

# TIBIAL SHAFT NONUNIONS

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- I. Definition
  - a. A fracture that does not heal in the expected time
  - b. Longer than twice the expected healing time
  - c. A fracture that will not unite without intervention
  - d. Minimum 6 months – no progress for 3 months
  
- II. Incidence
  - a. Most common long bone to have healing problems
  - b. Range from 2-10% (closed fracture) to 25-40% (grade III B open fracture)
  - c. Higher energy injury → longer time to healing
    - i. Compartment syndrome – Increased healing fracture
    - ii. Open fractures
    - iii. Bone loss
    - iv. Infections
  
- III. Contributing Factors
  - a. Infection
  - b. Poor vascularity
  - c. Fracture gap
  - d. Fracture instability
  - e. Soft tissue injury
  - f. Host factors
    - i. Increased age, DM, PVD, diet, smoking, medications
  
- IV. Prevention
  - a. Provide adequate stability
  - b. No distraction at fracture site
  - c. Biological enhancement when indicated
  - d. Less invasive methods of stabilization
  - e. If you do not think it will heal (bone loss) do something!
  
- V. Diagnosis
  - a. Develop anticipated time to healing
    - i. Most 3-6 months
    - ii. 6-12 months for severe fracture with bone loss

- b. Pain with weight bearing at fracture site
- c. Motion on exam
- d. X-rays – centered on fracture site
  - i. AP, Lat, and internal oblique
  - ii. Gap at fracture site, lack of callous
  - iii. Broken hardware
  - iv. Evidence of motion
- e. CT Scan
  - i. Sensitive but not specific
  - ii. Some fractures may be healed even with concerning CT Scan

VI. Classifying – helpful in directing treatment

- a. Aseptic versus septic
- b. Atrophic - oligotrophic - hypertrophic
- c. Stiff versus mobile

VII. Principles of work up/treatment

- a. Routine labs – vitamin D, Calcium, ERS, CRP, CBC
- b. Metabolic, systemic concern
- c. Nutrition
- d. Smoking cessation

VIII. General treatment principles

- a. Failure of biology
  - i. Poor healing response
  - ii. Atrophic or oligotrophic nonunion
- b. Failure of stability
- c. Deformity correction – fibular osteotomy often needed

IX. Nonunions that are minimally symptomatic and clinically well-aligned can be treated nonoperatively

- a. E-stim, Ultrasound
- b. Vitamin D replacement, Increased nutrition
- c. Extra corporeal shock wave treatment
- d. Teriparatide – off label

X. Common clinical scenarios

- a. Tibial nonunion after nailing
  - i. Dynamization
    - 1. Fracture gapped
    - 2. Axial stable fracture
    - 3. Diaphyseal location
  - ii. Exchange nailing
    - 1. not for metaphyseal location
    - 2. Not with bone loss – will not work
    - 3. Good success – increased size of nail 1-2mm
- b. Tibial nonunion after casting

- i. Correction of deformity
  - ii. Consider open nailing for diaphyseal location
- c. Plate fixation after nailing
  - i. Metaphyseal location
  - ii. Poor stability offered by nail
  - iii. Open procedures
    - 1. Correction of deformity
    - 2. Bone grafting
    - 3. Absolute stability
- d. Nonunion complicated by sepsis
  - i. Remove all nonviable infected tissue
  - ii. Durable soft tissue envelope
  - iii. External fixation for temporary or definitive stabilization
  - iv. Once infection resolved/controlled
    - 1. Stabilization
    - 2. Biologic enhancement