Imaging of hand and wrist masses. A University Hospital experience

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Purpose

The peripheral masses around hand and wrist are a common presentation in clinical practice. A vast majority of soft tissue mass lesions of the wrist and hand are benign [1, 2]. In our practice, the most common lesions encountered were ganglia (Fig 1-4). The most frequently seen solid masses include giant cell tumours of tendon sheath (GCTTS) (Fig 6-7), lipomas (Fig 21,22), Dupuytren's contractures (Fig 18), nerve sheath tumours (Fig 26-28), glomus tumours (Fig 24), haemangiom/a vascular malformations (Fig 9-12), tendon cheath fibroma (Fig 8) and synovial pathology (Fig 14,15). The malignant lesions are uncommon and include sarcoma, soft tissue osteosarcoma and squamous cell carcinoma (Fig 35-40). The ultrasound and MRI scans are not conclusive to differentiate between benign and malignant lesions, however in many circumstances a specific diagnosis may be achieved by taking into account the location of the lesion within the hand or wrist, its echogenicity/signal characteristics and presence or absence of neovascularity[2].

This pictorial review depicts the ultrasound and MRI appearances of the most commonly encountered soft tissue masses of the wrist and hand, encountered in a tertiary musculoskeletal centre over last 3 years.

Ganglion (Fig 1-4)

Ganglia are the most common cause for a palpable mass in the wrist and hand. Histologically, ganglia have a thin connective tissue capsule, but no true synovial lining, and contain mucinous material. Synovial cysts, which have a synovial lining, are histologically distinct from ganglia but are indistinguishable on imaging [6]. The terms "ganglion" and "synovial cyst" are therefore often used interchangeably.

Giant cell tumour of the tendon sheath (Fig 6-7)

Giant cell tumours of the tendon sheath (GCTTS) are benign tumors of unknown aetiology arising from the tendon sheath, considered as variant of pigmented villonodular synovitis (PVNS). These lesions usually affect the volar aspect of the first three digits [3-5], much less commonly affecting the wrist.

Fibroma of the tendon sheath (Fig 8)
This is a rare benign tumour of the tendon sheath which presents as firm, well-defined mass attached to the tendon sheath. The imaging appearances are similar to GCTTS.

Dupuytren's contracture (Fig 18)

Dupuytren's contracture is the proliferation of fibrous tissue within the palmar aponeurosis of the hand, which causes subcutaneous nodules on the palmar surface of the distal crease of the hand which progresses to cords and bands and, finally, the characteristic flexion contracture secondary to fibrous attachments to the underlying tendon sheath.

Lipoma (Fig 21,22)

Lipoma are the most common soft tissue tumour, however they are uncommon in the hand. They are lesions of mature adipose tissue which may occur in a subcutaneous or deep location, presenting as a slow-growing painless mass. Pressure effects can result on neighbouring structures such as nerves and vessels in locations where there is confined space, e.g. Carpal tunnel and Guyon's canal.

Schwannoma (Fig 27,28)

Schwannomas are common masses of the forearm and hand. Schwannomas arise from the schwann cells surrounding the nerve. In the hand and wrist, schwannomas arise from deeper and larger nerves (particularly the ulnar nerve) and often occur along the flexor surfaces.

Glomus tumour (Fig 24)

tumours are small hamartomas of the neuromyoarterial apparatus within the glomus body and are responsible for up to 5% of soft tissue tumours of the hand. They are most commonly found at the finger tip, either in the pulp or beneath the fingernail. Clinically, disappearance of pain after application of a tourniquet proximally on the arm is pathognomonic of the tumour and is known as the Hildreth sign.

Malignant masses (Fig 35-40)
Malignant tumours of the hand are uncommon. The lesions most often encountered are malignant fibrous histiocytoma in the older population, synovial sarcoma, rhabdomyosarcoma, malignant nerve sheath tumours, liposarcomas and extraskeletal chondrosarcomas. Because of non-specific morphological features, these tumours can be confused with benign lesions such as aggressive fibromatosis or ganglion cysts, particularly when they are small.

Synovial pathology (Fig 14,15)

Synovial hyperplasia and tenosynovitis can present as a focal masses around joints and tendons. This may occur as an isolated abnormality or in the setting of an arthropathy, particularly rheumatoid arthritis.

Foreign body granuloma

A foreign body granuloma is a reaction to exogenous materials that are too large to be ingested by macrophages. Initially there is suppuration around the foreign material. This is followed by granulomatous inflammation. In the later stage there is fibrosis. Hypo echoic lesion with an echogenic foreign body could be seen on ultrasound.

Foreign body granuloma (Fig 20)

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Miscellaneous findings (Fig 19, 25, 29, 30, 31, 32, 34)

Other rare findings that presented as lumps around the wrist included foreign body granuloma, displaced surgical anchor, haemangiopericytoma, osteophytes, sesamoid bones, thrombophlebitis and pseudoaneurysm.
Fig. 1: Ganglion cyst of the D2 flexor tendon on ultra sound, a. TS, b. LS

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Fig. 2: Ganglion cyst of the ulnar aspect of the wrist on ultra sound, a. panoramic view, b. LS

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**Fig. 3:** Ganglion cyst (yellow arrow) in the Guyon’s canal displacing the ulnar nerve (red arrow), sequential images

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Fig. 4: Ganglion cyst of the scapholunate ligament on MRI, a. axial T2 fat sat, b. coronal T2 fat sat

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**Fig. 5:** Giant cell tumor of the right D5 extensor tendon on ultrasound, a & b. LS and TS images, c & d. No significant Doppler flow, e. panoramic view

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Fig. 6: Giant cell tumor of the tendon around wrist on ultrasound, a. grey scale image, b. shows increased Doppler flow prompted for a MRI scan which confirmed GCT

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Fig. 7: Giant cell tumor of the wrist on MRI, a. T1 sagittal with Gad, b. T1 sagittal, c. T2 sagittal

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Fig. 8: Tendon sheath fibroma a. US LS image, b. US TS image

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**Fig. 9:** Arteriovenous malformation, US images a. axial, b. sagittal, c. Doppler showing flow

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Fig. 10: Arteriovenous malformation, MRI images a. T1w, b. T2w, c. T1 with Gadolinium

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Fig. 11: Haemangioma on ultrasound grey scale and Doppler (a & b), sclerotherapy with STD foam (c)

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Fig. 12: Haemangioma on MRI, a. axial T1, b. axial T2 STIR, c. T1 Gad

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Fig. 13: Calcium pyrophosphate dihydrate disease (CPPD) a & b x-ray appearance (DP & lateral) c & d MRI fat sat (axial & coronal)

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**Fig. 14:** Rheumatoid arthritis, a. US LS plane, b. US Doppler

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**Fig. 15**: Seronegative arthropathy with synovitis, a. gray scale image, b. Doppler image

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**Fig. 16:** Crystal arthropathy (calcium hydroxyapatite) a. x-ray appearance, b & d. US gray scale and Doppler images, c. CT appearance

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Fig. 17: Tophic gout of the right D3 PIPJ on ultrasound, a & b. hyper echoic foci represent crystals, c. increased Doppler flow

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Fig. 18: Dupuytren's disease of the palm a. US LS image, b. US TS image, c. US Doppler
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**Fig. 19:** Displaced anchor following a repair of Stener lesion a. post op, b. pre op.

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Fig. 20: Foreign body granuloma, central echoic foreign body with surrounding granuloma. a & b. US TS images, c. US LS image

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Fig. 21: Lipoma of the digit on MRI. a. T1 axial, b. T1 coronal, c. T2 STIR axial, d. T2 STIR coronal

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Fig. 22: Lipoma of the digit on ultrasound a. Grey scale image, b. US Doppler

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Fig. 23: A lesion on ultrasound which was indeterminate but considered benign (ganglion or GCT) went for biopsy, a. LS, b. TS

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Fig. 24: Glomus tumor of the finger a. grey scale image, b. Doppler image

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Fig. 25: Haemangiopericytoma of the finger, a. US image, b. pulse wave, c. Doppler flow

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Fig. 26: Neurogenic tumor on the radial aspect of the base of the proximal phalanx adjacent to the digital artery.

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**Fig. 27:** Schwannoma of the right median nerve US appearance showing eccentric location of the tumor (yellow arrow) compared to the nerve (red arrows).

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Fig. 28: Schwannoma of the right median nerve (yellow arrow), normal median nerve (red arrow). a. axial PD fat sat, b. axial T1, c. sagittal PD fat sat

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**Fig. 29:** Osteophytes from osteoarthritis presented as a lump at D4 DIPJ on US

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**Fig. 30:** Post surgical swelling a. US LS view, no significant Doppler flow, b. linear echogenic suture seen

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Fig. 31: Pseudoaneurysm of the radial artery after coronary angiography by radial access. US Doppler images

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Fig. 32: Sesamoid bone deep to flexor tendon presenting as a lump. a. US image, b. plain film

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Fig. 33: Tenosynovitis of the 2nd extensor compartment secondary to friction from metallic screws sticking out a. screws, b. tenosynovitis, c. Doppler flow

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Fig. 34: Thrombophlebitis around the right wrist a. LS with Doppler, b. TS image

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**Fig. 35:** Squamous cell carcinoma of the finger tip, characterized as benign lesion by US. a. gray scale image, b & c Doppler images

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**Fig. 36:** Soft tissue sarcoma of the hand a. Doppler, b. US

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Fig. 37: Soft tissue sarcoma of the hand, MRI a. sagittal post Gad, b. sagittal T1, c. axial T2, d. axial T1, e. axial post Gad

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Fig. 38: Sarcoma, panoramic view, sagittal. Proceeded for surgery.

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**Fig. 39:** Soft tissue osteosarcoma rare extra axial presentation - a & b. plain film appearance, c & d. US images

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Fig. 40: Soft tissue osteosarcoma, a rare extra skeletal presentation. a. T1 coronal, b. T2 coronal, c. T2 fat sat coronal, d. T2 fat sat sagittal

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Methods and Materials

We set out to perform a retrospective analysis through the radiology information system of a University Hospital looking specifically for the patients who were referred for hand and wrist ultrasound and MRI scans to image lumps, bumps, mass, swellings. The imaging requests for any other symptom were excluded from the study.

The request and report were analysed and specifically studied for the demographics, clinical details and outcome i.e. benign, malignant or inconclusive lesions and possible further imaging. The data was tabulated and analysed.
Results

The total number of patients included in the study was 370, out of which 37 were normal and 333 (Fig 411) were pathological in nature. The pathological scans were further studied.

Among the pathological scans, there were 118 males + 215 females. The age range was between 18 and 91 years old. Median age was 51 years old.

Initial scans performed were 27 MRI and 306 ultrasound. 11 patients after ultrasound proceeded to have MRI for further evaluation.

Primary diagnosis from the above imaging included 305 (Fig 42) benign lesions which did not have any further imaging. There were 24 intermediate lesions out of which 17 had further evaluation. There were 4 malignancy.

In the intermediate group (Fig 43), 5 were intermediate, 17 were intermediate probably benign and 2 were intermediate probably malignant. The 17 patients who were evaluated further had 8 MRI, 8 excision biopsy and 1 CT scan.
Fig. 41: Chart 1, Total lesions

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**Fig. 42:** Chart 2, Benign lesions

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![Pie chart showing categories of lesions: 17 indeterminate, 2 indeterminate but probably benign, 5 indeterminate but probably malignant.]

**Fig. 43:** Chart 3, Total intermediate lesions

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Conclusion

The ultrasound and MRI scans are not conclusive to differentiate between benign and malignant lesions, however in many circumstances a specific diagnosis may be achieved by taking into account the location of the lesion within the hand or wrist, its echogenicity/signal characteristics and presence or absence of neovascularity[2].
References

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