Acta Med. Okayama, 2023
Vol. 77, No. 1, pp. 81-84
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Acta Medica Okayama
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*Case Report*

# Navicular Bone Fracture after Radiofrequency Ablation in a Patient with Osteoid Osteoma

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**Osteoid osteoma (OO) is a benign bone tumor that presents with nocturnal pain. Computed tomography (CT)-guided radiofrequency ablation (RFA) has been widely performed for OO, and major adverse events post-RFA are rare. We report a case of OO in the left navicular bone of a 15-year-old male. He underwent RFA for OO, and the pain improved temporarily. At the 1-month follow-up, the patient complained of left foot pain, and a CT examination revealed a fracture of the ablated navicular bone. Fractures are rare but must be taken into account after bone RFA.**

**Key words:** osteoid osteoma, radiofrequency ablation, navicular bone, fracture

Osteoid osteoma (OO) is a benign bone tumor that commonly occurs during the first two decades of life; it manifests as nocturnal pain. Computed tomography (CT)-guided radiofrequency ablation (RFA) has been widely performed for OO because of its high effectiveness and low invasiveness. Although there are potential risks of adverse events (AEs) after RFA such as skin burns and infections, major AEs rarely occur. We report the case of a navicular bone fracture after RFA treatment for OO.

## Case

The patient was a 15-year-old male who reported left foot pain. He was referred for RFA of a left navicular bone tumor, suspected to be OO. The visual analog scale (VAS) score for the patient's pain was 3. A CT examination revealed an 8×7×5-mm lesion with a radiolucent nidus (Fig. 1A, B). RFA was performed with the patient under general anesthesia and CT fluoroscopy guidance. Although a percutaneous needle biopsy was performed simultaneously in the same session using an OSTYCUT® biopsy needle (Angiomed/Bard, Karlsruhe, Germany), the specimen obtained was judged as insufficient for diagnosis. Because the biopsy needle tract was in close proximity to the talocalcaneonavicular joint, a new tract for the radiofrequency electrode was drilled at a distal edge of the lesion, near the center of the navicular bone, with 2-mm Kirschner wire to avoid thermal damage to cartilage.

A 17-gauge radiofrequency electrode with a 1-cm exposed tip (Cool-tip™; Covidien, Mansfield, MA, USA) was introduced through the tract. Ablation was performed by applying 90°C of heat for 5 min (Fig. 2). The patient was discharged 2 days after this procedure,

Received April 7, 2022; accepted August 18, 2022.
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Conflict of Interest Disclosures: No potential conflict of interest relevant to this article was reported.

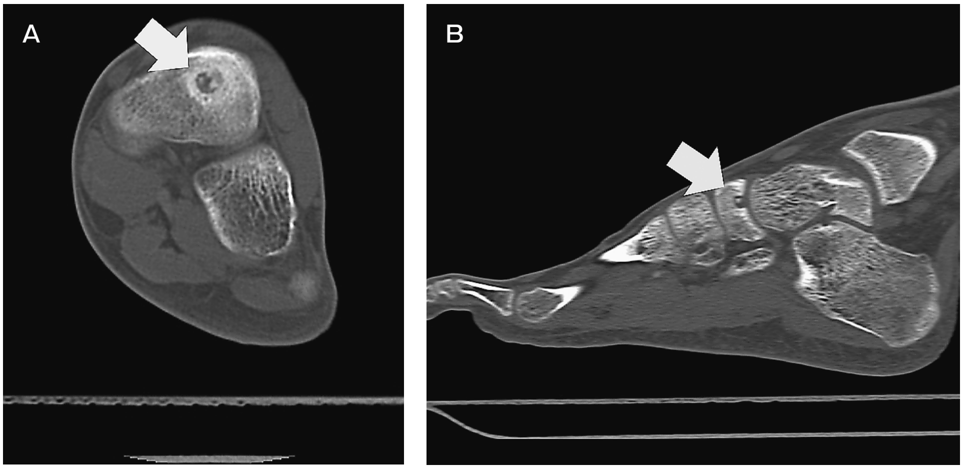


Fig. 1 Coronal (A) and sagittal (B) CT scans show the osteoid osteoma (OO) measuring 8 mm in the left navicular bone (*arrows*).

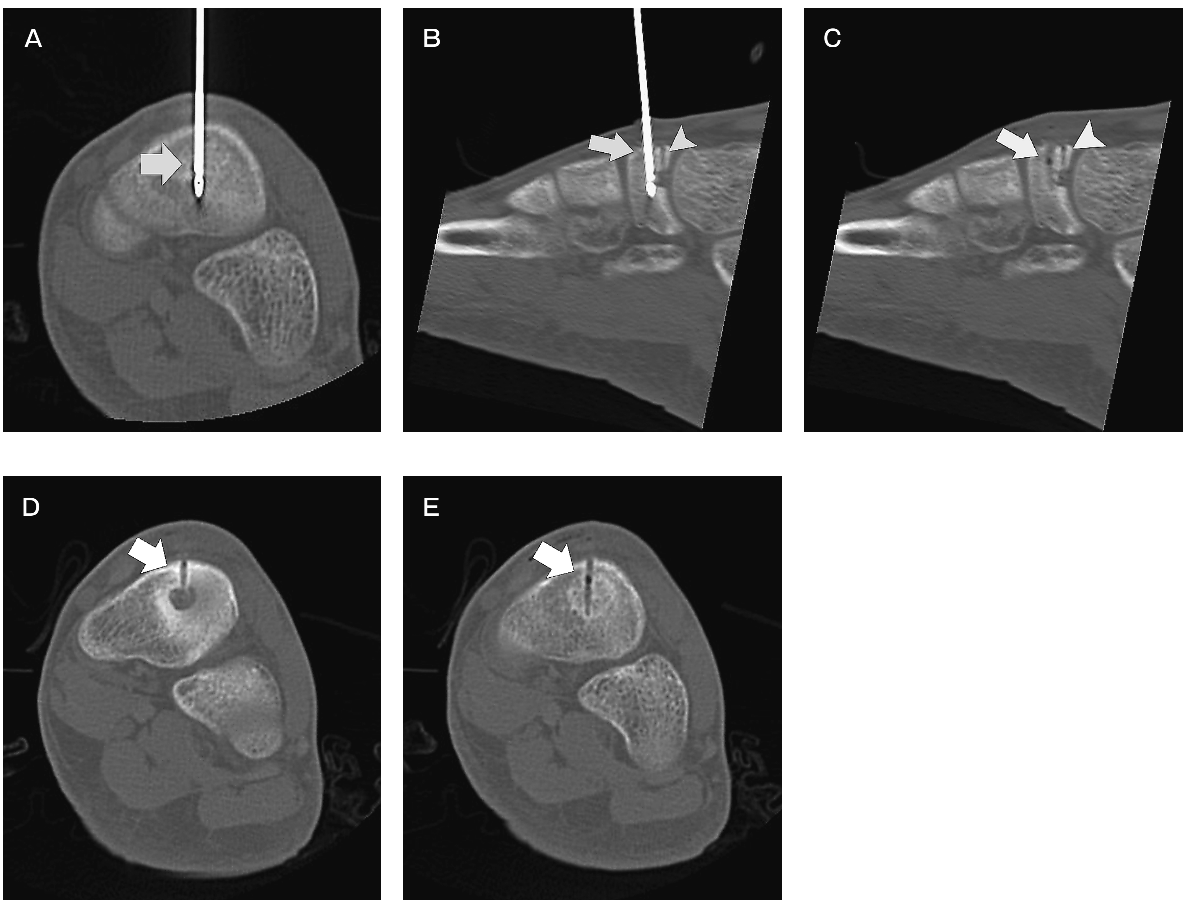


Fig. 2 (A) Coronal CT image during the patient's radiofrequency ablation (RFA) treatment showing the radiofrequency electrode (*arrow*). (B) Sagittal CT image during the RFA showing the radiofrequency electrode (*arrow*) and the tracts of the biopsy needle (*arrowhead*). (C) Sagittal CT image immediately after the RFA revealing the tracts of the radiofrequency electrode (*arrow*) and biopsy needle (*arrowhead*). (D) Coronal CT image immediately after the RFA demonstrating the tracts of the biopsy needle (*arrow*). (E) Coronal CT image immediately after the RFA: the tracts of the radiofrequency electrode (*arrow*).

with no AEs. Exercise was restricted for 1 month; however, no restrictions were made regarding walking.

At the 1-month follow-up, although the patient's pain had improved (VAS score, 0) temporarily, he complained of left foot pain. A CT examination revealed a fracture of the ablated navicular bone (Fig. 3). We suggested screw fixation, but the patient preferred conservative treatment. He began using crutches to avoid weight-bearing. Low-intensity-pulsed ultrasound was applied to accelerate fracture healing, and bone union was achieved 6 months after the above-described RFA, and exercise restrictions were not required (Fig. 4). Sixteen months later, although the patient had no problems with walking, he had left leg pain during exercise and another fracture was observed (Fig. 5). We suggested screw fixation and a bone graft, but the patient again preferred conservative treatment, which was thus continued.

**Fig. 3** Coronal CT image at 1 month after the RFA showing the fracture of the left navicular bone (*arrow*).

**Fig. 4** Coronal CT image 8 months after the RFA demonstrating bone union of the navicular bone.

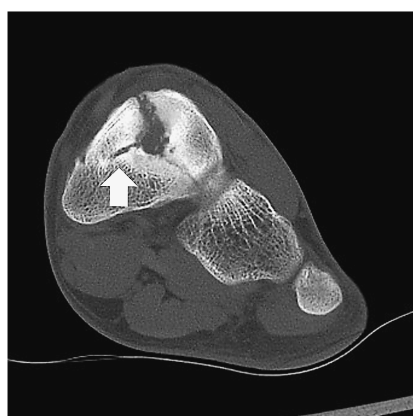

**Fig. 5** Coronal CT image 16 months post-RFA shows another fracture of the left navicular bone (*arrow*).

## Discussion

A systematic review of 223 feet and ankle OOs described tumors in the talus, calcaneus, phalanges, metatarsal bones, cuneiform bones, and cuboid bones [1]. Although the pathological diagnosis was not confirmed in our present patient, his case appears to be the first reported case of OO of the navicular bone in the English literature.

Major AEs rarely occur following RFA for OO; a 3% complication rate was reported, with the most common AEs being skin burns (0.7%) and infections (0.5%), while bone fractures reportedly occurred in 0.1% of the cases [2]. We have identified three reported cases of bone fractures secondary to RFA treatment for OO. One case involved the femoral shaft, and the other two involved the subtrochanter [3-5]. The fractures were caused by military training, sports activities (long jumper), and wrestling with a classmate, respectively.

Although the present patient complied with the exercise restriction, he still developed a bone fracture. The navicular bone, located above the cuboid bone, bears a load during walking and standing. In our patient's case, the biopsy needle tract and the electrode were positioned near the center of the bone sagittally, and the subsequent ablation of the bone caused the bone to be fragile, presumably resulting in the fracture due to repeated weight-bearing. Thus, RFA for small, thin weight-bearing bones should be avoided or may require a longer non-weight-bearing period.

After our patient's second fracture, surgical intervention was considered; however, since he had no difficulty performing activities of daily living and had no plans for further exercise, conservative treatment was administered. A second fracture was observed as a result of the conservative treatment, and this fracture may have been better treated with screw fixation after the first fracture.

In conclusion, we encountered a rare bone fracture complication after RFA in a young man with navicular bone OO.

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