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## Study of High Frequency Ultrasonography's Role in Evaluation of Hand and Wrist Pathologies.

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### ABSTRACT

High frequency ultrasonography (HFUS) has become increasingly valuable in assessing hand and wrist pathologies due to its non-invasive nature and high-resolution imaging capabilities. Ultrasound factors play a significant role in diagnosis of various pathologies in human body, particularly hand and wrist, structures of which are relatively superficial as compared to other parts of the body, such as abdomen and pelvis. This study examines the ultra-sonographic findings of hand and wrist pathologies in 61 patients who were referred to Department of Radio diagnosis. Data on age, sex and ultrasound findings were collected and analysed using descriptive statistics. Multiple hand and wrist pathologies were identified such as ganglion cyst (29.5%), tenosynovitis (21.3%), bursitis (13.1%), carpal tunnel syndrome (13.1%), and inflammatory synovitis (8.1%), thickening of finger pulleys (6.5%), post traumatic tendon rupture (6.5%) and giant cell tumour of tendon sheath / PVNS. (1.6%). Mostly the patients were >40 years of age with predominant female predilection. Findings suggest that middle-aged females, were mostly affected by hand and wrist pathologies and high frequency ultrasound plays an essential role in their diagnosis. Thorough knowledge of anatomy of wrist and its appearance on ultrasound is essential to give accurate diagnosis.

**Keywords:** ultrasound, hand and wrist.

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## INTRODUCTION

High frequency ultrasonography (HFUS) has become increasingly valuable in assessing hand and wrist pathologies due to its non-invasive nature and high-resolution imaging capabilities. This study investigates HFUS's role in diagnosing various conditions affecting the hand and wrist among 61 participants. Using descriptive methodology, the study explores the prevalence of pathologies such as ganglion cysts, tenosynovitis, bursitis, and carpal tunnel syndrome. Through detailed ultrasound imaging, abnormalities in flexor and extensor tendons, as well as specific pathologies, are visualized and characterized. Understanding the efficacy of HFUS in diagnosing and monitoring these conditions is crucial for optimizing patient care and treatment outcomes. The continuous development of ultrasound devices and transducers has led to a systematic increase in the importance of ultrasonography in the diagnosis of musculoskeletal diseases, including hand and wrist pathologies [1-3]. Ultrasound imaging of the musculoskeletal system is superior to other imaging methods in many aspects, such as multidimensional character of imaging, possibility of dynamic evaluation and precise assessment of soft tissues. Moreover, it is a safe and relatively inexpensive method, broadly available and well-tolerated by patients. However, the knowledge of anatomy is crucial to establish a correct ultrasound diagnosis [4].

## METHODOLOGY

The study aimed to investigate the role of high frequency ultrasound to evaluate the hand and wrist pathologies among a sample of 61 participants who were referred to Department of Radio diagnosis. A descriptive was employed, wherein individuals from various demographic backgrounds were recruited through convenience sampling. Ethical approval was obtained from the relevant institutional review board, and informed consent was obtained from all participants prior to their inclusion in the study.

Data collection was carried out high frequency transducers i.e. linear transducer (14L5) and hockey-stick transducer (17H7) compatible with TOSHIBA XARIO 200 Ultrasonography machine. Study period was 6 months (from May 2023 to October 2023)



**Figure 1: Hockey-stick transducer (17H7) compatible with TOSHIBA XARIO 200 Ultrasonography machine**



**Figure 2: Linear transducer (14L5) compatible with TOSHIBA XARIO 200 Ultrasonography machine**

**RESULTS**

**Table 1: Pathologies of hand and wrist detected on Ultrasound**

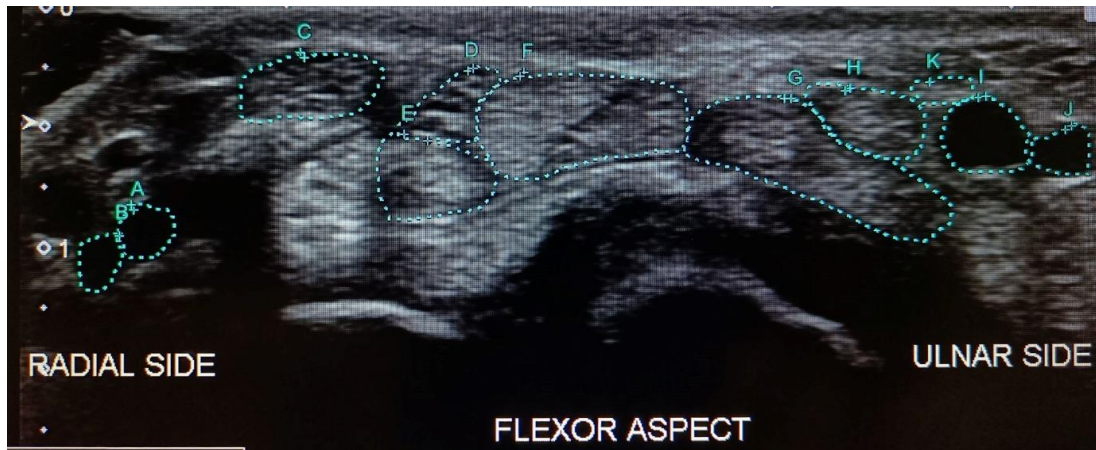
<b>Pathologies</b>	<b>No Of Cases</b>	<b>Percentage</b>
Ganglion Cyst	18	29.5
Tenosynovitis/ Tendinosis	13	21.3
Bursitis	8	13.1
Carpal Tunnel Syndrome	8	13.1
Inflammatory Synovitis	5	8.1
Thickening Of Pulleys Of Fingers	4	6.5
Post Traumatic Tendon Rupture	4	6.5
Giant Cell Tumor Of Tendon Sheath	1	1.6
<b>Total</b>	<b>61</b>	<b>100</b>

**Table 2; Age wise distribution of the patients**

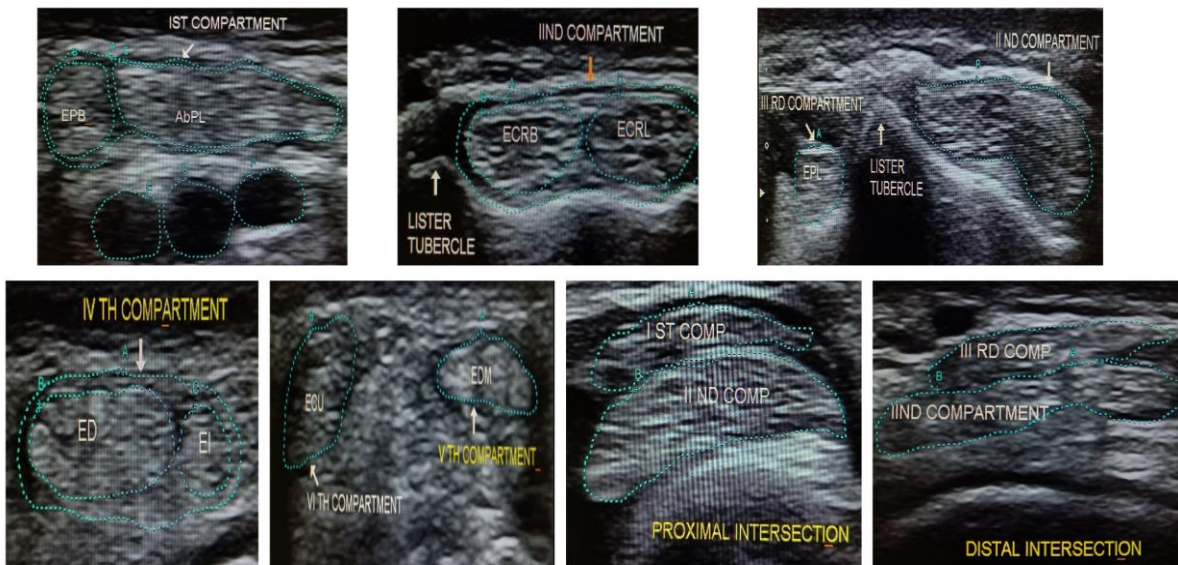
<b>Age (Years)</b>	<b>No. Of Cases</b>	<b>Percentage (%)</b>
0 -10	0	0
10-20	4	6.5
20-30	8	13.1
30-40	10	16.3
40-50	14	22.9
50-60	16	26.2
>60	9	14.7
<b>TOTAL</b>	<b>61</b>	<b>100</b>

**Table 3: Gender wise distribution of the patients**

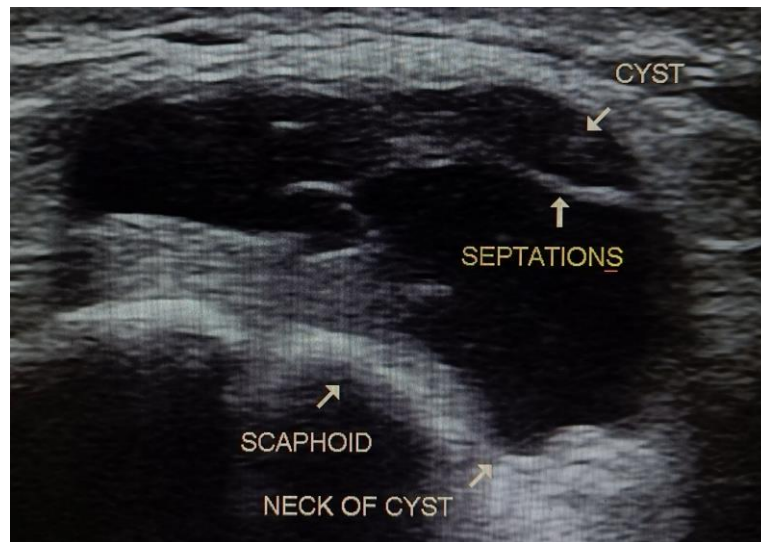
Sex	No Of Cases	Percentage
MALE	24	40
FEMALE	37	60
TOTAL	61	100



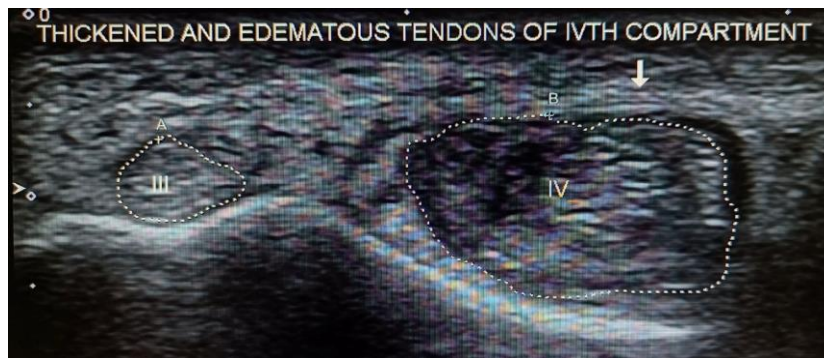
**Figure 3: Normal appearance of flexor wrist tendons on USG- A & B- Radial vessels, C- Flexor Carpi Radialis Tendon, D- Median Nerve, E- Flexor Pollicis Longus Tendon, F- Flexor Digitorum Superficialis Tendon, G- Flexor Digitorum Profundus Tendon, H- Flexor Carpi Ulnaris Tendon, I & J- Ulnar Vessels, K- Ulnar nerve**



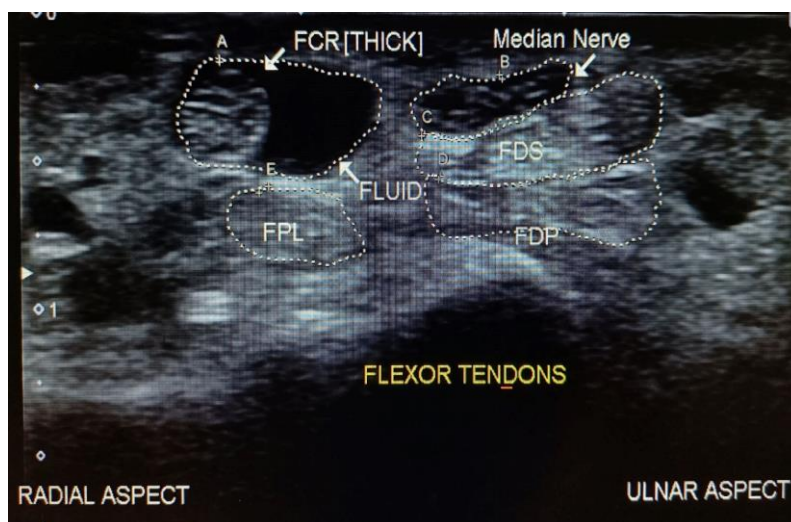
**Figure 4: Normal appearance of extensor wrist tendons on USG- EBP- Extensor Pollicis Brevis, AbPL- Abductor Pollicis Longus, ECRB- Extensor Carpi Radialis Brevis, ECRL- Extensor Carpi Radialis Longus, EPL- Extensor Pollicis Longus, ED- Extensor Digitorum, EI- Extensor Indices, EDM- Extensor Digiti Minimi, ECU- Extensor Carpi Ulnaris**



**Figure 5: Ganglion Cyst: Anechoic cystic lesion arising from dorsum of right wrist of a 27 year old female with internal septations. Posterior Acoustic enhancement is seen. On color doppler, no internal or peripheral vascularity is seen (Not shown)**



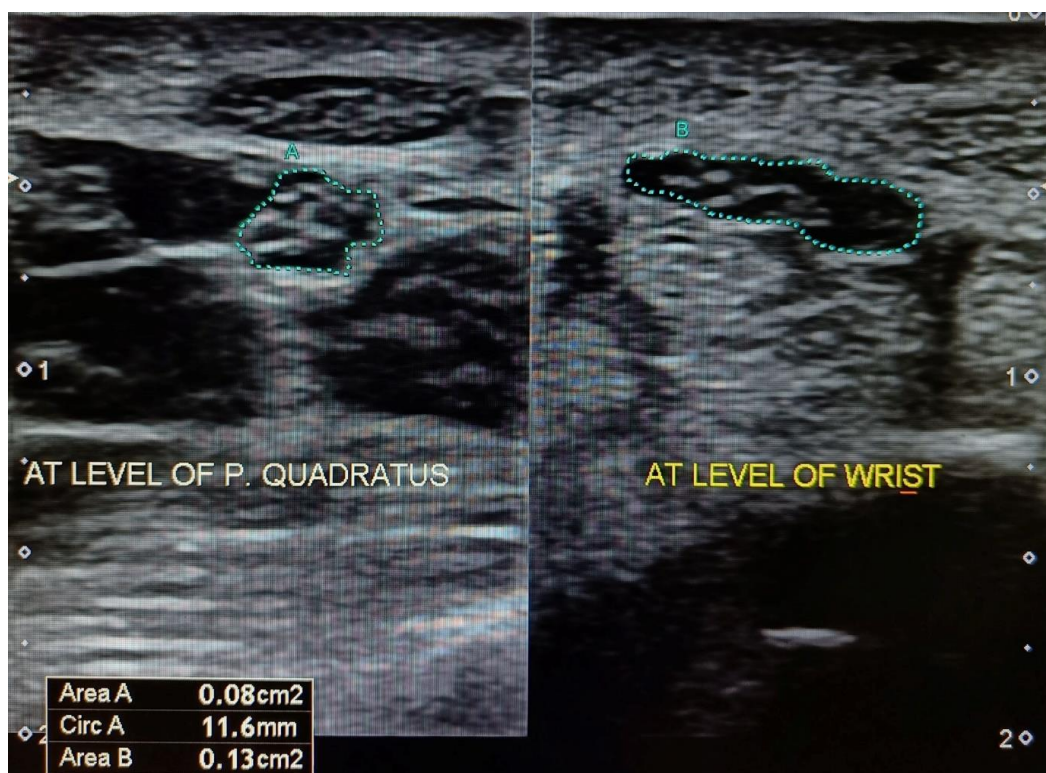
**Figure 6: Tendinosis: On Short axis view of IIIrd (Extensor Pollicis Longus) compartment and IVth (Extensor digitorum and Extensor Indicis) of a 55 year old male reveals thickened and hypoechoic IVth compartment tendons. On color doppler study there is increased vascularity. (Not shown)**



**Figure 7: Tenosynovitis: Anechoic cystic expansion of tendon sheath of Flexor Carpi Radialis tendon on short axis view of a 43 year old female, there is mild thickening of the tendon is seen. On color doppler study there is minimal increase in vascularity (Not shown)**



**Figure 8: Post traumatic tendon rupture: Long and short axis USG images of the Flexor digitorum superficialis and profundus tendons on right 3rd and 4th digits at the level of MCP joint of a 11 year old boy with history of trauma reveals discontinuity of the above mentioned tendons with its proximal stump retraction and interposed anechoic fluid between the stumps. Patient is unable to flex proximal and distal interphalangeal joints**



**Figure 9: Carpal Tunnel Syndrome: Short axis USG images of median nerve at the level of Pronator Quadratus muscle and at the wrist reveals a diffusely thickened, hypoechoic median nerve with 0.13 cm<sup>2</sup> area at the level of left wrist joint. Patient had history of tingling sensation on lateral aspect of the palm since 3 months. NCV test revealed prolonged distal latency and reduced conduction velocity in left median nerve**

### DISCUSSION

High frequency ultrasound (HFUS) has emerged as a valuable tool in the evaluation of hand and wrist pathologies due to its non-invasive nature, real-time imaging capabilities, and high resolution. This study investigated the role of HFUS in diagnosing various pathologies of the hand and wrist among a sample of 61 participants [5-7].

The study revealed a spectrum of pathologies detected using HFUS. Ganglion cysts were the most prevalent, followed by tenosynovitis/tendinosis, bursitis, and carpal tunnel syndrome. Other less common pathologies included inflammatory synovitis, thickening of pulleys of fingers, post-traumatic

tendon rupture, and giant cell tumor of tendon sheath. This highlights the diverse range of conditions affecting the hand and wrist that can be effectively visualized using HFUS [8, 9].

Age-wise distribution indicated a higher prevalence of pathologies in the 40-60 age group, with a peak in the 40-50 age group. This aligns with the increased likelihood of degenerative conditions such as tenosynovitis, bursitis, and tendon thickening occurring with age. Gender-wise distribution showed a slightly higher percentage of cases in females compared to males, suggesting potential gender-related differences in the prevalence of hand and wrist pathologies or differences in healthcare-seeking behavior. The normal ultrasound appearance of flexor and extensor wrist tendons provides a baseline for comparison with abnormal findings. Abnormalities such as ganglion cysts, tendinosis, tenosynovitis, and tendon ruptures were well-demonstrated through ultrasound images, aiding in their diagnosis and characterization [10-12].

The findings of this study have several implications for clinical practice. HFUS can serve as a reliable and efficient diagnostic tool for hand and wrist pathologies, offering high-resolution imaging without the need for ionizing radiation or contrast agents. Its ability to provide real-time dynamic imaging allows for accurate localization and characterization of abnormalities. Early detection of conditions such as tenosynovitis, carpal tunnel syndrome, and tendon ruptures is crucial for timely intervention and improved patient outcomes. HFUS enables clinicians to visualize subtle changes in soft tissues, facilitating early diagnosis and appropriate management strategies, which may include conservative measures, targeted injections, or surgical intervention.

Moreover, HFUS can aid in treatment planning and monitoring. For example, in cases of tenosynovitis, HFUS-guided injections of corticosteroids can be delivered precisely to the affected area, improving the efficacy of treatment while minimizing the risk of complications. Similarly, in tendon ruptures, HFUS can help assess the extent of injury and guide decisions regarding surgical repair. The study also highlights the importance of interdisciplinary collaboration between radiologists, orthopedic surgeons, and other healthcare professionals in the management of hand and wrist pathologies [13, 14].

In conclusion, this study highlights the valuable role of high frequency ultrasound in the evaluation of hand and wrist pathologies. By providing real-time, high-resolution imaging, HFUS enables early diagnosis, accurate localization, and tailored management strategies. Despite its limitations, HFUS represents a valuable adjunct to clinical examination and other imaging modalities, contributing to improved patient outcomes and quality of care in hand and wrist disorders.

## CONCLUSION

High frequency sonography offers a readily available, inexpensive, and portable diagnostic tool for assessing hand and wrist pathologies. Its dynamic evaluation capability allows for easy assessment of superficial components, aided by high frequency transducers with excellent spatial resolution. Ultrasound enables accurate delineation of various structures such as tendons, tendon sheaths, nerves, vessels, synovial tissue, and joint spaces, allowing for comparison with the contralateral side. While it serves as a first-line diagnostic modality, ultrasound may not adequately evaluate deeper aspects of joint spaces or underlying bones' medullary cavities. In such cases, correlating ultrasound findings with magnetic resonance imaging can provide a comprehensive assessment, with MRI serving as a problem-solving tool rather than a primary diagnostic modality.

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