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## **TO CORRELATE THE VALUE OF BLOOD SUGAR LEVEL AND HbA1C IN RELATION TO CLINICAL MANIFESTATION OF PERIPHERAL NEUROPATHY IN TYPE 2 DIABETES MELLITUS**

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### **ABSTRACT**

The study was undertaken with an objective to correlate the value of blood sugar level and HbA1C in clinical manifestation of diabetic peripheral neuropathy in type 2 diabetes mellitus. A total of 50 patients with Type 2 DM who were diagnosed on the basis of ADA criteria or who were taking treatment for Diabetes were included in the study. A detailed history and examination was done for all patients, and all patients underwent FBS, PPBS, HbA1c, Nerve conduction study, target organ evaluation for Diabetic complications. Out of them 25 were males and 25 were female. Estimation of glycosylated haemoglobin showed poor control in 26 patients (52%). Mean HbA1c in patient with diabetic neuropathy is  $8.61 \pm 1.66$ . In our study, diabetic neuropathy patients had mean fasting blood sugar of  $161 \pm 45.16$  mg%, mean post prandial blood sugar of  $240 \pm 83.83$  mg%.

**Keywords:** *Peripheral Neuropathy, Diabetes Mellitus, Glycosylated Haemoglobin*

### **INTRODUCTION**

Diabetes mellitus is the most common endocrinal metabolic diseases, Diabetic neuropathy has been defined as presence of symptoms and signs of peripheral nerve dysfunction in diabetics after the exclusion of other cause of neuropathy like hereditary, traumatic, alcoholic, toxic, metabolic, nutritional, immune mediated, and secondary to neoplastic disease (American Diabetes Association, 1988). Diabetic neuropathy is one of most common long term complication of diabetes mellitus and is clinically present in 30-50% of all diabetes patients (Dyck *et al.*, 1993; Young *et al.*, 1993). It is well known that Diabetes mellitus and its complications are rising in an epidemic proportion in Indian subcontinent. Conduction velocity slowly decreases as duration of diabetes increases and directly related to blood sugar levels. Conduction velocity improves with HbA1c levels returning to normal. Strict maintenance of euglycemic state is most essential to prevent or slow the progression of diabetic neuropathy in a patient of peripheral neuropathy (DCCT Trial, 1995).

### **MATERIALS AND METHODS**

The study includes all type 2 diabetics from OPD'S and IPD'S in the department of medicine MVJ MC & RH, HOSKOTE in the period between August 2010 to September 2012.

**Inclusion Criteria:** Patients who fulfill ADA criteria for diagnosis of diabetes, Diabetics of more than 5 years were selected for further evaluation of neuropathic symptoms / signs.

**Exclusions Criteria:** Nutrition deficiency, Alcoholism, Leukaemia, Infectious diseases, Chronic renal failure, Occupational diseases, Type 1 Diabetes mellitus, Unilateral reflex loss.

A detailed history was taken and examination done as per the proforma. With detailed emphasis on peripheral nervous system involvement, including cranial autonomic involvement-for target organ involvement due to diabetes in addition to hematological and routine work up.

All patients underwent nerve conduction studies for assessment of peripheral nerve involvement. Reading of ENMG was done with the help of neurologist FBS, PPBS, HbA1c, CBC, Routine urine, ESR, ECG, RFT, LFT, Autonomic function test nerve conduction study.

**Patients where Diagnosed Based on the ADA Criteria for Diabetes**

Symptoms of diabetes plus random blood glucose concentration of 11.1 mmol/L (200 mg/dL) or Fasting plasma glucose of 7.0 mmol/L (126 mg/dL)

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or Two-hour plasma glucose of 11.1 mmol/L (200 mg/dL) during an oral glucose tolerance test.  
Or HbA1c  $\geq 6.5\%$   
Or Subjects who are already on treatment for diabetes.

## **RESULTS AND DISCUSSION**

### **Results**

In this study, 50 diabetic patients of more than 5 years duration were screened clinically for peripheral neuropathy and proved with nerve conduction study. Among these 40 patients had abnormal blood sugars and HbA1c levels and remaining diabetics had normal blood sugars and HbA1c levels. Out of 50 cases nerve conduction study was abnormal in 36 patients (72%). 26 patients (52%) who had significant reduction of nerve conduction velocity had higher blood sugars and HbA1c levels. 3 patients who had good control of sugars also had symptoms of neuropathy.

Out of 50 diabetic patients, symptoms of neuropathy were present in 40 patients (80%). The symptoms with which the patients with neuropathy presented are burning feet in 20 patients (40%), tingling sensation of limbs in 11 patients (22%), numbness of limbs in 5 patients (10%), weakness of limbs in 4 patients (8%), both tingling and numbness 10 patients (20%) and postural giddiness 12 patients (24%), the commonest symptoms was burning pain at night hours in 20 patients (40%).

All the 50 patients were evaluated for HbA1c levels, patients who had abnormal nerve conduction study were found to be having higher values of HbA1c levels indicating the poor control of diabetes. The normal reference range of Monozyyme India Ltd test kit – 4-8gm%.

Mean HbA1c level found to be  $8.61 \pm 1.66$  and 40 patients (80%) had higher HbA1c values of more than 7. 94% of patients found to having HbA1c level more than 6.5, out of which 68% had poor values of HbA1c.

In this study we have found that there is direct correlation with uncontrolled blood sugars in type 2 diabetes in development of peripheral neuropathy.

### **Discussion**

Among the endocrinal metabolic diseases diabetes occupies the major share. The disease is responsible for significant mortality and morbidity due to the complications.

In this study of 50 patients with type 2 diabetes 25 were males and 25 females. Prevalence of diabetic neuropathy varies wildly due to the different diagnostic criteria employed.

In our study out of 50 patients mean fasting blood sugar is  $161 \pm 45.16$ mg%, mean post prandial blood sugar  $240 \pm 83.83$ mg%, 26 patients 52% who have deranged blood sugars were prone to develop neuropathy.

Study done by Dutt *et al.*, (2005) on 100 diabetic patients found that both fasting and post prandial Blood Glucose levels are higher in Neuropathic patients compared to non-Neuropathic group with average FBS ( $220 \pm 68$  mg%), average post prandial Blood sugar of  $333 \pm 84$  mg%.

Study done by Basu *et al.*, (2011) found that out of 82 diabetic patients studied 42 patient had peripheral neuropathy in their study they found fasting and post prandial Glucose levels and were associated and 2 times risk of Developing peripheral Neuropathy in diabetic patients. The mean fasting Glucose in their study is  $149 \pm 48$ mg%.

In a study done by Vishwanathan *et al.*, (2005) in 1319 type 2 diabetic patients in selected four different centres in India found that diabetic neuropathy patients have mean PPBS of  $278 \pm 91$  mg%. In a study done by Sawant (2007), where out of 65 patients they studied, found that average FBS in neuropathy patient is  $206 \pm 68$ .mg%.

The mean fasting and post prandial levels in present study was similar to the other studies reported by Viswanath *et al.*, (2005); Basu *et al.*, (2011); and Sawant (2007).

### **HbA1c and Peripheral Neuropathy**

In our study 80% of patients had abnormal HbA1c levels, and average HbA1c level in neuropathy patient is  $8.6 \pm 1.66$ .

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Duration and level of hyperglycemia are known to be related to incidence of neuropathy though relationship is well defined that reduction in HbA1c by 0.9% could reduce the incidence of diabetic neuropathy by 60%.

Study done by Basu *et al.*, (2011) found that out of 82 diabetic patients 42 patient had peripheral neuropathy, and they found mean glycosylated Hb% for development of the diabetic neuropathy is  $7.9 \pm 1.38$ .

Study done by Sawant (2007) in 65 patients showed an average HbA1c of  $7.74 \pm 1.48$  in the diabetic neuropathy patient.

Study done by the Morkid *et al.*, (2010) in 294 diabetic patients, found mean HbA1c of  $8.75 \pm 2.20$  for the development of peripheral neuropathy. Study done by Boyraj *et al.*, (2010), showed average HbA1c to develop peripheral neuropathy  $6.9 \pm 1.7$  in normal diabetic and in Obese patient  $7.9 \pm 1.4$ .

The average HbA1c levels in our study was  $8.6 \pm 1.66$  and is similar to other studies by Basu *et al.*, (2011); Sawant (2007); Mokrid *et al.*, (2010) and Boyraj *et al.*, (2010).

### **Conclusion**

Peripheral neuropathy is most common micro vascular complication of type 2 diabetes mellitus. Severe forms of Peripheral neuropathy were noted in uncontrolled blood sugars and high HbA1c. Hence, patients with diabetes must undergo frequent monitoring of blood sugars and HbA1c to rule out complications of long term diabetes. Burning pain and numbness are most common symptoms of peripheral neuropathy in Diabetes. One must have strong suspicion of complications in patients with uncontrolled blood sugar levels and must be evaluated for peripheral neuropathy especially in aged diabetics with history of diabetes more than 10 years.

### **REFERENCES**

- Ali H, Anwar M, Ahmad T and Chand N (2006).** Diabetes Mellitus from antiquity to present scenario and contribution of Greco- Arab physicians. *Journal of the International Society for the History of Islamic Medicine* **5** 46-50.
- American Diabetes Association (1988).** American academy of neurology consensus statement. Report and recommendations of the San Antonio conference on diabetic neuropathy. *Diabetic Care* **11** 592-7.
- American Diabetes Association (2010).** Diagnosis and Classification Of Diabetes Mellitus. *Diabetes Care* **33** S62-S69 th.
- American diabetic association standards of medical care in diabetes. *Diabetic care* 2005;
- Basu M et al., (2011).** Association of diabetic neuropathy with clinical and laboratory parameters in adult Indian subject. *The Indian practitioner* **vol** 139-144.
- DCCT Research Group (1995).** The effect of intensive diabetes therapy on the development and progression of neuropathy. *Annals of Internal Medicine* **122** 561–8.
- Dutt A, Naorem S, Singh TP and Wangjam K (2005).** Prevalence of Peripheral Neuropathy In Newly Diagnosed Type 2 Diabetics Mellitus. *International Journal of Diabetes in Developing Countries* **25**.
- Dyck P et al., (1993).** The prevalence by staged, severity of various types of diabetic neuropathy retinopathy, and nephropathy in a population based Cohort: the Rochester diabetic neuropathy study. *Neurology* **43** 817-24.
- Mohan V, Sasthry NG and Premalatha G (1996).** Autonomic dysfunction in non insulin dependent diabetes mellitus and fibrocalculus pancreatic diabetes in South India. *Diabetic Medicine* **13** 1038-1043.
- Mokrid K et al., (2010).** Risk factor and prevalence of diabetic peripheral neuropathy: a patients in study of type2 diabetic out patients in Bangladesh. *International Journal of Diabetes in Developing Countries* **30**.
- Ozgur Boyraj et al., (2010).** The effect of obesity on the assessment of diabetic peripheral neuropathy: a comparison of micigan patient version test and Michigan physician assessment. *Diabetic Research and Clinical Practice* 256-260.
- Powers AC (2016).** *Harrisons 's Principles of Internal Medicine*, 19 edition, **2**, Diabetes mellitus: Diagnosis, Classification, and Pathophysiology, (McGraw Hill, New York, USA).

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**Ramachandran A, Mohan V, Millan MC, Donald E and Snelatha C (1987).** Evaluation of clinical neuropathy in diabetes: use and limitations of biothesiometer 6<sup>th</sup> *National Congress on Diabetes*.

**Sawant JM (2007).** Association Of Poor Glycemic Control With Increased Lipid Peroxidation And Reduced Antioxidant Vitamin Status In Diabetic Neuropathy. *The Internet Journal of Endocrinology* 3(2).

**Sharma K, Cross J, Farronay O et al., (2002).** Demyelinating neuropathy in diabetes mellitus. *Archives of Neurology* 59 758–65.

**UK Prospective Diabetes Study Group (1998).** Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes. UKPD S38. *British Medical Journal* 317 703–713.

**Vishwanath V, Thomas N, Tendon N, Asirvatham A and Rajeshakar S (2005).** Profile of diabetic foot complications and its associated complications-A multicentric study from India. *Journal of Association of Physicians of India* 53 933-936.

**Young MJ et al., (1993).** A multicenter study of the prevalence of diabetic peripheral neuropathy in the United Kingdom Hospital Clinical Population. *Diabetologia* 36(2) 150-4.