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ROLE OF ULTRASONOGRAPHY IN THE DIAGNOSIS OF CARPAL TUNNEL SYNDROME

By

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ABSTRACT

Background: Carpal tunnel syndrome (CTS) is the most common form of peripheral entrapment neuropathy. The use of sonography for investigation and diagnosis of musculoskeletal conditions has been rapidly increasing over the past few decades. Recent studies have demonstrated advantages of sonographic techniques in the diagnosis of carpal tunnel syndrome (CTS).

Objective: Assessing the utility of ultrasonography in the diagnosis of carpal tunnel syndrome (CTS) and grading its severity.

Patients and Methods : Sixty hands in 46 patients with clinically and electro-physiologically confirmed carpal tunnel syndrome, and sixty asymptomatic hands in 34 healthy individuals as control group were included in the study and underwent high-resolution ultrasonography of the wrists. In ultrasonographic assessment the cross-sectional area (CSA) of the median nerve at the distal crease of the wrist and flattening ratio (FR) of the median nerve in the carpal tunnel as well as palmar bowing (PB) of the flexor retinaculum were measured. Ultrasonographic Data from the patients group and control group were compared to determine the statistical significance. The accuracy of the ultrasonographic diagnostic criteria for carpal tunnel syndrome was evaluated using receiver-operating characteristic (ROC) curve analysis. Sensitivity and specificity of ultrasonographic measurements were evaluated. Ultrasonographic measurements were correlated with severity of CTS according to nerve conduction studies (NCS).

Results: The CSA of the median nerve and PB of the flexor retinaculum were significantly larger in the CTS hands compared to the normal control hands. However, FR of the median nerve showed no significant difference between both groups. Increased cross-sectional area of the median nerve was the most predictive measurement of carpal tunnel syndrome. Using the ROC curve, a CSA cut-off value of 10 mm^2 provided a diagnostic sensitivity of 93.3 % and specificity of 98.3 % and PB cut-off value of 3.3 mm provided a diagnostic sensitivity of 90 % and specificity of 85 %. No significant differences in CSA and PB were found among patients with mild, moderate and severe carpal tunnel syndrome so that CSA and PB did not reflect the severity of the condition.

Conclusion: Ultrasonography is a useful non-invasive method for the diagnosis of carpal tunnel syndrome but not assessing its severity.

Key Words: Carpal tunnel syndrome, Ultrasonography, Median nerve, Diagnosis.

INTRODUCTION

Carpal tunnel syndrome is a clinical syndrome that occurs due to the compression of the Median nerve at the wrist and is considered a major cause of occupational disability (***Bongers et al., 2007)***.

Carpal tunnel syndrome is the most common nerve entrapment in human beings with an estimated prevalence of 5 % in the general population (***Kwon et al., 2008)***.

Diagnosis of CTS is based on clinical presentation and confirmed by electro-diagnostic studies ***(Keith et al., 2009)***.

Sensitivity and specificity of NCS for the diagnosis of CTS were reported to be 85% and 95% respectively. It may still give false positive and negative results. Besides, this technique is often uncomfortable for the patients (***Cartwright et al., 2012)***.

High resolution ultrasound (HRUS) has emerged as a feasible, simple, relatively low-cost, rapid, accurate, and noninvasive imaging method for evaluating the median nerve in the carpal tunnel ***(Andrea et al., 2011)***. Since then, several studies have been conducted to evaluate the role of ultrasound in diagnosing CTS and its advantages and disadvantages compared to nerve conduction studies (NCS). These studies have attempted to define the optimal criteria by which ultrasound measurements can be used to define CTS ***(Boutte et al., 2009)***.

Cross sectional area of the median nerve, flattening ratio of the median nerve and palmar bowing of the flexor retinaculum were the most commonly investigated criteria. The most predictive measurement was cross-sectional area of the median nerve. However, there is still much debate with regards to the level within the carpal tunnel that this measurement should be taken and furthermore what constitutes an abnormal value ***(Wang, 2008)***.

Numerous studies with different methods have been performed in this field and Ultrasound (US) measurements had a sensitivity of 29.4% to 100% and specificity of 47% to 100% ***(Roll et al., 2011).***

In this study, we aimed to evaluate the utility of high-resolution ultrasonography in CTS diagnosis through investigating different ultrasonographic diagnostic criteria in patients with clinical and electrodiagnostic evidence of CTS.

MATERIALS AND METHODS

This study was conducted in the National Institute of Neuro-Motor system in Giza district from May 2015 to December 2016. The study protocol was approved by Faculty of Medicine, Al-Azhar University. Verbal consent was obtained from all participants.

The study group included a total of 120 wrists in 80 participants divided in 2 groups; patients and control group. The patients group included 46 patients with 60 wrists who were referred to our department from orthopedic, neurology and neurosurgery clinics between May 2015 and December 2016 with a clinical diagnosis of carpal tunnel syndrome (CTS) .The control group included 34 individuals with 60 wrists selected from volunteer hospital staff who were free of symptoms or clinical signs of neuropathy.

The participants underwent ultrasonographic examination. The nerve conduction studies (NCS) were performed for the CTS patients.

- Inclusion criteria :

■ Patients with symptoms, clinical signs and NCS consistent with CTS.

- Exclusion criteria :

■ History of previous wrist surgery, fracture or traumatic nerve injury.

- Patients with history or clinical examination or investigations suggestive of proximal neurologic disorders that might result in numbness or paraesthesia e.g. cervical radiculopathy, Thoracic outlet syndrome, brachial plexopathy, proximal median neuropathy, ulnar neuropathy, polyneuropathy, motor neuron disease, spondylotic myelopathy, syringomyelia, stroke, multiple sclerosis.
- Participants with a variant of median nerve, such as bifid median nerve and persistent median artery were also excluded.

Demographic factors including age and gender were recorded in all participants in the study.

Nerve conduction studies (NCS) were performed using a Caldwell Sierra Wave® (Cadwell Laboratories, Kennewick, WA, USA). The latency, conduction velocity and amplitude of action potential of the median nerve were measured. The cut-off point used in the NCS was the median nerve distal sensory latency of 3.5 milliseconds and NCS results were considered supportive of CTS when median nerve distal sensory latency was more than 3.5 milliseconds.

Wrists with CTS were divided into three groups on the basis of the severity of CTS, i.e. mild, moderate, and severe :

- The mild group showed median nerve distal sensory latency of greater than 3.5 milliseconds up to 4.5 milliseconds.
- The moderate group had median nerve distal sensory latency prolonged by more than 4.5 milliseconds up to 5.5 milliseconds.
- The severe group had median nerve distal sensory latency prolonged by more than 5.5 milliseconds and/or median nerve sensory nerve action potential amplitude reduction below 25 mV.

High resolution US was performed by using an Aplio 400 Ultrasound System (Toshiba Medical Systems Corporation, Tokyo, Japan) with a 10–12 MHz linear array transducer. During the examination, the subjects were seated in a comfortable position facing the examiner, with the measured forearm resting on the table, the palm supine, and fingers semi-extended in the neutral position. The full course of the median nerve in the carpal tunnel is evaluated in both the transverse and longitudinal planes. The transducer was placed directly on the patient’s skin with gel. The median nerve was first imaged in a longitudinal scan, placing the US probe at the midline between the radius and ulna with the centre of the probe at the distal wrist crease to obtain an initial general overview of the median nerve. The probe was then rotated 90 degrees to obtain optimal axial (cross-sectional) images.

A transverse scan was then performed, keeping the probe directly perpendicular to the long axis of the median nerve and then measurements were performed:

- The cross sectional area (CSA) of the median nerve (measured in mm^2) at distal crease of the wrist was measured by continual tracing of the nerve circumference outlining the nerve contour using area measurement software (continuous boundary trace) of the ultrasound system.
- The elliptical diameters (transverse and antero-posterior) of the median nerve

were measured and the flattening ratio (FR) of median nerve was calculated as the ratio of the nerve's transverse dimension to the antero-posterior dimension.

- The palmar bowing (PB) of the flexor retinaculum is displacement (measured in mm) of the retinaculum from its attachments to the carpal bones and was measured at the trapezium - hamate level. Once the trapezium and hamate bones are identified, a line was drawn tangential to them. Then, the distance between this line and the most anterior portion of the flexor retinaculum was measured.

Measurements were repeated three times and average value was used for statistical evaluation.

Statistical analysis: Quantitative data were expressed as mean ± SD. While qualitative data were expressed as number and percentage. Independent t-test and ANOVA test were used for comparison between quantitative variables.

The arithmetic mean, range and the standard deviation of the ultrasonographic measurements in both CTS patients and control groups were determined and both groups were compared using independent t-test.

With use of the NCS as the reference standard, true-positive, true negative, false-negative and false-positive results were recorded.

The receiver operating characteristic (ROC) curve was used to find out cut-off points, sensitivity, specificity, positive and negative predictive values. Optimal cut-off point in ROC curve was chosen based on the optimum point with the most sensitivity and specificity.

The correlation between the NCS grade of CTS and US measurements was assessed.

The Statistical Package for Social Science (SPSS Inc., version 13.0 for Windows) was used for all statistical analyses. A P value <0.05 was considered significant.

RESULTS

Demographic data: In the patient group, 46 patients (60 wrists) were included in the study with mean age 45.5 years and age range from 29 to 75 years. There were 37 (80.4 %) females and 9 (19.6 %) males. Out of the 46 patients, 14 patients had bilateral CTS and 32 patients had unilateral CTS (right 17, left 15). CTS was associated with diabetes mellitus in 3 patients, hypothyroidism in 1 patient and rheumatoid arthritis in 1 patient, CTS was idiopathic in 41 patients.

The control group included 34 subjects (60 wrists) with mean age 36 years and age range from 23 to 56 years. There were 25 females (73.5 %) and 9 males (26.5 %).

NCS: The CTS patients were divided into three groups based the NCS results. There were 33 hands (55 %) with mild, 12 hands (20 %) with moderate and 15 hands (25 %) with severe CTS according to NCS.

Table (1): Demographic data and results of NCS of CTS and control groups.

Variables \ Groups		Control	CTS		P value
Number		34 (60 Hands)	46 (60 Hands)		
Gender	**(Women/Men)**	25/9	37/9		>0.05
	percentage	73.5/26.5 %	80.4/19.6 %		
Age (years)	**mean+ SD**	36.15 ± 8.94	45.54 ± 11.08		< 0.001
	Range	23-56	29-75		
Grade of CTS	**Mild**	NO NCS	33	55 %	
	Moderate		12	20 %	
	Severe		15	25 %	

CTS: Carpal tunnel syndrome, SD: Standard deviation, NCS: Nerve conduction studies.

Ultrasonographic measurements included cross sectional area (CSA) of the median nerve, flattening ratio (FR) of the median nerve and palmar bowing (PB) of the flexor retinaculum. The CSA of the median nerve showed statistically significant increase in the CTS patients (17.98 ± 8.66 mm^2) compared to the control group (7.8 ± 1.32 mm^2 - P value < 0.001). Also PB of flexor retinaculum was increased in CTS patients (4.31 ± 0.85 mm) in comparison to control group (2.6 ± 0.62 mm) and this increase was statistically significant (P value < 0.001). Although FR of the median nerve also increased in CTS patients (2.94 ± 0.58) in comparison to control group (2.92 ± 0.69). This increase did not reach statistical significance (P value > 0.05 - Table 2).

Table (2): Comparisons of ultrasonographic measurements of CTS patients and control.

Variables \ Groups	Control		CTS		P value
	Mean ±SD	**Range**	**Mean ±SD**	**Range**	
CSA(mm^2)	7.8 ± 1.32	5 - 11	17.98 ± 8.66	8 - 47	< 0.001
FR	2.92 ± 0.69	1.4 – 4.4	2.94 ± 0.58	1.8 – 4.7	> 0.05
PB (mm)	2.6 ± 0.62	1.3 - 3.8	4.31 ± 0.85	2.5 - 5.9	< 0.001

CTS: Carpal tunnel syndrome, CSA: Cross sectional area, FR: Flattening ratio,
PB: Palmar bowing, SD: Standard deviation

CSA cut-off value of 8 mm^2 yielded a sensitivity of 96.7 % and specificity of 68.3 % , cut-off value of 9 mm^2 yielded a sensitivity of 96.7 % and a specificity of 91.7 % , cut-off value of 10 mm^2 yielded sensitivity of 93.3 % and a specificity of 98.3 % and cut off value of 11 mm^2 yielded 85 % sensitivity and 100 % specificity. PB cut-off value of 3.1 mm yielded a sensitivity of 95 % and specificity of 78.3 %, cut-off value of 3.2 mm yielded a sensitivity of 95 % and a specificity of 80 %, cut-off value of 3.3 mm yielded sensitivity of 90 % and a specificity of 85 % and cut off value of 3.4 mm yielded 81.6 % sensitivity and 88.3 % specificity (Fig.1).

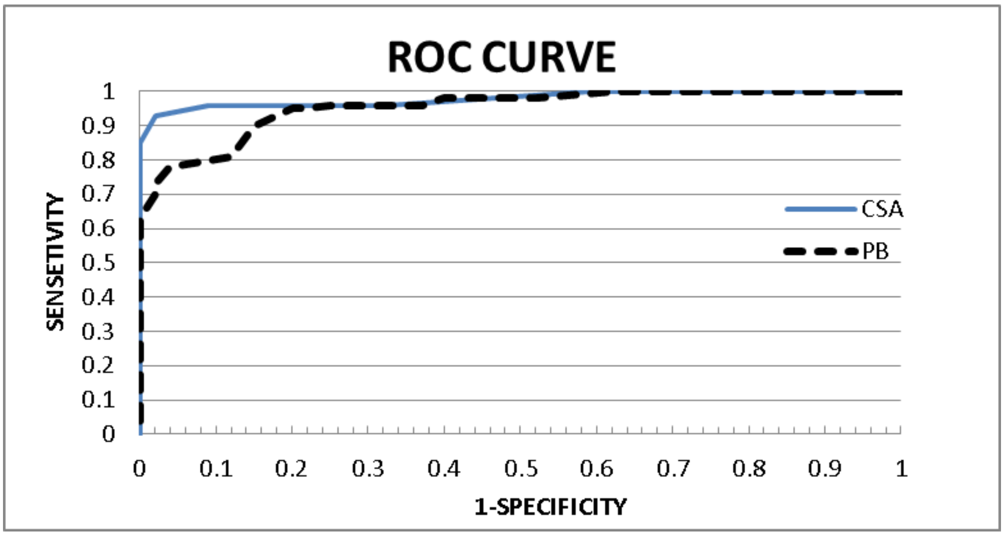


Figure (1): The receiver operating characteristic (ROC) curve for CSA and PB.

Comparison of different cut-off values of CSA and PB was performed for purpose of establishing the optimal cut-off value for CTS diagnosis which would achieve higher sensitivity and specificity and yields satisfactory positive and negative predictive values. Optimal CSA cut off value was 10 mm^2 which yielded 93.3 % sensitivity, 98.3 % specificity, 98.2 % positive predictive value and 93.6 % negative predictive value. The corresponding positive LR and negative LR were 54.9 to rule in and 0.07 to rule out CTS respectively. Optimal PB cut off value was 3.3 mm which yielded 90 % sensitivity and 85 % specificity, 85.7 % positive predictive value and 89.5 % negative predictive value. The corresponding positive LR and negative LR were 6 to rule in and 0.11 to rule out CTS respectively (Table 3).

Table (3): Optimal cut off value for CSA and PB.

Variables	Cut-off value	Sensitivity %	Specificity %	PPV %	NPV %	Positive LR	Negative LR
CSA	10.0 mm2	93.3	98.3	98.2	93.6	54.9	0.07
PB	3.3 mm	90	85	85.7	89.5	6	0.11

CSA: Cross sectional area, PB: Palmar bowing, PPV: Positive predictive value, NPV: Negative predictive value, LR: Likelihood ratio.

According to NCS results, 33 wrists out of 60 (55 %) were classified as mild CTS. Mean CSA in this group was 17.15 ± 7.58 mm^2 and mean PB was 4.29 ± 0.79 mm, 12 out of 60 wrists (20 %) were classified as moderate CTS with mean CSA of 18.16 ± 4.42 mm^2 and mean PB of 4.32 ± 0.89 mm, remaining 15 patients (20 %) were classified as severe CTS with mean CSA of 21.26 ± 12.37 mm^2 and mean PB of 4.35 ± 0.99 mm. Comparison of the ultrasonographic measurements CSA and PB among different CTS grades (mild, moderate, and severe) demonstrated that the mean CSA of median nerve has increased with increase of CTS grade. However, the differences did not achieve statistical significance (P value > 0.05). There was also no statistically significant difference among different CTS grades with respect to PB of the flexor retinaculum (P value > 0.05-Table 4).

Table (3): Ultrasonographic parameters from patients with different severity CTS.

Severity / Variables	Mild	Moderate	Severe	P value
CSA mm2 Mean ± SD	17.15 ± 7.58	18.16 ± 4.42	21.26 ± 12.37	> 0.05
PB mm Mean ± SD	4.29 ± 0.79	4.32 ± 0.89	4.35 ± 0.99	> 0.05

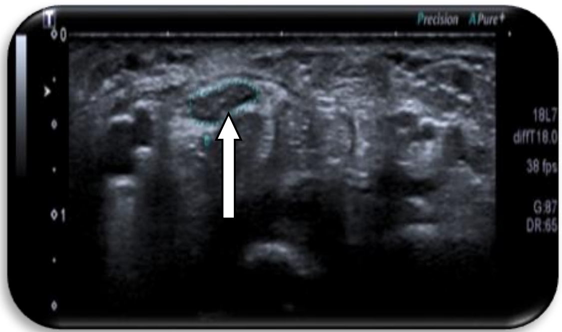
CSA: Cross sectional area, PB: Palmar bowing, SD: Standard deviation.

Representative cases

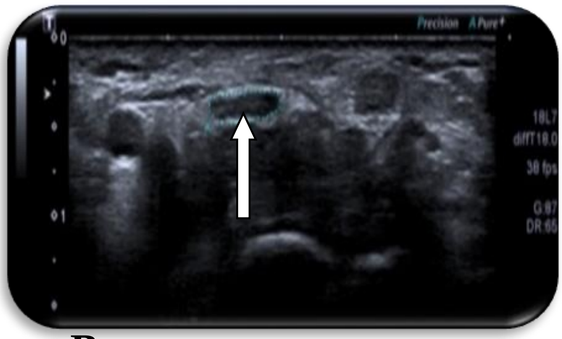
Control subject:

- 42 years old female who was clinically free from CTS.
- **Ultrasound results (Fig. 2):**

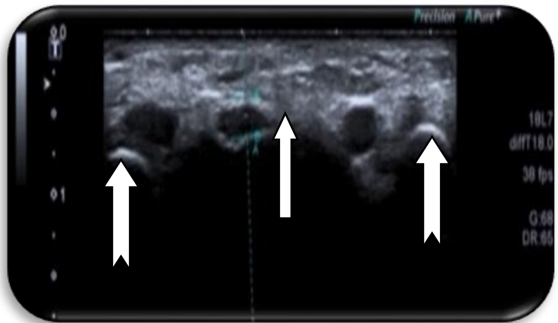
Site / Parameters	Right	Left
CSA	9 mm^2	9 mm^2
PB	2.5 mm	2.3 mm
FR	3.6	4.1



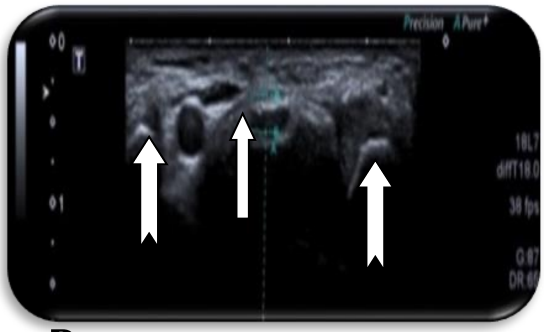
A: Right CSA. Arrow: median nerve



B: Left CSA. Arrow: median nerve

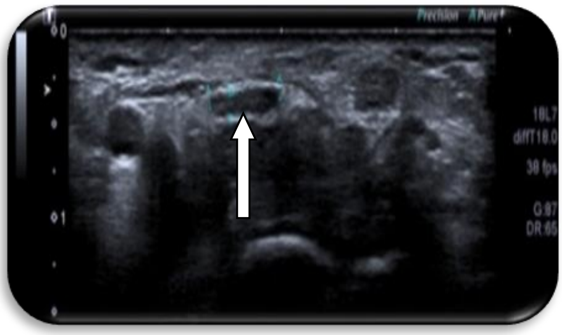


C: Right PB. Arrow: flexor retinaculum
Notched arrow; carpal bones



D: Left PB. Arrow: flexor retinaculum
Notched arrow; carpal bones

E: Right FR. Arrow: median nerve



F: Left FR. Arrow: median nerve

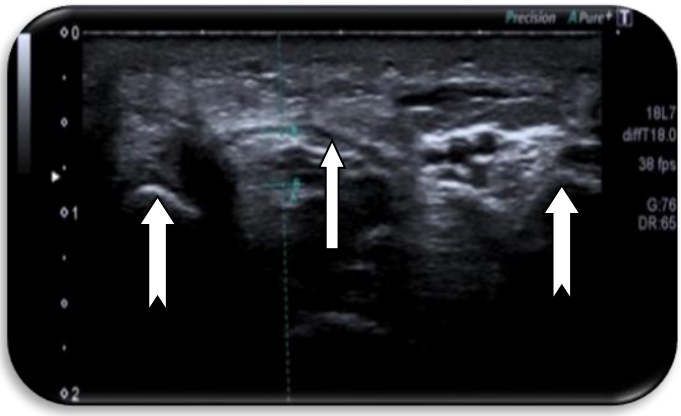
Figure (2): Sonographic cross sectional view of the carpal tunnel of both hands in healthy volunteer displaying cross sectional area (CSA) of the median nerve (A,B), Palmar bowing (PB) of the flexor retinaculum (C,D) and flattening ratio (FR) of the median nerve (E,F).

CASE NO.1 :

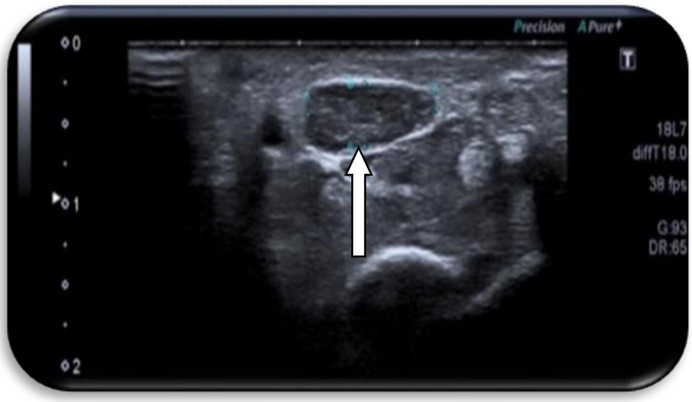
- 50 years old female with clinical diagnosis of unilateral CTS in the right hand.
- NCS revealed moderate right median nerve entrapment at the level of the wrist.
- **Ultrasound results (Fig. 3):**

CSA	37 mm^2
PB	3.6 mm
FR	2.8

A: CSA. Arrow: median nerve



B: PB. Arrow: flexor retinaculum
Notched arrow: carpal bones



C: FR. Arrow: median nerve

Figure (3): Sonographic cross sectional view of the carpal tunnel in patient with carpal tunnel syndrome in right hand displaying cross sectional area (CSA) of the median nerve (A), Palmar bowing (PB) of the flexor retinaculum (B) and flattening ratio (FR) of the median nerve (C).

CASE NO. 2:

- 48 years old male with clinical diagnosis of bilateral CTS.
- NCS revealed mild right and mild left median nerve entrapment at the level of the wrist.
- **Ultrasound results (Fig. 4):**

Site / Parameters	Right	Left
CSA	37 mm^2	22 mm^2
PB	3.3 mm	3.4 mm
FR	3.2	2.9

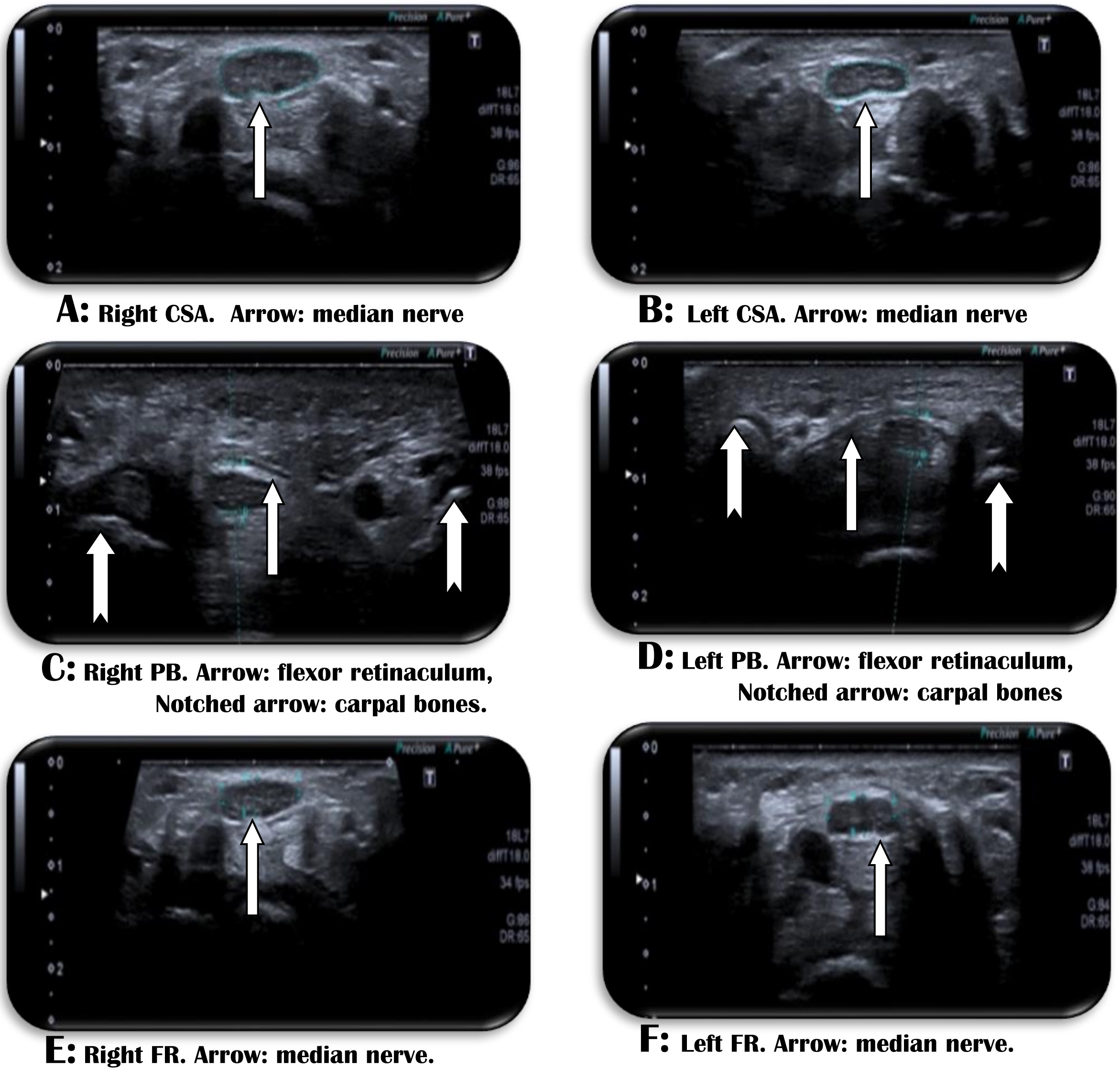


Fig.(4): Sonographic cross sectional view of the carpal tunnel in patient with bilateral carpal tunnel syndrome displaying cross sectional area (CSA) of the median nerve (A,B), Palmar bowing (PB) of the flexor retinaculum (C,D) and flattening ratio (FR) of the median nerve (E,F).

DISCUSSION

Carpal tunnel syndrome (CTS) is a combination of specific symptoms and signs that occur as a result to median nerve compression at the wrist. It represents the most common peripheral nerve entrapment disorder. CTS has been reported to be present in 3.8 % of the general population and accounts for 90% of all entrapment neuropathies **(*Alfonso et al., 2010*)**. It is recognized as one of the most important causes of the workplace morbidity with a prevalence of 7.8 % and annual incidence rate of 2.3 CTS cases per 100 persons in working population in USA (***Dale et al., 2013***).

Diagnosis of carpal tunnel syndrome is complicated by the lack of agreement on a gold standard or reference standard diagnostic method for verifying its presence or absence. The diagnosis of CTS relies mainly on the characteristic symptoms, provocative clinical tests and nerve conduction studies (NCS).

Although NCS are a valuable technique for the diagnosis of CTS and evaluating its severity (***Graham, 2008***), they have some disadvantages; being painful with false-negative gate between 10 % and 15 % (***Werner and Andary, 2011***).

Ultrasonography has the advantage of being painless, easily accessible, less time consuming and providing the ability for visualization of the carpal tunnel and the median nerve.

The appropriate US technique, probe position and ultrasound diagnostic criteria have not been fully established for CTS.

The objective of this study was to investigate the utility of ultrasonography for diagnosis of carpal tunnel syndrome and assessment of its severity. The study assessed the diagnostic accuracy of three sonographic parameters in CTS diagnosis, namely cross sectional area (CSA) of the median nerve at level of distal crease of the wrist, flattening ratio (FR) of the median nerve within the carpal tunnel and palmar bowing (PB) of the flexor retinaculum. Nerve conduction studies (NCS) were used as a reference standard diagnostic procedure.

This study included 46 patients with 60 wrists with unilateral or bilateral carpal tunnel syndrome and 34 healthy volunteers acting as control with 60 wrists also.

In the current study, the cross sectional area of the median nerve was found to be significantly higher in the CTS patients when compared with controls. These results were in agreement with other previous studies perfomed by ***Domanasiewicz et al. (2009)*** and ***Akcar et al. (2010)***. The increase in cross-sectional area could be attributed to the nerve edema as CTS is caused by median nerve compression in the carpal tunnel.

The present study revealed that optimal cut off value of CSA of median nerve for diagnosis of CTS was 10 mm^2, which yielded sensitivity and specificity (93.3%) and (98.3%) respectively. For the same cut-off value, positive and negative predictive values were calculated as 98.2 % and 93.6% respectively. CSA cut off value for different levels of the carpal tunnel has ranged from 9 mm^2 to 15 mm^2 (***Kwon et al., 2008)*** with varying sensitivities and specificities ranging from 70 % to 88 % and 63 % to 97 % respectively ***(Pastare et al., 2009).*** A possible explanation for this variability could be attributed to the difference of the studied population with regard to gender composition, age, body mass index (BMI), the differences in study design and measurement techniques. ***Tai et al. (2012)*** performed a meta-analysis and reported that a CSA ≥ 9 mm^2 is the best single diagnostic criterion.

In the present study, based on the statistical analysis of 60 wrists of CTS of different grades according to NCS results, no significant differences in CSA were found among different grades of CTS so that CSA could not reflect the grade of CTS. These results were similar to those studies performed by ***Kaymak et al. (2008), Moran et al. (2009) and Mhoon et al.*** (***2012)*** who reported that although median nerve ultrasound is a highly sensitive screening tool for CTS, it cannot determine its severity. However, ***Padua et al. (2008)*** and ***Karadag et al. (2010)*** reported that CSA was positively correlated with the NCS severity and is a useful tool for grading CTS and determining its severity.

Regarding PB of flexor retinaculum, the present study revealed that PB of flexor retinaculum significantly increased in the CTS group compared to control group which went in concordance with studies performed by ***Rayegani et al. (2014) and Kandasamy et al. (2015).*** PB of the flexor retinaculum was attributed to increase the pressure inside the carpal tunnel described in the pathogenesis of CTS.

The recorded optimal cut-off value of PB for diagnosis of CTS in current study was 3.3 mm with a sensitivity and specificity of 90 % and 85 % respectively. Positive and negative predictive values were recorded as 85.7 % and 89.5 % respectively. In previous studies, PB values have ranged between 2.5 and 4 mm ***(Yurdakul et al., 2016).***

Concerning the role of PB of flexor retinaculum in grading CTS, the present study revealed that the difference of PB of flexor retinaculum among different CTS grades is statistically insignificant so that it is not reliable for grading CTS severity.

According to current study, FR of the median nerve did not show significant difference between CTS group and control group. In published literature, the role of nerve flattening has varied among studies ***(Kandasamy et al., 2015).***

There were several study limitations, i.e. there was a significant difference between the mean ages of the control group and the patient group, and the lack of blinding to subjects status.

CONCLUSION

Ultrasonographic examination of the carpal tunnel was sensitive and specific enough and a useful non invasive diagnostic tool for carpal tunnel syndrome, but it did not reflect the severity of the condition.

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دور الموجات فوق الصوتية فى تشخيص متلازمة النفق الرسغى

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خلفية البحث: تعتبر متلازمة النفق الرسغى الأكثر إنتشارا من بين أمراض إختناق الأعصاب الطرفية. ولقد إزداد إستخدام الموجات فوق الصوتية بشكل ملحوظ فى الأونه الأخيرة فى تشخيص أمراض الجهاز العضلى الهيكلى. وقد أظهرت دراسات حديثة مميزات إستخدام الموجات فوق الصوتية فى تشخيص متلازمة النفق الرسغى.

الهدف من البحث: تقييم دور الموجات فوق الصوتية فى تشخيص متلازمة النفق الرسغى وتحديد شدة الإصابة.

المرضى وطرق البحث: تضمنت الدراسة ٦٠ يد من خلال ٤٦ مريض بمتلازمة النفق الرسغى تم تشخيصها إكلينيكيا وعن طريق الإختبارات العصبية الكهربائية ، كما تضمنت ٦٠ يد من خلال ٣٤ من الأشخاص الأصحاء الذين لا يعانون من متلازمة النفق الرسغى .وتم تقييم المجموعتين بواسطة الموجات فوق الصوتية من خلال قياس المساحة القطعية العرضية للعصب الأوسط ، ومعدل تسطح العصب الأوسط ، ودرجة التقوس الأمامى للرباط الرسغى القابض. وقد تمت المقارنة بين قياسات المجموعتين ، وكذلك تقييم الدقة التشخيصية للعوامل التشخيصية محل الدراسة ، وتحديد درجة الحساسية والخصوصية التشخيصية لهذه العوامل ، وربط هذه القياسات بشدة الإصابة طبقا لإختبارات توصيل الأعصاب.

النتائج: أظهرت الدراسة زيادة المساحة القطعية العرضية للعصب الأوسط ودرجة التقوس الأمامى للرباط الرسغى القابض بشكل ملحوظ فى مرضى متلازمة النفق الرسغى عنهما فى الأشخاص الأصحاء مما يجعل منهما عوامل تشخيصية فعالة فى تشخيص متلازمة النفق الرسغى، أما معدل تسطح العصب الأوسط فلم يكن هناك فرق ملحوظ فيه بين المجموعتين.

ولقد أظهرت الدراسة أيضاً أن القيمة المثالية الفاصلة فى تشخيص متلازمة النفق الرسغى للمساحة القطعية العرضية للعصب الأوسط كانت ١٠ملليميترات مربعة لتعطى٩٣,٣ ٪ حساسية تشخيصية و خصوصية ٩٨,٣ ٪ ، أما القيمة المثالية الفاصلة لدرجة التقوس الأمامى للرباط الرسغى القابض كانت ٣,٣ ملليميتر لتعطى ٩٠ ٪ حساسية تشخيصية و خصوصية ٨٥٪.

ولم يكن هناك فرقاً ملحوظاً فى قياسات المساحة القطعية العرضية للعصب الأوسط ودرجة التقوس الأمامى للرباط الرسغى القابض بين درجات متلازمة النفق الرسغى المختلفة ، الضئيلة والمتوسطة والشديدة ، مما يحد من قدراتها على تحديد شدة الحالة.

الإستنتاج: تعتبر الموجات فوق الصوتية وسيلة مفيدة غير نافذة لتشخيص متلازمة النفق الرسغى ولكنها تفتقد القدرة على تحديد شدة الحالة.

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