

Neurological Manifestations In Type- 1 Diabetes Mellitus In Children

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Summary:

J Fac Med Baghdad
2006; Vol. 48, No.3
 Received Sep 2005
 Accepted Jan 2006

Background: Diabetes mellitus type-1 is the most common endocrine metabolic disorder in childhood. Mononeuropathy, generalized polyneuro-pathy and autonomic neuropathy are frequent complications of diabetes mellitus and may give rise to troublesome manifestations.

Methods: sixty children suffering from type 1 diabetes mellitus admitted in Children Welfare Hospital- Medical City-Baghdad in the period from 1st Dec2000-31stJuly 2001 were included in this prospective descriptive study. History, especially symptoms of peripheral neuropathy, examination specially signs of peripheral neuropathy, absent sinus arrhythmia and postural hypotension and investigations like nerve conduction study were all performed and analyzed.

Results:

The study showed that out of 60 diabetic children 26(43.3%) had symptomatic polyneuropathy, 18 (30%) had postural hypotension and 16 (26.6%) had absent sinus arrhythmia. Neurological manifestations of diabetes mellitus occur frequently in diabetic children with long duration of illness.

Polyneuropathy is sensory more than motor and affected the lower limbs more than the upper limbs.

Conclusion: Early diagnosis of autonomic neuropathy in diabetic children is simple easy and requires minimum cooperation, so as detection of peripheral neuropathy in asymptomatic by nerve conduction study.

Keywords: IDDM; childhood; neurological manifestations. Iraq.

Introduction:

Diabetic neuropathy, including mononeuropathy, generalized polyneuro- pathy and autonomic neuropathy is a frequent complication of diabetes mellitus and may give rise to troublesome manifestations. Involvement of autonomic nervous system may result in impaired sympathetic response to hypoglycemia (1).

The proposed mechanism for alteration in neuropathy appears to be a combination of altered metabolism and vascular insufficiency (2).

The commonest presenting feature of neuropathy is distal symmetrical sensory neuropathy (3).

Signs and symptoms suggestive of autonomic neuropathy are absent sinus

, postural hypotension, nocturnal diarrhea, gastric fullness and hypoglycemic unawareness (4).

The etiology is unknown but recently antibodies to sympathetic ganglion have been demonstrated. It has also been found that adrenal medulla is enervated by preganglionic sympathetic nerve fibers.

Antisymphathetic antibodies to preganglionic nerve fibers will result in defect in adrenal medulla innervations and this would result in decrease in epinephrine (5). The measurement of heart rate variability during single or sustained deep breath could provide an estimate to respiratory sinus arrhythmia and could be used as an index of vagal outflow. Analysis of heart rate-respiratory relationship is the most predictive index of the risk of developing clinical dysautonomic neuropathy. Early puberty is a critical period for the development of diabetic cardiac autonomic dysfunction; therefore all type 1 diabetic patients should be screened for this complication by heart rate variables analysis beginning at the first stage of puberty regardless of duration of illness; microalbuminuria and level of metabolic control(6) .

Immediately on standing the arterial pressure in the head and upper part of the body tends to fall. The falling pressure at baroreceptors elicits an immediate reflex resulting in strong sympathetic discharge and minimizes the decrease in pressure in the head and upper body. On physiological bases, the ability of the baroreceptors to maintain a relatively constant blood pressure is important when a person stands up after having been lying down (7,8).

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Methods:

This prospective descriptive study was performed on sixty children suffering from type 1 diabetes mellitus (IDDM) attending the diabetic clinic in children welfare hospital –medical city - Baghdad during the period from 1st Dec. 2000-31st July 2001.

All diabetic children included were on insulin therapy. They were neither having any evidence of intrinsic central nervous system or respiratory disease nor were they taking any medication that might affect cardiovascular system.

For symptomatic peripheral neuropathy they were asked about suggestive symptoms like numbness, tingling sensation in feet and hands and pain described as pins and needles.

Absent sinus arrhythmia was searched for by ECG while the patient was lying flat ,record of heart rate during maximal deep breathing , R-R interval was measured to have a heart rate fall of less than 10 beats /minute was considered an evidence of absent sinus arrhythmia as a form of autonomic neuropathy .

Postural hypotension was recorded after lying for fifteen minutes quiet, measuring the resting blood pressure at oneand three minutes after standing.

A blood pressure fall of more than 20 mmHg was considered postural hypotension. The nerve conduction study including sensory and motor examination of median and ulnar nerves in upper limbs and peroneal nerve in lower limbs was performed. The nerve conduction velocity was calculated using electrical nerve stimulation technique and suitable recording electrodes with amplifying equipments .These measures are useful for the diagnosis of peripheral nerve disorders.

Results:

The mean age of the studied group was 10 years and the mean duration of illness was 5 years and 2 months. 27(45%) of them were boys and 33(55%) were girls with a male: female ratio of 0.8: 1. The neurological manifestations of diabetes mellitus occurred quite frequently in children with type 1 diabetes mellitus with highest prevalence in those with long duration of illness. These manifestations were found even in diabetic children with short duration of illness though in less frequency.

Twenty eight (46.6%) patients had a duration of illness of 1-3 years and 8(13.3%) had a duration of illness of 10-12 years.

Out of 60 diabetic children 26(43.3%) had symptomatic peripheral neuropathy, 18 (30 %) had postural hypotension and 16 (26.6%) had absent sinus arrhythmia.

In diabetic children with a duration of illness of 1-3 years symptomatic peripheral neuropathy was recorded in 25%, postural hypotension in 14.2% and absent sinus arrhythmia in 15.8%,while those

with a duration of illness of 10-12 years symptomatic peripheral neuropathy in 62. 5%, autonomic neuropathy in 75% and absent sinus arrhythmia in 50%.

Nerve conduction study was done for 25 patients. Only 9 (36%) had peripheral neuropathy. 6 (66.6 %) with lower limb and 3 (33.3%) with upper limb involvement.

Six (66.6%) had sensory and 3(33.3%) had motor neuropathy.

Out of these 9 patients with abnormal nerve conduction study

4(44.4%) were asymptomatic and 3(33.3%) had abolition of ankle jerk reflex.

Polyneuropathy is sensory more than motor and affected the lower limbs more than the upper limbs.

Table-1: Neurological manifestations in 60 children with type 1 diabetes mellitus

Duration of illness(years)	patients No. and %	Symptomatic peripheral neuropathy No. and %	Postural hypotension No. and %	Absent sinus arrhythmia No. and %
1-3	28(46.6%)	7(25%)	4 (143%)	5 (17.8%)
4-6	17(28.3%)	10(58%)	5(29.4%)	4 (3.5%)
7-9	7(11.6%)	4(57.1%)	3(42.8%)	3 (42.8%)
10-12	8(13.3%)	5(62.5%)	6 (75%)	4 (50%)
Total	60(100%)	26(43.3%)	18(30%)	16(26.6%)

Table- 2: Nerve conduction study results in 25 children with type 1 diabetes mellitus

Total No. and%	Peripheral neuropathy No. and%	Sensory neuropathy No. and%	Motor neuropathy No. and%	Lower limbs No. and%	Upper limbs No. and%
25 (100%)	9 (36%)	6 (66.6)	3 (33.3%)	6 (66.6%)	3 (33.3%)

Discussion:

The neurological manifestations of diabetes mellitus occurred quite frequently in children with type 1 diabetes mellitus with highest incidence in those with a long duration of illness. These manifestations were found even in diabetic children with a short duration of illness though in less frequency.

Depending on clinical signs and symptoms JD ward found that 13% of diabetic children developed diabetic neuropathy (9), while in this study it was noted in 26%. Another study done by Al-Naddawi and Kawther Ali also showed that 33.3% of diabetic children had peripheral neuropathy and correlated with the duration of illness (10). The higher percentages in Iraqi studies may be related to poor diabetic control, as proper diabetic control might delay appearance of neurological manifestations in diabetic children.

Solder et al. in prospective study on 144 children with newly diagnosed diabetes mellitus found

abnormal parasympathetic function (Heart rate variation) in 25% of diabetic children at the onset of diabetes and after 2 years deterioration was common. The explanation of this finding is that as hyperglycemia enhances the activity of sorbitol pathway promoting sorbitol excess. This changes the cellular osmolarity, ultimately impairing cellular physiological activity. The activity of Na/K ATPase is decreased, compromising neuronal function. Impaired blood flow reduces O₂ delivery to nerves further compromise them (11).

This study also showed that sub clinical peripheral neuropathy can be detected in asymptomatic diabetic children by NCS.

Another study performed by El Behr et al. recorded neurophysiologic neuropathy in 29% of diabetic children affecting mainly the lower limbs with 10% had clinical neuropathy in the form of abolition of ankle jerk reflex (12), while this study recorded higher percentage of both symptomatic and asymptomatic peripheral neuropathy diagnosed by clinical examination and nerve conduction study, also this can be attributed to poor diabetic control in the studied group and this is less than that recorded by Bao XH et al. who found 68.4% of Chinese diabetic children had neurophysiologic evidence of sub clinical neuropathy based on nerve conduction study (13).

The conclusion from this study is that early diagnosis of autonomic neuropathy in diabetic children is simple easy and requires minimum cooperation, so as detection of peripheral

neuropathy in asymptomatic by nerve conduction study.

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