



Original Article

Utility of ultrasound elastography in a cohort of patients with idiopathic carpal tunnel syndrome

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ABSTRACT

Objective: The aim of this study was to assess the accuracy of ultrasound elastography as a recent imaging technique in diagnosis of CTS and evaluation of its severity in patients suffering clinically compared to the results of the gold standard electrophysiological tests.

Materials and methods: This was a prospective cross sectional study included 100 patients clinically diagnosed as having unilateral idiopathic CTS (90% of the dominant hand), referred to radiology department from physical medicine department at Alexandria main university hospital from June 2015 till May 2016 after being evaluated electrophysiologically for correlation with the data of the ultrasound and ultrasound elastography of the median nerve. A control group of 100 patients with no wrist or hand complain were included in the study.

Results: As diagnosed electrophysiologically, there were 44 (44%), 35 (35%) and 21 (21%) patients with mild, moderate and severe degree of CTS respectively. The mean cross sectional area of the median nerve among the studied cases was $12.19 \pm 1.59 \text{ mm}^2$ while the mean strain ratio of the median nerve by ultrasound elastography was 2.20 (1.0–5.0).

Conclusion: In addition to electrophysiological study, ultrasound and ultrasound elastography are valuable tools for the diagnosis and classification of CTS.

1. Introduction

Carpal tunnel syndrome (CTS) is considered as a common entrapment neuropathy at the wrist secondary to median nerve compression with consequent tingling and numbness [1].

Diagnosis of CTS depends upon combination of history, clinical examination, besides electrophysiological study (EPS) which is the gold standard for diagnosis. The findings of this standard technique were correlated with radiological data [2].

Grey scale ultrasound was the traditional imaging technique for assessment of the median nerve in cases with CTS by measuring its diameter and then recently measurement of median nerve cross sectional area and its correlation with the anthropometric measurements has been used widely [3,4].

In cases with CTS there is increased diameter and cross sectional area of the affected median nerve, also there is more hypoechogenicity of the median nerve [3].

Stiffness based imaging, using ultrasound and MRI elastography, has been introduced to the radiological field recently in the last few years. Although in ultrasound elastography there are different

techniques but all with the same principle [5].

Ultrasound elastography as one of stiffness bases imaging can be used in cases with clinically suspecting CTS, in conjunction with clinical examination and EPS, as there is diminished elasticity with increased fibrosis of the nerve.

Ultrasound elastography of normal median nerve shows non stiff nerve which appears soft according to the used color scale while in cases of CTS the nerve is stiff and appears hard in color map [3].

The use of sonoelastography is considered a quantitative method for assessment of median nerve affection in cases with CTS by using the shear wave technique or semi-quantitative using strain ratio technique [3].

2. Aim of the work

The aim of this study was to assess the accuracy of ultrasound elastography as a recent imaging technique in diagnosis of CTS and evaluation of its severity in patients suffering clinically compared to the results of the gold standard electrophysiological tests.

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Table 1
Comparison between cases and controls according to CSA and SR.

	CTS (n = 100)	Normal (n = 100)	P
<i>Cross sectional area (mm²)</i>			
Mean ± SD	12.19 ± 1.59	8.44 ± 1.13	P < 0.001*
<i>Strain ratio</i>			
Median (IQR)	2.2(1.5–2.65)	1.2(0.9–1.4)	P < 0.001*

Normally quantitative data was expressed as Mean ± SD and compared using t test, While abnormally distributed data was expressed using Median (IQR) and was compared using Mann whitney test.

* Statistically significant at p ≤ 0.05.

3. Materials

This was a prospective cross sectional study included 100 patients clinically diagnosed as having unilateral idiopathic CTS (90% of the

dominant hand), referred to radiology department from physical medicine department at Alexandria main university hospital from June 2015 till May 2016 after being evaluated electrophysiologically for correlation with the data of the ultrasound and ultrasound elastography of the median nerve.

Patients with conditions associated with CTS other than idiopathic as diabetes, hypothyroidism, rheumatoid arthritis, amyloidosis, old or current wrist bones fracture and pregnancy were excluded.

A control group of 100 patients with no wrist or hand complain were included in the study.

The study protocol was approved by the Research Review Committee of the Alexandria Faculty of Medicine and an informed consent was obtained from each subject included in the study.

4. Methods

(1) Clinical examination of the patients to diagnose CTS.

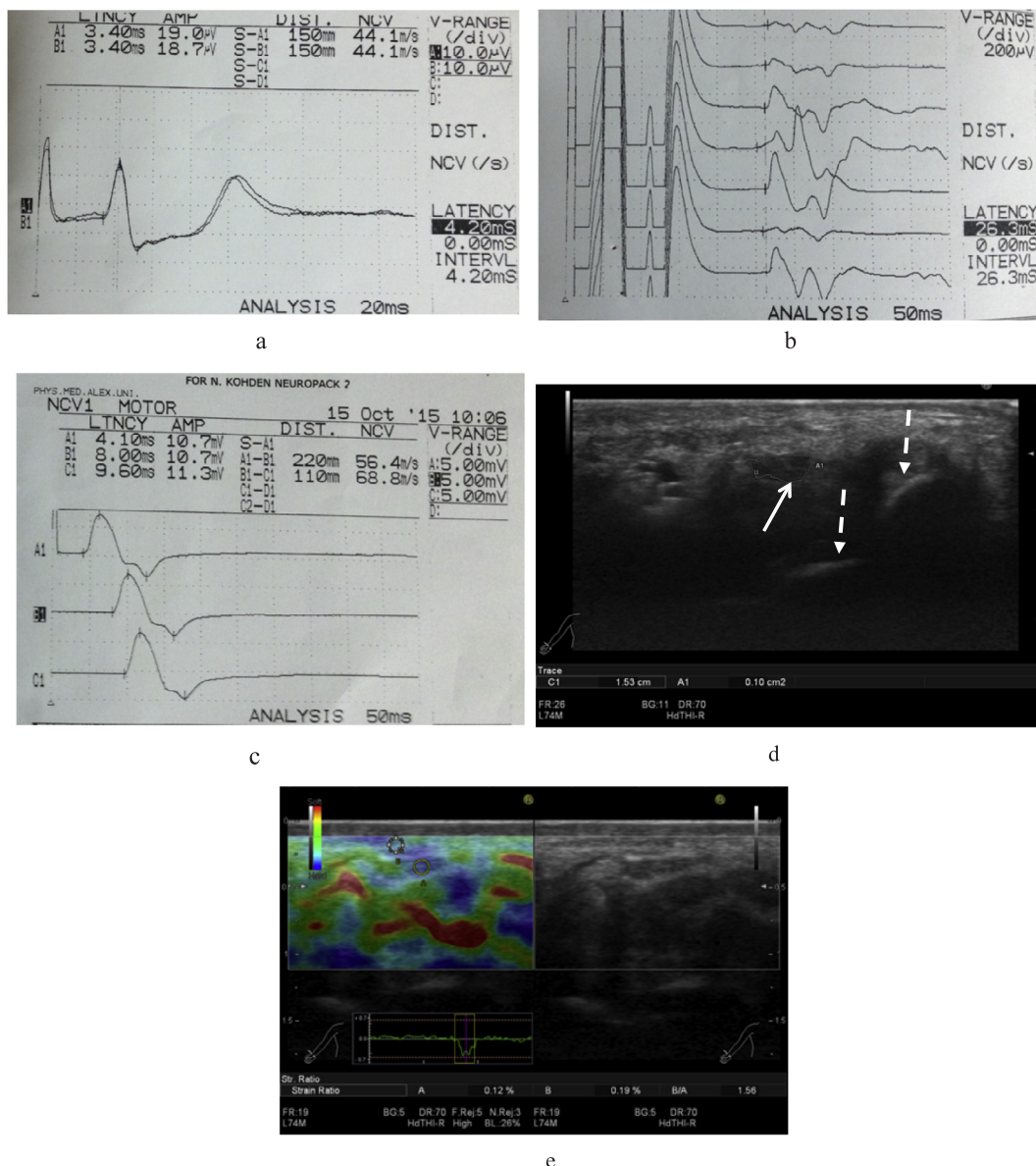


Fig. 1. Female patient 32 years diagnosed as mild degree of CTS by EPS (a–c) Sensory conduction antidromic study of the left median nerve showing prolonged peak latency (4.2 ms), normal amplitude (19 µV) and slowing of nerve conduction velocity (44.1 m/s). Motor conduction study of the left median nerve showing normal distal latency (4.1 ms), normal amplitude (10.7 mV) and normal nerve conduction velocity across forearm segment (56.4 m/s). Normal F-response of the left median nerve with minimal latency = 26.3 ms. Normal Sensory and Motor conduction studies of the left ulnar nerve showing normal distal latency, amplitude and nerve conduction velocity. (d) Grey scale ultrasound of the median nerve at the wrist (scaphoid and pisiform level: dashed arrows) showed cross sectional area of the median nerve = 10 mm² (white arrow). (e) Elastography of the median nerve showed strain ratio = 1.56.

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