Coalitions of the Tarsal Bones

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KEYWORDS

• Tarsal coalition • Talocalcaneal • Calcaneonavicular • Management • Resection • Fusion

KEY POINTS

- Tarsal coalitions develop due to failure of mesenchymal separation of tarsal bones.
- Most commonly coalitions are calcaneonavicular or talocalcaneal.
- Subtalar stiffness results in pathologic kinematics with increased risk of ankle sprains, most often planovalgus foot deformity and progressive joint degeneration.
- Resection of the coalition yields good results; tissue interposition may reduce the risk of reossification, and concomitant deformity should be addressed.
- The primary trigger to joint fusion is joint degeneration.

INTRODUCTION

Tarsal coalitions can present as osseous (synostosis), fibrous (syndesmosis), or cartilaginous (synchondrosis) connections between the tarsal bones, most commonly primary due to failure of mesenchymal separation.[1,2] Most coalitions found are calcaneonavicular and talocalcaneal; however, pretty much any 2 adjacent bones of the foot may be fused (**Fig. 1**). Any combination of coalitions can be found and even total coalitions[3] were described.

HISTORICAL PERSPECTIVE AND INCIDENCE

The entire historical perspective is summarized in **Table 1**. Clinical series estimate the incidence of tarsal coalitions about 1% to 6%; however, because they are often asymptomatic or undiagnosed the real incidence certainly might be higher.[2,4–7] Better accuracy may be obtained using cadaver series reporting rates of 12.7% to 13% in

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Fig. 1. Rare types of tarsal coalitions. (*A*) Osseous talonavicular coalition. (*B*) Bilateral osseous calcaneonavicular coalitions. (*C*) Fibrous naviculocuboidal coalition.

series of more than 100 dissected specimen.[8,9] MRI series on 574 consecutive patients revealed a similar rate of 11.5%.[5]

The most common found type is the calcaneonavicular coalition (53%–73%).[9,10] Together with the talocalcaneal coalition it accounts for greater than 90% of all tarsal coalitions[9]; 2.6% are either talonavicular or calcaneocuboid and the remaining distribute to various other connections of adjacent joints.[2,10]

Occurrence is bilateral in 50% to 68% overall,[2,4,10–12] calcaneonavicular in 40% to 60%, and talocalcaneal in 40% to 68%.[10,13] Coalitions distribute equally between the sexes or a male preponderance of up to 4:1 is found; however geographic variations may exist[2,13,14] (see **Table 1**).

CAUSE

Most coalitions are congenital. Leboucq in 1890 was the first to propose a failure of segmentation of primitive mesenchyme.[24] This is generally accepted since Harris found mesenchymal coalitions in fetal cadavers. However, today an autosomal dominant inherited pattern with a high penetrance is assumed.[11,13,25] Of patients with

Table 1
Historical perspective

Buffon,[15] 1769	First description of tarsal coalition
Cruveilhier,[16] 1829	First anatomic description of calcaneonavicular coalition
Zuckerkandl,[17] 1877	First description of talocalcaneal coalition
Anderson,[18] 1880	First description of talonavicular coalition
Kirmisson,[19] 1898	First radiological description
Holland,[20] 1918	First description of calcaneocuboid coalition
Badgley,[21] 1927	First description of surgical resection of a calcaneonavicular bar, demonstrating regaining subtalar flexibility[22]
Waugh,[22] 1957	First description of cubonavicular coalition
Lusby,[23] 1959	First description of naviculocuneiform coalition