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LETTER TO THE EDITOR

Nerve conduction study abnormalities in Indian children with type 1 diabetes

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Nerve conduction study(NCS) is considered the gold standard to detect diabetic sensorimotor peripheral neuropathy (DSPN) in children with type 1 diabetes (T1DM) [1]. NCS abnormalities range from 22 to 97% in children depending on the criterion used, ethnicity, and clinical profile [1]. NCS data in the paediatric population in India is scarce. This single-centre cross-sectional study aimed to explore patterns of DSPN in Indian children/adolescents with T1DM.

This was a single-centre observational cross-sectional study approved by the institutional ethics committee. We recruited T1DM children/adolescents aged 5–18 years without a history of systemic illness and healthy siblings as controls. Abbreviated NCS protocol was performed with Neuropack X1 instrument on sensory sural and motor common peroneal nerves (CPN) of the right lower limb to record amplitudes (Amp) and nerve conduction velocities (NCV) [2], as these two nerves are most sensitive indicators of DSPN [1]. Sample size calculation based on nerve conduction velocity (NCV) data was done to determine the significant difference in NCS parameters between T1DM versus controls. Allowing a margin of error of 2 m/sec on either side of the mean [3] and power of 90%, type 1 error of 5%, the calculated sample size was required to be 25 in each group [4].

Fifty-one T1DM subjects (19 males) and 50 age and gender-matched healthy children (21 males) were recruited. NCS parameters of 50 healthy children (mean ± SD) were sural nerve (amplitude (21.4 ± 5.7 μV), sural nerve conduction velocity (50.8 ± 3.4 m/s)), common peroneal nerve (amplitude (6.0 ± 2.4 mV), CPN-nerve conduction velocity (52.2 ± 4.6 m/s)). Abnormal nerve conduction values were taken as values below 2.5 SD of normal, and these cut-off values were applied to the T1DM cohort to identify children with subclinical neuropathy.

Children with T1DM (age 12.8 ± 3 years, T1DM duration 6.03 ± 2.9 years, HbA1c 9 ± 1.5%) had no or minimal evidence of clinical neuropathy as per Toronto clinical neuropathy score. The most common nerve conduction abnormality in T1DM children was in sural nerve conduction velocity ($n = 15$, 29.4%) followed by sural-amplitude ($n = 7$, 13.7%), peroneal nerve conduction velocity ($n = 6$, 11.7%). Patterns of involvement were pure sensory ($n = 12$), sensorimotor ($n = 4$), and pure motor ($n = 2$). Subclinical DSPN defined by abnormalities in any one of these parameters (with no or minimal signs/symptoms of neuropathy) was present in 18/51 (35.2%). Majority of them were post-pubertal ($n = 16/18$). HbA1c was significantly higher in the T1DM subgroup with abnormal NCS versus normal NCS (Table 1). However, there was no significant difference in age, gender, diabetes duration, and urine albumin-creatinine ratio (ACR) between the two groups (Table 1).

None of the children with T1DM had retinopathy. Five children had microalbuminuria (urine ACR > 30 μg/g creatinine on 2 occasions in the past 3 months). All five children having microalbuminuria also had subclinical neuropathy. NCS was abnormal in 13 out of 46 children with T1DM and no microalbuminuria.

Subclinical DSPN was found in a significant proportion (35%) of T1DM children. This study generated cut-offs to define subclinical DSPN from nerve conduction study data of a healthy cohort aged 5–18 years. This adds to the strength of the study as opposed to a previous study which might have overestimated the burden [5]. Using different criterion, Singh et al. reported subclinical DSPN in 56% of T1DM children, and CPN was most commonly affected [5].

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Table 1 Clinical and biochemical profile in T1DM with or without abnormal NCS

	T1DM with normal NCS ($n=33$)	T1DM with abnormal NCS ($n=18$)	p value
Age (years)	12.5 ± 3.4	13.3 ± 2.3	NS
Gender (male/female)	13/20	6/12	NS
Body mass index (kg/m^2)	17.8 ± 1.7	18.5 ± 0.9	NS
Diabetes duration (years)	5.8 ± 2.4	6.1 ± 3.1	NS
HbA1c (%)	8.3 (7.7–8.9) *	9.5 (8.9–10.1) *	0.01*
Creatinine (mg/dl)	0.5 (0.4–0.6)	0.5 (0.4–0.6)	NS
Urine ACR (µg/g creatinine)	8.2 (3.2–13.2)	10.1 (3–17.8)	NS

*p value < 0.05 is considered significant. Data with normal distribution was presented as mean standard deviation, and nonparametric data was presented as median (inter-quartile range). Differences of continuous data between the two groups were assessed using the Student t-test or Mann–Whitney test as applicable. Difference in the proportion of categorical variable was assessed using the chi-square test. Statistical analysis was performed using SPSS version 22

Abbreviations: T1DM, type 1 diabetes mellitus; *NCS*, nerve conduction studies; *ACR*, albumin-creatinine ratio

However, the present study found that the sural nerve was the most common nerve affected, thereby suggesting that sensory neuropathy precedes motor neuropathy in agreement with previous studies [6, 7]. The findings further suggested that subclinical neuropathy is common in T1DM children even in absence of microalbuminuria or retinopathy.

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Data Availability The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

Declarations

Conflict of interest The authors declare no competing interests.

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