impaction of the articular surface and instability of the metaphysis as well as damage to the soft tissues due to the lack of muscle cover to the medial border of the tibia.

Severe compression injuries are often seen in patients falling from a height, whereas shearing injuries are often seen in skiing injuries, the so-called boot-top fracture, or major motor vehicle trauma. It is with the complex force patterns of high-energy motor vehicle trauma that a combination of these types of injuries may be seen.

The prognosis of the injury depends on the amount of articular damage compared to the metaphyseal damage (as is clearly evident in Fig. 21.1), and is reflected in the revised classification. The prognosis will also depend on the handling of the soft tissues during internal fixation.

21.2.1.1 Axial Compression

Tibia

Articular Cartilage. Severe compression (Fig. 21.1a) usually causes impaction of the articular surface, often with marked comminution (Fig. 21.1b,c). On some occasions, the comminution is so great that anatomical repair of the articular surface is virtually impossible. If surgical repair is attempted, small avascular pieces of articular cartilage and subchondral bone may have to be discarded, leaving gaps on the joint surface. Osteoarthritis will inevitably follow no matter what form of treatment is used.

Metaphysis. Fractures of the distal metaphysis caused by compression associated with a rotation force often severely impact the metaphyseal bone, causing unacceptable axial malalignment (Fig. 21.1d). The result of uncorrected axial malalignment in the lower extremity is abnormal stress on the distal joint, which in time will destroy it. In the lower extremity, anatomical alignment is
necessary to prevent these major forces of weight bearing from destroying the joint.

Therefore, when these impacted fractures are reduced by closed manipulation, an extremely large periarticular gap is formed (Fig. 21.1d–h). Nature abhors a vacuum – if treated nonoperatively, the distal fragment may tend to displace into that gap in the postreduction period, necessitating multiple reductions. Also, since the compression fracture has been disimpacted, and since cancellous bone heals poorly under such conditions, union may be delayed. This, in turn, will require prolonged immobilization of the limb, with resultant poor ankle function.

**Fibula**

In many compression injuries the fibula may remain intact, which it never does in the shearing-type injury. With an intact fibula, the ankle is often driven into varus with severe impaction of the medial part of the tibial plafond (Fig. 21.1b,c).

### 21.2.1.2 Shear (Tension)

**Tibia**

**Articular Cartilage.** Pure shearing or tensile forces, free of axial loading and usually rotatory in nature, may spare the articular surface (Fig. 21.2a,b). Minor