Diagnosis and Treatment of Forefoot Disorders. Section 5. Trauma

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This clinical practice guideline (CPG) is based upon consensus of current clinical practice and review of the clinical literature. The guideline was developed by the Clinical Practice Guideline Forefoot Disorders Panel of the American College of Foot and Ankle Surgeons. The guideline and references annotate each node of the corresponding pathways.

Trauma (Pathway 6)

Trauma in the forefoot can range from simple, nondisplaced fractures to limb-threatening injuries. Proper evaluation and diagnosis is critical to determine the extent of injury and appropriate treatment.

Significant History (Pathway 6, Node 1)

Trauma to the toes, lesser metatarsals, and their respective joints involves various mechanisms and injury types (1, 2). These include a history of both direct and indirect trauma. Patients may exhibit symptoms acutely at the time of trauma or at a later onset. Symptoms include pain, swelling, discoloration, loss of joint motion, and difficulty standing and/or walking. An accurate history of the inciting traumatic event should be elicited.

Significant Findings (Pathway 6, Node 2)

Clinical examination of the traumatized forefoot may show pain upon palpation and motion of affected joints. The patient may have decreased range of motion, with or without tendon dysfunction. Deformity may or may not be present. The patient may experience pain with or without weightbearing. Soft tissue damage must be evaluated and any neurovascular compromise recognized. Edema is common and often does not allow a shoe to be worn. Ecchymosis and/or erythema may be present, depending on the injury type.

Radiographic Findings (Pathway 5, Node 3)

Radiographs are indicated in most cases of trauma to the forefoot to rule out fracture and/or joint dislocation. Anterior-posterior, lateral, and oblique views may be obtained with the patient in either a weightbearing or nonweightbearing position. In some cases, stress views under anesthesia may be required to identify the injuries.

Positive Diagnosis for Fracture or Dislocation (Pathway 6, Node 4)

Fractures should be evaluated and treated appropriately. Special attention should be directed to restoring articular congruity and segmental alignment, paying particular attention to maintaining alignment in the sagittal plane. Nondisplaced fractures of the forefoot may require only appropriate immobilization (Fig. 1), whereas displaced fractures may require closed or open reduction techniques (3-5) (Figs. 2 and 3). Of special note are fractures of the proximal diaphyseal area of the fifth metatarsal (Jones fracture) (6-8) (Fig. 4). Although many fractures of this type may be treated with immobilization and avoidance of weightbearing, internal fixation may be indicated in some patient populations (eg, high-caliber athletes) (9-26). Significant intra-articular injury of the interphalangeal or metatarsophalangeal joint may require subsequent arthroplasty.

Dislocations of the interphalangeal joints of the lesser toes probably are somewhat more common than dislocations of the metatarsophalangeal joint. Traumatic disloca-
TRAUMA

SIGNIFICANT HISTORY
- History of trauma
- Acute or late onset of symptoms
- +/- Pain/disability
- +/- Swelling/dyscoloration

SIGNIFICANT FINDINGS
- Pain upon palpation/ROM
- +/- Tendon dysfunction
- +/- Presence of deformity
- Localized pain with/without weightbearing
- Soft tissue damage and/or neurovascular compromise
- +/- Edema / erythema / ecchymosis

(++ for Fracture

Diagnostic Testing
Radiographic Evaluation

(-) for Fracture

FRACTURE or DISLOCATION
- Diagnose and treat appropriately (including any associated soft tissue injury, i.e., wound(s), tendon injury, compartment syndrome, nail/nailbed injury, etc)
- Further diagnostic imaging if unsatisfactory improvement (Tc scan, MRI, CT, ultrasound)

PUNCTURE WOUND NAIL / NAILBED INJURY TENDON PATHOLOGY COMPARTMENT SYNDROME
- Diagnose and treat appropriately
tions most often occur in the dorsal direction or in the transverse plane. Acute treatment focuses on reduction of the joint dislocation, which usually can be accomplished in a closed fashion (Fig. 5). In some cases, soft tissue interposition may require open reduction. Late repair and balancing of capsuloligamentous tissues rarely is necessary.

Diagnosis and treatment of any concomitant soft tissue injury (eg, soft tissue wound, tendon injury, compartment syndrome) are carried out appropriately. If clinical improvement is not seen within the expected timeframe, further diagnostic imaging such as technetium bone scan, magnetic resonance imaging (MRI), computed tomography (CT), or ultrasound may be indicated to evaluate for non-union or unrecognized osseous or soft tissue injury.

Negative Diagnosis for Fracture or Dislocation (Pathway 6, Node 5)

Trauma to the forefoot is always associated with a degree of soft tissue injury (27). This may include a variety of soft tissue conditions.

FIGURE 1 Fifth metatarsal fractures are not uncommon. This spiral oblique fracture visualized on (A) anteroposterior and (B) oblique radiographs was treated nonsurgically with immobilization. (C, D, and E) Gradual progression to bony union and good alignment is shown in these radiographs.
Puncture wounds of the foot are not uncommon and may or may not be associated with a retained foreign body \((28, 29)\). Appropriate wound care must be performed acutely, along with assurance of updated tetanus prophylaxis \((30-42)\). When seen subacutely, puncture wounds may present with signs and symptoms of infection, necessitating more aggressive incision and drainage as well as indicated laboratory testing. Further diagnostic imaging such as MRI and ultrasound may be indicated to identify a suspected retained foreign body not revealed on radiographic studies \((43-47)\).

Nail and nail bed injuries range from simple subungual hematoma to open fracture with tissue loss. Approximately one fourth of injuries with subungual hematomas also have fractures of the distal phalanx \((48-50)\). Nailbed lacerations frequently are associated with subungual hematomas. Simple nail bed lacerations can be irrigated and sutured with absorbable sutures \((51)\). A nail bed laceration associated with a fracture of the distal phalanx is technically an open fracture and should be treated accordingly. Degloving injuries involving the nail and distal phalanx can be treated with resection of bone to a

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**FIGURE 2** The fifth metatarsal base avulsion fracture is visualized on this \((A)\) radiograph and \((B)\) intraoperative photograph. The patient underwent open reduction–internal fixation with tension-banding of the fracture, as shown in the \((D)\) intraoperative view and on postsurgical \((E)\) anteroposterior and \((F)\) lateral radiographs.
proximal level, which allows for adequate soft tissue coverage (52).

Tendon disruption occurs most commonly with laceration and rarely with closed injury (Fig. 6). The majority of cases of extensor hallucis longus (especially proximal to the hood apparatus) and flexor hallucis longus disruption are treated with open repair of the tendon (53). The literature is less clear regarding the treatment of

FIGURE 3  This patient suffered an injury with fracture of the third and fourth metatarsals. (A) anteroposterior and (B) oblique radiographs show lateral displacement. The patient underwent open reduction–internal fixation with kirschner wire stabilization illustrated by (C) anteroposterior and (D) lateral postoperative radiographs.
FIGURE 4 The proximal fifth metatarsal fracture or Jones fracture has a poor prognosis compared with the avulsion fracture. This patient underwent open reduction–internal fixation with a axial screw through the tuberosity. (A) Intraoperative radiography and (B) clinical presentation illustrate screw orientation down medullary canal. (C) Anteroposterior and (D) oblique radiographs show final screw placement.

FIGURE 5 (A) MPJ dislocations occur, and this radiograph shows the displacement. (B) Closed reduction was performed in a Chinese finger-trap, with gravity reduction providing an (C) anatomic alignment.
extensor digitorum longus and flexor digitorum longus disruption.

The attention and care given to the soft tissue envelope is an integral part of the evaluation and management of any forefoot injury. High-energy and crush injuries should raise the level of suspicion for compartment syndrome (54, 55). Clinical signs include digital weakness or paralysis, gross edema, tense compartments, paraesthesia, mottled skin, and unrelieved pain (51, 56). Compartment pressures of the foot above 30 mm Hg to 35 mm Hg are diagnostic for compartment syndrome (57). Surgical decompression is indicated if compartment syndrome is suspected from clinical findings and/or compartment pressures (58-60).

Lacerations, abrasions, and degloving injuries also may involve the forefoot (61). Evaluation for associated neurovascular compromise, tendon injury, and other injuries must be performed.

References

5. Zenios M, Kim WY, Sampath J, Maddu BN. Functional treatment of acute metatarsal fractures: a prospective randomised comparison of