# Imaging of Tarsal Coalition

Julia Crim, MD

**KEYWORDS**

• C-sign • Talar beak • Subtalar coalition
• Calcaneonavicular coalition

A coalition is a congenital bony, cartilaginous, or fibrous connection (called a bar) between two or more bones. Coalitions are clinically significant because they prevent normal joint motion. They are most frequently seen in the hindfoot (tarsal coalition), but also occur in the wrist and occasionally the elbow.

The existence of tarsal coalition has been recognized since the eighteenth century,[1] but it was not until 1948 that Harris and Beath[2] made the first widely known report identifying tarsal coalition as a cause of a painful, rigid flatfoot, and the condition began to be viewed as a clinically significant entity.

Tarsal coalitions are attributable to congenital failure of segmentation of the tarsal bones.[3] They most commonly occur between the talus and calcaneus (subtalar coalition) and between the anterior process of the calcaneus and the navicular (calcaneonavicular coalition). They may also be seen between talus and navicular, between calcaneus and cuboid, or between multiple tarsal bones. Coalitions are usually an isolated anomaly, and are at least partly familial; review of first-degree relatives of patients who have symptomatic flatfoot found that 39% had asymptomatic coalitions.[4] A small fraction of coalitions are associated with carpal coalition, symphalangism, and fibular hemimelia.[1,3]

The prevalence of tarsal coalition has long been debated in the literature.[5–8] Most studies report a prevalence of 1% to 3% in the adult population. A recent retrospective record review found tarsal coalition had been diagnosed in 0.6% of more than 27,000 ankle MR imaging studies.[9] When the authors performed a second review of 607 MR imaging studies randomly selected from the initial database they diagnosed coalitions, primarily calcaneonavicular, in 12% of patients. Given that this prevalence is at enormous variance with previous reports, and weak diagnostic criteria were used for diagnosis, these results should be viewed with caution.

There are variable clinical presentations of tarsal coalition. Although it is a congenital condition, it is asymptomatic in early life. The classic presentation is in the second decade when the patient complains of chronic pain and is seen to have a rigid, flat foot on clinical examination. Patients who are not highly active often present later in life,[10] and some affected individuals may never become symptomatic. In college-age patients, the most common presentation is repeated ankle sprain. Because of Harris's[2] landmark study, coalitions are sometimes believed to be universally associated with flatfoot deformity. Only about half of coalitions are associated with flatfoot, however,[6] and they may even be associated with a cavus foot deformity.[10–13]

Tarsal coalition may be difficult to identify on clinical and imaging evaluation. Given the high prevalence of coalition, radiologists must be alert to the often subtle imaging findings.

## PERTINENT NORMAL IMAGING FINDINGS IN HINDFOOT

The middle subtalar joint can be evaluated on the anterior-posterior (AP) and axial (Harris) views. The sustentaculum tali is shaped like a flat brick. The middle subtalar facet, above it, has a straight contour. If the lateral radiograph (**Fig. 1**A) is well centered (ie, if the posterior subtalar joint is in profile), then the middle subtalar joint should always be in profile. On the Harris view (see **Fig. 1**B), the sustentaculum tali juts out from the medial margin of the calcaneus, and the

Department of Radiology, University of Utah School of Medicine, 30 North 1900 East #1A71, Salt Lake City, UT 84132-2140, USA
*E-mail address:* julia.crim@hsc.utah.edu

Radiol Clin N Am 46 (2008) 1017–1026
doi:10.1016/j.rcl.2008.09.005
0033-8389/08/$ – see front matter 

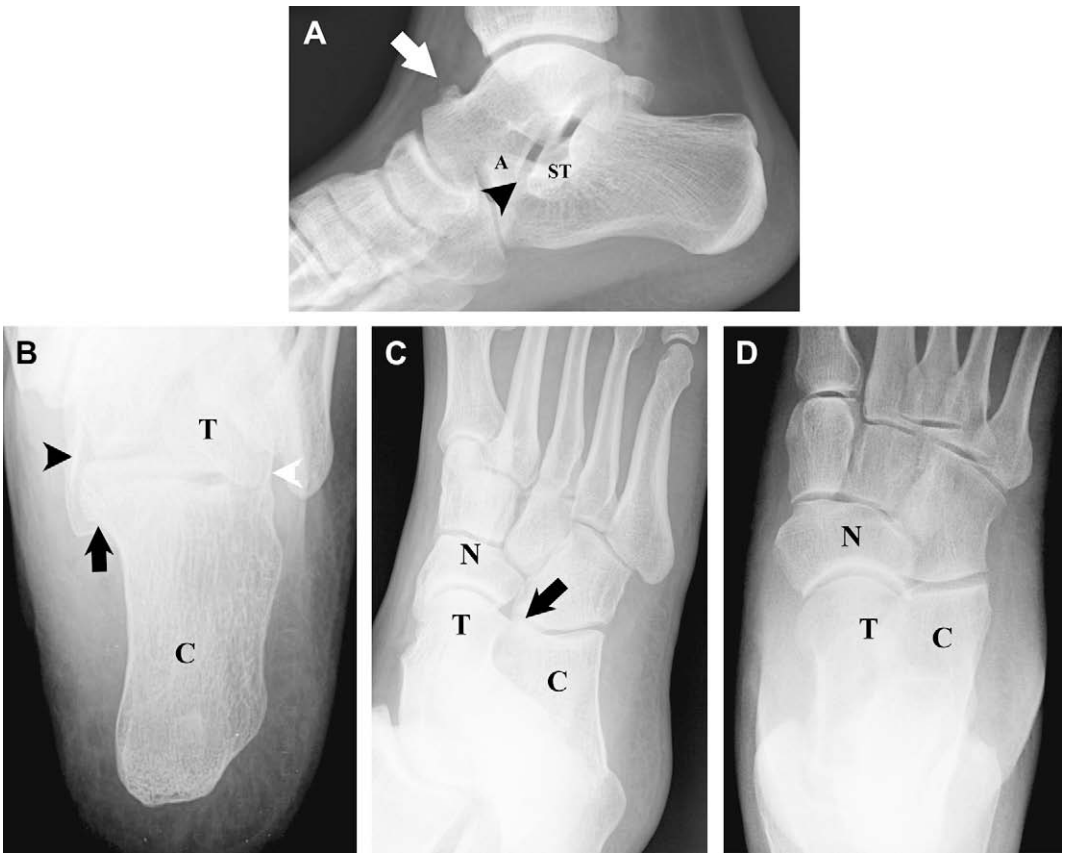


Fig. 1. Normal hindfoot radiographs. (*A*). Lateral radiograph shows normal appearance of sustentaculum tali (ST), which forms a rectangle below the middle subtalar facet (*arrowhead*). Anterior process of calcaneus (A) forms a triangle. This patient has a large talar ridge (*arrow*), which is a normal variant at the anterior attachment of the ankle joint capsule and not to be mistaken for a talar beak. (*B*) Harris view shows normal contour of undersurface of sustentaculum tali (*arrow*) and middle subtalar facet (*black arrowhead*) and posterior subtalar facet (*white arrowhead*). C, calcaneus; T, talus. (*C*) Oblique radiograph shows pointed tip of anterior process of calcaneus (*arrow*) separated from navicular (N). Calcaneus and navicular may approach more closely without a coalition being present. (*D*) Anteroposterior radiograph shows lateral margin of talus (T) and navicular (N) are aligned. Anterior process of calcaneus (C) is not visible on this view.

middle subtalar joint is visible above it and medial to the lateral subtalar joint.

The relationships of the calcaneus and navicular are evaluated on the lateral, oblique, and AP views. On the lateral view (see **Fig. 1**A), the anterior process of the calcaneus is pointed and short. On the oblique view (see **Fig. 1**C), the anterior process is triangular, and a space is present between the anterior process and the navicular. A caveat must be mentioned: in the context of a flatfoot deformity, the anterior process may come close to the navicular, but it maintains its normal triangular contour as opposed to the squared contour seen in calcaneonavicular coalition. On the AP view (see **Fig. 1**D), the lateral margins of the talar head and the navicular are aligned.

On CT and MR, the anatomic relationships of the subtalar joint are more easily seen. Coronal and sagittal cross-sectional imaging show the normal brick-shaped sustentaculum tali (**Fig. 2**A–C) and the flat contour of the middle subtalar joint. Note that the most posterior portion of the sustentaculum tali is nonarticular.

The anterior process of the calcaneus is best seen on sagittal CT and MR images (**Fig. 3**A). It is surprising how closely the anterior process of the calcaneus and the lateral margin of the navicular approach each other on axial images in some individuals (see **Fig. 3**B,C). As long as normal contours are maintained and there are no reactive changes in the adjacent bones, one may be confident that there is no coalition.

## RADIOGRAPHIC FINDINGS OF SUBTALAR COALITION

Subtalar coalitions almost always involve the middle subtalar facet, although an isolated coalition of the posterior facet may rarely occur. Osseous and nonosseous subtalar coalitions cause abnormal bone overgrowth of both the sustentaculum tali and the adjacent talus. These changes are readily seen on the Harris view (**Fig. 4**A), and it is on this view that radiographic diagnosis of coalition is traditionally made.[2,14,15] Osseous coalitions are characterized by a continuous bony bar. Nonosseous subtalar coalitions demonstrate bony overgrowth, with the talus and sustentaculum tali separated by a narrow, irregular cleft. Sclerosis and subchondral cysts are often visible.

The Harris view is not part of routine ankle or foot radiographic series, and therefore various radiographic signs of subtalar coalition visible on the routine lateral view have been described. None of these are infallible in isolation, but all raise the suspicion of coalition.

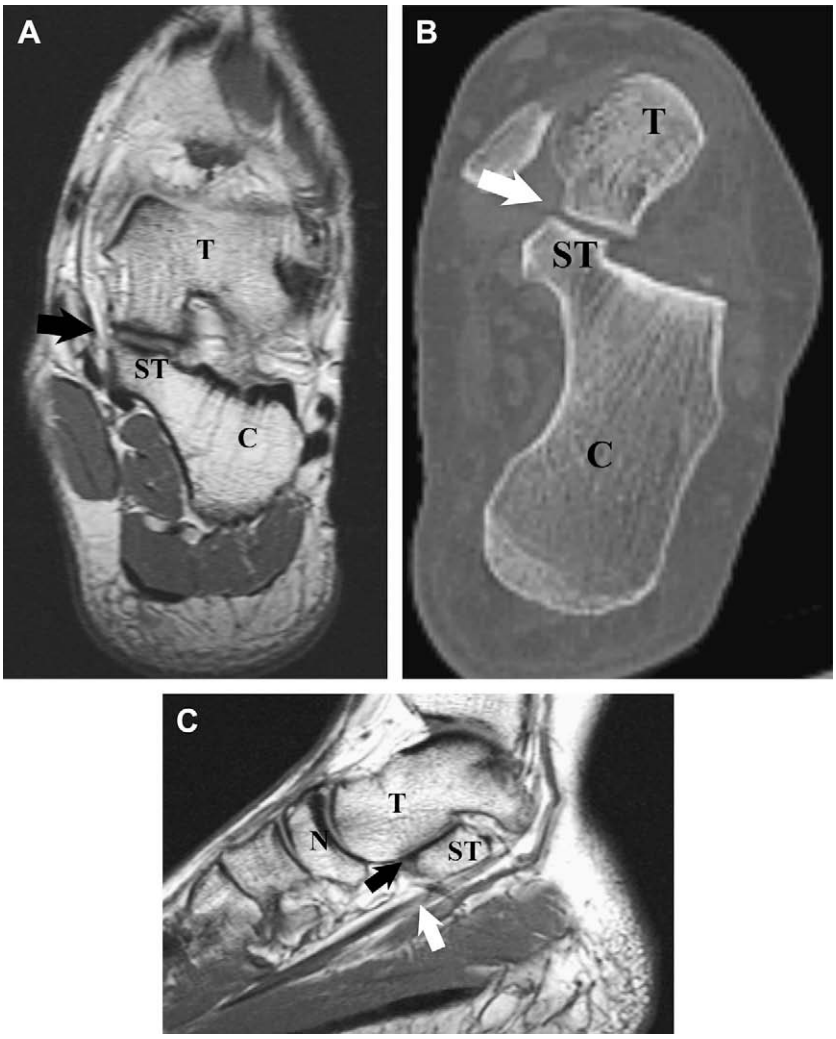


**Fig. 2.** Normal subtalar joint, MR imaging and CT. (*A*) Coronal proton density image through normal middle subtalar facet (*arrow*) shows sustentaculum tali (ST) is medial to body of calcaneus (C). Talus (T) body forms a short pillar, which articulates with sustentaculum tali. (*B*) Oblique axial CT through middle subtalar joint resembles a Harris view. Middle subtalar joint is marked by arrow. (*C*) Sagittal T1-weighted MR image shows sustentaculum tali and straight orientation of joint (*black arrow*). Flexor hallucis longus tendon (*white arrow*) passing beneath sustentaculum is a useful landmark.

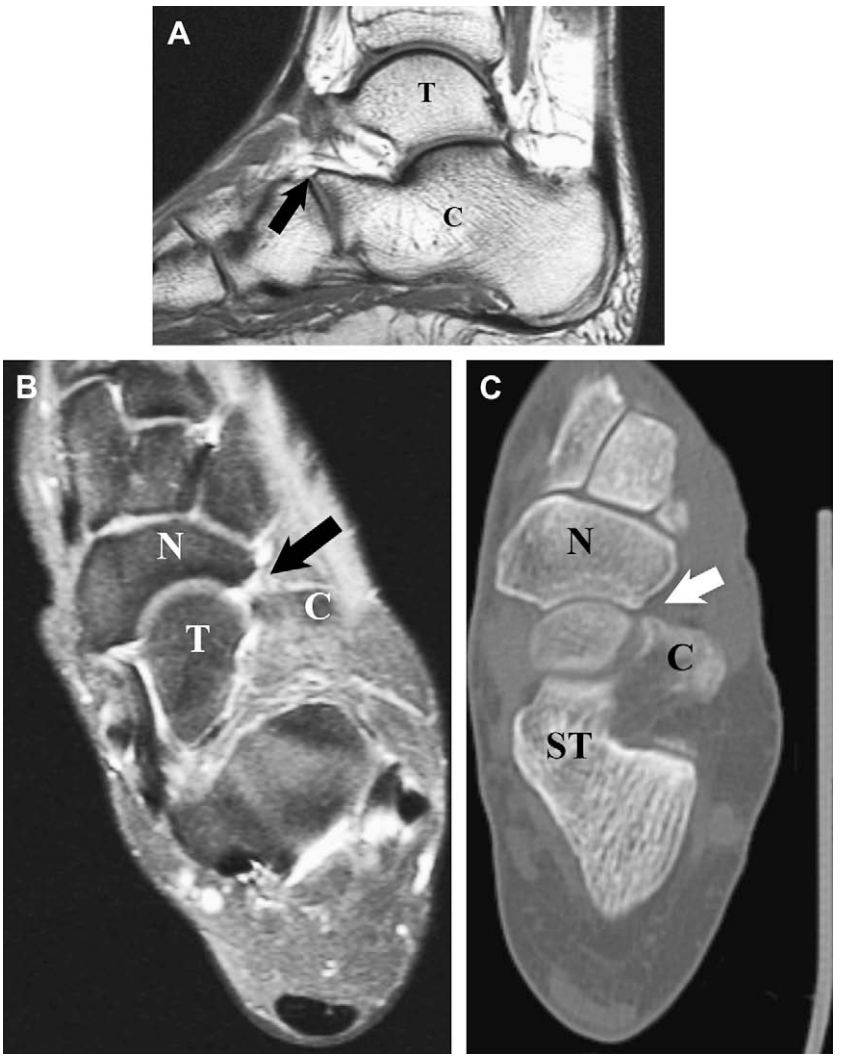


Fig. 3. Normal calcaneonavicular relationships, MR imaging and CT. (*A*) Sagittal T1 MR shows normal, triangular tip of anterior process of calcaneus (*arrow*). This plane is usually best for evaluation of suspected calcaneonavicular coalition. (*B*) Axial proton density with fat saturation MR shows small space (*arrow*) between anterior process and navicular. In this case, the gap is easy to see because of fluid from a talonavicular joint effusion; however, if no fluid is present it may be difficult to tell soft tissue fat from bone marrow fat. (*C*) Oblique axial CT shows how narrow the separation may be (*arrow*) between a normal anterior process of the calcaneus and the navicular. There are no alterations in bony contour or subchondral cysts, which would be seen in cases of non-bony coalition.

### C-Sign

Lateur and colleagues[16] first reported the C-sign as an indication of tarsal coalition. The C-sign is formed by continuity of the inferomedial border of the talus with the sustentaculum tali, seen on lateral radiograph (see **Fig. 4**B,C) The C-sign has been reported as having a sensitivity ranging from 40%[17] to 94%[16] and a specificity ranging from 87%[6] to 50%.[17] The C-sign results from close apposition of medial talus and sustentaculum tali, which occurs in most cases of flatfoot deformity. As Brown and coworkers[17] pointed out, C-sign is more indicative of flatfoot deformity than coalition.

### Dysmorphic Sustentaculum Tali

The normal sustentaculum tali appears rectangular on the lateral radiograph, resembling a building brick. When a subtalar coalition is present, the inferior contour becomes enlarged and rounded (see **Fig. 4**B,C). This sign was originally reported to

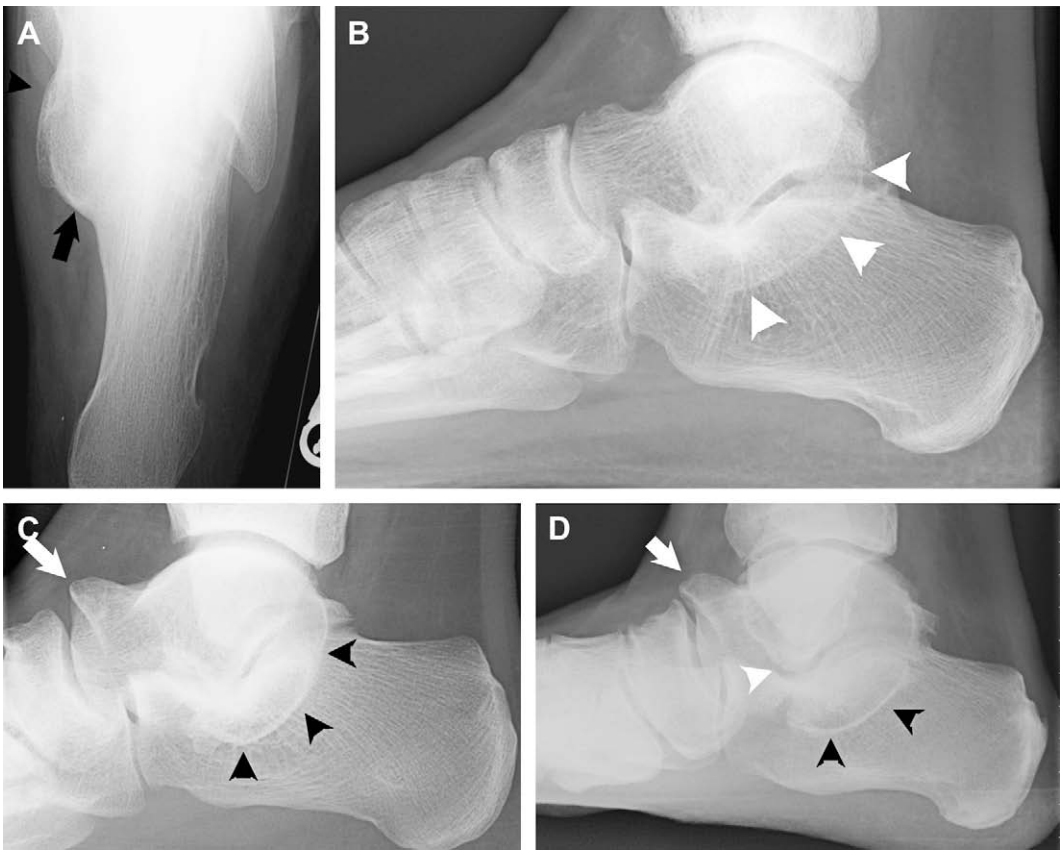


Fig. 4. Radiographs of subtalar coalition. (*A*) Harris view shows bulbous sustentaculum tali, with rounded inferior contour (*arrow*) and overgrowth in expected region of middle subtalar facet (*arrowhead*). (*B*) Lateral radiograph shows dysmorphic sustentaculum tali, with bony overgrowth and rounding of its inferior contour. Continuity of sustentaculum tali contour with that of medial talus is the C-sign (*arrowheads*). (*C*) Lateral radiograph shows talar beak (*arrow*) arising at talonavicular joint and curving away from joint and dysmorphic sustentaculum tali and C-sign (*arrowheads*). (*D*) Lateral radiograph shows rounded lateral process of talus (*white arrowhead*) and dysmorphic sustentaculum tali (*black arrowheads*). Bony prominence (*arrow*) at dorsal margin of talar head has features of both osteophyte and beak, perhaps because this is an older patient who has developed osteoarthritis.

have a sensitivity of 82% and a specificity of 70%,[6] but a more recent report found a sensitivity of 70%.[9]

### Blunted Lateral Process of Talus

Decreased motion of the middle subtalar facet increases stress at the posterior subtalar facet. As a result of the altered stress, the lateral process of the talus, normally triangular with an inferior apex, develops a rounded contour (see **Fig. 4**D).[15] This finding has had limited acceptance in the literature and is not commonly seen but can be a useful corroborating sign.

### Talar Beak

A talar beak may occur with either a subtalar or a calcaneonavicular coalition. Tarsal coalition decreases normal motion in portions of the hindfoot, with compensatory increase in the range of motion of the talonavicular joint. The articular surface of the talar head flares superiorly to accommodate the increased range of motion. This superior flare is called a talar beak (see **Fig. 4**C). There are three different types of prominences on the dorsal margin of the distal talus: talar beak, talar osteophytes, and talar ridge. Only the talar beak indicates coalition. The distinguishing radiographic features of these three entities were discussed by Resnick.[18] A talar beak, indicating coalition, is a widening of the joint surface, and flares upward away from the navicular. A talar osteophyte attributable to osteoarthritis originates slightly proximal to the joint and arcs forward over the joint. A talar ridge (see **Fig. 1**A), the normal anterior attachment of

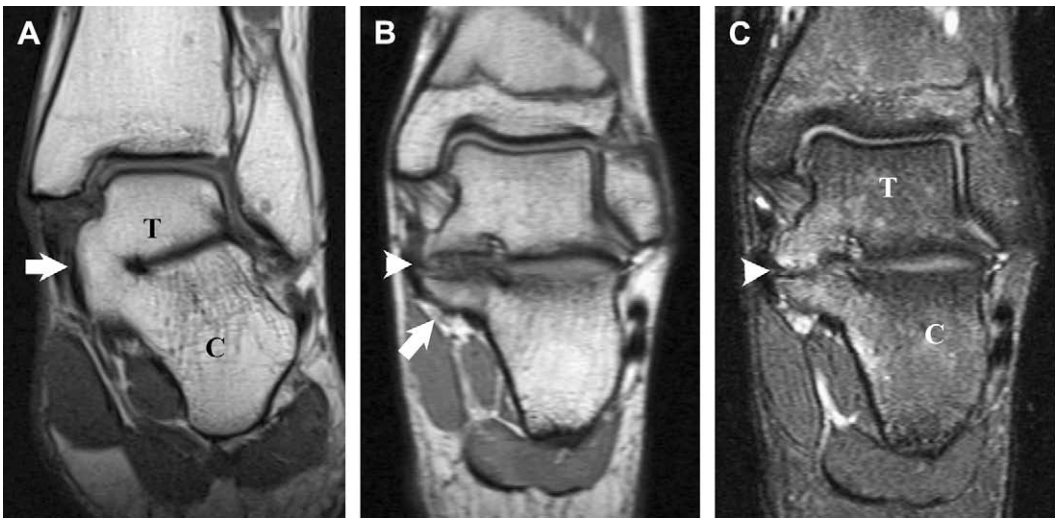


Fig. 5. MR image of subtalar coalition. (*A*) Coronal proton density image shows a bony coalition (*arrow*) with overgrowth of sustentaculum tali and adjacent talus. (*B*) Coronal proton density images shows a non-bony coalition, with a narrow cleft (*arrowhead*) between talus and sustentaculum tali, and a rounded inferior margin of the sustentaculum (*arrow*). (*C*) Coronal T2 with fat saturation image in the same patient as B shows that the cleft (*arrowhead*) is narrow and irregular. Subchondral cysts and bone marrow edema are useful clues for diagnosis.

the tibiotalar joint capsule, is centered more proximally on the talar neck. Occasionally it may be difficult to differentiate a talar beak and talar osteophytes (see **Fig. 4**D).

### *Absent Middle Facet Sign*

If the lateral radiograph is well centered on the hindfoot, then the middle facet articular surfaces and the joint space between them are visible in

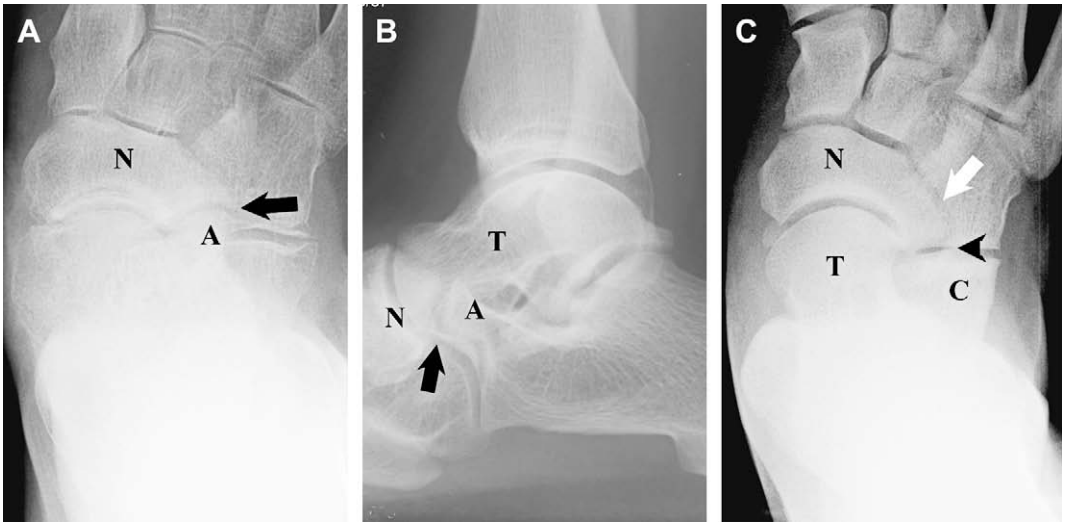


Fig. 6. Radiographs of calcaneonavicular coalition. (*A*) Oblique radiograph shows broadened anterior process (A) forming a connection (*arrow*) with the navicular (N). There is remodeling of both navicular and anterior process to form the closely congruent non-bony bar. (*B*) Lateral radiograph again shows broadened anterior process and non-bony coalition (*arrow*). (*C*) Anteroposterior process shows broadened navicular (reverse anteater sign, *arrow*). Coalition is hard to see (*arrowhead*) because anterior process of calcaneus is not in profile.

the normal foot (see **Fig. 1**A). The joint is not visible in cases of subtalar coalition (see **Fig. 4**A–D) due either to complete bony bar or to the obliquity of the narrow cleft between the bones in nonosseous coalition. This sign has a reported sensitivity and specificity ranging from 75% and 90%, respectively,[19] to 100% and 40%.[6] The absent middle facet sign is useful only in well-positioned radiographs. The posterior subtalar joint can be used as a positioning landmark on lateral radiographs; if the posterior subtalar joint is well seen in profile, then the middle subtalar joint should also be seen unless a coalition is present. If the posterior subtalar joint cannot be seen in profile because of malpositioning, the middle facet is often obscured also.

## CT AND MR IMAGING FINDINGS OF SUBTALAR COALITION

CT and MR imaging are the most reliable methods for diagnosing subtalar coalition.[6,9,20–25] Bony continuity across the middle subtalar facet is easily recognized, but a nonosseous subtalar coalition may be missed on MR if the irregular cleft between the dysmorphic bones is mistaken for a joint (**Fig. 5**A–C). Unlike a true middle subtalar facet, the interosseous space of a fibrous or cartilaginous coalition is narrow, obliquely oriented, and has an undulating contour. Subchondral cysts are often present. Bone marrow edema centered about the coalition is usually seen on fluid-sensitive MR imaging sequences.[26] The sustentaculum


**Fig. 7.** MR imaging and CT of calcaneonavicular coalitions. (*A*) Sagittal STIR MR shows anteater sign and enlarged lateral portion of navicular, separated by narrow fibrous bar (*arrow*). Sclerosis and cysts are seen adjacent to the bar. (*B*) Sagittal CT shows a similar coalition (*arrow*). Note irregularity of apposing surfaces and subchondral cysts. (*C*) Axial proton density with fat saturation image shows that bar (*arrow*) is difficult to appreciate because marrow and soft tissue fat have same signal intensity. (*D*) Coronal CT shows fibrous coalition. Elongated anterior process of calcaneus (A) projects superior to cuboid (Cu); it can be seen articulating with enlarged navicular (N). (*E*) Axial CT in same patient shows non-bony coalition (*arrow*) bordered by broad anterior process and reverse anteater sign.

tali is typically enlarged and has a rounded contour inferiorly. Associated tenosynovitis may be identified either in peroneal tendons or in flexor tendons, reflecting altered biomechanics.

## RADIOGRAPHIC FINDINGS OF CALCANEONAVICULAR COALITION

### *Anteater Sign*

This sign was originally described on oblique radiographs of the foot.[15,27] The normally triangular anterior process of calcaneus becomes elongated and its tip is squared like the snout of an anteater (**Fig. 6**A). The elongated anterior process abuts the lateral margin of the navicular. The sign is also visible on lateral radiographs (see **Fig. 6**B) where it has a sensitivity of 72% and a specificity of 90%[6] in one report, but a sensitivity of only 10% in a subsequent report.[9] The sign is more difficult to see on lateral radiographs because of the superimposition of overlying bones.

### *Elongated Navicular Sign (Reverse Anteater)*

This sign is visible on AP radiographs of the foot (see **Fig. 6**C). Normally, the lateral margins of the navicular and the head of the talus are aligned. When a calcaneonavicular coalition is present, the navicular extends further laterally, and the anteroposterior dimension of the lateral portion tends to be smaller than at the medial portion of the navicular. The original reported sensitivity of this sign was 50% and specificity was 100%,[6] although a subsequent report found a sensitivity of only 18%.[9]

## CT AND MR IMAGING FINDINGS OF CALCANEONAVICULAR COALITION

A calcaneonavicular coalition is often easier to see using conventional radiography than either MR


**Fig. 8.** Other coalitions. (*A*) Lateral radiograph shows complete absence of calcaneocuboid joint (*arrow*). (*B*) Lateral radiograph shows complete absence of talonavicular joint (*arrow*). (*C*) Coronal CT shows bilateral bony posterior subtalar facet coalitions (*arrows*). Note that only portions of the joints are fused. This type of coalition is not visible on radiographs.

imaging or CT, because of the oblique orientation of the small bar, which can be mistaken for normal bone on cross-sectional imaging. Sagittal images most reliably show the elongated anterior process of the calcaneus and its blunted tip (Fig. 7A,B). If images are oblique, or the midfoot is adducted, the bar may be difficult to see. Subchondral cysts or bone marrow edema in the anterior process of the calcaneus are useful hints that a coalition may be present.

For cases in which diagnosis is not definitive on sagittal images, axial and coronal planes are used. To accurately make the diagnosis on these images, it is important to remember that in the normal foot the distance between the anterior process of calcaneus and the navicular is often small. More important than the distance between the calcaneus and navicular are the abnormal shape of the anterior process and adjacent navicular, and the presence of reactive cysts and bone marrow edema. Unfortunately, fatty bone marrow may be difficult to distinguish from fat in soft tissues, making determination of bone outline difficult on MR (see Fig. 7C).

It may be difficult to distinguish between calcaneonavicular coalition (see Fig. 7D,E) and the normal cuboid-navicular joint (see Fig. 3D,E). A calcaneonavicular bar may be mistaken for cuboid-navicular joint because of the sigmoid shape of the calcaneocuboid joint. Axial and coronal images may cut obliquely through portions of each bone. This problem can be avoided by using a localizer to compare between planes and by comparing a single image to adjacent images.

## OTHER TYPES OF COALITION

Other types of coalition are rare. Coalitions are reported in the posterior subtalar facet and between the cuboid and navicular,[28] talus and navicular,[29–31] the navicular and cuneiforms,[32] the calcaneus and cuboid,[33] and between multiple bones.[4,5,34,35] These are generally easily seen on radiographs (Fig. 8A,B).

One rare type of coalition, the posterior subtalar coalition, is not visible on radiographs and is difficult to see even on advanced imaging. This coalition was originally described by Harris,[2] who detected it at time of surgical exploration. The posterior subtalar coalition usually involves the anteromedial margin of the posterior subtalar joint, and the posterior, usually nonarticular, portion of the sustentaculum tali (see Fig. 8C).

## COALITIONS OF MULTIPLE BONES

Extensive fusions of the hindfoot are often associated with fibular hemimelia or other congenital syndromes. When coalitions of multiple tarsal bones are present, the severe limitation of motion can result in a ball-in-socket configuration of the talus.[36–39] This configuration refers to a talar trochlea, which is convex superiorly from medial to lateral, as opposed to the normal concave configuration. Ball-in-socket talus is not a feature of a simple subtalar or calcaneonavicular coalition.

## REFERENCES


1. Mosier KM, Asher M. Tarsal coalitions and peroneal spastic flat foot [a review]. J Bone Joint Surg Am 1984;66(7):976–84.
2. Harris RI. Rigid valgus foot due to talocalcaneal bridge. J Bone Joint Surg Am 1955;37(1):169–83.
3. Harris BJ. Anomalous structures in the developing human foot [abstract]. Anat Rec 1955;121:1.
4. Leonard MA. The inheritance of tarsal coalition and its relationship to spastic flat foot. J Bone Joint Surg Br 1974;56(3):520–6.
5. Kulik SA Jr, Clanton TO. Tarsal coalition. Foot Ankle Int 1996;17(5):286–96.
6. Crim JR, Kjeldsberg KM. Radiographic diagnosis of tarsal coalition. AJR Am J Roentgenol 2004;182(2):323–8.
7. Percy EC, Mann DL. Tarsal coalition: a review of the literature and presentation of 13 cases. Foot Ankle 1988;9(1):40–4.
8. Stormont DM, Peterson HA. The relative incidence of tarsal coalition. Clin Orthop Relat Res 1983;(181):28–36.
9. Nalaboff KM, Schweitzer ME. MRI of tarsal coalition: frequency, distribution, and innovative signs. Bull NYU Hosp Jt Dis 2008;66(1):14–21.
10. Varner KE, Michelson JD. Tarsal coalition in adults. Foot Ankle Int 2000;21(8):669–72.
11. Barrett SE, Johnson JE. Progressive bilateral cavovarus deformity: an unusual presentation of calcaneonavicular tarsal coalition. Am J Orthop 2004;33(5):239–42.
12. Knapp HP, et al. Tarsal coalition in an adult with cavovarus feet. J Am Podiatr Med Assoc 1998;88(6):295–300.
13. Stuecker RD, Bennett JT. Tarsal coalition presenting as a pes cavo-varus deformity: report of three cases and review of the literature. Foot Ankle 1993;14(9):540–4.
14. Vaughan WH, Segal G. Tarsal coalition, with special reference to roentgenographic interpretation. Radiology 1953;60(6):855–63.
15. Conway JJ, Cowell HR. Tarsal coalition: clinical significance and roentgenographic demonstration. Radiology 1969;92(4):799–811.
16. Lateur LM, et al. Subtalar coalition: diagnosis with the C sign on lateral radiographs of the ankle. Radiology 1994;193(3):847–51.

17. Brown RR, Rosenberg ZS, Thornhill BA. The C sign: more specific for flatfoot deformity than subtalar coalition. Skeletal Radiol 2001;30(2):84–7.
18. Resnick D. Talar ridges, osteophytes, and beaks: a radiologic commentary. Radiology 1984;151(2):329–32.
19. Liu PT, et al. Absent middle facet: a sign on unenhanced radiography of subtalar joint coalition. AJR Am J Roentgenol 2003;181(6):1565–72.
20. Deutsch AL, Resnick D, Campbell G. Computed tomography and bone scintigraphy in the evaluation of tarsal coalition. Radiology 1982;144(1):137–40.
21. Herzenberg JE, et al. Computerized tomography of talocalcaneal tarsal coalition: a clinical and anatomic study. Foot Ankle 1986;6(6):273–88.
22. Pineda C, Resnick D, Greenway G. Diagnosis of tarsal coalition with computed tomography. Clin Orthop Relat Res 1986;(208):282–8.
23. Stoskopf CA, et al. Evaluation of tarsal coalition by computed tomography. J Pediatr Orthop 1984;4(3):365–9.
24. Newman JS, Newberg AH. Congenital tarsal coalition: multimodality evaluation with emphasis on CT and MR imaging. Radiographics 2000;20(2):321–32 [quiz 526–7, 532].
25. Lemley F, et al. Current concepts review: tarsal coalition. Foot Ankle Int 2006;27(12):1163–9.
26. Sijbrandij ES, et al. Bone marrow ill-defined hyperintensities with tarsal coalition: MR imaging findings. Eur J Radiol 2002;43(1):61–5.
27. Chambers CH. Congenital anomalies of the tarsal navicular with particular reference to calcaneo-navicular coalition. Br J Radiol 1950;23(274):580–6.
28. Johnson TR, Mizel MS, Temple T. Cuboid-navicular tarsal coalition—presentation and treatment: a case report and review of the literature. Foot Ankle Int 2005;26(3):264–6.
29. David DR, Clark NE, Bier JA. Congenital talonavicular coalition. Review of the literature, case report, and orthotic management. J Am Podiatr Med Assoc 1998;88(5):223–7.
30. Doyle SM, Kumar SJ. Symptomatic talonavicular coalition. J Pediatr Orthop 1999;19(4):508–10.
31. Frost RA, Fagan JP. Bilateral talonavicular and calcaneocuboid joint coalition. J Am Podiatr Med Assoc 1995;85(6):339–41.
32. Gregersen HN. Naviculocuneiform coalition. J Bone Joint Surg Am 1977;59(1):128–30.
33. Pensieri SL, et al. Bilateral congenital calcaneocuboid synostosis and subtalar joint coalition. J Am Podiatr Med Assoc 1985;75(8):406–10.
34. Craig CL, Goldberg MJ. Calcaneocuboid coalition in Crouzon's syndrome (craniofacial dysostosis): report of a case and review of the literature. J Bone Joint Surg Am 1977;59(6):826–7.
35. Pachuda NM, Lasday SD, Jay RM. Tarsal coalition: etiology, diagnosis, and treatment. J Foot Surg 1990;29(5):474–88.
36. Jensen JK. Ball and socket ankle joints. Clin Orthop Relat Res 1972;85:28–31.
37. Pistoia F, Ozonoff MB, Wintz P. Ball-and-socket ankle joint. Skeletal Radiol 1987;16(6):447–51.
38. Ruiz Santiago F, et al. Ball-and-socket ankle joint with hypoplastic sustentaculum tali. Eur Radiol 2002;12(Suppl 3):S48–50.
39. Vichard P, Pinon P, Peltre G. [Ball and socket ankle associated with congenital synostosis of the tarsus. Report of a case (author's transl)]. Rev Chir Orthop Reparatrice Appar Mot 1980;66(6):387–90 [in French].