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## Unilateral osteonecrosis in a patient with bilateral os centrale carpi: imaging findings

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**Abstract** The os centrale carpi is one of the accessory ossicles that have been described in the carpus. We report on the imaging findings of a rare case of unilateral osteonecrosis in a patient with bilateral os centrale carpi. The differential diagnosis of this entity and the suggested etiology for the development of osteonecrosis are discussed.

**Keywords** Carpal bones · Accessory ossicles · Osteonecrosis · Radiographs · MRI · Gadolinium · DTPA

### Introduction

The os centrale carpi is a relatively rare accessory carpal bone. When present, it occupies the vestigial central row in the carpus between the scaphoid, capitate, and trapezoid [1]. The ossicle is usually of no clinical significance but has been reported to cause painful clicking [2], to simulate a scaphoid fracture [3], and to cause pain due to osteonecrosis [4].

We describe a case of a man with disabling pain in the left wrist and with radiographic evidence of bilateral os centrale carpi. The preoperative diagnosis, which was based on findings from radiographs, computed tomography (CT), and unenhanced and gadolinium-enhanced magnetic resonance (MR) imaging, was osteonecrosis of the left accessory ossicle

and secondary degenerative osteoarthritis. Surgical and histopathologic findings confirmed the diagnosis. This is, to the best of our knowledge, the first reported case (including the MR findings) of a patient with osteonecrosis of an os centrale carpi.

### Case report

A 21-year-old man was seen with a 3-year history of pain in his left wrist. At that time he sustained a fall from a motorcycle which was treated with a soft bandage. No radiographs were taken. In the last 2 months the soreness and pain in his wrist interfered with his duties to the point that he had to stop working. On physical examination there was swelling on the dorsoradial aspect of his midcar-

pal joint. With the clinical suspicion of scaphoid nonunion the patient was referred to our radiology department. Posteroanterior, lateral and posteroanterior ulnar deviation radiographs of the left wrist revealed a small triangular sclerotic bony fragment at the distal medial end of the scaphoid (Fig. 1) and projecting dorsally. Because the margins of this fragment were so smooth radiographs of the opposite wrist were taken and a similar bony fragment was seen but exhibiting a normal density (Fig. 1). These radiographic findings were typical of bilateral os centrale carpi, with osteonecrosis on the left. To confirm the diagnosis of osteonecrosis a CT study of the symptomatic wrist was performed. CT images demonstrated a marked sclerotic smooth triangular ossicle in the dor-

**Fig. 1** Posteroanterior ulnar deviation radiographs of left and right wrists show bilateral ossicles overlapping the distal pole of the scaphoid consistent with os centrale carpi. The left side os centrale carpi appears slightly sclerotic (*arrow*)

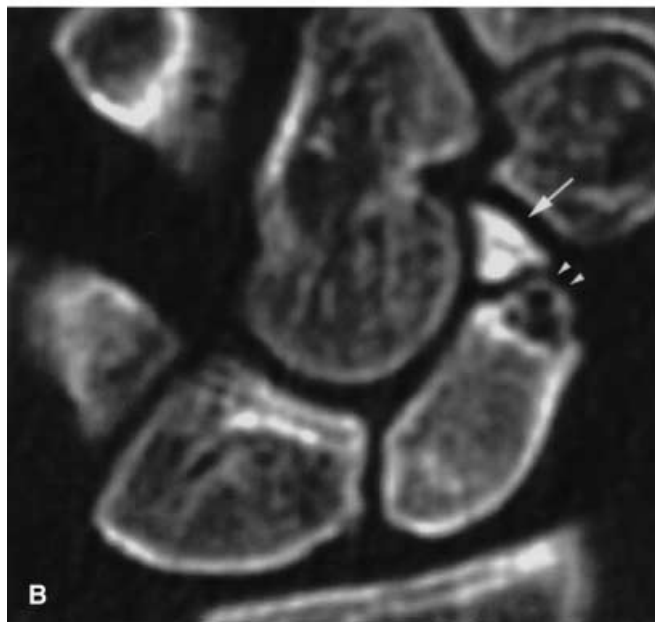
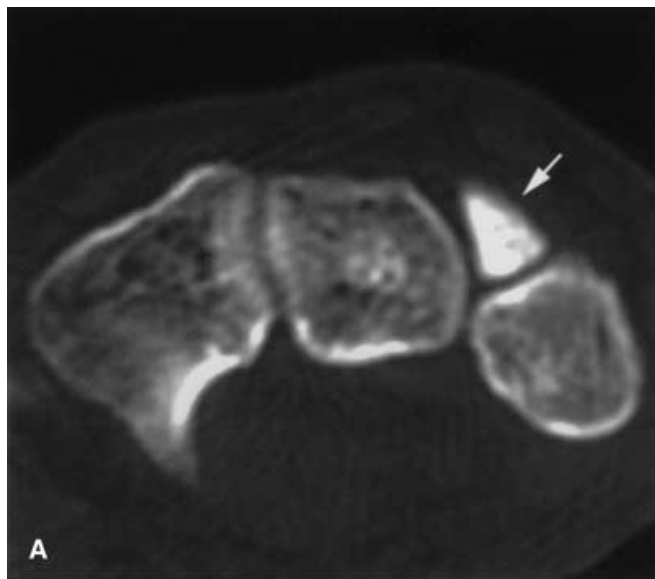


sal aspect of the joint between the scaphoid, capitate, and trapezoid bones (Fig. 2A). The adjacent distal pole of the scaphoid showed subchondral sclerosis and lucent defects (Fig. 2B).

An unenhanced and gadolinium-enhanced MR examination was done in order to evaluate the vascular status of the ossicle. The os presented homogeneous low signal intensity on all pulse sequences (Fig. 3A). Fat-suppressed T1-weighted gadolinium-enhanced MR imaging revealed complete absence of enhancement of the accessory bone indicative of avascular necrosis (Fig. 3B).

Because of disabling symptoms surgical excision of the os was done.

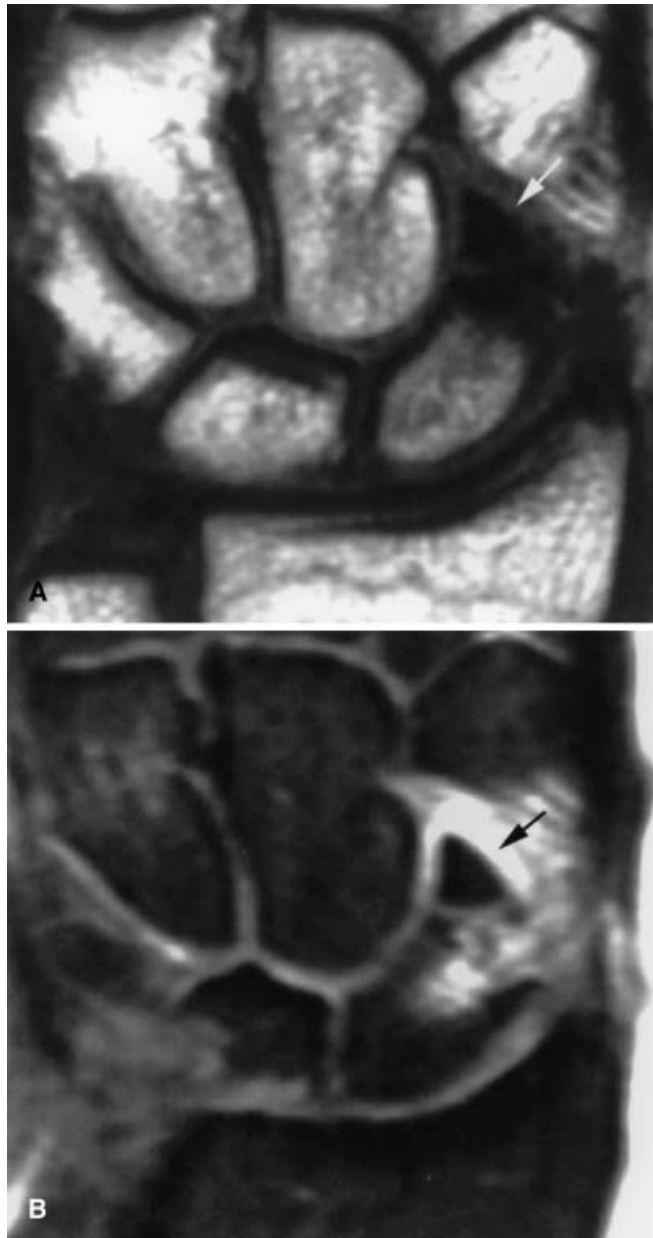
Gross examination showed that the triangular fragment of bone was approximately 7 mm in diameter and was covered with hyaline cartilage except in a small area of the articular surface with the scaphoid (Fig. 4). Microscopically the bone showed extensive avascular necrosis and focal reparative reaction (Fig. 5). Nine months after surgery, the patient returned to his original duties and continues to report complete relief of symptoms.



## Discussion

More than 20 accessory ossicles have been described in the carpus [5]. Most of these, however, are of no clinical significance and seem to occur as isolated anatomic variants

**Fig. 2** **A** Axial CT scan shows a marked sclerotic smooth triangular ossicle in the dorsal aspect of the joint between the scaphoid and capitate (*arrow*). **B** Coronal CT image demonstrates clearly the os centrale carpi (*arrow*). Subchondral sclerosis and lucent defects are evident in the adjacent distal pole of the scaphoid (*arrow-heads*)



**Fig. 3** **A** Coronal T1-weighted spin echo image shows homogeneous low signal intensity of the os centrale carpi (*arrow*). **B** Coronal fat suppressed T1-weighted gadolinium-enhanced MR image demonstrates complete absence of enhancement of the accessory bone (*arrow*). Adjacent soft tissue contrast enhancement consistent with synovitis is obvious

with an incidence of 0.3–1.6% [1, 4, 5]. The os centrale carpi is located in the dorsal aspect of the space between the scaphoid, capitate, and trapezoid bones [1]. Phylogenetically it is a remnant of the central row

of carpals which are present in more primitive animals. With the exception of humans and some African apes, the os centrale carpi is a normal bone in primates. In the human embryo a cartilaginous os centrale carpi with its center of ossification appears at about 6 weeks, fusing with the scaphoid at 8 weeks, forming part of its distal ulnar portion [5]. In some instances, the os centrale may form a projection from the scaphoid or may rarely fuse with the capitate or trapezoid [5]. The incidence of these occurrences is un-

known. More commonly, it is present as part of congenital malformation syndromes such as Holt-Oram, hand-foot-uterus syndrome, Larsen's syndrome, and otopalatodigital syndrome [1, 4, 5, 6]. However, other problems in these syndromes are so overwhelming that os centrale is a very minor component [6]. As an isolated finding it is a relatively rare condition and bilaterality is even more unusual [4].

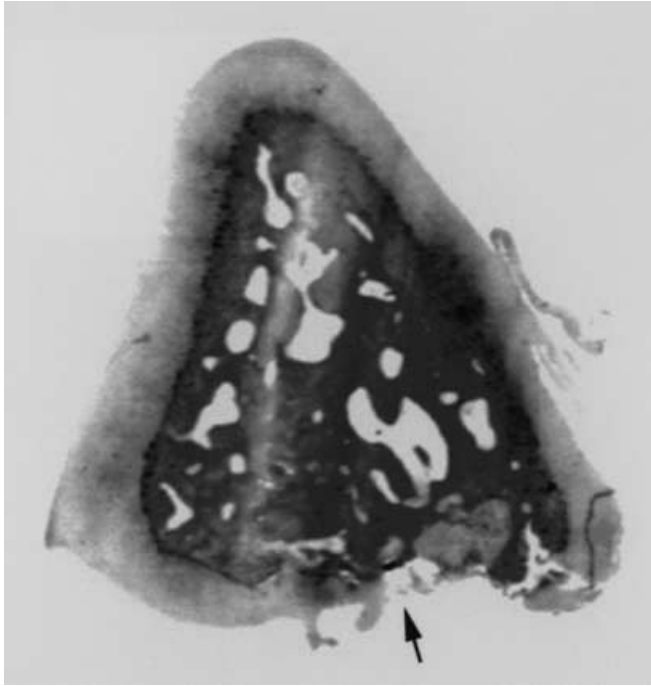
The os centrale carpi has three radiologic patterns of presentation [1, 6]. It may appear as a well-margined independent bone, which may be single or double. It may occur as an incompletely separated bony element with smooth contours, or may be present as a radiographically empty space in the area of its usual appearance. Surgical exploration in such a presentation, however, has resulted in a finding of synovial tissue only [1].

This anomaly must be differentiated from soft tissue calcifications and other abnormalities involving the scaphoid bone. The differential diagnosis includes: acute fracture, old fracture with nonunion, avascular necrosis, bipartite scaphoid, dysplasia epiphysealis hemimelica, and congenital hypothyroidism [1, 6].

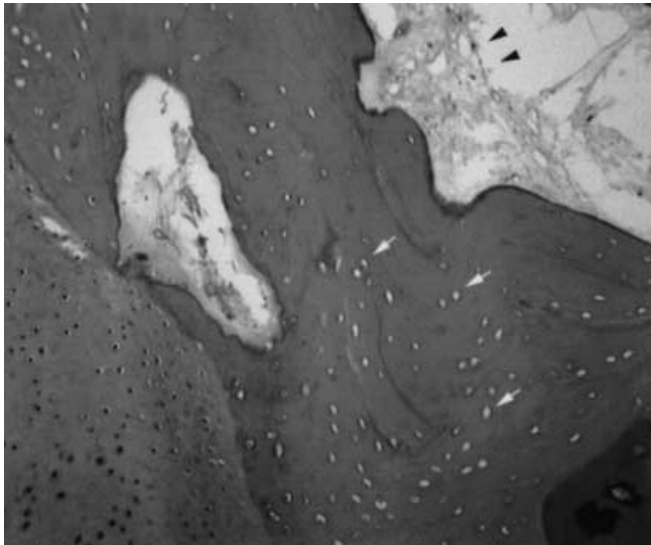
An acute scaphoid fracture shows noncorticated sharp or irregular margins. Symmetric findings do not help much in the differentiation because both fractures and os centrale carpi can be unilateral or bilateral.

An old scaphoid fracture may show cyst-like formation or a pronounced patchy decalcification along the fracture line. There may be osteopenia in the distal fragment, while its proximal fragment may show normal or increased radiodensity. Although there are some differences between an os centrale carpi and an old fracture, radiographic differentiation may not always be possible without a history of trauma [1].

Similarly, os centrale carpi may be confused with a bipartite scaphoid [1, 4], an elusive entity which appears as a transverse lucent line through the waist or, less frequently, at the proximal pole of the bone, in-



**Fig. 4** Microscopic section of the surgical specimen The ossicle is covered by hyaline cartilage except in a small area in the articular surface for the scaphoid (*arrow*)



**Fig. 5** Photomicrograph of the ossicle shows extensive avascular necrosis of bone marrow. The bone characteristically shows empty lacunae and cortical disruption indicate lack of viability. There are areas of marrow fibrosis and loss of normal adipose cell structure

stead of its distal pole. An os centrale carpi makes for additional volume above and beyond that of a complete scaphoid, while the two bone fragments of the bipartite

scaphoid when volumetrically combined make a normal complete scaphoid [4, 7].

Dysplasia epiphysealis hemimelica rarely occurs in the hands,

but when it does it affects only one extremity and results in osteochondromatous-like masses in the carpus. These lesions extend beyond the normal location of the os centrale carpi and are usually larger than the ossicle [1].

Cretinism (congenital hypothyroidism) results in a disturbance of the normal ossification of the scaphoid. In this disease multiple ossification centers are seen proximal and distal to the bone [1].

Usually, the os centrale carpi is asymptomatic. However, Adolfsson reported two cases presenting with intermittent wrist pain [2]. In these patients the findings at arthroscopy indicated that the ossicles were mobile within the wrist and caused symptoms as a result of interference with movement of the surrounding carpal bones. Because the problems apparently began after a traumatic episode, it is possible that the ossicles tore loose by a forced, sudden movement of the wrist. Lane et al. reported a case of painful wrist produced by osteonecrosis of an os centrale carpi and secondary degenerative changes [4]. Radiographic evaluation in Lane et al.'s report consisted of radiographs and trispiral tomography of both wrists. Studies of the symptomatic right wrist demonstrated an os centrale carpi with a sclerotic and fragmented appearance and articular irregularity and narrowing, consistent with osteonecrosis and associated degenerative disease, which was histologically confirmed. Nevertheless, different authors have shown a lack of correlation between radiographic sclerosis and osteonecrosis, emphasizing the importance of performing MR imaging to determine the vascularity of carpal bones [8]. MR imaging, especially with intravenous administration of gadolinium, provides a better evaluation of the degree of ischemia and the extension of the necrotic bone because an increase in signal intensity implies vascularized vital tissue and absence of enhancement implies lack of blood perfusion consistent with se-

vere ischemia and necrosis [9]. The symptoms in our patient were most likely caused by osteonecrosis and development of secondary degenerative arthritis and synovitis. The exact cause of the osteonecrosis is only speculative, but the clinical history suggests a traumatic origin. We believe that the ossicle was partially attached to the scaphoid and the union was broken at the time of the accident. Because the vascular supply from the scaphoid was interrupted the os centrale underwent avascular necrosis.

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