ORIGINAL RESEARCH PAPER

Volume-7 | Issue-9 | September-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A STUDY OF DIABETIC PERIPHERAL NEUROPATHY IN CHILDREN HAVING TYPE 1 DIABETIC MELLITUS.

Pediatrics

Dr. Deepak Madavi Associate Professor In The Department Of Paediatrics, Iggmc, Nagpur.

Dr. Milind Suryawanshi* Assistant Professor In The Department Of Paediatrics, Iggmc, Nagpur. *Corresponding Author

ABSTRACT

AIMS: To determine the association between Diabetic peripheral neuropathy and glycated hemoglobin (HbA1c) level in type I diabetic children.

MATERIALS AND METHODS: The 50 children included in the study were selected prospectively by the department of paediatrics at a tertiary hospital in Central India from Jan 2017 to June 2018. Patients with T1DM were selected based on the inclusion criteria (i.e., age greater than 6 yrs and absence of other co-morbidities).

OBSERVATION AND RESULTS: Fifty patients with T1DM were enrolled in this study. The mean diabetes duration of patients was 8.38±3.79 yr (mean age16.68±6.68 yr). The mean HbA1c level was 8.6±2.1% in patients without DPN and 10.5±3 in those with DPN (P=0.016). Overall, 24% of the subjects were presented with DPN according to nerve conduction velocity study (NCV) findings. A positive correlation was found between NCV and clinical symptoms with signs (P<0.001, r=0.45 and P<0.001, r=0.644, respectively).

KEYWORDS

Diabetic peripheral neuropathy

INTRODUCTION:

We know that Type 1 diabetes mellitus (T1DM) is a chronic immune-mediated disease, in which the pancreas ceases to produce enough insulin (1). The overall increase in the incidence of T1DM was estimated at nearly 3%, and the annual incidence of this condition varied from 0.61 cases per 100000 populations in China to 57.6 cases per 100000 in Finland (2, 3). Middle East region, have the highest incidence rate at 31.4 and 22.3/100000 per year (4).

Annually, 1 to 35 new cases of T1DM (younger than 14 yr) per 100000 populations are diagnosed per year. In various countries, the incidence rate of T1DM has at least doubled over the past two decades. The incidence of this condition seems to raise as the distance from the equator increases (5, 6).

Peripheral nervous system involvement is a common complication of T1DM, and unlike adults, patient's polyneuropathy has no clinical manifestations in diabetic children (7). The prevalence of neuropathy varies depending on the severity and duration of hyperglycemia (1). The prevalence of peripheral neuropathy in both adults and children ranges between 7% and 57% (8).

Nerve conduction velocity (NCV) test is the method of choice for the diagnosis of neuropathy. The incidence of neuropathy in different studies ranges from 10% to 68% among diabetic patients (9, 10).

In this study, we evaluated the sign and symptoms of peripheral polyneuropathy and its correlation with glycated hemoglobin (HbA1c) level as an indicator of metabolic control in diabetic patients

MATERIALS AND METHODS:

The cases were the children presenting at a tertiary hospital in central India and were recruited prospectively upon initial evaluation by the department of paediatrics from Jan 2017 to June 2018. Patients with T1DM were selected based on the inclusion criteria, i.e., age of six years or older, and absence of other comorbidities. On the other hand, patients with neurological disorders, such as mental retardation, secondary diabetes, systemic diseases, or maturity-onset diabetes of the young were excluded from the study. Thus, a total of 50 children were selected for the study.

Vibration perception, temperature sensation, pinprick sensation, MMT and ankle reflex were examined in the participants. A tuning fork (128 Hz), cold and warm water test, and a reflex hammer were used for the evaluations. Neuropathy was evaluated through electrodiagnostic studies. The reference for evaluation and comparison of the electro-diagnostic parameters of sensorimotor responses were based on the tables from the “Electrodiagnosis in diseases of the nerve and muscle” and “electro-diagnostic medicine”.

The sensory nerves evaluated were the median and ulnar nerves in the upper limbs, Sural and superficial peroneal nerves in the lower limbs, and sural as well as superficial peroneal nerves in lower limbs. The methods used for the stimulation, recording, and analysis of the data were based on the standards of the books aforementioned.

NCV and distal latency tests were performed in the following nerves: Common peroneal nerve, tibial nerve, superficial peroneal nerve, and sural (sensory) nerve in the lower extremities, as well as median (motor and sensory) nerves in the upper extremities, were observed in the tests.

For data analysis, SPSS Ver. 16 was applied, and the collected data with referral codes were imported into the software. P-value less than 0.05 were considered statistically significant.

RESULTS:

Fifty T1DM patients with the mean age of 16.68±6.98 yr and disease duration of 8.36±3.79 yr were enrolled (Table 1). Overall, 54% (n=27) of the participants were female. Twenty one (42%) patients were clinically asymptomatic, while 29 (58%) cases had at least one of the signs or symptoms of peripheral neuropathy. Abnormal pain sensation was detected in 9 (18%) patients, and the frequency of paresthesia, numbness, and burning sensation was 6%, 28%, and 8%, respectively; in total, and 30 (60%) patients had one abnormal symptom. Neurological examination was suggestive of impaired temperature sensation in 6 (12%) cases. Reduced vibration perception, abnormal Achilles reflex, and impaired touch perception were reported in 5 (10%), 15 (30%), and 3 (6%) cases, respectively; overall, 29 (58%) patients had one abnormal sign. Abnormal Achilles reflex and numbness were the most common findings in our study population (Table 2).

Based on the comparison between the two groups by Kappa coefficients, clinical signs were not significantly associated with peripheral neuropathy, while a significant correlation was found between peripheral neuropathy and clinical symptoms (Table 3). NCV was normal in 38 (76%) patients and abnormal in 12(24%) cases. The mean HbA1c level was 8.6±2.1 (mmol/ml) in patients without peripheral neuropathy, and 10.5±3 in those with peripheral neuropathy (P=0.016) (Table 1).

DISCUSSION:

It is known that Diabetic neuropathy is a major complication of T1DM. This term usually refers to polyneuropathy and can be classified into two broad subclinical and clinical stages. The prevalence of diabetic neuropathy in developing countries ranges between 10% and 68% (9,11). In Western countries, up to 60% of all patients with diabetes are affected by diabetic neuropathy (10). However, the estimated rates of children are inaccurate, considering the prevalence of subclinical diabetic neuropathy observation in this age group.

In the present study, DPN was reported in 24% of the patients, according to the electrodiagnostic studies, while 25% of these cases were clinically asymptomatic. Nearly one-fourth of young patients who recently diagnosed with diabetes had pathological findings in the distal nerves (9). Moreover, subclinical DPN was reported in up to 60% of patients in Isfahan, Iran (12). Various studies have introduced diabetes duration as a major factor in DPN development (11, 13-16), although this finding has not been confirmed in other studies (17, 18), similar to the present research. On the other hand, diabetic neuropathy and abnormal NCV findings have been reported in patients with recently diagnosed diabetes by some researchers (14, 19).

Patients with diabetic neuropathy have few complaints, and their physical examination may reveal variable degrees of sensory loss (20).

Although hyperglycemia plays a crucial role in the progression of DPN, DPN can also occur without hyperglycemia (21).

Our results revealed that poor diabetes control could be associated with DPN, and HbA1c level, used as an index for glycemic control over the past six months. In fact, in the present study, diabetic neuropathy had no positive correlation with age, sex, BMI, duration of disease, or hyperlipidemia, whereas a significant correlation between HbA1c level and diabetic neuropathy was observed.

1. Clinical and biochemical characteristics of diabetic patients with and without neuropathy

RISK FACTORS	NEUROPATHY		P-VALUE
	PRESENT	ABSENT	
Sex (male/female)	3/9	20/18	0.094
Age (yr)	19.7±10.1	15.7±5.4	0.20
Diabetes duration (years)	11.3±9.4	7.4±3.7	0.18
BMI (kg/m^2)	21.1±2.6	19.7±3.3	0.16
Triglyceride (mg/dl)	105.6±66.5	83.7±44.7	0.35
Cholesterol (mg/dl)	158.33±34.8	188.7±64.4	0.28
HbA1c	10.58±3.05	8.63±2.1	0.016

2. Frequency of signs and symptoms in diabetic patients according to nerve conduction velocity (NCV)

		Abnormal NCV N=12 (24%)	Normal NCV N=38(76%)	Total N=50
SYMPTOMS	Burning sensation	3 (25)	1(2.6)	4 (8)
	Pain sensation	3 (25)	6(15.8)	9 (18)
	Paresthesia	2 (16)	1(2.6)	3 (6)
	Numbness	5 (41.7)	9 (23.7)	14 (28)
SIGNS	impaired temperature sensation	6 (50)	0 (0)	6 (12)
	Reduced pain sensation	0 (0)	0 (0)	0 (0)
	Reduced vibration perception	5 (41.7)	0 (0)	5(10)
	Impaired touch perception	3(25)	0 (0)	3(6)
	Abnormal Achilles reflex	9 (75)	6 (15.8)	15 (30)

3. The correlation between clinical indices and nerve conduction velocity (NCV)

	Conduction	Normal NCV N=38(76%)	Abnormal NCV N=12 (24%)	Kappa coefficient
Abnormal signs	Absent	24 (63.2)	3 (25)	Kappa=0.290 P-Value=0.021
	Present	14 (36.8)	9 (75)	
	Total	38 (100)	12 (100)	
Abnormal symptoms	Absent	32 (84.2)	1 (8.3)	Kappa=0.664 Sig<0.001
	Present	6 (15.8)	11(91.7)	
	Total	38 (100)	12 (100)	

REFERENCES:

1. Edwards JL, Vincent AM, Cheng HT, Feldman EL. Diabetic neuropathy: mechanisms to management. Pharmacol Ther. 2008;120(1):1–34.
2. Incidence and trends of childhood Type 1 diabetes worldwide 1990-1999. Diabet Med . 2006;23(8):857–66.
3. Diana K. Trialsin prevention of Type 1 Diabetes: Current and Future. Can J Diabetes. 2014;38(4):279–284.
4. International Diabetes Federation. IDF Diabetes Atlas.Brusseles, Belgium: 2013. 6th ed. http://www.idf.org/diabetesatla.
5. Soltesz G, Patterson CC, Dahlquist G. Worldwide childhood type 1 diabetes incidence--what can we learn from epidemiology?Pediatr Diabetes. 2007;8 Suppl 6:6–14.
6. Silink M. Childhood diabetes: a global perspective. Horm Res. 2002;57 Suppl 1:1–5.
7. Abbott CA, Carrington AL, Ashe H, Bath S, Every LC, Griffiths J, et al. The North-West Diabetes Foot Care Study: incidence of, and risk factors for, new diabetic foot ulceration in a community-based patient cohort. Diabet Med. 2002;19(5):377–84.
8. Hajas G, Kissova V, Tirpakova A. A 10-yr follow-up study for the detection of peripheral neuropathy in young patients with type 1 diabetes. Pediatric Diabetes. 2016
9. Trotta D, Verrotti A, Salladini C, Chiarelli F. Diabetic neuropathy in children and adolescents. Pediatr Diabetes. 2004;5(1):44–57.
10. Sajic S, Petrovic R. Subclinical peripheral neuropathy in type 1 diabetic adolescents and its relationship with metabolic control. Srp Arh Celok Lek. 2005;133(7-8):358–62.
11. Bao XH, Wong V, Wang Q, Low LC. Prevalence of peripheral neuropathy with insulin-dependent diabetes mellitus. Pediatr Neurol. 1999;20(3):204–9.
12. Hasani N, Khosrawi S, Hashemipour M, Haghighatiyan M, Javdan Z, Taheri MH, et al. Prevalence and related risk-factors of peripheral neuropathy in children with insulin-dependent diabetes mellitus. J Res Med Sci. 2013;18(2):132–6.
13. Nelson D, Mah JK, Adams C, Hui S, Crawford S, Darwish H, et al. Comparison of conventional and non-invasive techniques for the early identification of diabetic neuropathy in children and adolescents with type 1 diabetes. Pediatr Diabetes. 2006;7(6):305–10.
14. Weintrob N, Amitay I, Lilos P, Shalitin S, Lazar L, Josefsberg Z. Bedside neuropathy disability score compared to quantitative sensory testing for measurement of diabetic neuropathy in children, adolescents, and young adults with type 1 diabetes. J Diabetes Complications. 2007;21(1):13–9.
15. Booya F, Bandarian F, Larijani B, Pajouhi M, Nooraei M, Lotfi J. Potential risk factors for diabetic neuropathy: a case control study. BMC Neurol. 2005;5:24.
16. Riihimaa PH, Suominen K, Tolonen U, Jantti V, Knip M, Tapanainen P. Peripheral nerve function is increasingly impaired during puberty in adolescents with type 1 diabetes. Diabetes Care. 2001;24(6):1087–92.
17. Karsidag S, Morali S, Sargin M, Salman S, Karsidag K, Us O. The electrophysiological findings of subclinical neuropathy in patients with recently diagnosed type 1 diabetes mellitus. Diabetes Res Clin Pract. 2005;67(3):211–9.
18. Meh D, Denislic M. Subclinical neuropathy in type I diabetic children. Electroencephalogr Clin Neurophysiol. 1998;109(3):274–80.
19. Semiz S, Fisenk F, Akcurin S, Bircan I. Temporary multiple cranial nerve palsies in a patient with type 1 diabetes mellitus.Diabetes Metab. 2002;28(5):413–6.
20. Malgrange D, Richard JL, Leymarie F. Screening diabetic patients at risk for foot ulceration A multi-centre hospital-based study in France. Diabetes Metab. 2003;29(3):261–8.
21. Smith AG, Ramachandran P, Tripp S, Singleton JR. Epidermal nerve innervation in impaired glucose tolerance and diabetes-associated neuropathy. Neurology. 13;57(9):1701–4.