Clinical and Nerve Conduction Study Correlation in Patients of Diabetic Neuropathy

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Abstract
Aims and Objectives: 1) To study types of neuropathy in Type 2 diabetes. 2) To correlate clinical features of peripheral neuropathy with nerve conduction study in Type 2 diabetes.

Material: A total of 50 diabetics, whose onset of diabetes after the age of 30 years were studied from Dr. D. Y. Patil hospital and research centre.

Type 2 Diabetes mellitus with symptom suggestive of peripheral neuropathy were studied and included. Chronic alcoholic, peripheral neuropathy due to any other known cause were excluded.

Method of Collection of Data: History of symptoms like paraesthesia like tingling sensation, burning feet, hyperaesthesia, foot ulcer, history of weakness and gait abnormality was noted. Complete central nervous system examination was performed to look for signs such as diminished ankle jerk, diminished power. Sensory examination for loss of light touch, superficial pain, temperature sense, vibration and joint position was done. Nerve conduction studies were performed using Clarity Octopus NCV/EMG machine. Written and informed consent from patient were taken.

Results: 1) 46 patients i.e. 92% presented with complaints of tingling sensation and 32 patients i.e. 64% had burning feet. 2) 29 patients i.e. 58% have diminished ankle jerk, 29 patients i.e. 58% have diminished or loss of vibration sense, in 21 patients i.e. 42% patients have diminished light touch and 20 patients i.e. 40% patients have loss of joint position senses. 3) NCV performed on 50 patients of diabetic neuropathy out of which all patients i.e. 100% had involvement of lower limb and only 24 patients i.e. 48% had involvement of upper limb also. 4) Involvement of tibial and sural nerve is more common i.e. 86% and 82% respectively. 5) 42 patients i.e. 84% found to have distal symmetrical polyneuropathy, 2 patients i.e. 4% had isolated tibial nerve involvement, 4 patients i.e. 8% had pure sensory sural nerve involvement, and only 1 patient each of isolated medial and plantar nerve involvement.

Conclusion: Distal symmetrical polyneuropathy is most common form of diabetic neuropathy. Involvement of tibial and sural nerve is more common in diabetic neuropathy.

Introduction

Diabetes mellitus is characterised by chronic hyperglycaemia with disturbance of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action or both. The two broad categories of DM are designated type 1 and type 2. Type 1 diabetes is the result of complete or near-total insulin deficiency. Type 2 DM is a heterogeneous group of disorders characterised by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production.

Chronic complications can be divided into vascular and nonvascular complications. The vascular complications of DM are further subdivided into microvascular (retinopathy, neuropathy, and nephropathy) and macrovascular complications (coronary artery disease, peripheral arterial disease, cerebrovascular disease). Nonvascular complications include problems such as gastroparesis, infections, and skin changes. Long standing diabetes may be associated with hearing loss.
A widely accepted definition of diabetic peripheral neuropathy is “the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after exclusion of other causes. Patients with type 2 diabetes mellitus may present with distal polyneuropathy after only a few years of known poor glycaemic control; sometimes, these patients already have neuropathy at the time of diagnosis.

Nerve conduction studies (NCS) and electromyography (EMG) can document the characteristics of the neuropathy (e.g., axonal, demyelinating) and the localisation (e.g. mononeuropathy versus radiculopathy or distal neuropathy) and, possibly, the severity and even prognosis for morbidity. Multiple consensus panels recommend the inclusion of electrophysiological testing in the evaluation of diabetic neuropathy. These same panels recommend the use of NCV/EMG procedures in clinical research studies.

**Material and Methods**

A total of 50 diabetics presenting to our hospital, whose onset of diabetes after the age of 30 years were studied. Chronic alcoholics and patients with neuropathy due to any other known cause were excluded. Detail history regarding complaints of neuropathy was taken. History of symptoms like paraesthesia like tingling sensation, burning feet, hyperaesthesia, foot ulcer, history of weakness and gait abnormality was noted. Complete Central Nervous System examination was performed to look for signs such as diminished ankle jerk, diminished power. Sensory examination for loss of light touch, superficial pain, temperature sense, vibration and joint position was done.

**Nerve Conduction Study**

Nerve conduction studies were performed using Clarity Octopus NCV/EMG machine (Figure 1). Written and informed consent from patient was taken.

Patient’s limb was placed in relaxed position as any movement of limb can hamper the results. It is important to keep the limb warm as any degree rise or fall in temperature can change the results so room temperature was maintained between 21–23°C. It is important to reduce electrode impedance which is usually achieved by applying electrode gel under the electrode and by affixing the electrode with adhesive tape to the skin.

**Results**

In our study we found that out of 50 patients of diabetic neuropathy 46 patients i.e. 92% presented with complaints of tingling sensation and 32 patients i.e. 64% had burning feet. Above finding suggested that most patients presented with sensory symptoms. Out of 50 patients only 3 patients i.e. 6% had foot ulcers as presenting complaint. In our study out of 50 patients of diabetic neuropathy 29 patients i.e. 58% have diminished ankle jerk. 29 patients i.e. 58% have diminished or loss of vibration sense, in 21 patients i.e. 42% patients have diminished light touch and 20 patients i.e. 40% patients have loss of joint position senses.

In our study nerve conduction study performed on 50 patients of diabetic neuropathy out of which all patients i.e. 100% had involvement of lower limb and only 24 patients i.e. 48% had involvement of upper limb also. In our study of diabetic neuropathy we performed nerve conduction study in tibial, sural, medial plantar and lateral plantar nerves in lower limb and median and ulnar nerve in upper limb. In this study we found that involvement of tibial and sural nerve was more common i.e. 86% and 82% respectively. Involvement of medial and lateral plantar nerve was similar i.e. 76%. And involvement of median and ulnar nerve was 48% and 46% respectively.

In our study 42 patients i.e. 84% found to have distal symmetrical polyneuropathy, 2 patients i.e. 4% had isolated tibial nerve involvement, 4 patients i.e. 8% had pure sensory sural nerve involvement, and only 1 patient each of isolated medial and plantar nerve involvement (Figure 2). Isolated median and ulnar nerve involvement was not found in our study.

**Discussion**

Most recognised neurologic complications associated with diabetes involve the peripheral nervous system. The diabetic neuropathies include several distinctive clinical syndromes with differing
clinical manifestations, anatomic distributions, clinical courses, and possibly underlying pathophysiologies. Diabetic neuropathy has been defined as presence of symptoms and/or signs of peripheral nerve dysfunction in diabetics after exclusion of other causes, which may range from hereditary, traumatic, compressive, metabolic, toxic, nutritional, infectious, immune mediated, neoplastic, and secondary to other systemic illnesses. Since the manifestations of diabetic neuropathy closely mimic chronic inflammatory demyelinating polyneuropathy, alcoholic neuropathy, and other endocrine neuropathies, hence, before labelling diabetic neuropathy it is mandatory to exclude all other causes of peripheral nerve dysfunction. Nerve conduction studies are frequently used to assess the presence of severity of peripheral nerve involvement in patients with diabetes. They are sensitive, specific, reproducible, and easily standardised. Studies are most commonly performed on upper and lower limbs on motor and sensory nerves.

Nerve conduction studies performed with surface or needle electrode, surface technique are more widely used, easier to perform, more comfortable and produce results that are easier to measure. Result of nerve conduction studies show amplitude, distal latency of compound muscle action and sensory potentials, conduction velocity of fastest conducting fibre, and minimal F- wave latencies. Nerve conduction studies do not always correlate well with symptoms and signs.

In our study we correlated symptoms and signs of neuropathy with findings of nerve conduction studies. In our study we found that nerve conduction detects neuropathy changes even before signs develop. Severity of neuropathy is also well established by nerve conduction findings. Sensory neuropathy (SNAP) are always better appreciated by nerve conduction studies than conventional vibration tests.

Motor neuropathies (CMAP) which is not picked on routine clinical examination are observed in nerve conduction studies. The nerve conduction studies are of better diagnostic value than vibration perception threshold, diabetic neuropathy symptom score, and diabetic neuropathy examination score.

**Conclusion**

In our study of diabetic neuropathy we correlated signs and symptoms of diabetic neuropathy with nerve conduction studies performed on tibial, sural, medial plantar, lateral plantar, median and ulnar nerves and found that:

1. Tingling sensation is most common presentation of diabetic neuropathy followed by burning feet. Very few patients presented with complaints of foot ulcer in our study.
2. Diminished ankle jerk, loss of vibration senses, diminished light touch and loss of joint position are most frequently found signs of diabetic neuropathy.
3. Involvement of lower limb is more common due to length dependent dying back process. Involvement of upper limb is associated with longer duration of diabetes and severe form of neuropathy.
4. Involvement of tibial and sural nerve is more common in diabetic neuropathy suggesting that long nerves are commonly affected.
5. Distal symmetrical polyneuropathy is most common form of diabetic neuropathy as compared with other forms of sensory/motor neuropathy.

**References**

8. P Jayaprakash, Anil Bhansali, et al. Validation of bedside methods...


