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CASE REPORT

Sonographic demonstration of fluid–fluid levels in an aneurysmal bone cyst secondary to a giant cell tumour of the calcaneus

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Introduction

Giant cell tumour of bone is usually found around the knee or in the distal radius and is unusual in the tarsal bones. Aneurysmal bone cysts are known to arise within a pre-existing lesion in 30–35% of cases of which giant cell tumour of bone is the most common. We present the imaging findings of a giant cell tumour of bone with a secondary aneurysmal bone cyst component arising in the calcaneus. Sonography is usually of limited value in the investigation of intra-osseous abnormalities in the mature skeleton due to poor acoustic penetration of the ultrasound beam through cortical bone. Where there is cortical breakthrough of the tumour ultrasound can assess the lesion and guide biopsy. In the present case ultrasound clearly visualized shifting fluid–fluid levels as an ultrasonographic feature of this tumour.

Case report

A 22-year-old man presented to his local accident and emergency department with a 2-year history of pain in the left heel, which had not responded to treatment by physiotherapy or osteopathy. There was no history of trauma to this area and the pain had increased in severity in the month before presentation. He had no significant past medical history. General physical examination was normal. Examination of the left ankle revealed mild generalized swelling, but a good range of joint movement. Radiographs of the ankle demonstrated a large expanded lucent lesion extending forward from a sub-articular position to replace the anterior three quarters of the bone. The lesion had a thin and radiographically continuous sclerotic border. Magnetic resonance imaging (MRI) was undertaken (0.5 T, Gyroscan T5, Philips, Medical Systems, Best, The Netherlands) with the ankle positioned in a head coil. This revealed a multi-septated, expanded lesion in the anterior part of the calcaneus with cortical breakthrough postero-medially and extra-osseous extension. There were several enhancing septa and also multiple fluid–fluid levels (Fig. 1). Computed tomography (CT, GE 9800, General Electric Medical Systems, Milwaukee, WI, USA) confirmed marked expansion of the calcaneus with destruction of the postero-medial cortex (Fig. 2). As the CT study demonstrated a breach in the medial cortex of the calcaneus, an ultrasound examination was performed in order to assess the possibility of ultrasound-guided biopsy of the lesion. Ultrasound (10–5 MHz Linear array transducer, HDI 3000, Advanced Technology Laboratories Ltd) clearly demonstrated the lesion and confirmed the presence of fluid–fluid levels within it showing echo-poor upper and echogenic-dependent layers, the fluid levels were confirmed to shift on repositioning the patient (Fig. 3). This study demonstrated a paucity of solid elements medially, with a more appropriate area for biopsy lying laterally within the cyst, for this reason ultrasound was felt to be an unsuitable method for guiding percutaneous biopsy.

The radiological features were considered to represent an aneurysmal bone cyst, which was thought likely to be secondary to a pre-existing lesion in view of the patient's age.

The lesion was biopsied with CT guidance under local anaesthesia using an 8 G Jamshidi biopsy needle. Histological examination revealed proteinaceous material with scanty cells, no malignant cells were identified but a definitive diagnosis could not be reached. Open curettage was then performed, pathological analysis showed a giant cell tumour with an aneurysmal bone cyst component (Fig. 4).

Discussion

Giant cell tumour of bone is an uncommon lesion representing between 4 and 9.5% of primary bone neoplasms, and is thought to originate from

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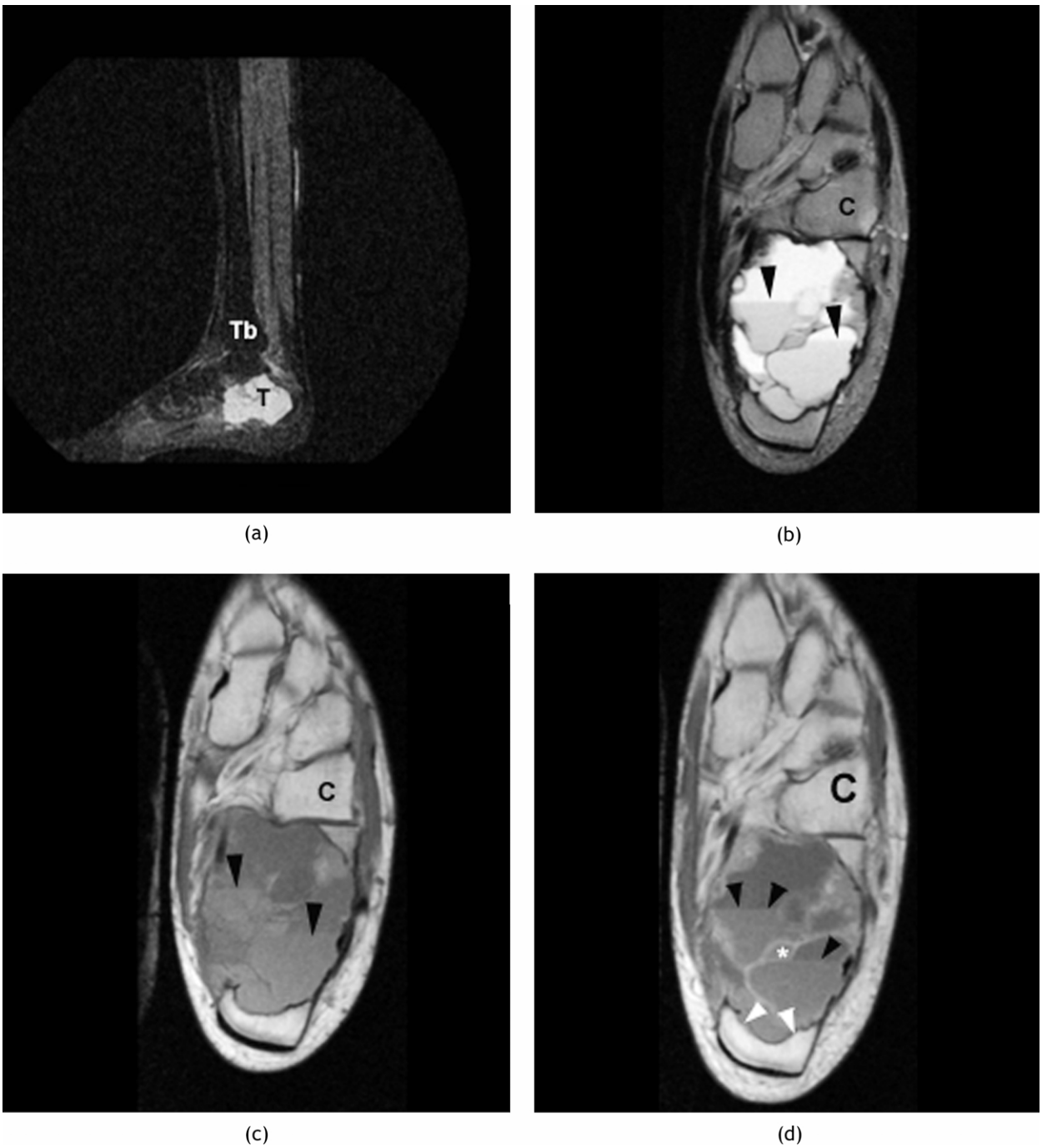


Figure 1 MRI of the left heel. (a) Sagittal STIR image. (TR 1500, TE 13, TI 100) showing a multiseptated expanded lesion in the mid and anterior parts of the calcaneus. (b) Axial T2-weighted turbo spin-echo fat-suppressed image (TR 4919, TE 120) showing a multilocular expansile lesion within the calcaneus extending anteriorly to the cuboid (C) articulation. The lesion contains multiple fluid–fluid levels (black arrowheads). (c) and (d) Axial T1-weighted turbo spin-echo images pre- and post-gadolinium enhancement (TR 631, TE 11). There are enhancing internal septa (asterisk) and multiple fluid–fluid levels (black arrowheads). There is medial cortical destruction and extension of the mass into the adjacent soft tissues. C, cuboid.

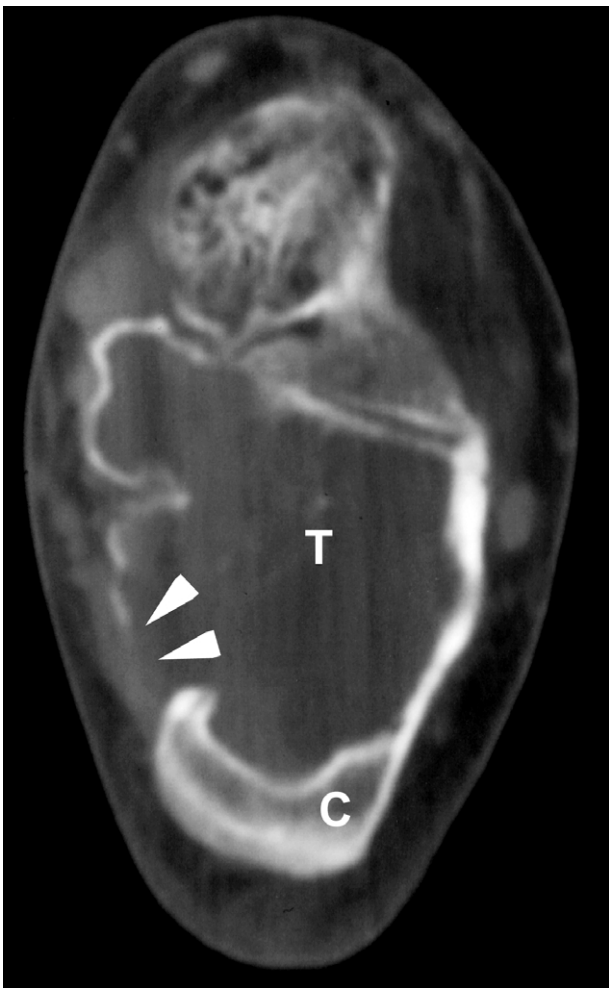


Figure 2 Axial CT image. The calcaneus (C) is expanded by tumour (T) with thinning and destruction of the medial calcaneal cortex (white arrowheads).

undifferentiated cells of the supporting tissues of bone marrow. It is most commonly seen in early adulthood with a peak incidence in the third decade with a slight female predominance and is usually seen in the skeletally mature patient.[1] The tumour is most commonly located around the knee with the distal radius as the next most common site, it is believed to have a metaphyseal origin, but has usually involved both the epiphyseal and metaphyseal regions at presentation.[1]

Giant cell tumour is unusual in the tarsal bones; three out of 327 cases reported by Campanacci et al.[2] (of which two were in the calcaneus) and four out of 411 cases reported by Dahlin[3] occurred at this site. Patients with giant cell tumour in the hands and feet appear to comprise a group that is approximately 10 years younger at presentation than those with giant cell tumour at more typical locations.[1]

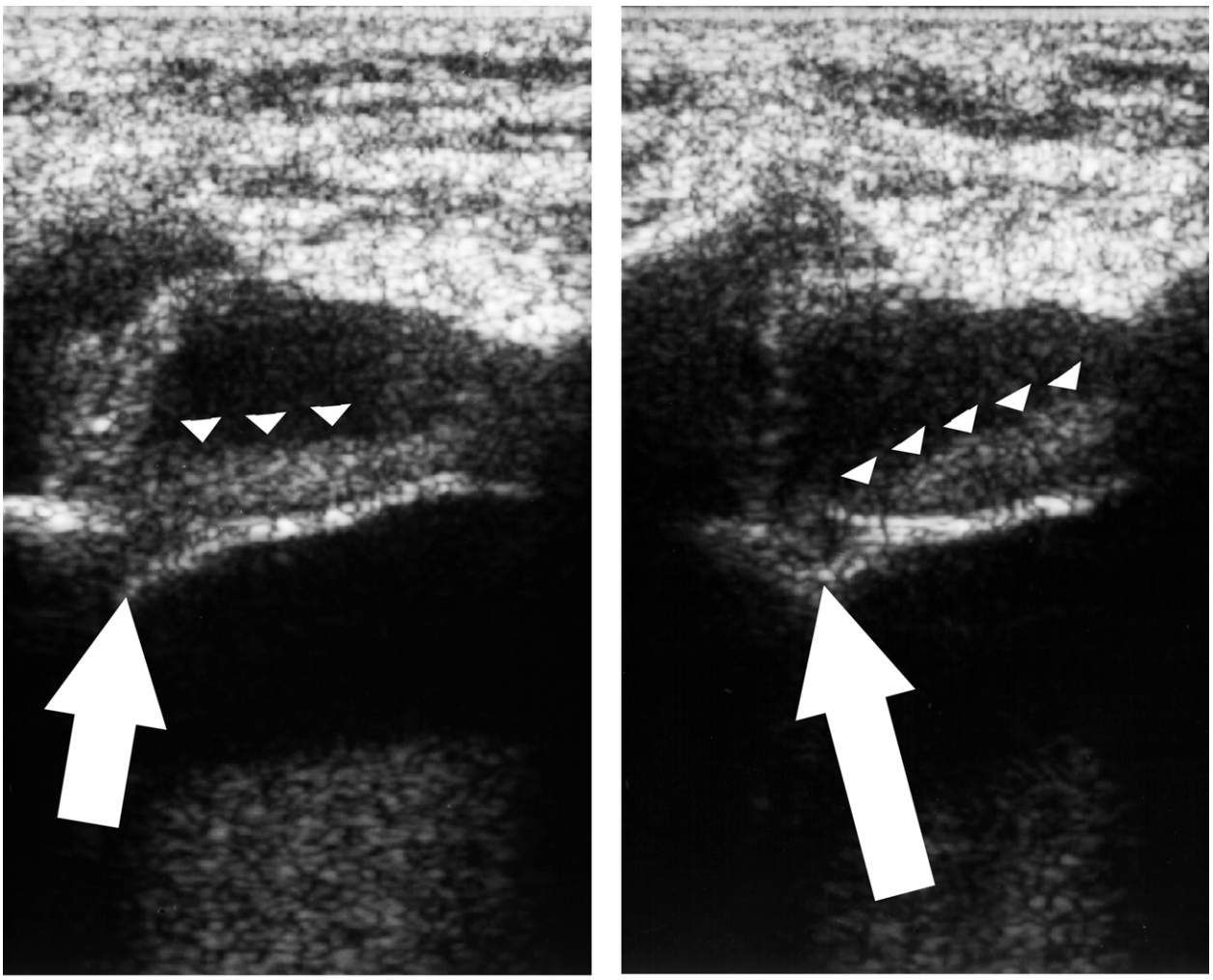
Aneurysmal bone cysts may be a primary bone tumour or may arise secondary to a pre-existing benign or malignant bone lesion.[1] Approximately 30–35% of aneurysmal bone cysts exist in association with another bone lesion[1,4] and in this group the age at presentation is on average approximately 27 years, 9 years older than the average of those with primary aneurysmal bone cysts.[5] Giant cell tumour is the most common lesion to undergo transformation to aneurysmal bone cyst.[4,5] Like giant cell tumour primary or secondary aneurysmal bone cyst is unusual in the tarsal bones and was present at this site in only 10 out of 238 cases reported by Vergel De Dios et al.[6]

Aneurysmal bone cyst transformation of giant cell tumour of the calcaneus is the subject of a single previous case report.[8] This case shows the typical radiological findings of an aneurysmal bone cyst in a small bone namely an expanded lytic lesion. Cortical thinning, bowing and destruction demonstrated by CT are common features of aneurysmal bone cyst[6,7] and the MRI findings of enhancing septa and multiple fluid levels are also well described.[1,6,7]

Sonography is becoming increasingly prevalent as a primary investigation of patients with local pain syndromes often without radiography or other imaging techniques being used. An awareness of the ultrasound appearances in cases such as this is potentially useful as this could be the first investigation undertaken in a given patient. There are few reports of the sonographic features of aneurysmal bone cysts in the paediatric age group with no reports in the adults. Suh and Han[9] examined an aneurysmal bone cyst of the ilium with a low frequency transducer (3.5 MHz) and were able to demonstrate multiple reflective lines, which moved when the patient was repositioned, corresponding to fluid–fluid levels on CT. Haber et al.[10] report on an aneurysmal bone cyst of the scapula in a 1-year-old patient. Using a 7.5 MHz transducer they showed multiple fluid levels with a lower echogenicity supernatant and higher echogenicity dependent layer,[10] their findings are very similar to those seen in this adult case.

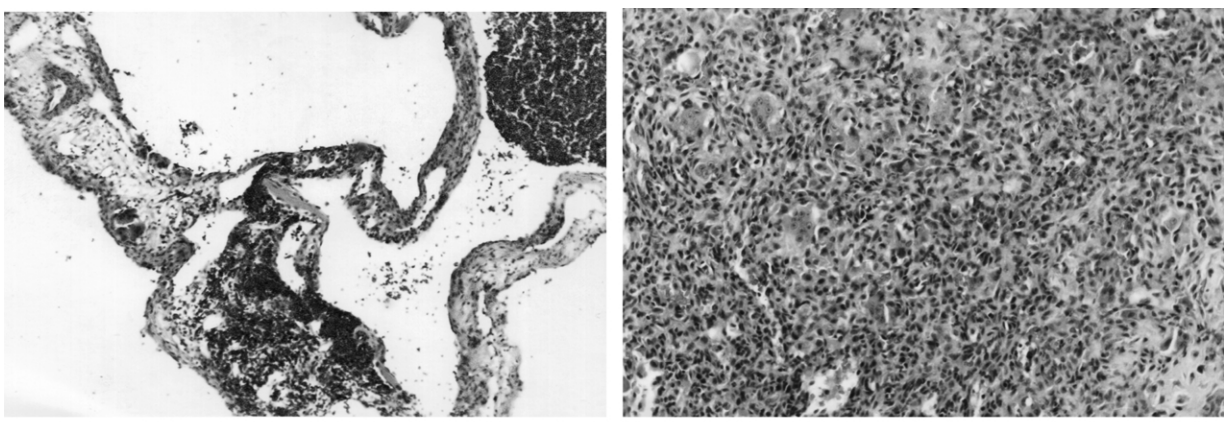
The fluid–fluid levels visible in some cases of aneurysmal bone cysts on CT, MRI and ultrasound examination are thought to represent settling of a cellular sediment from serum[6,11] and are fairly characteristic of aneurysmal bone cysts.[1] However, similar appearances can rarely be seen in telangectatic osteosarcoma, fractured solitary bone cyst, Brown's[12] tumours and giant cell tumour.[9]

This case report describes a secondary aneurysmal bone cyst arising from a giant cell tumour occurring in an unusual site. Ultrasound of intraosseous lesions in the mature skeleton would normally be precluded by almost complete



(a) (b)

Figure 3 Ultrasound images. (a) Image obtained from the medial aspect of the calcaneus showing two fluid–fluid levels with echo-poor upper layers and echogenic lower layers (white arrowheads). Cortical thinning and interruption is also seen (white arrow). (b) Image from the same site as (a) after repositioning the patient showing that the fluid–fluid levels have shifted (white arrowheads). The same area of cortical interruption is also noted (white arrow) and serves as a reference point to demonstrate the shifting fluid–fluid levels.



(a) (b)

Figure 4 Histological appearance of curettage. (a) Large calibre blood-filled spaces are present. The walls are branching and contain fibrous tissue, inflammatory cells and osteoclast-like giant cells. (b) Solid areas represented a minority of the curetted tissue. This figure shows areas typical for giant cell tumour of bone.

reflection of sound from the cortical bone surface. In this case, however, ultrasound was able to demonstrate shifting fluid levels within the lesion with a high frequency transducer presumably due to the marked cortical thinning present. The presence of these fluid–fluid levels, whilst not diagnostic of aneurysmal bone cyst, was able to increase diagnostic confidence before biopsy. Ultrasound allowed assessment of possible feeding vessels in order to avoid them at the time of biopsy. No such vessels were demonstrable in the case presented, which proved useful information at the time of subsequent CT biopsy.

To our knowledge the sonographic demonstration of shifting fluid–fluid levels within an aneurysmal bone cyst has only been demonstrated in two previous case reports[8,9] and never in the appendicular skeleton of an adult.

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