



# EVALUATION OF DIABETIC MEDIAN NEUROPATHY IN CHILDREN WITH TYPE1 DIABETES USING ULTRASONOGRAPHIC IMAGING AND ELECTROPHYSIOLOGY

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## INTRODUCTION

Diabetic neuropathy is recognized as the most common clinical picture of nervous system disorders caused by DM and is considered the most common type of neuropathies. It affects patients with both type1 and type2 diabetes, but it progresses more rapidly and its manifestations are more severe in type 1 diabetes(T1DM). Earlier observations and population-based cohort studies have shown that 66% of patients who have T1DM develop some form of neuropathy

## AIM OF THE WORK

This study was primary designed to evaluate the relationship between the sonographically measured cross-sectional area(CSA) of the median nerve and nerve conduction study (NCS) in children with type1 diabetes(T1DM)complaining of DPN.

## SUBJECTS AND METHODS

**Subjects:** The present study included 40 (10 males and 30 females) type 1 diabetic adolescents who were recruited from the regular attendants of the Pediatric Diabetes Clinic, Children's Hospital, Ain Shams University over 10 months period between January to June 2013. To be eligible for the study patients had to satisfy the following criteria: (1) children with T1DM, who are able to perform all neurological examinations and tests and (2) having diabetes for more than five years. We divided the diabetic children into 2 groups; children with and without diabetic peripheral neuropathy (DPN). DPN was diagnosed on the basis of sensory symptoms in the form of bilateral tingling and numbness which started a few months ago. Full clinical neurological examination was done to confirm peripheral neuropathy if present. We adopted the simple rapid bedside neuropathy disability score (NDS) as a screening tool for DPN. Exclusion criteria included: Exclusion of neuropathies other than DPN was considered. This includes the following: patients with other significant chronic diseases (renal, liver and thyroid diseases) and other systemic diseases that affect the central nervous system.

Twenty healthy children and adolescents served as a control group (mean age of 13.9 ± 3.3 years). They were chosen from apparently healthy males and females with no obvious medical disorder. They were age and gender matched with the studied group

**Methods:** All subjects underwent the following:

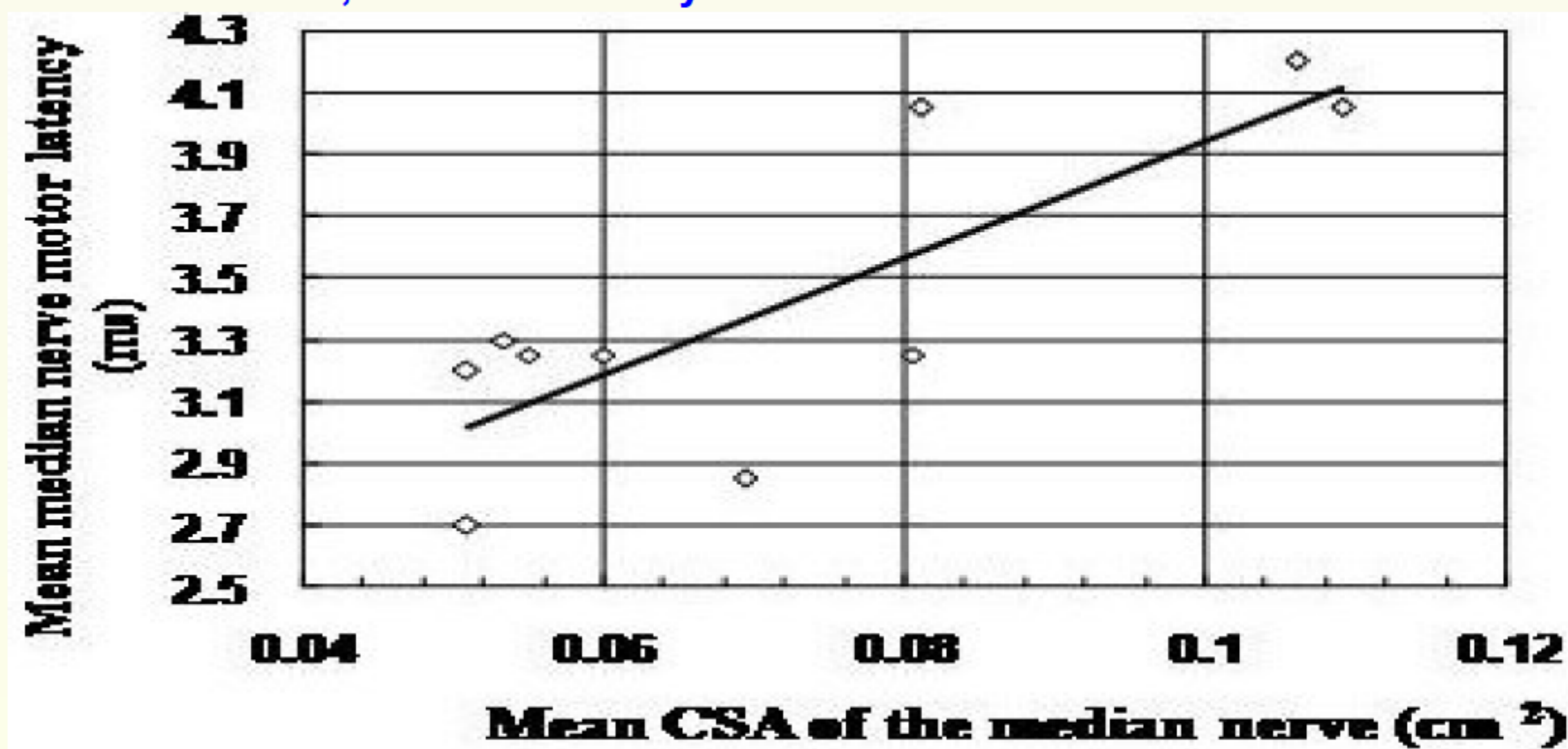
- **Detailed Questionnaire:** Complete history taking including their age, diabetes duration, complications, insulin regimen, symptoms of diabetic neuropathy
- **Clinical assessment:** Physical examination includes: anthropometric measures; weight in kg, height in cm and body mass index (BMI); blood pressure. Additionally, full clinical neurological examination was done to detect evidence of peripheral neuropathy. Diabetic retinopathy (DR) was diagnosed by doing complete ocular examination including visual field testing, slit-lamp biomicroscopy, Volk lens and indirect ophthalmoscopy.
- **Investigations:** HbA<sub>1c</sub>, All participants performed NCS and sonographic measurement of CSA for the median nerve in the wrist(in the carpal tunnel). All NCS were done on both median nerves measuring the motor nerve conduction velocity (MNCV) and the motor latency from the elbow to the wrist joint.

## RESULTS

- Patients with T1DM (mean age 15.2 ± 2.9 years, duration 8.4± 4.1 years, all participants were on intensive insulin therapy in a dose ranging from 0.5 to 2.5 IU/kg/day with a mean of 0.4 - 1.8 IU/kg/ day.
- The mean median nerve CSA was larger in diabetic children with DPN compared to those without DPN and controls(0.073 cm<sup>2</sup>, 0.072 cm<sup>2</sup>, 0.043 cm<sup>2</sup> respectively, P=0.01), but there was no significant difference between diabetic children without and with DPN(P=0.79) Table 1, Fig.1.
- The mean value of median nerve motor latency was diminished in patients with DPN in comparison to patients without DPN and controls ( 3.5 ms, 3.4 ms, 2.96 ms respectively, P=0.005) Table 1.
- The mean value of median nerve MNCV in the control individuals showed no significant difference (p = 0.085) compared to that of children without DPN and statistically significant difference (p =0.016) compared to that of children with DPN as it was 54.6 m/s versus 52.9 m/s and 54.6 m/s versus 51.5 m/s respectively, Table 1.
- In the group of children with DPN, the mean median nerve CSA for both wrists had a highly significant positive correlation with median nerve motor latency for both wrists (r= 0.735; p = 0) and no correlation with mean median MNCV for both wrists (r= 0.079; p= 0.741) Fig.2.
- The increased median nerve CSA in the wrist was correlated with the median nerve motor latency(r= 0.735; p= 0.01), duration of diabetes(r= - 0.566; p= 0.009) and HbA<sub>1c</sub> (r= -0.733; p= 0.05), nevertheless, with non significant correlation with median nerve MNCV (r= -0.079; p= 0.741).
- The best cut-off value of the sonographically measured median nerve CSA for discrimination between control individuals and children with DPN is (0.046) (i.e. >0.046) identify children with DPN and <(0.046) identify control individuals with sensitivity =100%, specificity = 80%, positive predictive value =83.3%, negative predictive value =100%.
- The best cut-off value of the mean median nerve motor latency of both wrists between control individuals and diabetic children whether without or with DPN is 3 (i.e. >3) identify diabetic children (without DPN or with DPN) and <(3) identify control individuals with sensitivity = 80%, specificity =70%, positive predictive value =72.7%, negative predictive value =77.8%.

Parameter	The mean value of median nerve CSA	The mean value of median nerve motor latency	The mean value of median nerve MNCV
Control individuals versus children without DPN	HS (p= 0)	HS (p= 0.001)	NS (p= 0.085)
Control individuals versus children with DPN	HS (p= 0)	HS (p= 0.005)	S (p= 0.016)
Children without DPN versus children with DPN	NS (p= 0.828)	NS (p=0.747)	NS (p= 0.312)

Table (1) :Comparison between the studied groups as regards the mean value of median nerve CSA, its motor latency and mean value of median nerve MNCV.



Fig(2):Linear Regression analysis showing positive correlation between the mean CSA of the median nerve and its motor latency among children with DPN

## CONCLUSION

- Our data implicate that sonographic measurement of CSA is a good alternative to NCS results of motor latency and MNCV for the diagnosis and follow up of diabetic neuropathy. Moreover, the duration of disease and impaired glycemic control play an important role in the development of peripheral neuropathy.

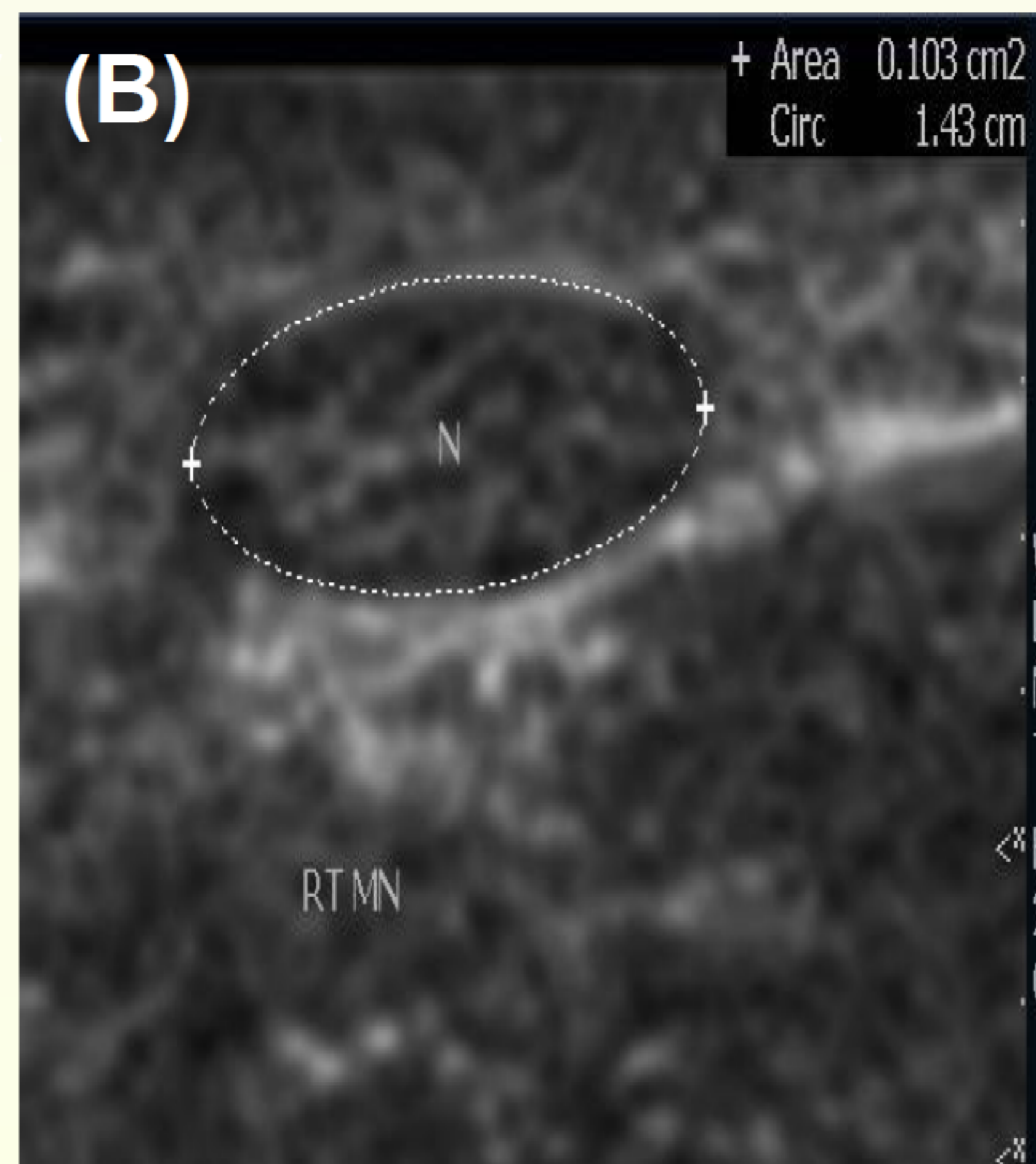
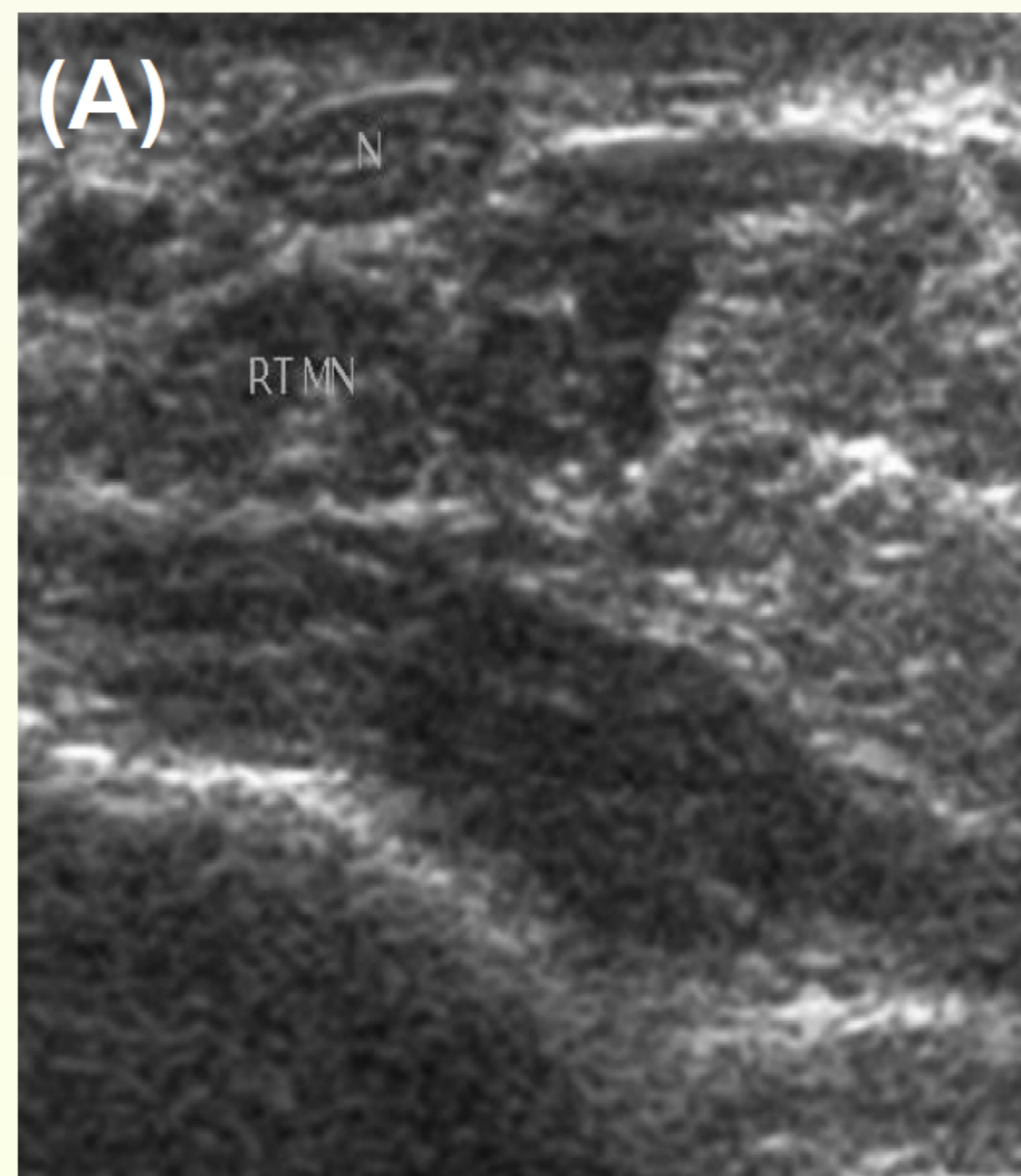


Fig (1) :The median nerve CSA in a child with DPN: (A) Transverse scan of the median nerve in the wrist showing the neuronal fascicles and the epineurium. (B) The sonographically measured CSA at the inner border of the perineurium using the manual tracing technique was 0.103 cm<sup>2</sup>.

