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TIB/FIB, FOOT AND ANKLE TRAUMA

Objectives

- Provide a basic overview of fractures below the knee
- Understand the management of these fractures
- Be aware of potential pitfalls and complications

Proximal Tibia Metaphyseal Fractures

- Most common in 3-6 year olds
- Typically occurs from a valgus force to an extended knee
- Most are non-displaced
- Treated in LLC for 4-6 weeks

Proximal Tibia Metaphyseal Fractures

Post Traumatic Tibia Valga

- Most common theory is over-growth
- Peaks around 1 year post-injury
- Reported incidence is up to 50%
- Can spontaneously resolve but may take up to 3-4 years

Posttraumatic Tibia Valga in Children

A Long-Term Follow-up Note*

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Investigation performed at the Alfred I. duPont Institute, Wilmington

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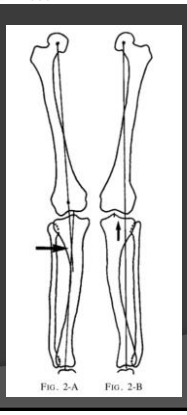


FIG. 2-A FIG. 2-B

FIG. 5-B

Anteroposterior radiograph and photograph, made at the time of maximum valgus deformity, twelve months after the initial fracture. At this time, the metaphyseal-diaphyseal angle measured 19 degrees of valgus, the mechanical tibiofemoral angle measured 16 degrees of valgus, and the mechanical axis of the affected limb was forty-two millimeters lateral to the center of the knee joint. The metaphyseal-diaphyseal and mechanical tibiofemoral angles of the uninvolved limb measured 2 and 3 degrees of valgus, respectively.

FIG. 5-C

Anteroposterior radiograph and photograph, made at the age of twenty-three years and three months, sixteen years and eleven months after the initial fracture. At this time, the metaphyseal-diaphyseal angle measured 10 degrees of valgus, the mechanical tibiofemoral angle measured 8 degrees of valgus, and the mechanical axis of the affected limb was twenty-four millimeters lateral to the center of the knee joint. The metaphyseal-diaphyseal angle, the mechanical tibiofemoral angle, and the deviation of the mechanical axis of the uninvolved limb measured 2 degrees of varus, 3 degrees of valgus, and eleven millimeters medial to the center of the knee joint, respectively. The patient had pain in the knee and ankle that limited participation in strenuous sports, and he was unhappy with the appearance of the affected limb.

ORIGINAL ARTICLE

Hemiepiphysiodesis for Posttraumatic Tibial Valgus

Peter M. Stevens, MD, and Felicity Pease, MS

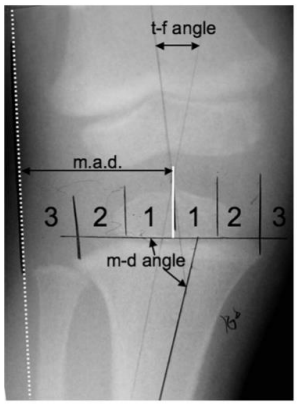
Abstract: Posttraumatic tibial valgus is a recognized complication of proximal tibial metaphyseal fractures in children. There is no consensus regarding management of this malalignment; approaches range from repeated osteotomy to therapeutic nihilism. The authors present 12 patients with an average age at fracture of 4 years 11 months, each of whom who was successfully managed by temporary hemiepiphysiodesis. An additional patient (age 33 years) is included to illustrate the potential long-term outcome of "benign neglect."

Using staples or, more recently, a 2-hole plate for guided growth, we have demonstrated correction of posttraumatic tibial valgus by all criteria; including mechanical axis deviation, lateral tibial metaphyseal-diaphyseal angle, tibiofemoral angle, and tibial length. We conclude that hemiepiphysiodesis is a safe and effective method of treatment with a high degree of patient/parent satisfaction. There have been no permanent growth arrests.

Key Words: hemiepiphysiodesis, posttraumatic tibial valgus, 2-hole plate, benign neglect, Cozen's phenomenon

(*J Pediatr Orthop* 2006;26:385–392)

TABLE 2. Radiographic Measurements on Full-length Weight-Bearing Anteroposterior Films



Zones, dividing the knee into quadrants, medial or lateral zone 1, are considered physiological, requiring no treatment. Lateral zone 2 or 3 warrant intervention. m.a.d. indicates mechanical axis deviation (horizontal distance between the actual mechanical axis [dotted line] and the center of the knee); t-f angle, tibiofemoral angle (anatomic axis encompassed by the femoral and tibial diaphyses); m-d angle, tibial metaphyseal-diaphyseal angle (this would normally be 0 to 3 degrees of varus).

"We recommend this procedure in patients who have persistent (>1 year after fracture) pathological genu valgum defined as greater than one zone difference in the mechanical axis when compared with the contralateral side."

Trampoline Fracture

TIBIAL SHAFT FRACTURES

Essential Surgeon Knowledge

- What are acceptable alignment limits
- Treatment principles of specific fracture types
- Muscle forces

Isolated Tibial Diaphyseal Fractures

- Under age 11, most are the result of indirect forces
- Typically oblique and run anteromedial to proximal posterolateral
- Majority are treated by long leg casting or closed reduction and casting

Intact Fibula

Tibia + Fibula

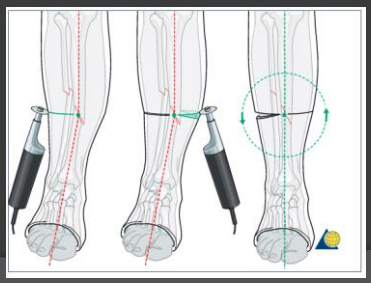
- Almost always results in valgus alignment
- Close reduce and mold cast accordingly

General Guidelines for Alignment

- Varus/Valgus Angulation
  - Up to 10 degrees in those less than 8yo
  - Up to 5 degrees >8yo
- Translation
  - 50% apposition in adolescents
- 1 cm shortening
- Minimal recurvatum
- Up to 10 degrees apex anterior angulation

Surgical Indications

- Absolute
  - Failure to obtain an adequate closed reduction
- Don't forget about cast wedging



- Relative
  - Open fracture
  - Fracture associated with significant soft tissue injury
  - Floating knee
  - Head trauma
  - Multi trauma
  - Compartment syndrome

Methods of Fixation

- Perc pins
- Plating
- Flexi nails
- IM rod
- Ex fix

- Implant choice is tailored to the fracture pattern, age of the patient, and soft tissue injury

Distal Tibia Metaphyseal Fxs

- If casted with foot in neutral, often puts fracture in recurvatum
- One exception where it is better to cast in slight plantar flexion

Images from Rockwood and Green

Distal Tibia Metaphyseal Fxs

- Percutaneous pinning for unstable fractures

Distal Tibial Physeal Fractures

- Salter Harris I and II >50%
- Are almost always treated closed unless there is soft tissue interposition that blocks reduction
- There is about 15% incidence of growth arrest after SH2 fx

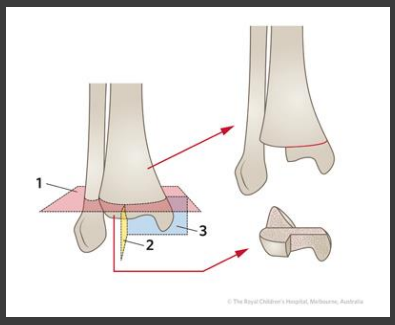
SH3 and SH4 Injuries

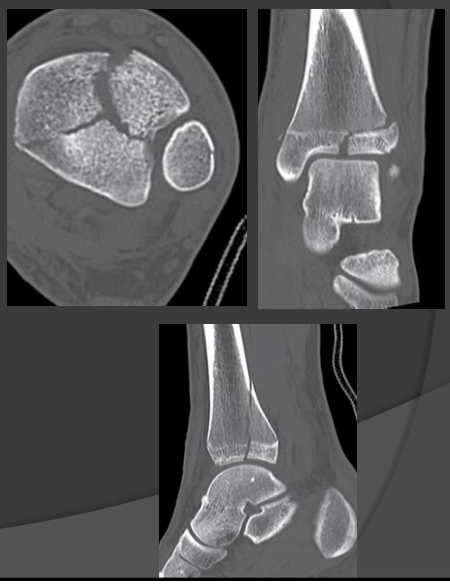
- Carry a higher risk of growth arrest despite appropriate treatment
- Do not accept any displacement
- If any displacement ORIF with fixation in the epiphysis is treatment of choice

Transitional Fractures

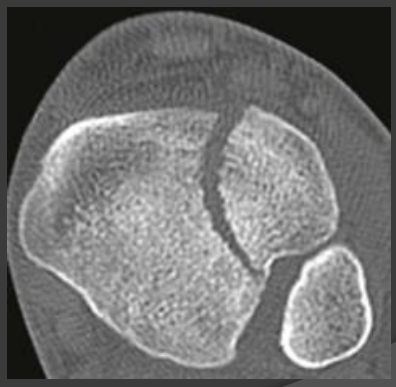
- Occur when kids are transitioning from being skeletally immature to mature
- Tillaux, Triplane
- Order of closure of distal tibial physis is responsible for the fracture patterns seen
  - Closes centrally first, then medially, and last laterally

Triplane Fracture





Juvenile Tillaux Fracture



Treatment

- Both are external rotation injuries
- Closed reduction and cast in internal rotation
- If >2mm displacement, ORIF

Hindfoot Fractures

- Rare in children
- Most calcaneal fractures in children <14 are extra-articular
- Older age group treat like an adult

- Talus has a high percentage of cartilage in growing child, so it can absorb more bending forces

Lisfranc Injuries

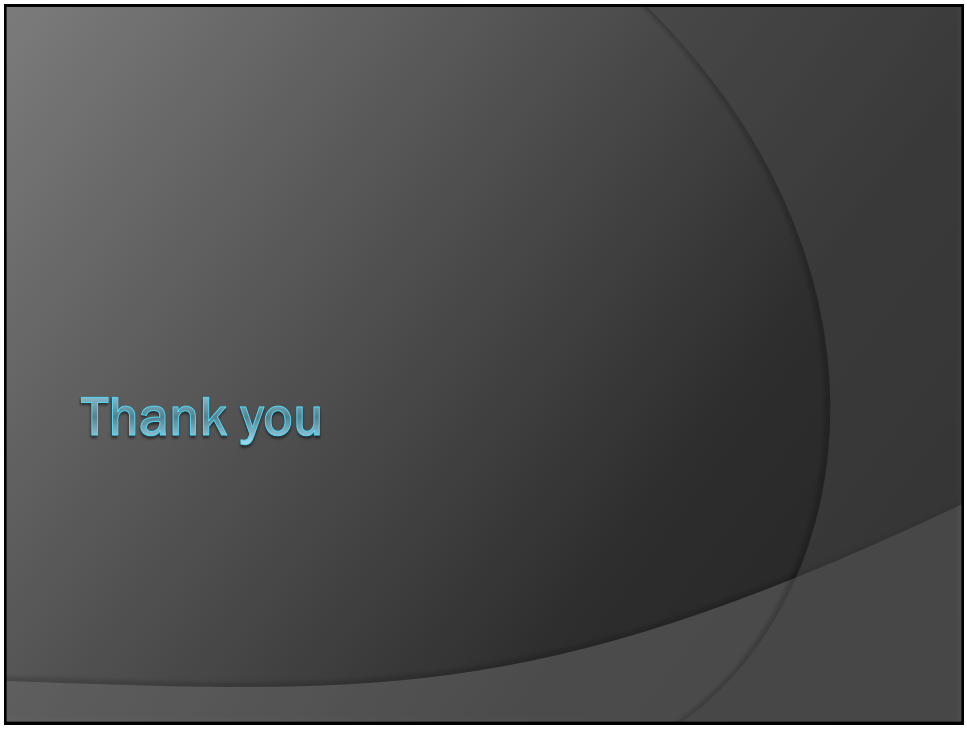
- Rare
- Presence of a cuboid fracture, especially with a 2nd metatarsal fracture should raise suspicion
- Non displaced injury can be treated with with casting for 4 weeks
- Displaced injuries need to be reduced and fixed

Metatarsal Fractures

- Most common pediatric foot fracture
- Primarily treated non-operatively
- Jones fractures do carry a risk of nonunion in children
  - Delayed or nonunion is treated with internal fixation +/- bone grafting

Phalanx Fractures

- Most are treated symptomatically with buddy tape
- Salter Harris III fracture of the proximal phalanx of the great toe require surgery if >1/3 joint surface or is >2mm displaced
- Seymour Fracture-open fx of distal phalanx of great toe
  - Needs nail bed removal and repair and antiobiotics


Thank you