

Subtalar Coalition in Pediatrics



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KEYWORDS

- Subtalar tarsal coalition • Talocalcaneal tarsal coalition
- Calcaneonavicular tarsal coalition • Tarsal coalition resection
- Calcaneal lengthening osteotomy

KEY POINTS

- Subtalar tarsal coalition is an autosomal dominant developmental malformation that affects between 2% and 13% of the population.
- The most common locations are between the calcaneus and navicular and between the talus and calcaneus.
- If prolonged attempts at nonoperative management do not relieve the pain, surgery is indicated.
- The exact surgical technique(s) should be based on the location of the pain, the size and histology of the coalition, the health of the other joints and facets, the degree of foot deformity, and the excursion of the heel cord.

DEFINITION

- Tarsal coalition is a fibrous, cartilaginous, or bony connection between 2 or more tarsal bones that results from a failure of differentiation and segmentation of primitive mesenchyme.
- It is a developmental malformation in that it is
 - Not present at birth (therefore, not congenital), although it is genetically programmed to develop
 - A synchondrosis/synostosis, which is in the category of malformation—failure to separate, and
 - Also a deformity, because most affected feet have valgus deformity of the hindfoot

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EPIDEMIOLOGY

Tarsal coalition has been described in the archaeological remains of several civilizations since pre-Columbian times.¹ The association of the anatomic abnormality with the clinical syndrome of a painful flatfoot occurred 26 years after the introduction of radiographic imaging in 1895. In 1921, Slomann² linked the so-called peroneal spastic flatfoot with calcaneonavicular coalitions seen on radiographs. Almost 3 decades later, Harris and Beath^{3,4} linked peroneal spastic flatfoot with talocalcaneal coalition. Tarsal coalition has also been linked with the infrequently occurring tibialis spastic varus, or cavovarus, foot since 1965.^{5,6}

Some tarsal coalitions are associated with other congenital disorders, such as fibular hemimelia,⁷ clubfoot,⁸ Apert syndrome,⁹ and Nievergelt-Pearlman syndrome. These tend to be extensive in regard to the number of tarsal bones involved and the percentage of involvement of the subtalar joint. The natural history and prognosis for these types, although not well studied, seem good.

More commonly, tarsal coalitions occur as isolated anomalies. The overall incidence of tarsal coalitions was proposed by Harris and Beath in 1948 as 2%, on the basis of routine physical examinations of Canadian Army enlistees.^{3,4} On the basis of a cadaveric study by Phitzner in 1896, the rate of calcaneal navicular synostosis was found to be 2.9% and, if talocalcaneal coalitions are included, the incidence of tarsal coalition might reach 6%.^{1,10} A radiographic study by Lysack and Fenton¹¹ documented a general prevalence of calcaneal navicular coalition of 5.6%, which was significantly greater than previously reported. And a recent cadaver study by Ruhli and colleagues¹² found the incidence of tarsal coalitions to be 13%.

The most common sites of coalition are in the middle facet of the talocalcaneal joint and between the anterior process of the calcaneus and the navicular.

- Talocalcaneal and calcaneonavicular coalitions occur with approximately equal frequency.¹³
 - Together, they account for approximately 90% of all coalitions.¹³
 - They coexist in a small percentage of feet.¹⁴
 - They are bilateral in 50% to 60% of cases.^{15,16}
- Talonavicular, calcaneocuboid, naviculocuneiform, and cubonavicular coalitions are uncommon.¹³
- The true incidence of tarsal coalition, as well as the relative frequency of affected joints and the frequency of bilaterality, is not known, because most affected individuals are asymptomatic and go uncounted.

ETIOLOGY

Wray and Herndon¹⁷ suggested an autosomal dominant pattern of inheritance with variable penetrance based on a single-family study. Leonard¹⁸ confirmed an autosomal dominant pattern with almost full penetrance in a study of 31 index patients and 98 first-degree relatives. Tarsal coalitions have been found in monozygotic twins.¹⁹

CLINICAL FEATURES

- Progressive flattening of the longitudinal arch with valgus deformity of the hind-foot generally predates symptoms but is rarely the presenting complaint.
- The insidious onset of vague and aching pain in a child between the ages of 8 and 16 years is characteristic.

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