

Aggressive giant cell tumour of the metacarpal

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Section: Musculoskeletal system

Area of Interest: Musculoskeletal bone Musculoskeletal soft tissue

Procedure: Diagnostic procedure

Procedure: Intraoperative

Imaging Technique: Nuclear medicine conventional

Imaging Technique: MR

Imaging Technique: MR-Diffusion/Perfusion

Imaging Technique: CT

Imaging Technique: Experimental

Special Focus: Neoplasia Case Type: Clinical Cases

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Patient: 54 years, female

Clinical History:

A 54-year-old female patient presented with a 2-month history of insidious onset of swelling and pain at the left thumb. Initial conservative treatment failed. Physical examination confirmed swelling at the 1st carpometacarpal (CMC) joint and a limited abduction. The patient was otherwise well with no history of prior malignancy.

Imaging Findings:

Plain radiographs demonstrated an expansile osteolytic lesion in the proximal epiphysis and diaphysis of the left 1st metacarpal bone (MC1). The cortex appeared markedly thinned. There was no surrounding sclerosis nor periosteal reaction (Fig. 1). CT confirmed a large lytic lesion with soft tissue attenuation, cortical thinning and destruction (Fig. 2). MR imaging showed bone marrow replacement with distal epiphyseal sparing. The lesion was of low signal intensity (SI) on T1-weighted images (WI) and intermediate to high SI on T2-WI. Moderate enhancement and soft-tissue extension was noted on contrast-enhanced images (Fig. 3). Bone scintigraphy demonstrated increased radionuclide uptake but absence of multifocality (Fig. 4). Surgical biopsy and subsequent histopathological examination revealed Giant Cell Tumour (GCT). Preoperative imaging (Fig. 5-6) 3 months later preceding MC1 resection (Fig. 7) and cement grafting (Fig. 8) showed marked increase of the lesion size. Histopathological findings of the resection specimen confirmed GCT without malignant degeneration.

Discussion:

GCT of bone is a benign, but locally aggressive lesion with a tendency for local recurrence after resection. Metastasis is rare. Histologically, it is composed of multinucleated giant cells within a stroma of mononuclear cells.

GCT account for approximately 5% of all primary bone tumours [1, 2]. It predominantly occurs between 20 and 50 years of age with a female predominance [1, 3, 4].

GCT of the bone commonly occur in the epi-metaphyseal region of long bones. The distal femur, proximal tibia and distal radius are commonly involved, with the spine and sacrum being less involved [3, 5]. The bones of the hand and foot are rarely involved, with a reported frequency of about 2% of all GCT. Metacarpal involvement is extremely rare [5].

Clinical presentation is usually nonspecific including pain, swelling, limited range of motion and pathological fractures [1, 5].

On conventional radiographs and CT, GCT is typically seen as an eccentric, epi-metaphyseal osteolytic lesion, with well-defined non-sclerotic border and extension underneath the subchondral articular bone [1-3, 5-7]. GCT may also show aggressive features consisting of poorly demarcated margins, cortical thinning and destruction and soft tissue extension [5]. CT may be useful in evaluating cortical bone integrity, absence of matrix mineralisation and demonstration of pathologic fracture [2, 4]. GCT of the hand tends to be less eccentric and more centrally located [7].

MR imaging can help determine the precise intramedullary and soft-tissue extent of the lesion [7]. Generally, GCT has a low-to-intermediate signal on T1-WI and a heterogeneous-high signal on T2-WI [2-4, 7]. However, due to intra-tumoural haemosiderin or fibrosis, the signal may be low on T2-WI [2]. The lesion enhances after intravenous gadolinium contrast administration, reflecting the increased vascular supply [6]. Bone scintigraphy may detect multifocality [4].

Extensive curettage or resection is the treatment of choice of GCT of the hand bones [2, 6, 7]. The combination of intraoperative cryogenic agents or methyl-methacrylate packing and resection has resulted in a recurrence rate of less than 10% [6]. For maintenance of the CMC function, resection is followed by bone reconstruction using an autogenous bone graft or allograft [2].

Although histology is mandatory for a definitive diagnosis, analysis of imaging characteristics of a lesion can be helpful in suggesting the correct diagnosis of a GCT. Epiphyseal extension and the low SI on T2-WI on MRI are useful signs in imaging characterisation of aggressive GCT even at rare localisations such as the metacarpal.

Written informed patient consent for publication has been obtained.

Differential Diagnosis List: Giant cell tumour of the bone, Aneurysmal bone cyst, Expansile lytic acrometastases, Osteosarcoma, Chondroblastoma, Chondrosarcoma, Brown tumour, Plasmocytoma

Final Diagnosis: Giant cell tumour of the bone

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Figure 1

a



Description: Plain radiograph of the left thumb shows an expansile osteolytic lesion in the proximal epiphysis of the metacarpal bone with diaphyseal extension. The cortex appears markedly thinned and is focally destroyed. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

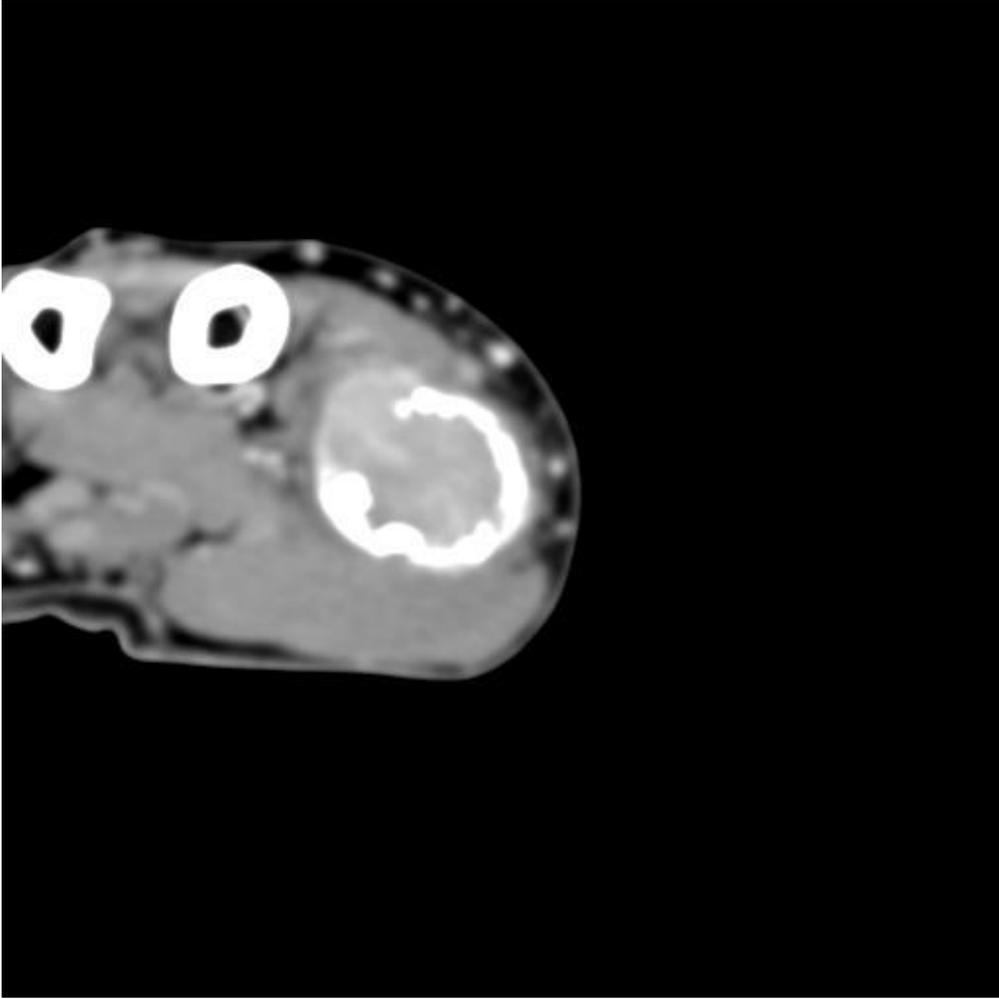
Figure 2

a



Description: Sagittal reformatted image confirmed a large lytic lesion, marked thinning of the cortex and cortical destruction. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

b



Description: Axial contrast-enhanced CT image shows enhancement of the intramedullary soft tissue lesion. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

Figure 3

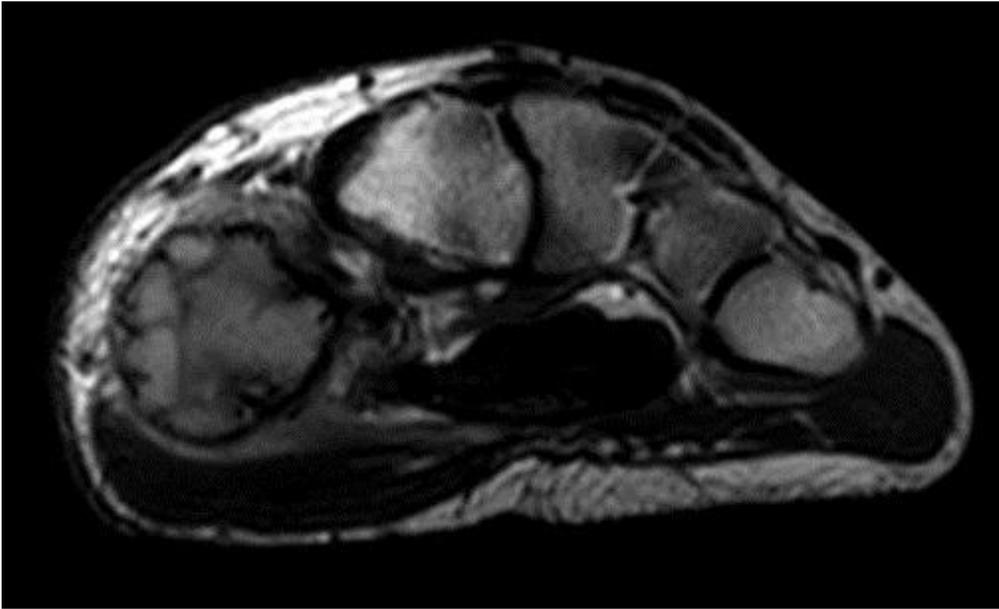
a



Description: Coronal T1-WI shows bone marrow replacement in the diaphysis and proximal epiphysis.

Origin: De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

b



Description: Axial T2-WI shows heterogeneous, intermediate to high SI of the lesion with intralesional foci of low signal intensity. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

c



Description: Coronal contrast-enhanced T1-WI with fat suppression demonstrates moderate lesion enhancement and soft-tissue extension. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

Figure 4

a



Description: Bone scintigraphy demonstrates increased radionuclide uptake and central photopenia. This finding is known as the "doughnut" sign. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

Figure 5

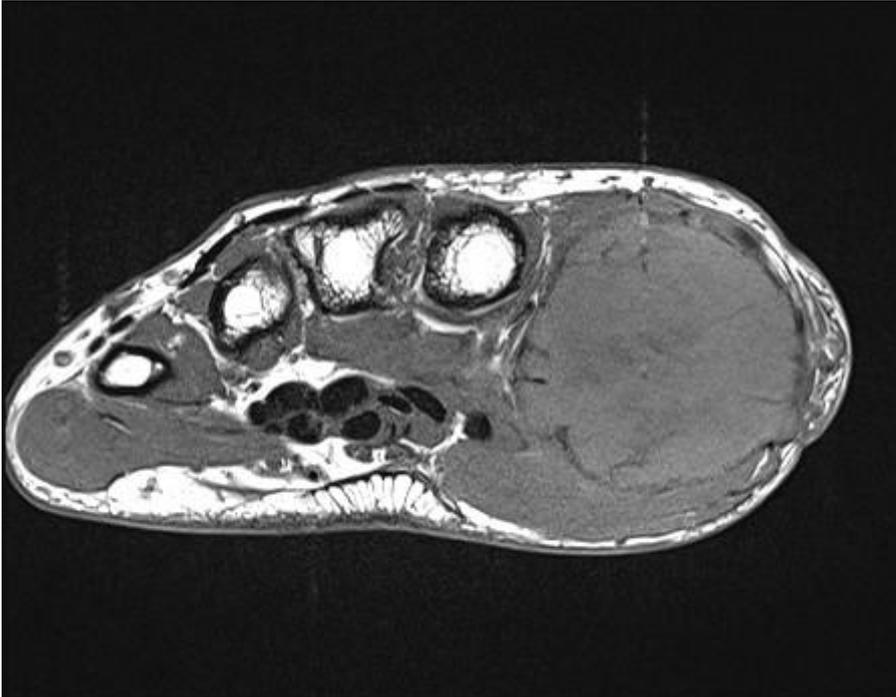
a



Description: Plain radiograph performed three months later. There is marked increase of the size, expansion and cortical breakthrough of the lesion. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

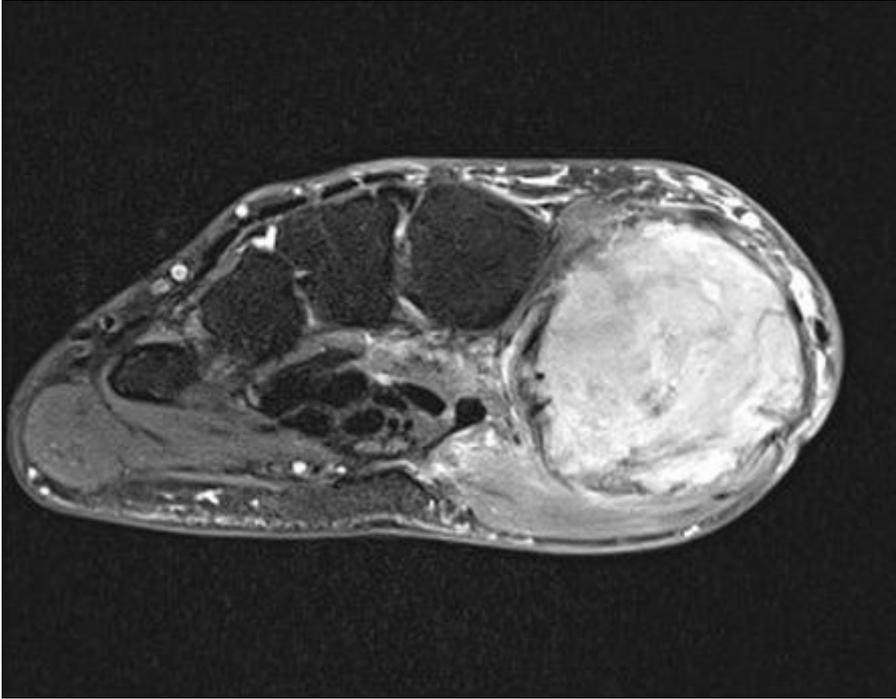
Figure 6

a



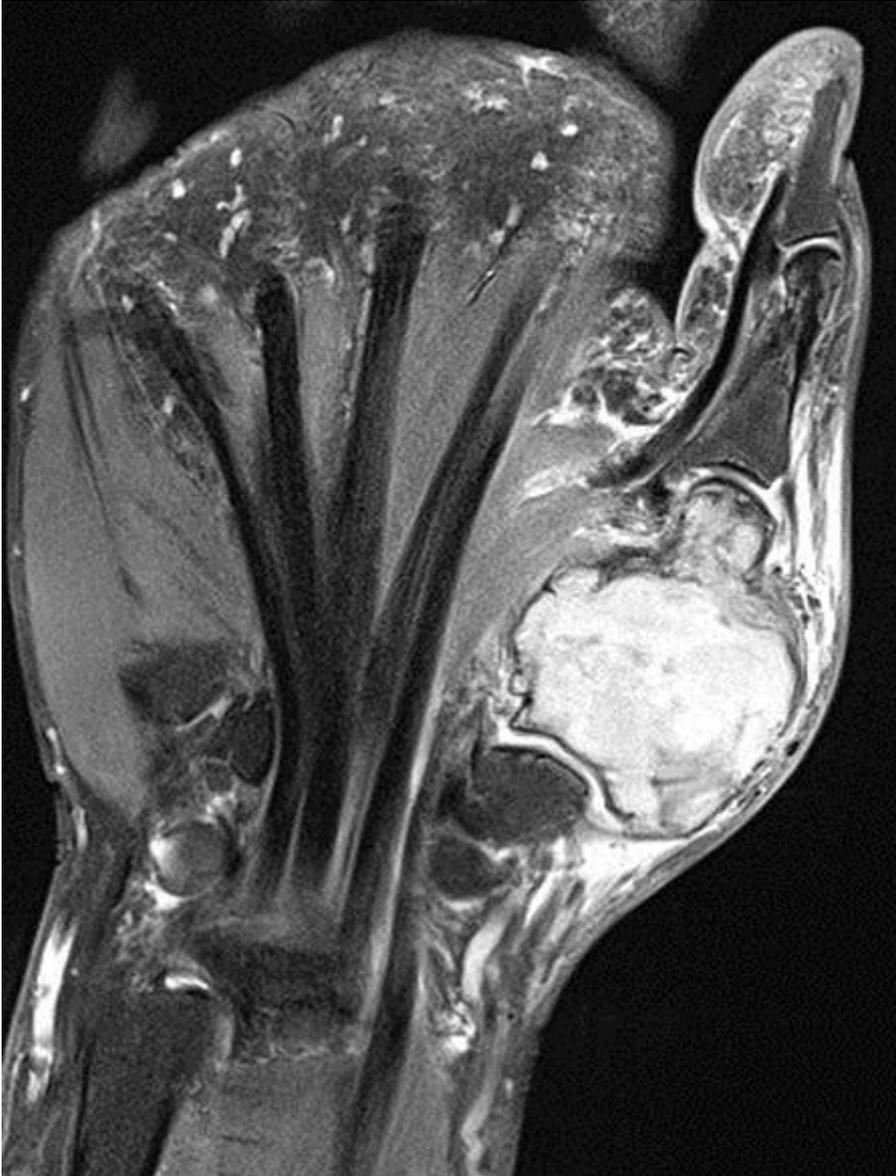
Description: MR findings performed three months after initial MR examination. Axial T1-WI shows further tumour growth. Bone marrow replacement is of heterogeneously low signal intensity. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

b



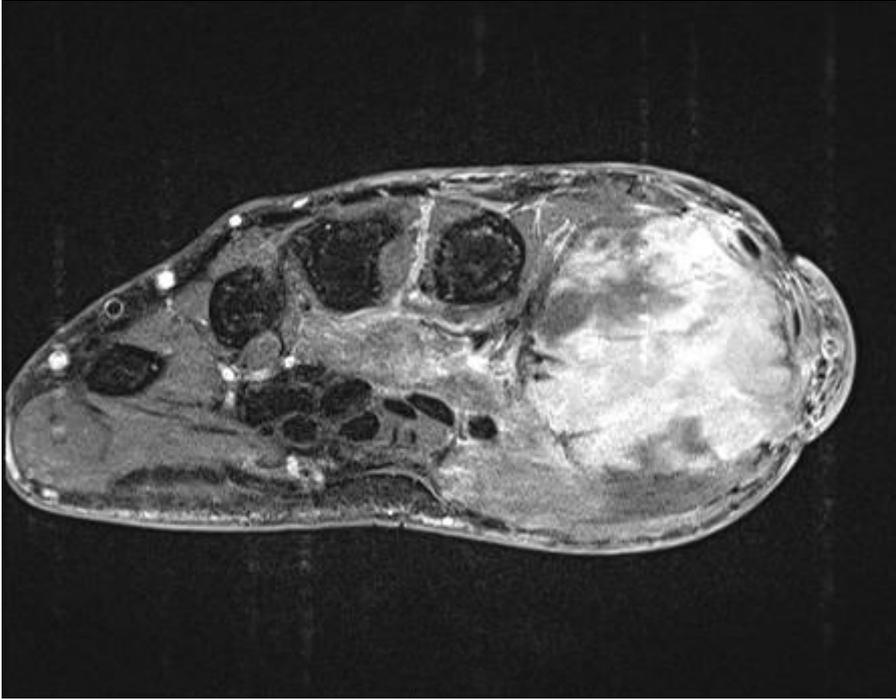
Description: On axial and coronal fat-suppressed T2-WI an intermediate to high SI is seen with intralesional areas of low signal intensity. There is no extension into the CMC and metacarpophalangeal joint **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

c



Description: On axial and coronal fat-suppressed T2-WI an intermediate to high SI is seen with intralesional areas of low signal intensity. There is no extension into the CMC and metacarpophalangeal joint. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

d



Description: On axial contrast-enhanced T1-WI with fat suppression demonstrates heterogeneous enhancement of the lesion and its soft tissue extension. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium

Figure 7

a



Description: Operative view of first metacarpal. **Origin:** Planckaert G, UZ Ghent, Ghent, Belgium

b



Description: Resection specimen measuring 5.4 cm. **Origin:** Planckaert G, UZ Ghent, Ghent, Belgium

Figure 8

a



Description: Post-operative plain radiograph of the left thumb. The resection cavity is filled with methylacrylate bone cement. **Origin:** De Backer A, Department of Radiology, AZ Sint-Lucas, Ghent, Belgium