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Original Research Article

HIGH RESOLUTION ULTRASONOGRAPHY IN THE EVALUATION OF TENDON ABNORMALITIES IN HAND AND FINGERS

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Abstract

Background: High-Resolution Ultrasonography (HRUS) has long been the main stay for radiologists. The wide and easy availability with improvement in technology along with its portability, safety and low cost makes HRUS as first line of imaging investigation for evaluation of musculoskeletal diseases. The current work aimed to study the etiological spectrum of tendon pathologies of the hands and fingers and their work-up with USG and its correlation with imaging and clinical findings. **Materials and Methods:** An observational study was undertaken by the Dept. of Radiology at IGIMS, Patna, Bihar. The study was conducted during the period between August 2022 to January 2023. The study included 50 patients who presented during the study period with complaints of pain or masses of the hands and the fingers, referred for assessment of tendons, causing pain and swellings. The study was approved by the scientific and ethical committee of the hospital. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science) software for Windows, version 22.0 (IBM Corp., Armonk, NY). **Result:** This study included 50 patients with a slight male predominance, the male to female ratio being 1.27:1. The age of the study participants ranged from 18 to 58 years (mean ± SD, 35.6 ± 17.2). They presented with different pathologies, tenosynovitis (18 cases), trigger finger (10 cases), tendon tear (10 cases), simple ganglion (8 cases), solid masses (2 cases), and foreign body (2 cases). The confirmatory diagnosis was made by MRI. All the cases were unilateral. Right side was more commonly affected (32%). **Conclusion:** USG of hands should be a fundamental part of the imaging protocol when tendon abnormalities of the hands and the fingers (tenosynovitis, trigger finger, tendon tear, tendon related masses, and foreign body) are suspected, as it achieves high level of diagnostic confidence because it is powerful, easily available and less expensive imaging tool.

INTRODUCTION

High-Resolution Ultrasonography (HRUS) has long been the main stay for radiologists. The wide and easy availability with improvement in technology along with its portability, safety and low cost make HRUS as first line of imaging investigation for evaluation of musculoskeletal diseases. HRUS coupled with necessary anatomical knowledge make clinical diagnosis more accurate and precise, thus reducing the uncertainty of choice of therapy.[1] HRUS has been used as an extension to physical examination. It can be performed instantly in the clinic, with assessment of multiple joints at same time.

Tendons abnormalities of the hand and the fingers are common disorders, particularly among athletes and in the elderly. They may be symptomatic degenerative changes, inflammatory, or tendon rupture. Tendon disorders are a common cause of pain and loss of function. Chronic tendon disorders are much more common than acute injuries and are the result of overuse or age-related tendon degeneration.[2] The quality of ultrasonographic (USG) assessment of anatomical structures in the hand has highly improved over the time. The development of high-resolution USG with the highest possible frequency of transducer and superficial location of most tendons allow the spectrum of tendon abnormalities to be easily depicted with USG.[3,4] The role of USG in the assessment of tendon disorders is steadily increasing due to its low cost, wide-spread availability, non-invasiveness and rapid assessment. It offers dynamic

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assessment of the flexor and extensor tendons, collateral ligaments, and supporting structures of the finger, such as the extensor hood and the volar plate, as well as space-occupying lesions.[5,6] The current work aimed to study the etiological spectrum of tendon pathologies of the hands and fingers and their work-up with USG and its correlation with imaging and clinical findings.

MATERIALS AND METHODS

An observational study was undertaken by the Dept of Radiology at IGIMS, Patna, Bihar. The study was conducted during the period between August 2022 to January 2023. The study included 50 patients who presented during the study period with complaints of pain or masses of the hands and the fingers, referred for assessment of tendons, causing pain and swellings. Patients with history of operative intervention were excluded. The study was approved by the scientific and ethical committee of the hospital. Written and verbal consents were obtained from all patients. Patients were subjected to fill clinical history including the patient's name, age, sex, complaint (hand and finger pain or swelling), and associated symptoms. Clinical examination was done by the referring physician.

USG examinations were performed with SAMSUNG H60 ultrasound machine using superficial linear transducer (8 MHZ). During superficial USG examination of the hand and fingers, the patient was examined while sitting upright, with the hand placed on a cushion. For examination of the anatomical snuff box, the hand was placed in prone position. Proximally, the snuff box is demarcated by the radial styloid, and distally by the base of the first metacarpal. Its radial boundary is formed by two tendons (extensor pollicis brevis and abductor pollicis longus) and on the ulnar aspect by extensor pollicis longus. The floor of the snuff box is formed by the scaphoid proximally and the trapezium distally. It contains the radial artery and cephalic vein. For examination of palmar spaces, hand was kept in supinated position. We move the transducer axially from proximal to distal to examine the lateral, medial, and central spaces. The palm is divided into three spaces by two septa passing from the palmar aponeurosis to the thumb and fifth metacarpal. The lateral space contains thenar muscles, the medial contains hypothenar muscles, and the central contain long flexor tendons, lumbricals, the superficial and deep palmar arches, and median nerve. For the examination of the flexor tendons of the palm of the hand, namely the flexor digitorum superficialis and flexor digitorum profundus, we move the transducer distal to carpal tunnel to the level of metacarpal region. Axial and longitudinal plane images should be obtained over this tendon. For the examination of the flexor tendons of the fingers, namely the flexor digitorum superficialis and flexor digitorum profundus, we move the transducer to the fingers. Axial and longitudinal plane images should be obtained over this tendon. For the examination of the extensor tendons of the hand and fingers, namely the extensor digitorum, we move to the dorsal aspect of the hand and fingers. Axial and longitudinal plane images should be obtained over this tendon.

Data were statistically described in terms of mean, standard deviation, frequencies (number of cases) and percentages when appropriate. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science) software for Windows, version 22.0 (IBM Corp., Armonk, NY).

RESULTS

This study included 50 patients with a slight male predominance, the male to female ratio being 1.27:1. The age of the study participants ranged from 18 to 58 years (mean ± SD, 35.6 ± 17.2). They presented with different pathologies, tenosynovitis (18 cases), trigger finger (10 cases), tendon tear (10 cases), simple ganglion (8 cases), solid masses (2 cases), and foreign body (2 cases). The confirmatory diagnosis was made by MRI. All the cases were unilateral. Right side was more commonly affected (32%).

USG detected 16 out of 18 cases with tenosynovitis. It detected 8 out of 10 (80%) cases of trigger finger. It detected 7 out of 10 (70%) cases with complete tendon tear. USG detected 8 out of 8 (100%) cases with simple ganglions and confirmed by post-operative follow-up. It detected 2 out of 2 (100%) cases with solid lesion and 2 out of 2 (100%) cases with foreign body. Over all, USG correctly diagnosed 43 cases (true positive) [Table 1].

Table 1: Comparative result of the diagnostic tools applied in the study.

Case diagnosis	Diagnostic tool	
	MRI	USG
Tenosynovitis	18 (100%)	16 (88.9%)
Trigger finger	10 (100%)	8 (80%)
Tendon tear	10 (100%)	7 (70%)
Simple ganglion	8 (100%)	8 (100%)
Solid mass	2 (100%)	2 (100%)
Foreign body	2 (100%)	2 (100%)

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DISCUSSION

USG technology has been rapidly advancing over the past few years. The development of high-resolution transducers has increased the potential of ultrasound to evaluate superficial anatomical structures of the hand and fingers.[3] In view of reliability and a good sensitivity: specificity ratio, USG has been proposed as the initial imaging modality in assessing tendon pathologies.[7]

In the current study, USG diagnosed 88.9% of isolated tenosynovitis with peritendinous fluid collection and increased vascularity. USG is highly sensitive and specific in the diagnosis of tenosynovitis. First evidence of USG ability to reveal tendon pathology was given by Grassi et al,[8] detecting signs of finger flexor and/or extensor tenosynovitis in 80% patients. In our study, USG diagnosed trigger finger associated with tendinosis and tenosynovitis in 80% cases by detecting thickening and hypervascularity of pulley system. Our findings were in agreement with the study done by Vuillemin et al,[9] where the sonographic signs of stenosing tenosynovitis of the digits have been well described. Hypoechoic thickening of pulley A1 next to the metacarpo-phalangeal joint is a constant finding which may be associated with hypervascularization detected on Doppler imaging (91% of all cases), peritendinous effusion, tendinosis, or tendinosis with effusion. Among studied cases, USG diagnosed 70% cases of tendon tear and the finding was discontinuity of the tendons with hematoma in acute cases. Hodgson et al,[10] had published that USG is powerful tool for assessment of the tendons with high sensitivity and specificity and over all accuracy in detection of tendon tears. In our study, USG correctly detected foreign bodies among 100% cases with extension to tendon fibers with surrounding fluid collection, this is in agreement with Tahmasebi et al,[11] who reported a higher accuracy and sensitivity (90.2% and 97.9%, respectively), for USG in detecting radiolucent foreign bodies. If high resolution USG is available, we recommend it as the first imaging modality for evaluating the patients with clinically suspicious radiolucent foreign body because of its availability, high sensitivity, and absence of radiation. In patients with a history of soft tissue foreign body and negative radiography, we recommend USG as the most important diagnostic tool before discharging patients. USG gives important information about the size, depth, and relationship of foreign bodies to other structures such as vessels and tendons and makes exploration easier for the surgeon. Furthermore, an important advantage of USG is the possibility of real-time USG guided removal of foreign body under sterile condition, and due to its safety and less complication rate, it may replace surgical exploration in coming years. In our study, USG diagnosed 100% of simple ganglions related to tendon sheath and 100% cases of solid lesions related to tendon sheaths with intact fibers of the tendon and confirmed by histopathological examination as giant cell tumor of tendon sheath. Our study is in agreement with study done by Faruch et al,[12] in that USG is a good technique to assess a mass of the hand. USG allows identifying the anatomical structures from which the lesions originate. USG is essential to analyze the tumor matrix, by identifying if the lesion is cystic or solid. A cyst appears as a well-circumscribed, anechoic lesion with posterior acoustic enhancement. Color Doppler ultrasonography is essential to assess the vascularity of the soft tissue mass. The vascularity of masses is a criterion of aggressiveness. Finally, ultrasonography is also part of the management plan by guiding infiltration of sclerosing agents or biopsy procedures.

CONCLUSION

USG of hands should be a fundamental part of the imaging protocol when tendon abnormalities of the hands and the fingers (tenosynovitis, trigger finger, tendon tear, tendon related masses, and foreign body) are suspected, as it achieves high level of diagnostic confidence, because it is powerful, rapid, easily available , non ionizing and less expensive imaging tool.

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