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Measurement of Normal Median Nerve Area at the Level of Wrist Joint in Adult using Diagnostic Ultrasonography

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Abstract: ***This study was done in Sudan University of science and technology, college of medical radiological science Khartoum, Sudan, during period from April- to August, 2016 .There were 100 subjects, of age above 17 years, selected randomly all subjects had not any symptoms related to median nerve pathology. Musculoskeletal ultrasound scanning using 7-10 MHz transducers were performed for the wrist joints and the median nerve area of both hands were obtained. The results of this thesis states that the mean of right and left median nerve area (MNA), were (7.32±2.51) mm2, and (6.43±2.14) mm2 respectively, with no significant difference between males and females. The study found out that, there is linear increase in the median nerve area in relation to increase in the patient's age and weight, by 0.163±0.024 and 0.17±0.03 mm2/year for right and left median nerve area respectively, and by (0.04±0.02) and (031±0.01) mm2//kg for the right and left median nerve area respectively. Moreover the normal median nerve has a hypo echogenicity (hypoechoic). The study conclude that the median nerve area measurement is important to detect any abnormal increment in MNA and ultrasound is a best modality to scanning the median nerve in means of availability, cost and ease of use, so it's recommended to use ultrasound confidently as a diagnostic modality to detect any median nerve injury.***

Keywords: Medial nerve , Wrist , Ultrasonography

1. Introduction

Alzheimer's Musculoskeletal ultrasonography is non-invasive diagnostic exam which provide immediate information in the structure and the characteristics of the median nerve. The Median Nerve extends along the middle of the arm and forearm to the hand. It arises by two roots, one from the lateral and one from the medial cord of the brachial plexus; these embrace the lower part of the axillary artery, uniting either in front of or lateral to that vessel. Its fibers are derived from the sixth, seventh, and eighth cervical and first thoracic nerves. As it descends through the arm, it lies at first lateral to the brachial artery; about the level of the insertion of the Coracobrachialis it crosses the artery, usually in front of, but occasionally behind it, and lies on its medial side at the bend of the elbow, where it is situated behind the lacertus fibrosus (bicipital fascia), and is separated from the elbow-joint by the Brachialis (Peter L, W, 1995).

In the forearm it passes between the two heads of the Pronator teres and crosses the ulnar artery, but is separated from this vessel by the deep head of the Pronator teres. It descends beneath the Flexor digitorum sublimis, lying on the Flexor digitorum profundus, to within 5 cm. of the transverse carpal ligament; here it becomes more superficial, and is situated between the tendons of the Flexor digitorum sublimis and Flexor carpi radialis. In this situation it lies behind, and rather to the radial side of, the tendon of the Palmaris longus, and is covered by the skin and fascia. It then passes behind the transverse carpal ligament into the palm of the hand. In its course through the forearm it is accompanied by the median artery, a branch of the volar interosseous artery (Peter L, W, 1995).

Ultrasonically, in the transverse plane, the median nerve appears hypoechoic with a hyperechoic border, containing multiple bright reflectors. The median nerve is also rounded or oval in the proximal wrist, becoming progressively flatter as it passes through the carpal tunnel. Within the carpal tunnel, the median nerve is intimately related to the flexor retinaculum. In the longitudinal plane, the median nerve is seen anterior to the flexor digitorum tendons, coursing in a parallel plane. The nerve is easily differentiated from the tendons lying posteriorly, as the nerve lacks the tendons' characteristic fibrillar pattern (Devin Dean, 2007).

Carpal tunnel syndrome is a median nerve entrapment syndrome that has become the second most common reason for employee loss of work, following low back pain and ahead of shoulder pain. Patients who present with CTS typically complain of chronic tingling in their fingers, often worse at night, in the distribution of the median nerve (Lee D et al. 1999).

Studies have shown that if the cross-sectional area of the median nerve as measured during ultrasound imaging exceeds 15 mm2, there is good correlation with abnormal EMG's and carpal tunnel disease can be confirmed. (Lee D et al. 1999).

The advantage of the using ultrasound imaging it is mobility and low cost as well as ability to measure the dimension of the nerve, check for the presence of masses or cyst and evaluate the structure and echogenicity of the nerve (Paul and Scott, 2008).

2. Material and Method

2.1. Study population

The data of this study were collected of subjects not suffer of any median nerve disease.

Sampling:
The sample of this study in 100 volunteers with different age, gender, weight, height, and occupations have normal median nerve.

Inclusion criteria:
Subjects not suffering from any symptoms related to median nerve injury with ages above 17 years.
2.1.3. Exclusion criteria:
Patient with history of median nerve disease and children.

Machines:
The data was collected using (E-CUBE, medical system) Ultrasound machine made in coria, and (Siemens medical system) ultrasound machine made in Germany, each with linear array 7-10 MHz, using coupling gel, Weight Measuring equipment and Height Measuring Tape were used for measuring body characteristics.

Study design:
This is a retrospective cross sectional study where the volunteers were selected randomly.

Area of study and duration:
It was conducted in ultrasound department of College of Medical Radiological Sciences of Sudan University of Sciences and Technology and Ribat University Hospital, Khartoum state of Sudan republic, during the period from April to august 2016.

Sonographic Technique:
The median nerve was examined with a real time linear transducer having a short focal zone (1 to 4cm), volunteers were examined with their forearm resting comfortably on a flat surface with the elbow in mid flexion and their wrist in supination, Proper time gain compensation and dynamic range were used, Imaging was performed in the transverse plane at the level of the palmar crease, with the ulnar artery being the medial landmark of the carpal tunnel, the width and the anterio-posterior diameter were measured then the median nerve area was calculated for both hands.

Data collection:
The data was collected using the following variables: median nerve areaof both hands, echogenicity (ultrasound findings), Age, gender, weight, height and occupations.

Data analysis
The data was analyzed by using Statistical Packaged for Social Studies (SPSS) and Excel under windows.

3. Result Presentation

Table 1 shows frequency distribution of person's age

Percent	Frequency	Age group
10.0	10	<20
67.0	67	20-25
8.0	8	26-30
5.0	5	31-35
3.0	3	36-40
2.0	2	41-45
5.0	5	46-50
100.0	100	Total

Table 1 shows frequency distribution of person's weights

Percent	Frequency	Weight (kg)
6.0	6	<50
45.0	45	50-60
26.0	26	61-70
12.0	12	71-80
6.0	6	81-90
2.0	2	91-100
3.0	3	111-120
100.0	100	Total

Table 3 shows The relationship between age and MNA (Right and Left).

Model		Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	2.544	.615
	Age (years)	.163	.024
2	(Constant)	2.978	.678
	Age (years)	.174	.027

Table 4 shows the relationship between Weight and MNA (Right and Left).

Model		Unstandardized Coefficients		T	Sig.
		B	Std. Error		
1	(Constant)	4.656	1.006	4.627	.000
	Weight (kg)	.040	.015	2.622	.010
2	(Constant)	4.520	.932	4.847	.000
	Weight (kg)	.031	.014	2.224	.028

Table 4 shows frequency Distributions of gender and MNA means

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Left MNA (mm^2)	Female	55	6.63	2.108	.284
	Male	45	6.43	2.137	.319
Right MNA mm^2)	Female	55	7.15	2.137	.288

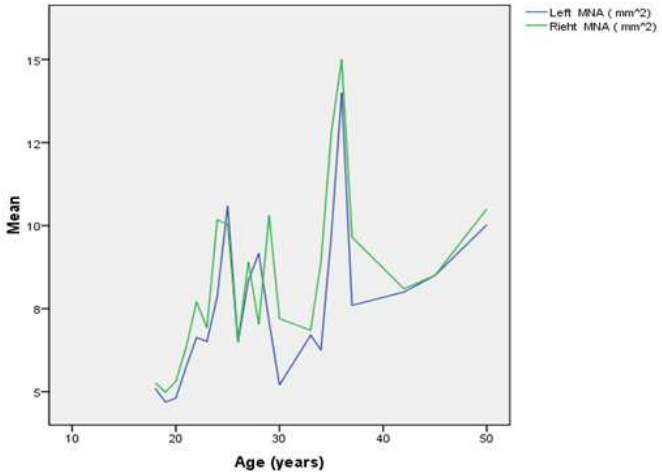

Figure 1: show The linear relationship between age and MNA (Right and Left).

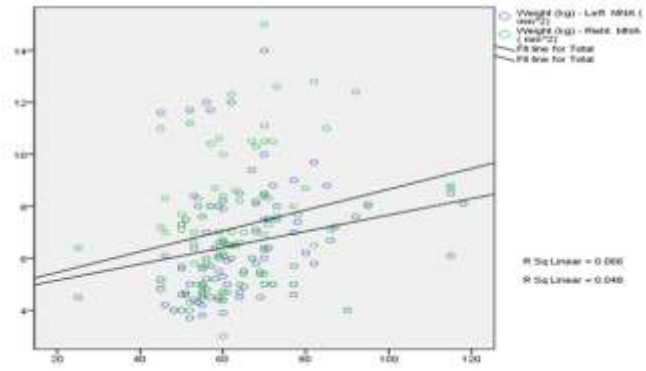

Figure 2 show The linear relationship between Weight and MNA (Right and Left).

4. Discussion

The results of this study reveals that the means of the RT MNA for male and females were 7.32±2.51, and 7.15±2.14 respectively, and the means of the LT MNA for males and females were 6.43±2.14, and 6.63±2.11 respectively, same as the result found in the previous study of (Bathala, L, et al, 2014) and (Burg EW, et al, 2013).

Also shows that there is no statistically significant difference between the means of MNAs for males and females . And this means that the gender do not affect MNA.

Much more the study reveals that there was positive relationship between age and MNA , that's to say when patient's age increases by 1year the RT & LT MNA increases by 0.163±0.024 and 0.17±0.03 mm2 respectively. Those linear relationships can be stated in the formula: RT MNA=0.16*age + 2.544, LT MNA=0.17*age+2.99, and that what documented by (Yao L, Gai N, 2004, Bathala, L, et al, 2014 and Burg EW, et al, 2013) in a previous studies.

Related to the weight of individuals and MNA the study found that there was positive relationship between weight and MNA . that's to say when patient's weight increases by 1kg the RT & LT MNA increases by .040±0.02 and .031±0.01 mm2//kg respectively. Those linear relationships can be stated in the formula: RT MNA = 0.04 * weight + 4.66, LT MNA = 0.03 * weight + 4.52 respectively.

concerning the effect of person's occupations and MNA, , the study conclude that the occupation greatly affect the MNA measurement and this was based on table , take a look at the Sig. values in the last column; The Sig. values are 0.0000 for both right MNA left MNA. So it conclude that there was statistically significant differences between Occupations in MNA Means.

5. Conclusion

This is a retrospective cross sectional study conducted to know the normal measurements of the Median Nerve Area, and to identify the relationships between these measurements and the individual body characteristics in adult.

The data was collected by doing musculoskeletal ultrasound scanning using 7-10 MHz transducers, 100 subjects with ages above 17 years were selected randomly, from whom have not any symptoms related to median nerve pathology, at period from April- to August, 2016.

The results of this study states that the mean of RT and LT MNA, were (7.32 ± 2.51) mm2, and (6.43 ± 2.14) mm2 respectively, with no significant difference between males and females.

The study conclude that there was linear increasing relationship between the median nerve area and patient's age and weight, by (0.163 ± 0.024) and (0.17 ± 0.03) mm2/year for RT and LT MNA respectively, and by (040 ± 0.02) and (0.031 ± 0.01) mm2//kg for the RT and LT MNA respectively.

6. Recommendations

High resolution musculoskeletal ultrasound is a respectful modality, and should be used confidently in measurements and evaluation of median nerve area and pathologies. In order to improve image quality, patients should be well positioned, and ultrasound machines must be well adjusted to have better resolution. Another factors like ethnics…etc.), that might affect the median nerve area were not included here. There for other studies should be done to cover these factors.

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