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Growing wrist mass

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Abstract

A 46 year old man presented with a growing mass over his wrist. Erosions of the triquetrum and hamate were present radiographically. Magnetic resonance imaging (MRI) showed a solid mass arising from the extensor carpi ulnaris tendon, which was T₁ hypointense and isointense, T₂ hypointense, and bloomed on gradient echo images. The preoperative diagnosis of giant cell tumour of the tendon sheath was confirmed on histopathological examination of the excised specimen. The clinical, pathological, and imaging features, with emphasis on MRI findings, of this condition are reviewed.

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Clinical history

A 46 year old man presented with a one year history of a growing mass in his left wrist. He stated that the mass developed soon after minor contusion to the wrist. On examination, the mass was located over the ulnar aspect of the wrist. It measured about 2 cm in diameter and was mildly tender. It was fixed in the longitudinal plane to the deep structures but was mobile in the transverse plane. The mass was not attached to the overlying skin, which had a

normal appearance. Hand and wrist movements were normal, and sensation was intact. There was no other systemic abnormality.

Imaging findings

A radiograph of the left wrist showed osteolytic involvement of the ulnar aspects of the triquetrum and hamate. Both these bones had well defined "punched-out" erosions with sclerotic margins. The joints were normal and bone density was preserved (fig 1). Magnetic resonance imaging (MRI) demonstrated a well defined, lobulated soft tissue mass eroding the ulnar aspect of the triquetrum and hamate. The base of the fifth metacarpal, pisiform, and ulnar styloid were in close proximity to the mass but were unaffected. The mass arose from the extensor carpi ulnaris tendon, and involved the proximal abductor and flexor digiti minimi muscles. The mass was isointense on T₁ weighted and proton density weighted images with small areas of hypointensity within, becoming generally more hypointense on T₂ weighted images. On gradient echo images the lesion appeared more prominent with a further increase in hypointense signal, confirming the magnetic susceptibility effect due to the presence of haemosiderin deposits. There was moderate heterogeneous contrast enhancement, sparing the areas of haemosiderin deposition (figs 2 and 3).

Differential diagnosis

On radiographs, the finding of well defined sclerotic-marginated bony erosions is consistent with a longstanding non-aggressive process. When the joint space is preserved and two adjacent carpal bones are affected, the main differential diagnosis will include intra-articular synovial disease, extra-articular synovial disease arising from the tendon sheath, and extra-articular non-synovial disease.

MRI is the imaging method of choice for evaluating the presence and extent of soft tissue masses of the musculoskeletal system. It is particularly useful for assessing masses in the hand and wrist, where benign lesions predominate.^{1 2} A specific diagnosis may be made, or strongly suspected, from the characteristic MRI features of certain lesions, such as ganglion, haemangioma, arteriovenous malformation, lipoma, and giant cell tumour of the tendon sheath.¹⁻⁴

Lesions with predominant T₂ shortening will appear largely hypointense on T₂ weighted images. T₂ shortening may be due to low cellularity, high collagen content, fibrotic scar tissue,



Figure 1 Anteroposterior radiograph of the left wrist showing erosions of the ulnar aspects of the triquetrum and hamate. The margins of the erosions are well defined with a sclerotic rim.

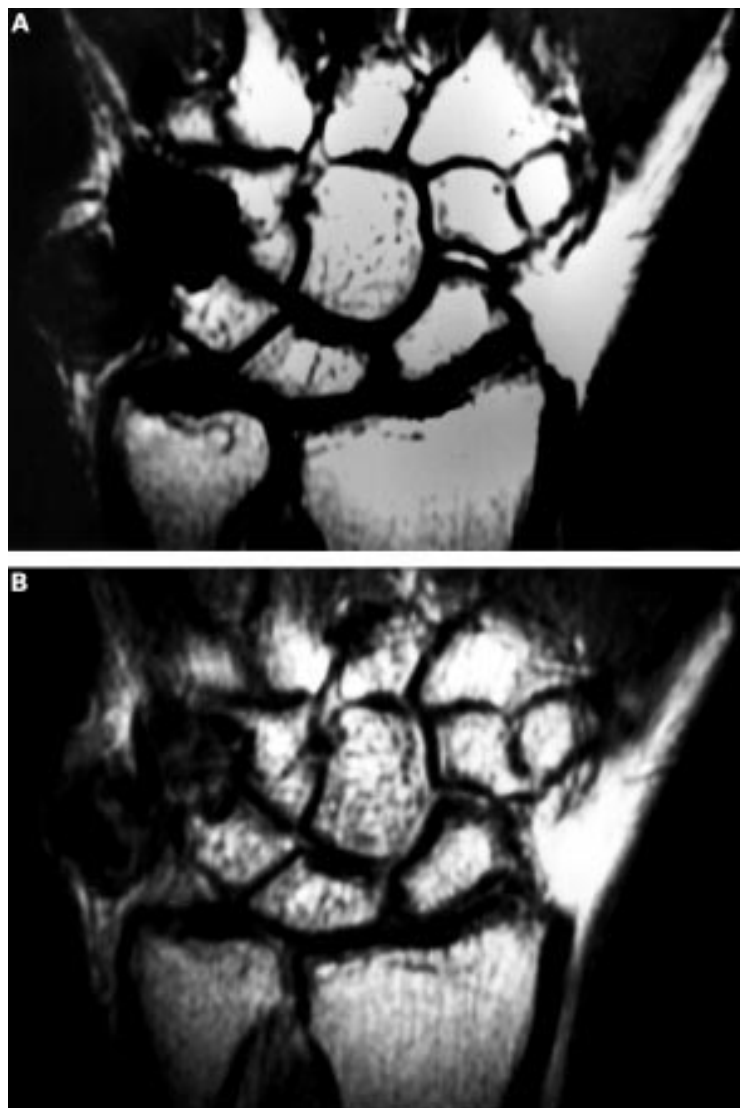


Figure 2 Coronal magnetic resonance images of the left wrist. (A) Spin echo T_1 weighted and (B) fast spin echo T_2 weighted images show a lobulated soft tissue mass eroding the triquetrum and hamate. The mass is largely hypointense on both sequences.

mineralised tissue, foreign body, air, amyloid deposition, or the presence of haemosiderin, which produces a magnetic susceptibility effect (box 1).⁵ Mineralisation due to calcification, ossification, or air can be excluded by careful evaluation of radiographs which should be available when interpreting MR scans of musculoskeletal masses. Fibrotic scar tissue and foreign bodies can usually be identified based on shape and location, together with a careful history and clinical examination. Hypocellular lesions with high collagen content, such as fibromatosis, nodular fasciitis, elastofibroma dorsi, and Morton's neuroma, though all displaying low T_2 signal intensity, can be differentiated by morphological appearances, site, and location.⁵

Diagnosis

The diagnosis was giant cell tumour of the tendon sheath (GCTTS), arising from the extensor carpi ulnaris tendon.

At surgery, a well encapsulated tumour extending from the tendon sheath of the extensor carpi ulnaris tendon and invading adjacent

Box 1 Lesions with low signal intensity on both T_1 and T_2 weighted images

Low cellularity/high collagen

- Fibromatosis
- Nodular fasciitis
- Elastofibroma dorsi
- Morton's neuroma

Haemosiderin deposition

- GCTTS/PVNS*
- Haemophilic arthropathy

Synovial amyloid

Fibrotic scar tissue

Mineralised lesions

- Calcification
- Ossification

Foreign body

Air

*GCTTS/PVNS = giant cell tumour of the tendon sheath/pigmented villonodular synovitis.

bones was found. The tumour was fleshy and yellowish-brown in colour. It was attached to the pisiform and thenar muscles. The tumour could be easily separated from the underlying bone and was excised en bloc. The excised specimen measured 2.4×1.7 cm. It had a multilobulated appearance with a yellow-brown cut surface. Histologically, it was a typical GCTTS, which was formed by areas of foam cells as well as areas of mononuclear cells, many of which contained haemosiderin particles (fig 4). The patient made a good postoperative recovery and was well on clinical follow up.

Discussion

GCTTS is part of the spectrum of a benign synovial proliferative disorder of unknown cause affecting the joints, bursae, and tendon sheaths. GCTTS (or nodular tenosynovitis) represents the extra-articular form of this entity whereas pigmented villonodular synovitis (PVNS) refers to the diffuse and nodular intra-articular form. GCTTS and PVNS are, however, histologically identical, differing in clinical presentation and behaviour, treatment, and prognosis. GCTTS can be further subdivided into the diffuse and localised types.⁶ The diffuse type of GCTTS is typically located in or around large joints and will not be further discussed. This article will concentrate on the localised type of GCTTS that is typically found in the hand and wrist.

Localised GCTTS, although considered a rare entity, is one of the commonest soft tissue masses of the hand. In a review of 3016 soft tissue tumours of the hand and wrist seen at the Department of Soft Tissue Pathology, Armed Forces Institute of Pathology, Washington DC, GCTTS comprised 18% of benign tumours. As this series consisted largely of consultation cases, there were relatively few ganglia, which is considered to be a much commoner lesion.¹ In an analysis of 18 677 benign soft tissue tumours from the same institution, GCTTS comprised 3.9% of cases.⁷ Ushijima *et al*, reporting 207

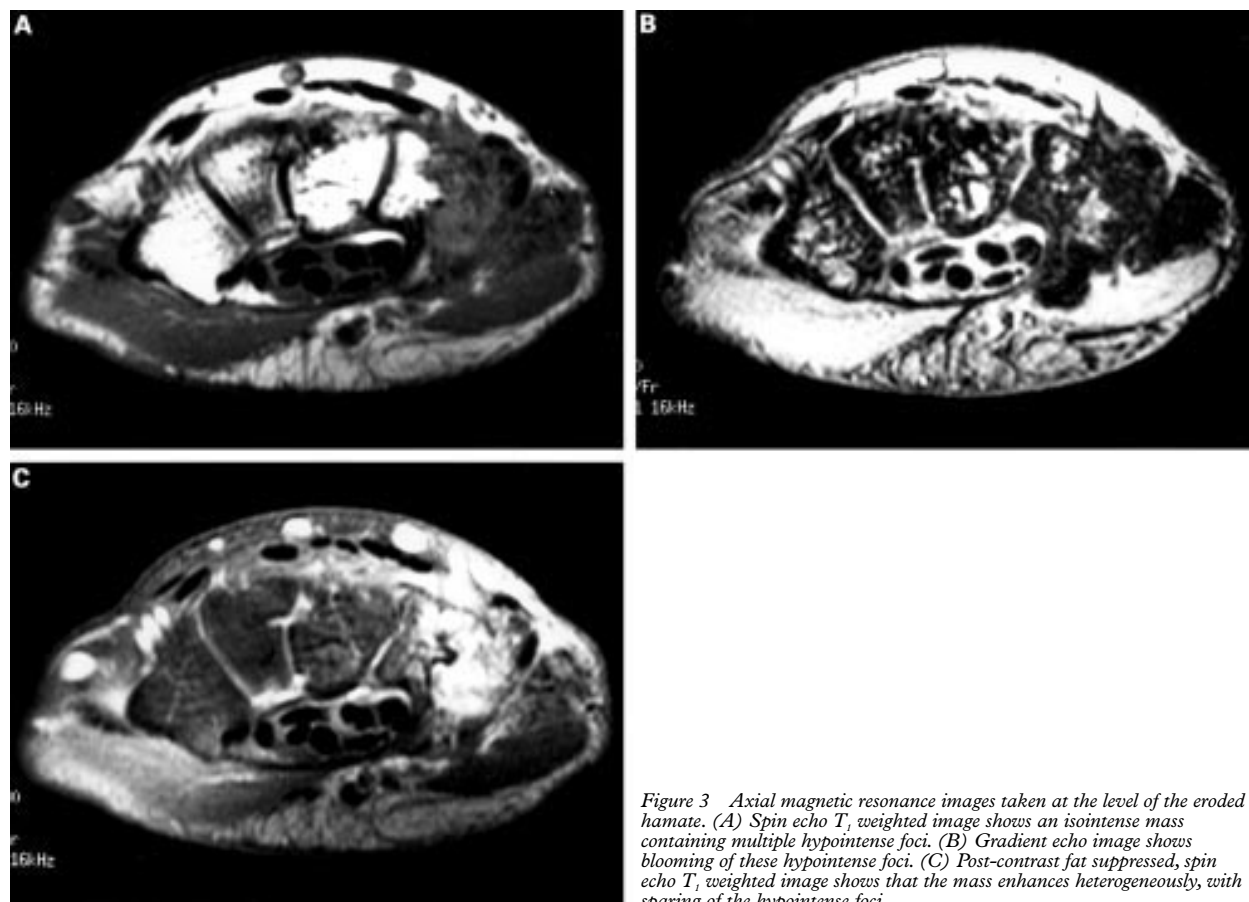


Figure 3 Axial magnetic resonance images taken at the level of the eroded hamate. (A) Spin echo T_1 weighted image shows an isointense mass containing multiple hypointense foci. (B) Gradient echo image shows blooming of these hypointense foci. (C) Post-contrast fat suppressed, spin echo T_1 weighted image shows that the mass enhances heterogeneously, with sparing of the hypointense foci.

cases of GCTTS, found GCTTS to be more than seven times as common as PVNS.⁸

GCTTS usually affects adults, with a peak incidence in the third to fifth decades of life. There is a slight female predominance, the female:male ratio being 1.5–2.1:1. GCTTS is located in the hand and wrist in 65–89% of lesions. In the hand the volar aspects of the first three digits are most commonly affected.^{6–10} Patients usually present with a painless soft tissue mass. The mass may be slowly growing or be static for many years. The mass is typically small, with an average size of 1.1 cm.¹¹ On palpation, the mass is freely mobile under the skin but remains attached to deeper structures.^{8–10}

At gross pathological examination, GCTTS is typically seen as a small rubbery well encapsulated mass. Its colour may be variable, ranging from yellow to brown, depending on the number of foam cells and amount of haemosiderin deposition within the tumour. The mass is often multilobulated. Microscopically, the tumour consists of histiocytic mononuclear cells, multinucleated giant cells, foam cells, and collagenous fibrous strands. Synovial hyperplasia and hypervascularity are features. Variable amounts of haemosiderin are present. The lesion is surrounded by a collagenous capsule that penetrates the lesion, subdividing it into smaller nodules.^{6–8} Malignant GCTTS is rare but has been described.¹²

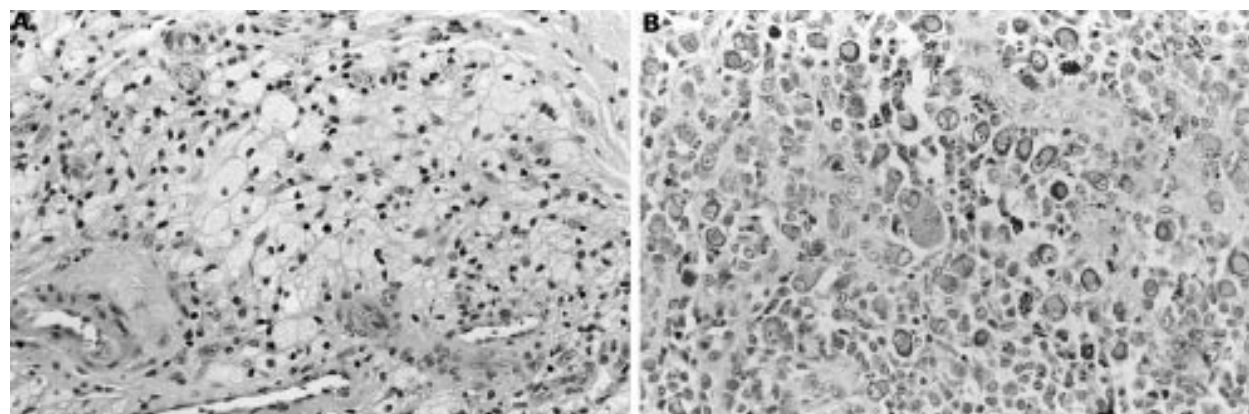


Figure 4 Photomicrographs show a typical giant cell tumour of the tendon sheath characterised by areas of foam cells (A) in a background of mononuclear cells (B), some of which contain haemosiderin particles (haematoxylin and eosin, magnification $\times 330$).

On radiographs, a soft tissue mass may be detectable. Pressure erosions are present in about 15–20% of cases.^{8–10} Other associated bone abnormalities include cystic change, degeneration, periosteal reaction, and calcifications.^{8–10} The presence of calcifications in a periarticular location should suggest the possibility of synovial sarcoma. However, 95% of synovial sarcomas are extra-articular, though they are often situated near a joint or tendon sheath. Calcifications occur in approximately 30% of these tumours.¹³

Ultrasonography shows markedly thickened synovium, complex heterogeneous echogenic masses, and loculated joint effusions. On power Doppler ultrasonography, increased flow in the synovial mass is typically seen. A pattern of relatively increased flow in the synovial capsule periphery may be present. These ultrasonographic findings are, however, non-specific and may be seen in synovitis of different aetiologies.^{14–15}

On computed tomography (CT) the presence of haemosiderin deposits within the lesion may produce areas of high attenuation. As the lesion is hypervascular, contrast enhancement is often present. CT is also useful in detecting small erosions not visible or not clearly defined on radiographs.^{15–17} Generally, imaging techniques, such as ultrasonography, CT, and bone scintigraphy, do not have a significant role in the assessment of GCTTS.

To date, there have only been a limited number of articles analysing the MRI appearances of GCTTS, with the first two reports appearing in 1989.^{18–19} This lesion is seen as a well defined soft tissue mass which is located adjacent to or partially enveloping a tendon. It has a predominantly hypointense signal (relative to skeletal muscle) on both T₁ and T₂ weighted images. This characteristically low signal intensity is due to abundant collagen as well as haemosiderin deposition, which produces a magnetic susceptibility effect.^{18–22} After contrast injection, strong enhancement is seen because of the presence of numerous proliferative capillaries in the collagenous stroma.²³

If the typical MRI appearances of GCTTS are present, the diagnosis can easily be made. However, the morphology of individual cases of GCTTS may be variable, and this is reflected in the MRI findings. If less haemosiderin is present, the predominant signal intensity of the lesion tends to be isointense rather than hypointense on T₁ weighted images.^{19–21} On T₂ weighted images, the lesion may be heterogeneously hyperintense, closely resembling other non-specific soft tissue tumours. We have found the presence of a hypointense capsule and multiple hypointense foci to be useful diagnostic features. These hypointense areas are seen on all pulse sequences, being more prominent (blooming effect) with increasing echo time (proton density and T₂ weighting) and on gradient echo

sequences. This is due to the magnetic susceptibility effect of haemosiderin deposits. We have also noted the presence of scattered tiny T₁ mildly hyperintense foci, which represents the lipid-laden foam cells found in GCTTS (Peh *et al*, unpublished data).

GCTTS is treated by local excision. Recurrence is, however, not uncommon, being seen in about 8–20% of patients.^{8–24} In summary, MRI is a valuable diagnostic tool for the preoperative diagnosis of GCTTS, particularly if the characteristic MRI features are present.

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