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Role of Ultrasonography in Diagnosing Wrist Pathologies and to Correlate with Magnetic Resonance Imaging: A Cross Sectional Study

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I. INTRODUCTION

- **Wrist and hand disorders have a strong impact on the daily activities of patients**. A **correct diagnosis** is **crucial for accurate patient management and prompt recovery.**
- Sonography is an easily accessible, rapid, radiation-free, non-invasive imaging technique with useful dynamic capabilities suitable to study small and superficial structures.
- Wrist magnetic resonance imaging can be challenging and expensive; therefore, it is usually performed as a second-line imaging modality.
- In daily clinical practice, **indications for wrist and hand sonography are frequently based on the experience of the referring physician** and sonographer but are still not supported by a defined "evidence- based" approach.
- The level of evidence for the use of wrist and hand sonography is **still low**, and more studies are recommended on this topic.

AIMS AND OBJECTIVES

- **Aim:** To determine the role of ultrasonography in diagnosing various wrist pathologies and to correlate the findings with MRI.

- **Objectives:**

1) To evaluate a patient with suspected wrist pathology by USG (Ultrasonography) as the first imaging modality and to arrive at a diagnosis.
2) To compare the sonographic diagnosis with that of MRI (Magnetic Resonance Imaging).

METHODOLOGY

The patients were included for the study based on the inclusion and exclusion criteria mentioned as follows: -

- **Inclusion criteria:** 1. Patients belonging to all age groups presenting with symptoms related to wrist joint. 2. Patients presenting with swelling in the wrist area.
- **Exclusion Criteria:** 1. Open fractures 2. Non-consenting cases

Methodology: The patients included in the study underwent sonographic evaluation after an initial clinical examination. A sonographic diagnosis was made. Following which patients underwent MRI imaging. The diagnosis made by sonographic evaluation and MRI evaluation was then compared.

- **Imaging tools used:**
- Philip Epiq 5G – Probes used: L12-4, L12-5
- Philips Affiniti 30 - Probes used: L12-3, L12-5
- Samsung HERA W9 - Probes used: L12-5
- Siemens MAGNETOM Avanto **1.5T**

MRI Sequences used for the study:

1. PD FS - Axial, coronal and sagittal
2. Non PD FS – Axial, coronal and sagittal
3. STIR Axial
4. T2 FS Coronal
5. T1 Axial and coronal.

- Average time period for sonographic evaluation of wrist: **15 minutes**
- Average time period for MRI evaluation of wrist: **30 minutes; 45 minutes with Gadolinium based contrast.**

Ultra sonographic examination

- USG examinations were performed using **linear array transducer**.
- During examination of wrist joints, the patient was examined in supine or sitting upright

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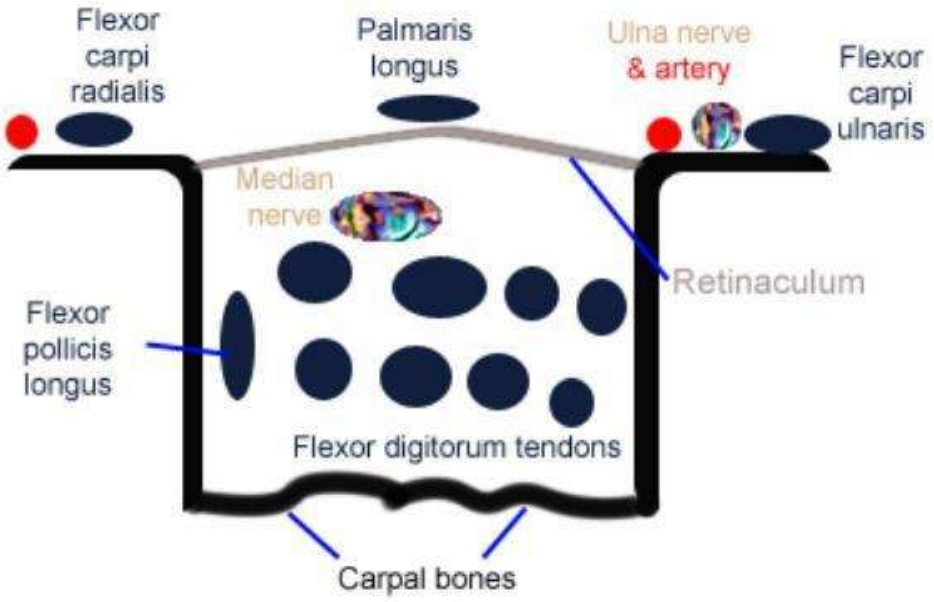
positions, with the hand placed on a cushion and fully pronated then supinated.

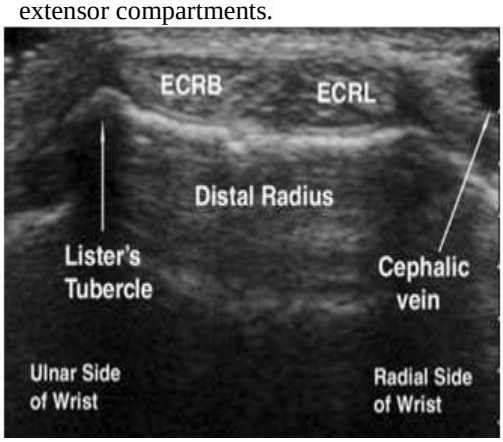
- The standard USG examination of the wrist begins with evaluation of its extensor aspect; then, we follow by the flexor aspect.
- According to the clinical presentation of the patient, USG images can be obtained in different positions of the wrist (flexion and extension, pronation and supination), with the patient seated in front of the examiner.

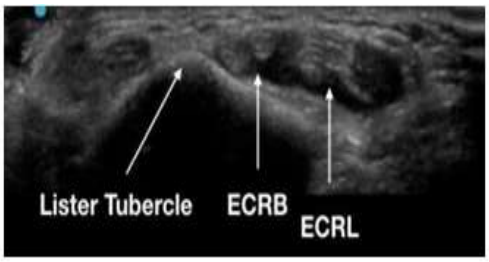


We begin with the examination of dorsal aspect by placing the transducer on a transverse plane over the extensor aspect of the wrist to identify the extensor tendons.

In general, one should first recognize a given tendon and then follow it on short-axis planes down to the distal insertion with careful examination of the following compartments:

1. We start by first identifying **the Lister's tubercle** which is a bony landmark on distal radius that separates the second and third extensor compartments.





2. The first compartment by positioning the patient's wrist halfway **between pronation and supination**; we place the probe over the lateral aspect of the **radial styloid** to examine the first compartment of the extensor tendons—abductor pollicis longus (ventral) (APL) and extensor pollicis brevis (dorsal) (EPB).

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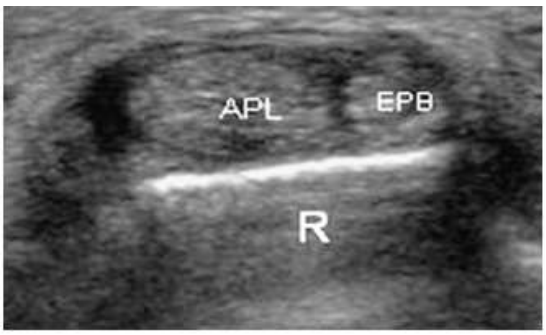
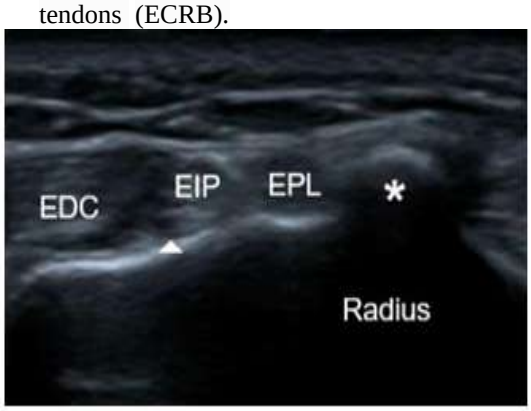
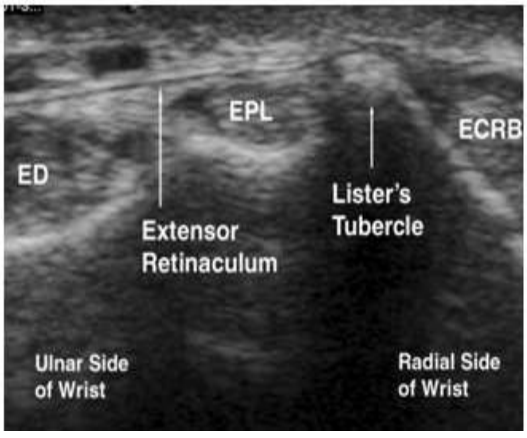
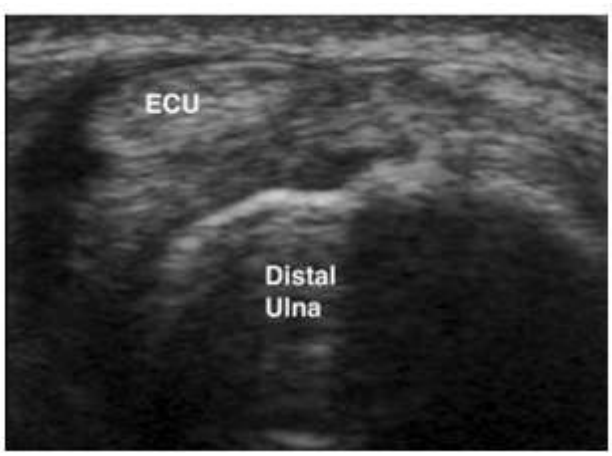


3. With the palmar aspect of the wrist facing the examination table, shift the probe medially on transverse planes to visualize the second compartment—extensor carpi radialis longus (ECRL) and extensor carpi radialis brevis tendons (ECRB).





4. On the medial side of the Lister's tubercle, the extensor pollicis longus (EPL) tendon is identified and examined.



5. For the examination of the fourth and fifth compartments, we place the transducer on the transverse plane over the mid dorsal wrist to examine the fourth compartment (extensor digitorum communis – EDC, and extensor indicis proprius- EIP) and fifth compartment (extensor digiti minimi tendon - EDM).

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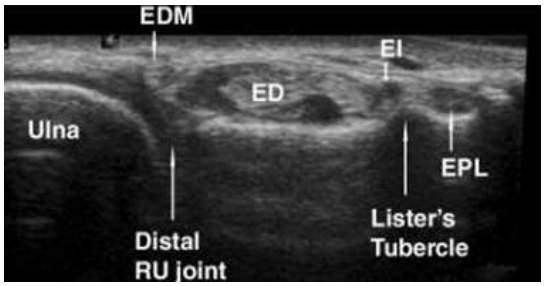
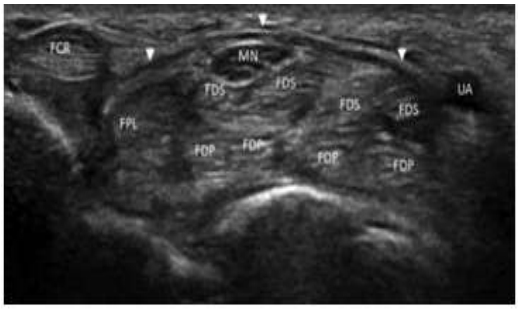
FIRST IMAGE: Ultrasound of the Extensor Digitorum Communis tendon at the level of the extensor retinaculum.
SECOND IMAGE: Ultrasound of the common extensor digitorum tendons which has divided into 4 proximal to the wrist crease.

6. For the examination of the sixth compartment, namely the extensor carpi ulnaris tendon, we place the wrist in slight radial deviation. Axial and longitudinal plane images should be obtained over this tendon.



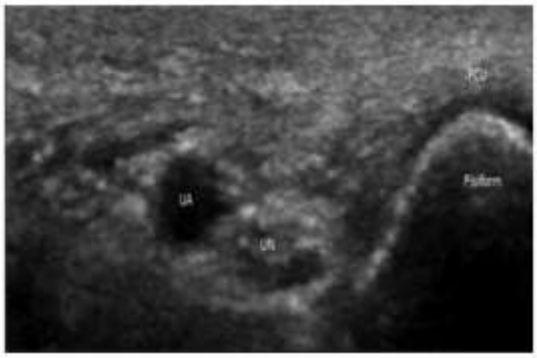
Transverse sonogram shows the third through the fifth extensor compartments. Note the position of the extensor digiti minimi (EDM) tendon, above the distal radioulnar (RU) joint.

7. For the examination of the ventral aspect of the wrist, namely the proximal **carpal tunnel**, the patient keeps the dorsal wrist facing the examination table. We search for the bony landmarks of the proximal carpal tunnel—the scaphoid tubercle (radial sided) and the pisiform (ulnar sided)—placing the probe over the palmar crease on axial plane. The following contents are checked: flexor retinaculum and nine long flexor tendons.
8. For the examination of the distal carpal tunnel, we move the probe to a more distal transverse plane to identify the two bony landmarks of the distal carpal tunnel—the trapezium tubercle (radial sided) and the hamate hook (ulnar sided).



- **Image showing**: Flexor carpi radialis tendon and carpal tunnel. During a volar examination of the wrist, a transverse scan depicts the flexor pollicis longus (FPL) tendon, the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) tendons, as well as the median nerve (MN), all running through the carpal tunnel. The flexor retinaculum (arrows) circumscribes the carpal tunnel superiorly and is hypoechoic because of anisotropy. Right above the carpal tunnel, the flexor carpi radialis (FCR) tendon and ulnar artery (UA) are visualized.

- **Guyon canal** and flexor carpi ulnaris tendon. During a volar examination of the wrist, a transverse scan shows the ulnar artery (UA) and ulnar nerve (UN) within the Guyon canal. The ulnar nerve appears as a fascicular structure, and it has already divided into its superficial and deep branches. The ulnar artery is anechoic. On the ulnar side, the Guyon canal is delimited by the pisiform bone and flexor carpi ulnaris (FCU) tendon



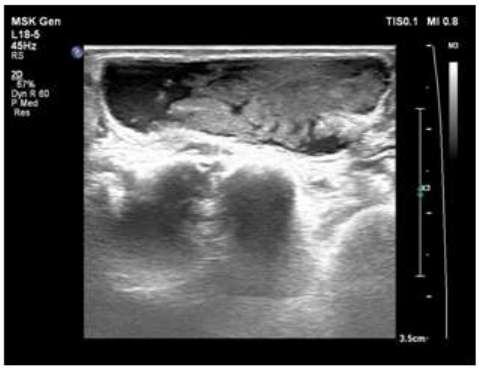
II. RESULTS

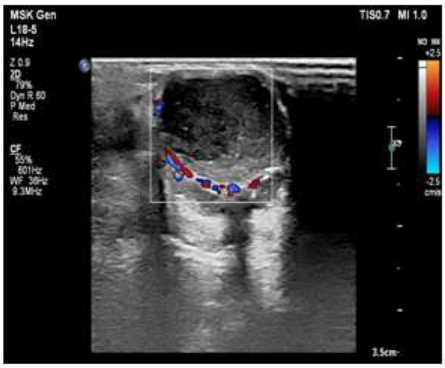
- Out of the total **15 cases** included in our study, the diagnosis of **10** cases was correlating on both USG and MRI imaging modalities.
- Among the 10 correlating cases, **6** were diagnosed to be **Ganglion cysts**, **2** cases of **Rheumatoid arthritis**, **1** case Of **infective arthritis** and **1** case of **Neurogenic tumour /Soft tissue neoplasm**.
- Further, among the above mentioned 10 cases, a **clinical suspicion of CTS** was made for one of the subjects; however the median nerve was normal on USG, MRI and including NCS.
- **1** out of the 15 cases showed **partly correlating** finding on USG and MRI imaging modalities, namely Extensor Carpi Ulnaris tendinosis. The same subject also had partial **injury to the ulnar carpal collateral**

ligament and ulnomeniscal homologue which, however, could not be detected by USG but were picked up on MRI.

- **4** out of the remaining 15 cases did not show any correlating findings on both USG and MRI imaging Modalities.
- Among the 4 non-correlating cases, 1 was a case of **subtle fracture** scaphoid and trapezoid bones with sprain of radial collateral ligament and adjacent soft tissue edema, 1 case of subtle old scaphoid bone fracture with injury to the **TFCC**, 1 with dorsal intercarpal ligament sprain and 1 with pronator quadratus sprain, all of which were detected only on **MRI**.

CASE 1 : SONOGRAPHIC IMAGES OF A 55 YEAR OLF LADY WITH RIGHT WRIST SWELLING FOR 1.5 YEARS AND AN ELEVATED RA FACTOR SHOWING **DISTENDED FLUID FILLED CAPSULAR RECESS WITH SYNOVIAL HYPERTROPHY AND INCREASED VASCULARITY** WHICH WAS **PARTLY COMPRESSIBLE** ON TRANSDUCER PRESSURE. THE SAME PATEINT ALSO HAD UNDERLYING BONY EROSIONS SEEN ON SONOGRAPHY. A SONOGRAPHIC DIAGNOSIS OF **SYNOVITIS WITH ARTHRITIS** WAS MADE.





X RAY IMAGES OF THE PATIENT SHOWED **BONY EROSIONS** INVOLVING THE WRIST JOINT WITH **JOINT SPACE NARROWING.**

MRI OF THE SAME PATIENT SHOWED **BONY EROSIONS** IN DISTAL ASPECTS OF RADIUS, ULNA AND CARPAL BONES WITH ARTICULAR SURFACE IRREGULARITIES, **JOINT NARROWING**, **CYSTIC AREAS** IN DORSUM OF HANDS AND INTEROSSEOUS SPACE AND MARKED **SYNOVIAL HYPERTROPHY.**

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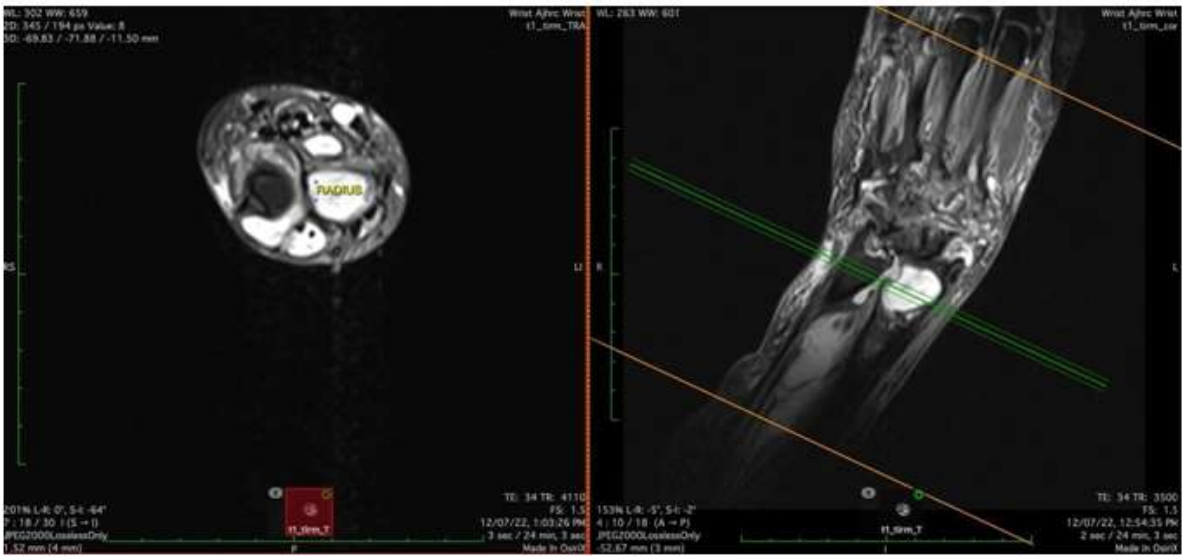
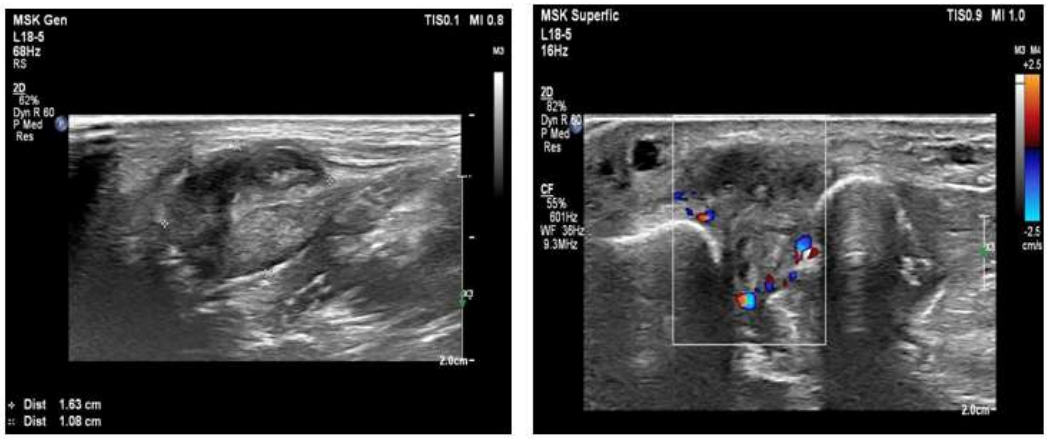


CASE 2: SONOGRAPHIC EVALUATION OF A 25 YEAR OLF FEMALE PATIENT WITH COMPLAINTS OF RIGHT WRIST SWELLING, PAIN AND A NEGATIVE WORK UP FOR ARTHRITIS SHOWED A WELL DEFINED OVOID HYPOECHOIC VASCULAR LESION DEEP TO EXTENSOR TENDON BETWEEN THIRD AND FOURTH METACARPALS SUGGESTING LIKELY POSSIBILITIES OF **SOFT TISSUE NEOPLASM / NEUROGENIC TUMOR.**



SERIAL MRI IMAGES OF THE SAME PATIENT SHOWING AN ALTERED SIGNAL INTENSITY LESION MEASURING ABOUT 1.29cm X 2.47cm IN THE DISTAL DORSAL ASPECT BETWEEN THE THIRD AND FOURTH METACARPALS WHICH WAS **ISOINTENSE ON T1 WEIGHTED IMAGES, HETEROGENOUSLY HYPERINTENSE ON T2/ STIR AND SHOWING NO DIFFUSION RESTRICTION. THERE WAS EFFACEMENT OF ADJACENT SMALL MUSCLES OF THE HAND WITH INDISTINCT PLANES**. THE UNDERLYING BONES, JOINTS AND SURROUNDING SOFT TISSUE APPEARED NORMAL WITH NO OBVIOUS MAJOR NEUROVASCULAR INVOLEMENT. MR MORPHOLOGY WAS SUGGESTIVE OF PERIPHERAL NERVE SHEATH TUMOR / HEMANGIOMA AND FURTHER EVALUATION WAS SUGGESTED. ON LAST FOLLOW UP HOWEVER, NO FURTHER PROCEDURES WERE DONE.

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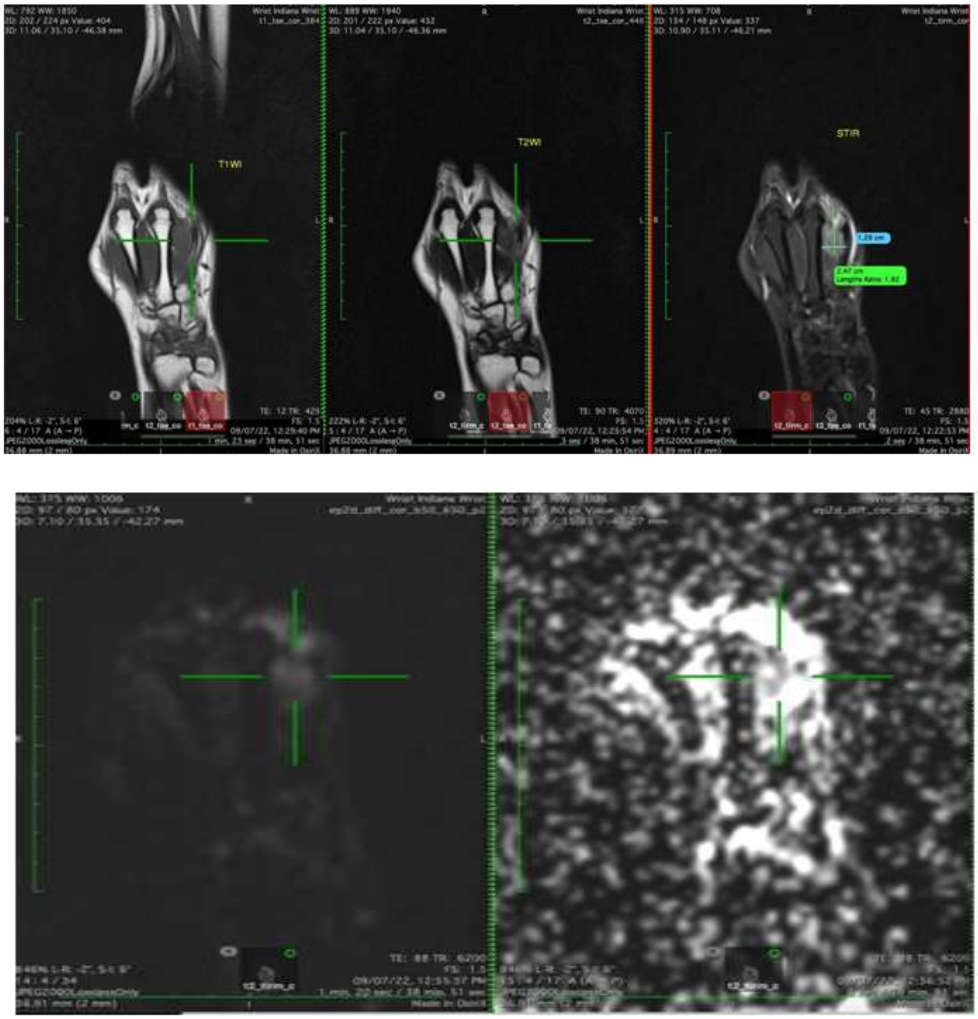
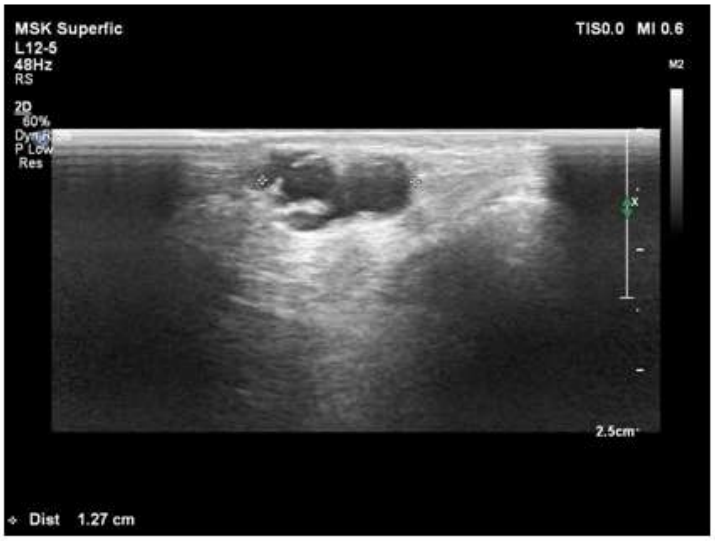


CASE 3: SONOGRAPHIC IMAGE OF A 23 YEAR OLD FEMALE PATIENT WITH COMPLAINTS OF SWELLING OVER DORSUM OF LEFT WRIST SHOWED A WELL DEFINED CYSTIC LESION SUGGESTIVE OF **GANGLION CYST**. THE DEEPER EXTENT HOWEVER COULD NOT BE PROPERLY ASSESED ON ULTRASOUND.



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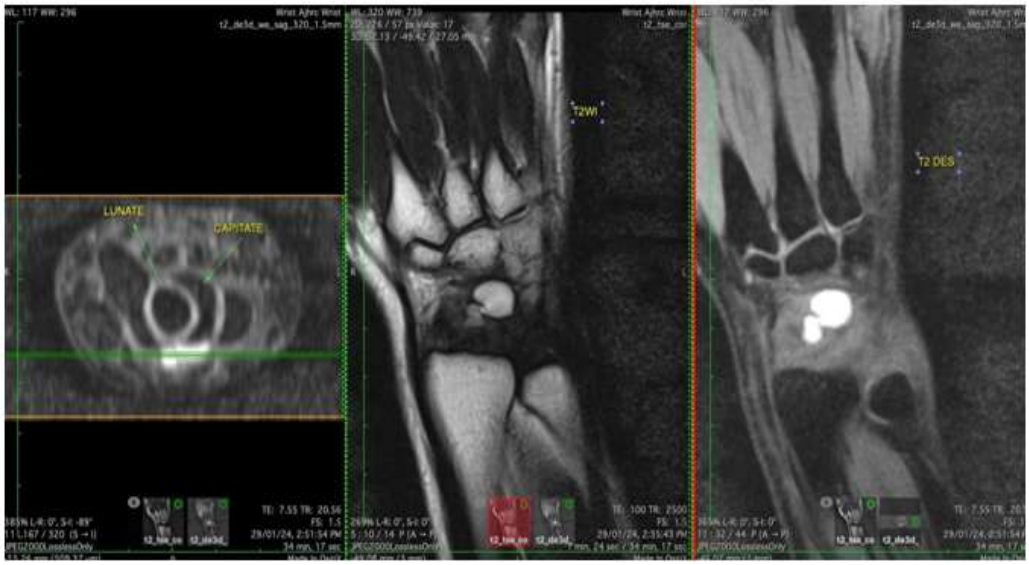
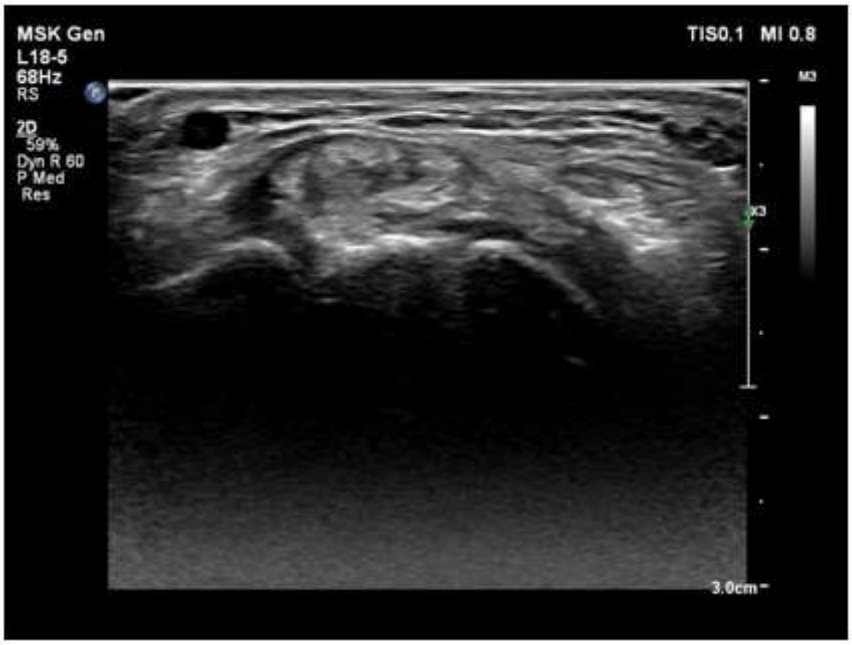
MRI IMAGES OF THE SAME PATIENT SHOWED WELL DEFINED CYSTIC ALTERED SIGNAL INTENSITY LESION IN DORSUM OF THE LEFT WRIST ARISING FROM THE UNDERLYING **CAPITO-LUNATE JOINT SPACE** CONSISTENT WITH GANGLION CYST



CASE 4: NORMAL SONOGRAPHIC IMAGES OF A 22 YEAR OLD FEMALE PATIENT WITH HISTORY OF FALL FOLLOWING WHICH SHE COMPLAINED OF PAIN OVER RIGHT WRIST.



MRI IMAGES OF SAME PATIENT SHOWED FOCAL AREAS OF ALTERED SIGNAL INTENSITY IN THE **PRONATOR QUADRATUS MUSCLE** WHICH WAS CONSISTENT WITH **SPRAIN**.

III. DISCUSSION

- The various pathologies included in our study could be broadly classified as solid lesions, cystic lesions, tenosynovitis, ligamentous injuries, osseous and joint space pathologies.
- The most common wrist pathology in our study was that of ganglion cyst.
- USG is a good modality in the characterization of mass lesions as solid or cystic and assessment of lesion size, internal structure vascularity, and its relation to surrounding structures.

- USG, however, has a limited role in assessing osseous and ligamentous abnormalities of the wrist like subtle carpal bone fractures, marrow edema, TFCC injury, etc, in whom MRI has the upper- hand.

IV. CONCLUSION

Based on the findings of our study following conclusions could be drawn out :

- Clinical examination of the wrist joint does not provide adequate insight on the cause of wrist pain.
- **USG** is **an easy, readily available, inexpensive** imaging tool that allows good assessment of **solid and cystic** lesions of the wrist, its **internal structures and vascularity**, as well as its **relation** to the adjacent structures in real- time. A cyst appears as a well-circumscribed walled lesion, anechoic with posterior acoustic enhancement.
- **Significant** advantages of USG over MRI are the ability to **home in on the area of symptoms** and the ability of dynamic examination of the tendons and **comparison** of the finding in one side with the contra-lateral side.
- USG is also better than MRI in the detection of **soft calcifications** in peri-arthritis or tendinitis.
- However, USG is **operator dependent**.
- **MRI** has an upper hand in detecting **osseous and ligamentous** abnormalities of the wrist.
- MR imaging helps discriminate between **benign and malignant** lesions. MR imaging shows features of aggressiveness and signs of malignancy: poorly defined margins, invasion of intravascular, nervous or osseous structures, peritumoral edema, heterogeneous signal in case of necrosis, and intense enhancement.
- Even though MRI is not operator dependent, it is however, **time consuming** and an **expensive** imaging modality and does not allow for real time and quick assessment.
- In conclusion, USG along with MRI is better for a quick and decisive diagnosis for the wrist joint pain with accuracy.

KEYWORDS:

- USG- Ultrasonography.
- MRI- Magnetic Resonance Imaging
- PNST- Peripheral Nerve Sheath Tumor
- CTS- Carpal Tunnel Syndrome
- NCS- Nerve Conduction Study

BIBLIOGRAPHY

[1]. Wong DC, Wansaicheong GK, Tsou IY. Ultrasonography of the hand and wrist. Singapore Med J. 2009; 50(2): 219- 25.

[2]. Hemeeda Y, Maaly M, El-kholy M. Role of MRI in evaluation of painful wrist joint, Menofia Medical journal. 2015; 28(2): 503-507.

[3]. Chail V, NA, Balasubramanyam R, Singh R, Chail R. MR Evaluation in non Traumatic Chronic Wrist Pain. International Journal of Contemporary Medicine, Surgery and Radiology. 2020; 5(1).

[4]. Hampole AB, Jeevika MU, Nirnay KK, Hita S, Anup SL, Ganesh G. Ultrasonography and MRI Evaluation in Wrist Joint Pain. Asian J. Med. Radiol. Res. 2021; 9(1): 17-22.

[5]. El Shibiny A, Abdul Rahim S, AL Jbory N. Assessment of wrist joint pain by Magnetic Resonance Imaging. Sohag Medical Journal. 2019; 23(2): 31-40.

[6]. Bianchi S, Santa D, Glauser T, Beaulieu J, van Aaken J. Sonography of Masses of the Wrist and Hand. American Journal of Roentgenology. 2008; 191(6): 1767-1775.

[7]. Singh K, Thukral C, Gupta K. Tendo-ligamentous pathologies of the wrist joint: Can ultrasonography replace magnetic resonance imaging? The Egyptian Journal of Radiology and Nuclear Medicine. 2017; 48(3): 653-660.

[8]. Sit W, Tse S, Chu P, Lo K. Benign Soft Tissue and Osseous Tumors of the Hand: a Pictorial Essay. Hong Kong Journal of Radiology. 2020; 23(4): 289-300.

[9]. El-Deek A, Dawood E, Mohammed A. Role of ultrasound versus magnetic resonance imaging in evaluation of nonosseous disorders causing wrist pain. Egyptian Journal of Radiology and Nuclear Medicine

[10]. Nung R, Lee R, Ng A. Ultrasonographic Findings of Suspected Retained Foreign Body in Soft Tissue Following Penetrating Injury. Hong Kong Journal of Radiology. 2017; 76-83