The Journal of Foot & Ankle Surgery 54 (2015) 734–738

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Isolated Fifth Metatarsocuboid Coalition: A Case Report

Hayato Kobayashi, MD, PhD [1], Yasunori Kageyama, MD, PhD [2], Yoji Shido, MD, PhD [3]

[1] Department of Orthopaedic Surgery, Fujieda Heisei Memorial Hospital, Shizuoka, Japan
[2] Department of Orthopaedic Surgery, Hamamatsu Minami Hospital, Shizuoka, Japan
[3] Department of Orthopaedic Surgery, Hamamatsu University School of Medicine, Shizuoka, Japan

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
arthrodesis
opening wedge distal tibial osteotomy
osteoarthritis
tarsometatarsal coalition
varus ankle

ABSTRACT

Isolated tarsometatarsal coalitions are extremely rare, and the previous 5 documented cases involved the first and third metatarsocuneiform joints. We report the case of a 69-year-old female with symptomatic fifth metatarsocuboid coalition associated with ipsilateral varus-type ankle osteoarthritis and instability. The patient was successfully treated by arthrodesis of the fifth metatarsocuboid joint, resection of the hypertrophied tuberosity of the fifth metatarsal, advancement of the peroneus brevis tendon, opening wedge distal tibial osteotomy, and calcaneal displacement osteotomy. After 1 year, 6 months, she was able to walk well, although she complained of minor discomfort under the fifth metatarsal base, which resolved with the use of protective padding. Radiographs at this stage confirmed consolidation of both the arthrodesis and the osteotomy sites. Although isolated fifth metatarsocuboid coalition is less likely to be encountered than other tarsal coalitions, it can sometimes be painful enough to necessitate surgery.

Isolated tarsometatarsal coalitions are quite rare, and only a small number of case reports have involved the first (1–3) and third (4,5) metatarsocuneiform joints. We report the case of a 69-year-old female with symptomatic fifth metatarsocuboid coalition, associated with ipsilateral varus-type ankle osteoarthritis and instability. Our report represents the first of this condition in the orthopedic data.

Case Report

A 69-year-old female presented with a more than 50-year history of insidious pain and swelling in her right fifth metatarsocuboid joint. The patient also complained of severe right ankle pain and instability, after experiencing a torsional skiing injury in her 30s. Although she had been treated conservatively for degenerative arthritis by several local physicians, her symptoms had not improved. The physical examination revealed a complete lack of motion in the lateral column of the tarsometatarsal (Lisfranc) joint. Anterior drawer and varus-valgus stress tests of the ankle were both positive. The patient had mild flatfoot and a painful protuberance over the dorsolateral to plantar aspects of the fifth metatarsal base. However, the characteristic peroneal spastic flatfoot often seen in talocalcaneal or calcaneonavicular coalitions was not observed. She had no history of collagen disease or fracture treatment. The blood test results, including the erythrocyte sedimentation rate, C-reactive protein, rheumatoid factor, and rheumatoid arthritis particle agglutination test, were within normal limits.

Radiography of her right foot taken from a medial oblique view showed a narrowed, almost obliterated, fifth metatarsocuboid joint (Fig. 1). The contralateral left foot did not exhibit any abnormalities. The radiograph showed the characteristics of end-stage osteoarthritis. On the weightbearing radiographs of the ankle, we observed the symptoms of a stage 2 varus-type ankle osteoarthritis in accordance with the Takakura-Tanaka classification (6,7) (Fig. 2). Axial, sagittal, and coronal computed tomography scans confirmed a general osseous continuity between the cuboid and fifth metatarsal (Fig. 3). The cuboid also presented a large subchondral bone cyst. These clinical findings led us to the diagnosis of isolated fifth metatarsocuboid coalition and ipsilateral varus-type ankle osteoarthritis.

The prescribed conservative treatment included oral nonsteroidal anti-inflammatory drugs, a custom-made functional orthosis, cuboid-metatarsal padding, intra-articular steroid injection, and immobilization with a removable walking boot. Nearly 9 months after the initial visit, this treatment had proved unsuccessful; thus, surgical intervention was advised. The surgical procedures included arthrodesis at the fifth metatarsocuboid joint, partial resection of the hypertrophied tuberosity of the fifth metatarsal, and advancement of the peroneus brevis tendon. Multiple percutaneous retrograde drilling toward the fifth metatarsocuboid joint and subchondral bone cyst was performed using 2-mm Kirchner wires by way of 2 lateral screw

Financial Disclosure: None reported.
Conflict of Interest: None reported.

Address correspondence to: Hayato Kobayashi, MD, PhD, Department of Orthopaedic Surgery, Fujieda Heisei Memorial Hospital, 123-1 Mizukami, Fujieda, Shizuoka 426-8662 Japan.
E-mail address: heisei.kobayasi@ny.tokai.or.jp (H. Kobayashi).

1067-2516/$ - see front matter © 2015 by the American College of Foot and Ankle Surgeons. All rights reserved.
http://dx.doi.org/10.1053/j.jfas.2014.06.030

Fig. 1. Preoperative medial oblique radiograph showing a narrowed, almost obliterated fifth metatarsocuboid joint.

holes before screw insertion. The peroneus brevis tendon was reattached to the peroneus tertius insertion and residual periosteum. Opening wedge distal tibial osteotomy concomitant with medial displacement calcaneal osteotomy shifted the medial overload laterally in the ankle. This procedure enhanced the stability of the talus by shutting the relatively widened ankle mortise and correcting the flatfoot deformity. For the distal tibial osteotomy, 2 interconnected porous calcium hydroxyapatite ceramic wedges were inserted and secured with a 5-mm locking plate using a minimally invasive plate osteosynthesis technique (8).

Immobilization of the patient's leg was achieved using a nonweightbearing short cast for 8 weeks after surgery. The patient received physiotherapy and low-intensity pulsed ultrasound 12 weeks after the intervention until full weightbearing had returned to normal to prevent undesirable iatrogenic fracture through the screw holes that would render later treatment intractable. Recovery was unremarkable, and the patient was able to resume normal activities approximately 5 months after surgery. After 8 months, the patient had no pain or instability in the operated ankle, and the plate was removed as scheduled (Fig. 4). After 1 year, 6 months, she was walking well, although she had minor discomfort under the fifth metatarsal base, which resolved with the use of protective padding. However, the patient did not express any discomfort around the metatarsal head or calcaneocuboid joint. Radiographs at this stage confirmed the consolidation of both the arthrodesis and the osteotomy sites (Fig. 5). The pre-existing subchondral bone cyst in the cuboid had also almost vanished and consolidated. All headless compression screws were undamaged and showed no evidence of loosening.

Discussion

Approximately 1% of the population has a tarsal coalition. In Europe and the United States, the most common types are talocalcaneal and calcaneonavicular coalition (9,10). Stormont and Peterson (9) in a published data review that included all tarsal

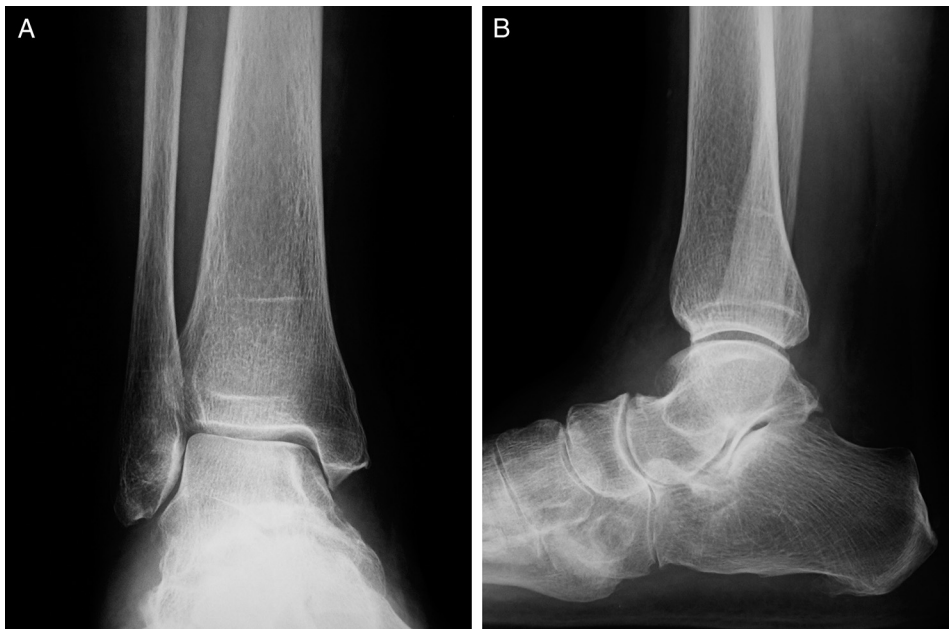

Fig. 2. Preoperative (*A*) anteroposterior and (*B*) lateral weightbearing radiographs of the ankle showing a stage 2 varus-type ankle osteoarthritis according to the Takakura-Tanaka classification (6,7).

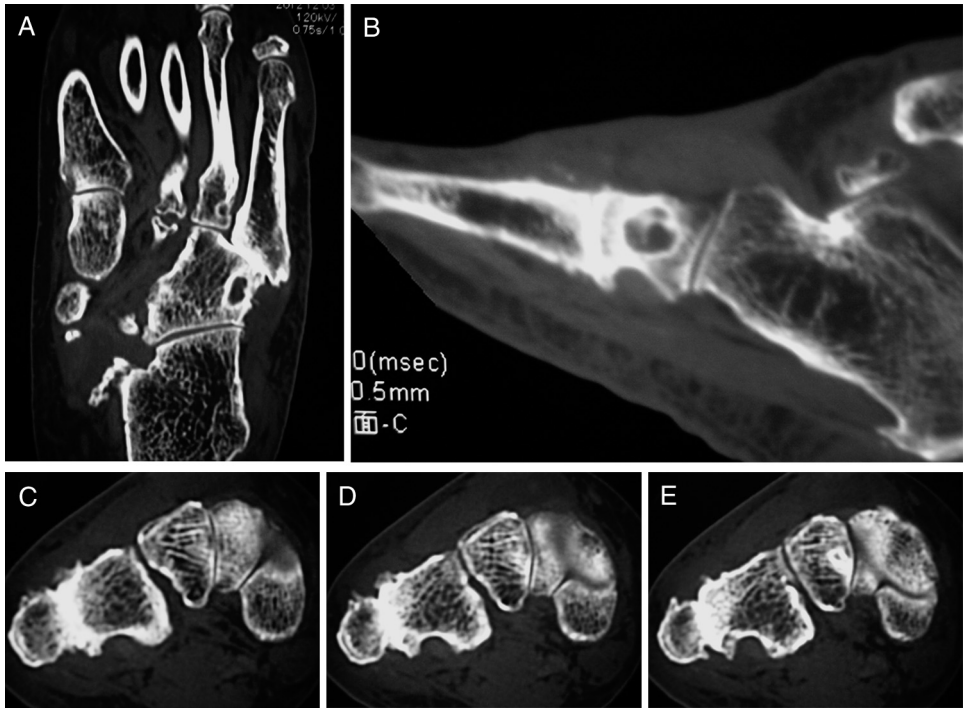

Fig. 3. Preoperative (*A*) axial, (*B*) sagittal, and (*C* to *E*) coronal computed tomography scans showing global osseous continuity between the cuboid and the fifth metatarsal. Note the large subchondral bone cyst in the cuboid.

coalitions reported an incidence of 53% for calcaneonavicular coalitions and 37% for talocalcaneal coalitions. In contrast, isolated naviculocuneiform coalition has been relatively common in Asian countries (11–13). Kumai et al (13) stated that among all coalitions (202 feet in 127 patients), the actual incidence of talocalcaneal (119 feet in 74 patients), first naviculocuneiform (62 feet in 40 patients), and calcaneonavicular (21 feet in 13 patients) coalitions was 58.9%, 30.7%, and 10.4%, respectively. To our knowledge, isolated tarsometatarsal coalition had been reported only in the first (1–3) and third (4,5) metatarsocuneiform joints. However, we were unable to find any previous reports referring to tarsometatarsal coalitions in the fourth and/or fifth metatarsocuboid joints.

According to the histopathologic study by Kumai et al (13), nerve elements were present only in the periosteum and the articular

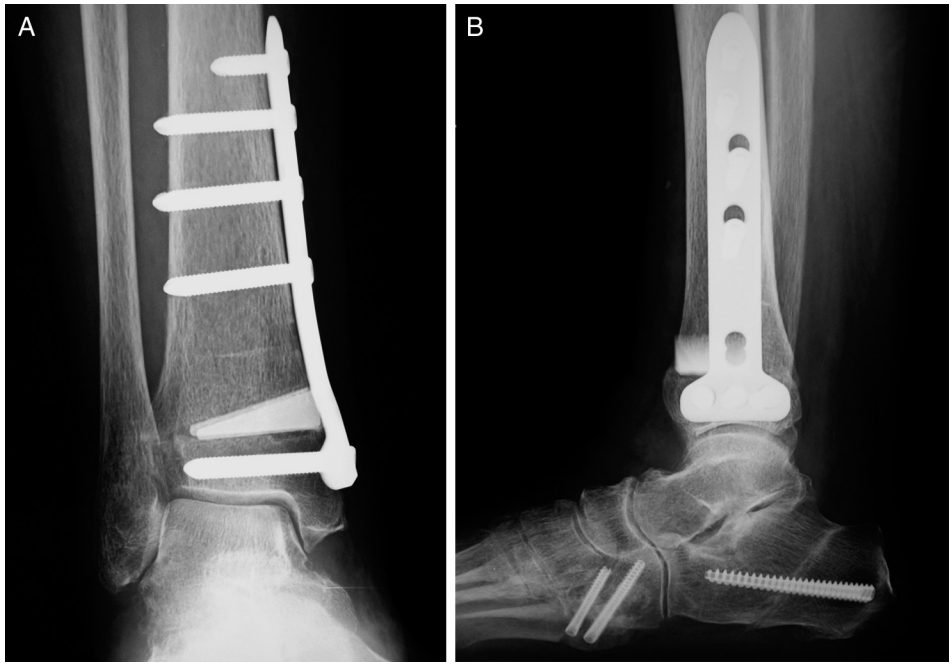

Fig. 4. (*A*) Anteroposterior and (*B*) lateral weightbearing radiographs, taken 8 months postoperatively showing the consolidation of both the arthrodesis and the osteotomy sites.

Fig. 5. (*A*) Anteroposterior, medial oblique view, and (*B*) lateral weightbearing radiographs, taken 1 year, 6 months postoperatively showing the fifth metatarsocuboid joint arthrodesis with a partial resection of the hypertrophied tuberosity of the fifth metatarsal. Note how the pre-existing subchondral bone cyst in the cuboid has almost vanished and consolidated. The 3 headless compression screws were intact, with no evidence of loosening.

capsule surrounding the coalition. They did not observe any nerve elements in the fibrocartilaginous tissue at the coalition and assumed that the mechanical abnormality resulting from incomplete coalition was the source of pain. Moreover, Kumai et al (12), in their morphologic study, divided coalitions into 3 patterns according to the computed tomography findings: irregular, cystic, and combined. They hypothesized that initially irregular coalitions would gradually develop into cystic and, eventually, into combined patterns. Secondary reactions resulting from the coalitions became stronger with time, and the radiographic findings became similar to those of osteoarthritis. They also documented that the mean age at onset of the symptomatic calcaneonavicular, talocalcaneal, and first naviculocuneiform coalitions was 17.8, 20.1, and 31.9 years, respectively.

More recently, different new treatments of isolated tarsometatarsal coalition have been described. Day et al (4) and Fujishiro et al (3) fully relieved the patient of pain by immobilizing the ankle using either a cast (4) or an arch support (3). In contrast, Takakura and Nakata (1) and Stevens and Kolodziej (5) used arthrodesis and achieved excellent results for the treatment of unnecessary joint coalitions (e.g., the first to the third metatarsocuneiform joints) with moderate extension toward the joint surface. Tanaka et al (2) also suggested that the method of operation should be selected in accordance with the particulars of the individual lesion and recommended resection of the coalition for small dorsal lesions.

The etiology of tarsal coalition, either congenital or acquired, has been reported extensively in published podiatric and orthopedic studies. Acquired tarsal coalition can result from inflammatory arthritis, infection, trauma, neoplasm, or other causes (14,15). In the present case, the etiology of the fifth metatarsocuboid coalition was unclear, which has usually been the case for any coalition (10,16). We agree that previous trauma cannot be denied as a possible cause of this coalition. An alternative diagnosis for this uncommon tarsal coalition includes post-traumatic degenerative arthritis, which also occurs infrequently (17–22). However, we believe that post-traumatic arthritis, in particular, in the case of the fourth or fifth metatarsocuboid joint, will not completely fuse by simple percutaneous drilling and internal fixation without curettage of the articular cartilage and can often result in failed arthrodesis.

Prolonged metatarsocuboid incomplete coalition might have increased the mechanical stress at the distal cuboid, leading to the deterioration of the subchondral bone cyst and any subsequent symptoms. Because it was believed that this coalition was partially united, percutaneous drilling to attain additional solid fusion, with prophylactic screw fixation, was performed to prevent excessive stress across the fifth metatarsocuboid joint.

In general, arthrodesis of the first, second, and third metatarsocuneiform joints will minimally compromise foot function, provided that the appropriate metatarsal length and position are maintained. In contrast, arthrodesis of the fourth and/or fifth metatarsocuboid joints should be avoided whenever possible and should be recommended only when all other treatment options have failed owing to the vital importance of maintaining functional motion and load transfer during gait throughout the lateral column of the tarsometatarsal (Lisfranc) joint complex (17–20,23). Despite the detrimental biomechanical effects of fusing the lateral tarsometatarsal joint, we chose arthrodesis to alleviate the debilitating symptoms in our patient, rather than resection or tendon interposition arthroplasty (21,22), because of the vast extension of the coalition in the joint surface.

The pre- and postoperative radiographs of the feet taken from a medial oblique view revealed a distinctly obliterated joint space at the fifth metatarsocuboid articulation. Computed tomography scans showed a continuous bone bridge across the joint. This conflicting result was confirmed to have been caused by a partial lack of osseous fusion (fibrocartilaginous fusion) on the plantar aspect of the joint, suggesting that the patient had presented with an extremely rare nonosseous tarsal coalition. Although this condition is less likely to be encountered than other tarsal coalitions, it can sometimes be painful enough for patients to undergo surgery.

References

1. Takakura Y, Nakata H. Isolated first cuneometatarsal coalition: a case report. Foot Ankle Int 20:815–817, 1999.
2. Tanaka Y, Takakura Y, Sugimoto K, Kumai T. Non-osseous coalition of the medial cuneiform–first metatarsal joint: a case report. Foot Ankle Int 21:1043–1046, 2000.
3. Fujishiro T, Nabeshima Y, Yasui S, Fujita I, Yoshiya S, Fujii H. Coalition of bilateral first cuneometatarsal joints: a case report. Foot Ankle Int 24:793–795, 2003.
4. Day FN III, Naples JJ, White J. Metatarsocuneiform coalition. J Am Podiatr Med Assoc 84:197–199, 1994.

5. Stevens BW, Kolodziej P. Non-osseous tarsal coalition of the lateral cuneiform-third metatarsal joint. Foot Ankle Int 29:867–870, 2008.
6. Takakura Y, Tanaka Y, Kumai T, Tamai S. Low tibial osteotomy for osteoarthritis of the ankle: results of a new operation in 18 patients. J Bone Joint Surg Br 77:50–54, 1995.
7. Tanaka Y, Takakura Y, Hayashi K, Taniguchi A, Kumai T, Sugimoto K. Low tibial osteotomy for varus-type osteoarthritis of the ankle. J Bone Joint Surg Br 88:909–913, 2006.
8. Kobayashi H, Kageyama Y, Shido Y. Less invasive distal tibial oblique osteotomy using locking plate and artificial bone wedges. Orthop Surg 64:1001–1005, 2013.
9. Stormont DM, Peterson HA. The relative incidence of tarsal coalition. Clin Orthop Relat Res 181:28–36, 1983.
10. Kulik SA Jr, Clanton TO. Tarsal coalition. Foot Ankle Int 17:286–289, 1996.
11. Miki T, Yamamuro T, Iida H, Ohta S, Oka M. Naviculo-cuneiform coalition: a report of two cases. Clin Orthop Relat Res 196:256–259, 1985.
12. Kumai T, Tanaka Y, Takakura Y, Tamai S. Isolated first naviculocuneiform joint coalition. Foot Ankle Int 17:635–640, 1996.
13. Kumai T, Takakura Y, Akiyama K, Higashiyama I, Tamai S. Histopathological study of nonosseous tarsal coalition. Foot Ankle Int 19:525–531, 1998.
14. Jacobs AM, Sollecito V, Oloff L, Klein N. Tarsal coalitions: an instructional review. J Foot Surg 20:214–221, 1981.
15. Page JC. Peroneal spastic flatfoot and tarsal coalitions. J Am Podiatr Med Assoc 77:29–34, 1987.
16. Sakellariou A, Claridge RJ. Tarsal coalition. Orthopaedics 22:1066–1073, 1999.
17. Moeller RR, Homstad MD, Thul JR, Hoffman SJ. Arthrodesis of the fifth metatarsocuboid joint: a case report. J Am Podiatr Med Assoc 78:313–317, 1988.
18. Mann RA, Prieskorn D, Sobel M. Mid-tarsal and tarsometatarsal arthrodesis for primary degenerative osteoarthritis or osteoarthritis after trauma. J Bone Joint Surg Am 78:1376–1385, 1996.
19. Komenda GA, Myerson MS, Biddinger KR. Results of arthrodesis of the tarsometatarsal joints after traumatic injury. J Bone Joint Surg Am 78:1665–1676, 1996.
20. Park DS, Schram AJ, Stone NM. Isolated lateral tarsometatarsal joint arthrodesis: a case report. J Foot Ankle Surg 39:239–243, 2000.
21. Berlet GC, Anderson RB. Tendon arthroplasty for basal fourth and fifth metatarsal arthritis. Foot Ankle Int 23:440–446, 2002.
22. Mirmiran R, Hembree JL. Tendon interposition arthroplasty of the fourth-fifth metatarsocuboid joint. J Foot Ankle Surg 41:173–177, 2002.
23. Ouzounian TJ, Shereff MJ. In vitro determination of midfoot motion. Foot Ankle 10:140–146, 1989.