Research Paper Physiology

Type II Diabetic Peripheral Neuropathy of Median Nerve Correlation of Sonographic Findings With Nerve Conduction Studies

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ABSTRACT

Aim: The aim of this study was to determine the correlation between nerve conduction study and morphology of the median nerve as seen by sonography in type II diabetic peripheral neuropathy. Methods. Twenty eight with type 2 diabetes (mean ± SD, 58.2 ± 6.7 years) and Twenty fifth healthy volunteers (mean, 57.48 ± 5.62 years) were enrolled in this study The cross-sectional area (CSA) and echo intensity of the peripheral nerve were evaluated at the carpal tunnel and proximal to the wrist (wrist) of the median nerve and in the tibial nerve at the ankle. Results. Diabetic peripheral neuropathy is characterized by anteroposterior flattening and significantly increased central echogenicity seen both on the axial as well as longitudinal images. Conclusion. These results suggest that sonographic examinations are useful for the diagnosis of diabetic neuropathy.

KEYWORDS : Cross Sectional Area, Diabetic Neuropathy, Median Nerve and Sonography

1. Introduction

Peripheral nerve ultrasonography using high frequency linear transducer has become possible due to increased resolution[1]. Sonographic evaluation of entrapment neuropathies like carpal tunnel syndrome (CTS) have been used recently[2]. Nerve conduction studies (NCS) are the most objective noninvasive measures of nerve function. They represent a valuable tool of evaluation of neuropathy in large clinical and epidemiological studies NCS should not be considered a substitute for careful clinical examination, because NCS have many pitfalls and their results must be interpreted in the context of clinical data[3]. The test is highly sensitive and its not invasive, but can be a little painful due to the electrical shocks. The shocks are associated with a low amount of electrical current so they are not dangerous to anyone. Who already has an electrical device in body. The test takes longer time to perform[4]. The duration of diabetes and poor glycemic control proved to be more important risk factors over 5 yr as related to the development of subclinical neuropathy. Therefore it can be used as a screening tool for asymptomatic diabetics[5,6].

II. Materials and Methods

IIa. Chemicals:

Glucose kits and HbA1C were purchased from immune Diagnostic kits, USA and All the other chemicals used were of analytical grade.

IIb. Sonographic examinations

Sonographic examinations was performed by the ultrasound equipment PHILIPS HD 11 with a multi–frequency linear probe of 7.5 to 12 MHz

IIc. Electrophysiologic Examinations

Routine NCS was performed using conventional procedures and standard electromyography (Neuropack MEB-2200; Nihon Kohden Corporation, Tokyo, Japan). All examinations were performed in a room with an ambient temperature of 25°C. The skin surface temperature in all cases was 31°C to 33°C. All NCS were performed on both hands, and 2 sets of signals were measured

III. Ethical concern

Ethical clearance was obtained from the Ethical committee meeting conducted at Meenakshi Medical College and Hospital.

IV. Statistical Analysis

Data were analyzed using the SPSS software package, version 17.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed using range, mean, SD, and median, whereas qualitative data were expressed as frequency and percentage. Qualitative data were analyzed using the χ^2 -test; also, exact tests such as Fisher's exact were used to compare the two groups. Non-normally distributed quantitative data were analyzed using the Mann-Whitney test to compare the two groups. The Pearson coefficient was used to analyze the correlation between any two variables. P value was assumed to be statistically significant at 0.05.

V. Experimental Design

Twenty eight patients with type 2 diabetes with neuropathy were enrolled in this study at the Meenakshi Medical College and Research Institute, Kanchipuram (20 men and 8 women; age range, 40–69 years; mean 58.24 ± 6.709). Our control group consisted of 25 healthy volunteers without diabetes mellitus or CTS (14 men and 11 women; age range, 48–69 years; mean, 57.48 ± 5.620).

Every participant was able to walk unaided, and none had received hemodialysis.

All the participants gave their full consent. Their physical measurements like height, weight, BMI etc. were calculated. They had their blood bio -chemical tests for glucose (fasting and post prandial, random),HbAc1.Later all of them had ultrasound examination done in both the wrists. Some had their tibial nerve ultrasonography. A standard protocol was maintained for USG. Then all these patients were subjected to nerve conduction studies.

We studied a total of 126 (56+ 50+15+5) peripheral nerves (including 106 median nerves and 20 tibial nerves) of 53 participants who had both sonography and NCS done .

Nerve conduction study parameters that were obtained included tests of motor function like Nerve conduction velocity (*NCV*), compound muscle action potential (*CMAP*) distal latency (*in ms*) and sensory components including amplitude of the F wave

All participants were in the supine position on a table with fingers semi ex-tended during examination of the median nerve and in the prone position during examination of the tibial nerve. The volar wrist crease and pisiform bone or medial malleolus were used as initial external reference points and landmarks during scanning. Transverse and longitudinal sonograms of the nerve at each position were recorded

VI. Results:

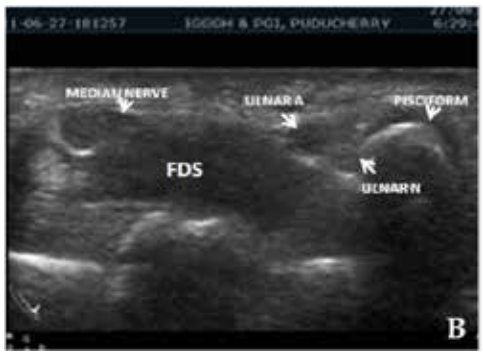
1a. Electrophysiologic Studies of Nerve function.

Table. 1. Shows that electrophysiological value of type II diabetes patients. Nerve conduction studies (NCS) are the most objective noninvasive measures of nerve function. They represent a valuable tool of evaluation of neuropathy in large clinical and epidemiological studies NCS should not be considered a substitute for careful clinical examination, because NCS have many pitfalls and their results must be interpreted in the context of clinical data.

Electrophysiological value of type II diabetes patients

Variable	Value
Cross Sectional area(CSA)mm2	13.2 ± 1.7
Nerve Conduction velocity (m/s)	40.3 ± 4.1
Ampliude o CMAP	5.7 ± 0.5
Distal latency (ms)	4.8 ± 0.3

1b. Axial section showing median nerve corresponding to the hand specimen



1c. Longitudinal section of median nerve in wrist lying superficial to FDS tendon of index finger

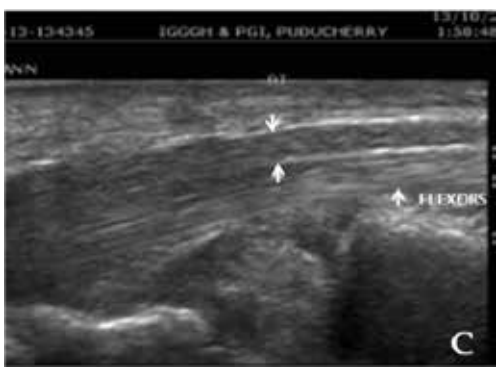
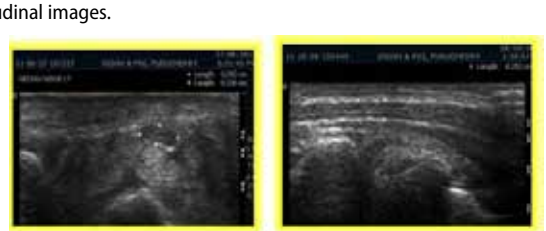


Figure 1b and 1c shows that normal axial section of median nerve corresponding to the hand specimen and Longitudinal section of median nerve in wrist lying superficial to FDS tendon of index finger respectively.

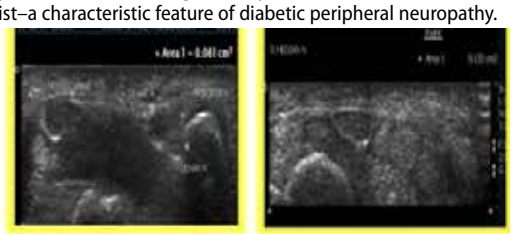
2. MORPHOLOGICAL CHANGES IN DIABETIC PERIPHERAL NEUROPATHY

Figure. 2. shows that significantly morphological changes in diabetic peripheral neuropathy compared with normal subjects . Diabetic peripheral neuropathy is characterized by anteroposterior flattening and increased central echogenicity seen both on the axial as well as longitudinal images.



3. Median nerve CSA at wrist

Figure. 3. Shows that significantly increased in median nerve CSA at wrist–a characteristic feature of diabetic peripheral neuropathy.



VII. Discussion :

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and projected to be 4.4% in 2030[7,8]. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people >65 years of age[9].

Diabetes Mellites is becoming a major cause of premature disability in India and peripheral neuropathy is a common complication ,sometimes even the presenting symptom ,of Diabetes mellites[10], The diagnosis of neuropathy is based mainly on the characteristic symptoms and signs ,confirmed with NCS ,till date. However the NCS are time-consuming , slightly invasive and generally not well tolerated for repeated evaluation. On the otherhand USG studies are non-invasive, cost effective and can be done quickly ,even as a bed side procedure.. They are also useful alternatives to NCS with high sensitivity and specificity.

The goal of the investigation of peripheral neuropathy is to establish the diagnosis , determine whether it is an axonal or demyelinating process and to find its cause.

Nerve conduction studies (N.C.S.)can distinquish demyelinative neuropathy (slowing of conduction velocity or conduction block) from axonal neuropathy (low action potential amplitudes).

Electromyography (E.M.G.)can distinquish denervation atrophy from primary muscle disease.

The Pressure- Specified –Sensory Device testing provides a clinical measurement of loss of sensory loss of sensory discrimination in chronic peripheral neuropathies. This test is limited ,if used alone ,as it does not discriminate focal disease (e.g. entrapement neuropathies) from diffuse abnormality of the affected nerve (e.g. diabetic neuropathy).The effectiveness of this device increases dramatically when combined with ultrasongraphic studies. Such a combined study helps plan effective treatment strategy, possibility of early surgical intervention leading to improvement in patient symptoms

The use of diagnostic ultrasound for peripheral nerve lesions is becoming more prevalent nowadays as the related hardware, software and techniques in ultrasonography improve tremendously..Several recent articles focus on the use of ultrasound in diagnosing or mapping peripheral nerve injuries[11]. Even in animal studies the correlation between anatomical measurements and ultrasound measurements have been established. But there are only few previous studies found ,both in Indian and world literature, focusing on monitoring or documenting peripheral nerve lesions in diabetic peripheral neuropathy using diagnostic ultrasonography.

Sonographic criteria for the diagnosis of neuropathy have been proposed by several studies and confirmed in our study also. We found that the CSA of both median and tibial nerves in diabetic patients were significantly larger than those in controls. Carpal tunnel syndrome and tarsal tunnel syndrome (TTS) are the most common entrapment neuropathies that can occur in diabetics.

Several studies have shown that the CSA of median and tibial nerves were significantly larger in all diabetic patients with polyneuropathy than in controls. Our study has also confirmed this finding. It has also been shown that some diabetic patients without neuropathy also have significant increase in CSA

Of the two songraphic measurements of nerve C.S.A, we used the easier reproducible method. Further multilevel assessment of the median nerve has been suggested by some authors as there are individual variations in the swollen part of the median nerve. We studied the median CSA with reference to the fixed bony landmark (the pisiform bone) in all cases.

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Using sonography in the median nerve, Sernik et al[12] showed decreased echogenicity of the median nerve in symptomatic CTS wrists. This has been shown even in tibial nerves. Kim et al reported that 6.8% of diabetic patients had asymptomatic electrophysiologic CTS[13].

In experienced hands high-resolution USG is a very effective imaging

modality for capturing morphologic changes in the peripheral nerves and for making correct diagnoses. It could be used either as a first-line imaging modality in patients with suspected peripheral nerve lesions before further treatment is administered or as a useful tool for follow-up imaging or as a screening tool in asymptomatic diabetic patients.

VIII. CONCLUSION

In the present study, sonographic findings correlate well with nerve conduction studies in diabetic peripheral neuropathy.

Based on nerve conduction studies alone, it is not possible to distinguish carpal tunnel syndrome (CTS) from diabetic peripheral neuropathy (DPN). Sonography can differentiate these two entities

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