

TARSAL COALITION (RIGID FLATFOOT)

Background

1. **Definition:** Abnormal connection between two tarsal bones. Results in rigidity around ankle and limited rotation in hind foot. Foot and ankle problems second most common musculoskeletal problem seen by primary care physicians
2. Under 10 years of age, acute injury is most common cause¹
Tarsal coalition must be considered in patients with chronic ankle sprains, chronic/worsening pain with activity, rigid hind foot and restricted subtalar movement.^{1,2,3} (SOR:B)

Anatomy of the Foot

1. Hind foot is comprised of seven separate bones:
 - Rear foot: calcaneus and talus
 - Midfoot: Navicular; medial, intermediate, lateral cuneiform; and cuboid



Pathophysiology

1. Embryologic development and ossification:
 - Each tarsal bone typically develops from single ossification center.
 - The calcaneus differs due to additional, small posterior apophysis.
 - Ossification at calcaneus begins in sixth fetal month
 - Ossification of talus begins in seventh fetal month
 - All other tarsal bones ossify after birth
 - Cuboid in first few months
 - Remaining during first 3-4 years of life
 - Following 4th year of life, failure to differentiate early mesenchymal tissue into complete, separate tarsal bones leads to abnormal association between bones (coalition)

- Initial connection is usually fibrous or cartilaginous, followed by completion of ossification later in life.^{2,4,5}
- 2. Common locations:
 - *Calcaneonavicular* - usually becomes symptomatic in 9-13 year olds
 - Pain usually located over lateral ankle
 - *Talocalcaneal* - generally present in early adolescents (13-16 year olds)
 - Pain usually vague and deep within hind foot
 - Less common sites include talonavicular, calcaneocuboid, cubonavicular, and naviculocuneiform.
 - Generally, coalition may be associated with pain medially, at the subtalar joint, or laterally at sinus tarsi.
- 3. Incidence:
 - ~1% of population has a tarsal coalition.
 - Bilateral coalition occurs in about 50-80% cases.
 - Most coalitions are asymptomatic.
- 4. Conditions associated with Tarsal Coalition:
 - Fibular hemimelia (hypoplasia of the fibula)
 - Syndactyly
 - Apert Syndrome (a form of acrocephalosyndactyly)
 - Niervergelt Syndrome (Pearlman's Syndrome)
 - Carpal coalition
 - Congenital club-foot (associated with talocalcaneal coalition)

Diagnosics

1. History/Presentation:
 - Recurrent ankle sprains are common presenting symptom, especially in young children.^{3,6}
 - Pain develops during early adolescence as bones ossify
 - Leads to limited hind foot rotation.
 - Pain can be insidious⁶, or in association with acute traumatic injury.
 - Limp is common after activity
2. Physical Exam:
 - Rigid flatfoot.
 - Marked decrease of hind foot motion
 - Especially noted with inversion and eversion.
 - Peroneal muscle spasms often present
 - Can be elicited with rapid inversion of foot.⁶
 - Peroneal spasms hold foot in everted, flatfoot posture.
3. Diagnostic Testing:
 - Laboratory testing – rarely used, but may be indicated to rule out other conditions.
 - Plain radiographs
 - AP, lateral, and oblique views of foot usually reveal most common coalitions^{2,6,7,8}
 - Talocalcaneal coalitions best seen using oblique radiographs.
 - Harris-Beath View may reveal talocalcaneal joint coalition.^{9,10}

- On lateral view, “*anteater sign*” is pathognomonic for calcaneonavicular coalition
 - Anterior process of calcaneous extends distally appearing like snout of an anteater
- Also on lateral view, “*c-sign*” indicates talocalcaneal coalition
 - Medial outline of talar dome converges with inferior outline of sustentaculum tali
- Computed tomography (CT) of foot, using fine cuts, considered best study to confirm tarsal coalition.¹⁰
- MRI or technetium-99m bone scan may be necessary if fibrous or cartilaginous coalition suspected, or if high suspicion remains despite normal radiographs and CT scan.^{2,9,11} (SOR:B)

Differential Diagnoses

1. Fracture
2. Infection
3. Flexible flatfoot-pes planus, without restriction of talar motion, usually without pain
4. Accessory navicular bone-medial prominence at navicular bone
5. Congenital vertical talus-rigid flatfoot deformity; present as neonate
6. Kohler’s disease-avascular necrosis of navicular bone; usually seen at 6-9 years of age

Therapeutics

1. In asymptomatic children, observation used if coalition incidental finding
2. With minimal symptoms, activity modification often sufficient.
3. If symptoms persist, conservative treatment goal is reducing stress on foot.⁶
 - Orthotics
 - Physical therapy
 - Temporary short leg casting sometimes necessary. (SOR:B)
 - Severe symptoms, or if symptoms persist for longer than 4-6 weeks.
 - Non-weight bearing cast for 4-6 weeks.
 - Physical therapy
 - Gradual return to activity.
 - Outcome is variable.
4. Surgical options available if conservative treatments fail.¹²
 - Coalition resection prior to skeletal maturity
 - Hind foot arthrodesis (ankle joint fusion) in recalcitrant cases
5. Follow-up-protocols vary based on treatment success
 - Conservative treatment with observation and physical therapy; evaluation at 4-6 week intervals; assess progress; adjust treatment modality. (SOR:B)
 - If casting indicated, closer follow up required, about every 2-3 weeks. Once out of cast, likely able to extend to every 4-6 weeks. (SOR:B)
 - Referral to Orthopedic surgeon if conservative measures fail.

Prognosis

1. Despite appropriate treatment, pain, restricted motion (inversion and eversion) and limited walking or running possible.
2. Post-surgical complications include cast sores, post-operative infection, inadequate pain relief, arthritic changes, and recurrence of coalition despite resection.

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