Etiology and Biomechanics of the Adult Acquired Flatfoot

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I. DEFINITION AND CHARACTERISTICS OF FLATFOOT
- A. Foot in which height of longitudinal arch is diminished
- B Typically collapse of arch, hindfoot valgus, forefoot abduction
- C. Three-dimensional malalignment

II. ETIOLOGY OF ADULT FLATFOOT
- A. Neuropathic arthropathy
- B. Degenerative arthritis—hindfoot, midfoot, ankle
- C. Fracture malunion
- D. Inflammatory arthropathy
- E. Posterior tibial tendon dysfunction (PTTD)
- F. Hypermobile flatfoot
- G. Other: muscle imbalance, tarsal coalition

III. SPECIFIC CAUSES OF PTTD
- A. Degeneration/attenuation with age
- B. Chronic tenosynovitis
- C. Systemic inflammatory diseases
- D. Trauma
- E. Friction/compression of tendon by medial malleolus
- F. Zone of hypovascularity of tendon
- G. Metabolic disorder
- H. Other

IV. POSTERIOR TIBIAL ANATOMY
- A. Anatomy of the posterior tibial tendon and muscle
  - 1. Origin
    - a. Tibia-lateral and posterior
    - b. Fibula-medial, proximal two-thirds
    - c. Intermuscular septa
    - d. Interosseous membrane-posterior

2. Insertion
    a. Navicular tuberosity
    b. Plantar cuneiforms 1, 2, 3
    c. Plantar base of metatarsals 2, 3, 4
    d. Plantar cuboid and sustentaculum tali

B. Function of the PTT
    1. Maintains arch height
    2. Maintain hindfoot position
    3. Maintains relationship forefoot to midfoot and hindfoot
    4. Plantarflexion, supination of foot

V. THREE-DIMENSIONAL ANALYSIS OF THE FLATFOOT DEFORMITY

VI. ANATOMIC ELEMENTS SUPPORTING THE ARCH

VII. ROLE OF POSTERIOR TIBIAL IN SUPPORTING THE ARCH

VIII. FACTORS PREDISPOSING TO PTTD
- A. Anatomic, mechanical
- B. PT gliding resistance

IX. PATHOGENESIS
- A. Tenosynovitis, attenuation, tendon rupture-partial, complete
- B. PTTD pathoanatomy
- C. Natural history of PTTD

X. NORMAL AND PATHOLOGIC GAIT
- A. Gait analysis in PTTD patients
- B. PT muscle activity during normal walking

XI. EVALUATION
- A. Pain posteromedial foot/ankle
- B. Swelling along course of PT tendon
- C. Change in foot shape-flat foot, “my ankle is falling over”
- D. Uneven wear of shoes
- E. Instability with ambulation

XII. PHYSICAL EXAMINATION
- A. Deformity with weight bearing
    1. Valgus deviation of heel
    2. Loss of height of medial longitudinal arch
    3. Abduction of forefoot
- B. Tenderness along course of PT tendon

C. Pain in medial aspect of ankle/hindfoot with active contraction of PT muscle against resistance
D. Supination strength reduced
E. Single heel rise test: while standing on the involved foot only, unable to raise heel off ground
F. Swelling ± erythema along course of PT tendon
G. May be flexible, rigid, or partially correctable deformity with manual manipulation
H. May have restricted hindfoot motion, painful hindfoot motion

XIII. DIAGNOSTIC STUDIES

A. Plain film radiographs
   1. Standing AP foot
   2. Standing lateral foot
   3. Standing AP ankle
   4. Oblique foot
B. CT: simulated weightbearing
C. MRI, ultrasound
D. Gait analysis

XIV. PTTD STAGES

1. Stage I: Tendonitis, no deformity
2. Stage II: Flexible flatfoot, tendon dysfunction
3. Stage III: Rigid flatfoot, hindfoot arthritis
4. Stage IV: Flatfoot with valgus ankle

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