Original Research Article

A Comparitive Evaluation of Blood Sugar and Glycosylated Haemoglobin in Clinically Manifested Diabetic Neuropathy

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Abstract

Aim & Objective: The present study has been undertaken to monitor the levels of blood sugar and HbA1C in diabetic neuropathy**Methodology:** The present study was conducted at Mahatma Gandhi Memorial Hospital, Warangal. The study was undertaken between June'2018 to May'2019 both in inpatient and outpatient department. Diabetic patients seeking consultation for the symptoms suggestive of neuropathy were screened and labeled as suffering from diabetic neuropathy based on the inclusion and exclusion criteria**Results:** 60 patients of diabetic neuropathy were studied Out of them36 were males and 24 were female.The age of the patients varied between to 16 years to 70 years (mean:52.2yrs).The incidence of IDDM were 2 and that of NIDDM were 58.The duration of diabetes varied from0 to 25 years (mean 8.7 years).Only 11 patients received regular treatment. Symptoms of sensory system involvement were the most common 47 (78.3%) patients followed by motor symptoms 20 (33%) cases. Autonomic symptoms 10 cases and cranial nerve symptoms 2 cases. Examination of the cranial nerve revealed diabetic retinopathy in 33 patient,I IIrd cranial nerve palsy in 2 patient and LMN facial nerve palsy in one patient. Symmetrical sensory loss was confined to the lower limbs in all patients. Distal symmetric sensory neuropathy was the most common type of clinical neuropathy. III cranial nerve palsy was the most common cranial neuropathy. Motor and autonomic neuropathies were found in significant number of patients. Blood sugar estimation revealed evidence of poor control in 12 patients (20%). In patients with peripheral neuropathy with or without associated complications of diabetes (Like retinopathy, autonomic neuropathy) estimation of glycosylated hemoglobin was a better indicator of poor metabolic control.**Conclusion:** The efficacy of glycosylated hemoglobin estimation in assessing diabetic control is not influenced by Age, Sex, duration, or diabetes and a mode of therapy.Longer the duration and poorer the control of diabetes, more are the chance of development of the complications of diabetes.

Keywords: HbA1c, Blood Sugar, Neuropathy, Diabetes.

Introduction

According to the International Diabetes Federation (IDF), the worldwide prevalence of Diabetes Mellitus (DM) has risen dramatically over the past two decades from an estimated 30 million cases in 1985 to 415 million in 2017. Based on current trends, the IDF projects that 642 million individuals will have diabetes by the year 2040. Although the prevalence of both type 1 and type 2 DM is increasing worldwide, the prevalence of type 2 DM is rising much more rapidly because of increasing obesity, reduced activity levels as countries become more industrialized, and the aging of the population. In 2015, the prevalence of diabetes in individuals aged 20-79 ranged from 7.2-11.4%. The countries with greatest number of individuals with diabetes in 2015 are: China (109.6 million), India (73 million), United States (30.3 million), Brazil (14 million) and the Russian Federation (9 million). The prevalence of DM increases with age. [1]

The spreading diabetes epidemic is a major health concern for India and a great threat to the nation. According to recent estimates, presently India has, 62 million diabetic subjects, and this is projected to increase to 100 million i.e. rise by 250% by the year 2035. [2]

In the CUPS study, 12% of individuals above age of 20years in Chennai were found to be diabetic in the year 1997.The prevalence of diabetes is increasing rapidly and it is estimated that the number of diabetics in worldwide will double by the year 2020 projection published. In the year 1997, International Diabetes Institute stated that there will be more than 400 million people with diabetes by 2020 with the Simple measures like good glycemic control and neuroadjuvants, visual inspection of feet and foot care can save and salvage feet at risk. Diabetic Neuropathy is one of the most common troublesome complications of Diabetes Mellitus.Diabetic neuropathy has been defined by the consensus conference of San Antonio as peripheral neuropathy either clinically evident or sub-clinically that occur s in the setting of diabetes mellitus without other causes. The present combination of the triad of neuropathy, retinopathy and nephropathy in the course of the lifelong disease regarded this "Triopathy" as consequences rather than complication. [4-6]Diabetic neuropathy is one of most common long term complication of DM and is clinically present in 30-50% of all diabetes patients. [7,8]The primary pathological role of Hyperglycemia in diabetic complications is well established. With the increasing knowledge that maintenance of euglycemia greatly reduces, if not prevents the risk of diabetic complications and at times helps even in regression of such complications, monitoring the control of diabetes is essential for the successful management of the diabetes. The responsibility of the patient and his physician in close monitoring control of diabetes and tailoring the various components in their management have assumed greater significance. [9]The present study has been undertaken to monitor the levels of blood sugar and HbA1C in diabetic neuropathy. The study of diabetic neuropathy has been undertaken for the many reasons. The diabetes is a frequent cause of peripheral neuropathy. It affects almost every part of nervous system and produces, various type of neuropathy. It has significant morbidity and mortality. Its incidence increases, [14] when the control of diabetes is poor.

It is very well established that tight control of diabetes reduces if not prevents the risk of neuropathy. The benefit of other mode of therapy like myo-inositol supplementation and all doses reductive inhibitors remains to be established. Until then the clinician should monitor the patient's neurological status by routine methods and assess the control

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of diabetes by the available parameters and give practical advice that may save a limb and life.

Aims & Objectives

1. To assess the efficacy of metabolic control of diabetes in the development of diabetic neuropathy.
2. To compare the value of estimation of blood sugar and Glycosylated Haemoglobin (HbA1c) in monitoring the control of diabetes in diabetic neuropathy.
3. To identify the predisposing factors for the development of diabetic neuropathy.

Materials and Methods

The present study was conducted at Mahatma Gandhi Memorial Hospital, Warangal. The study was undertaken between June'2018 to May'2019 both in inpatient and outpatient department. Diabetic patients seeking consultation for the symptoms suggestive of neuropathy were screened and labeled as suffering from diabetic neuropathy based on the inclusion and exclusion criteria described by PIRART. [10]

Inclusion Criteria

1. Loss of knee/ankle jerk
2. Sensory deficits
3. Other neurological abnormalities

Exclusion Criteria

1. Other causes of neuropathy especially alcoholism
2. Generalized areflexia without signs of neuropathy and
3. Unilateral reflex loss

Among those diagnosed to be suffering from diabetic neuropathy, further exclusion of the factors which would lead to falsely abnormal, values for HbA1C was done before proceeding further.

1. Anaemia (Hb<10 gm%)
2. Acute metabolic complications
3. Ingestion of antibiotics and asprin
4. Alcohol intake
5. Uremia
6. Hemoglobinopathies
7. Recent Blood Transfusion
8. Hyperlipidemia

In all, 60 patients of diabetic neuropathy who satisfied the above criteria were selected and were subjected to a thorough evaluation as per working proforma.

A battery of tests of cardiovascular autonomic function as described in Hutchison's clinical method was performed in all patients. [11] Normal and abnormal values in tests were described by Ewing and Clarke (1982) given below.

Laboratory Investigations done in all patients include:

1. Urine - Sugars & Ketone bodies.
   - Albumin
   - Microscopy
2. FBS and PPBS (Folin-wu method).
3. Blood
   - Hb%
   - Urea
   - Creatinine
   - Cholesterol
4. Glycosylated hemoglobin (HbA1C) by Ion Exchanges Chromatographic method.
5. ECG, X-ray chest and other investigations whenever necessary were done.

HbA1C was estimated in blood sample taken for FBS estimation.

Ion exchange Resin Chromatographic method of estimation of Hb A1C

(GlycoHb) (KYNOCK and LEHMANN 1977) [12]

Results

History

Out of 60 cases studied 36 (62.6%) were males and 24 (38%) were female.

Table 1: The age and sex distribution of these cases is as below

Age in years	Male	Female	Total	Percentage
< 25 years	0	3	3	5
26-35 years	1	1	2	3.33
36-45 years	11	3	14	23.3
46-55 years	7	4	11	1.6
56-65 years	12	8	20	33.3
66 and above	5	5	10	16.6
Total	36	24	60	100

Diabetic neuropathy was common in the age group of 56 to 65 years in both male and female (33.3%)

Table-2 depicts the duration of diabetes in these patients varied from freshly detected cases to 25 years.Patient with IDDM and NIDDM could be further sub classified depending upon the duration of diabetes as under.

Table 2: Age distribution

Duration of diabetes in years	No of type 1 DM patients	No of type2 DM patients	Total no of diabetes	Percentage
<5 years	0	18	18	30
6 to 10 years	1	23	24	40
11 to 15 years	0	13	13	21.6
>15 years	1	4	5	8.4
Total	2	58	60	100

Average duration of diabetes was 8.7years. NIDDM was more common (58 out of 60).

The treatment that the patients were receiving at the time of evaluation with its regularity is shown in the following table-3.

Table 3: Treatment

Nature	Regular	Irregular
Insulin	4	12
Oral hypoglycemic agents (OHA)	6	18
Both OHA and insulin	1	9
Total	11	39

Ten patients were not on any treatment at the time of evaluation. Out of these, 6 patients were detected to be diabetic when they were admitted to this hospital for evaluation of neuropathy. Diabetic neuropathy was commonly observed in those patients with irregular treatment.

None of the patients had previous medical records documenting their diabetic status (urine-sugar, blood sugar and glycosylated hemoglobin estimation) prior to this evaluation except 5 patients who had previous admission record and record documenting glycemic status. Hence diabetic control status could be assessed as either good or poor depending on symptoms of diabetes, regularity or otherwise of treatment and previous hospital admissions for their complications of diabetes, excluding the 6 patients who were detected on admission 46 patients were classified as "poor" controlled diabetics either because of failure to take treatment or persistence of symptoms in spite of treatment. Remaining 8 patients were judged to be 'good' controlled with minimal parameters. Out of 60 patients 26 patients were smokers & 34 were non smokers.

Table -4 depicts the symptoms pertaining to the involvement of the nervous system due to diabetes mellitus were further analyzed in 60 cases as follows:

Table 4: Symptoms

Symptoms	No. of Patients	Percentage
Sensory symptoms	47	78
Motor symptoms	20	33.3
Cranial nerve symptoms	2	3.3
Autonomic symptoms	10	16.6

Among 60 patients, sensory symptoms were commonly observed in 47 (78.3%) patients.

General Physical Examination: Revealed 19 patients were obese with BMI > 25, 10 cases had cataract while 3patients had vascular disease, and hypertension was observed in 5 patients.

Cardiovascular System Examination: Revealed evidence of aortic stenosis in one case, asymmetrical septal hypertrophy in one case, cardiomegaly in 3 cases. Hypertensive retinopathy changes observedin12cases.Evidenceof myocardial infarction was noted in 16 cases.

Respiratory System Examination: On examination of the respiratory system two patients had emphysema and two had evidence of healed -fibro cavitary lesion in the right upper zone.

Musculoskeletal System: Examination showed evidence o chronic degenerative joint disease in 5 and cervical spondylosis in one.

Per abdomen: Examination revealed chronic pancreatitis in one case, diabetic gastro- paresis in 2 cases.

Neurological examination

1. Higher mental function: Evaluation was normal in all patients.
2. Cranial nerves: 33 patients showed evidence of diabetic retinopathy,12 patients showed hypertensive retinopathy changes, third nerve palsy without pupillary involvement seen in 2 (two) patients.
3. Motor system: 20 patients showed distal muscle weakness; only one patient had proximal muscle weakness in both lower limbs. However there was no significant wasting except in one case who showed moderate wasting of thigh muscles.
4. Sensory system: 56 patients had sensory deficits

The following observations were made

1. Impairment of temp, touch, and pain, sensation.-46
2. Impairment of vibration sensation-56
3. Impairment of joint / position sensation-10
4. Total vibratory sensoryloss-Nil
5. Total loss of temp, touch, and pain sensation-Nil

5. **Reflexes –**

Table 5:Reflexes

Reflexes	Sluggish	Absent	Total
Ankle Jerk	3	57	60
Knee Jerk	8	20	28

Diminution or loss of both ankle jerks was present in all 60 cases while 28 patients showed sluggish or absent Knee Jerks in total 60 patients.

6. **Gait:**

Gait was normal in all patients except 4 patients had sensory ataxia and all of these patients showed positive Romberg's test.

7. **Autonomic nervous system evaluation:**

16 patients showed objective evidence of autonomic neuropathy. Diabetic gastroparesis was seen in 2 cases. **Sexual dysfunction** was noted in 26 (70.2 %).

Types of Neuropathy:

The types of Neuropathy observed in these 60 patients were as follows.

Table 6: Types of Neuropathy

Types of neuropathy	No of cases	Percentage
Distal symmetrical sensory neuropathy	36	60
Distal symmetrical sensori-motor neuropathy	24	40
Autonomic neuropathy	18	30
Cranial neuropathy	2	3.33
Proximalmotorneuropathy/poly radiculopathy	1	1.67

Investigations

1. **Urine examination:** showed Glycosuria in 52 patients, Albuminuria in 23 patients, Ketonuria in 3 patients.
2. **Blood investigation:**

Blood Sugar estimation (fasting and post prandial) was normal in only 9 cases. The rest could be further sub divided based on, the degree of control (Based recommendations of the American diabetes association and the European NIDDAM policy group – 1988) as follows:

Table 7: Blood sugar Examination

Degree of Control	No. of cases	Percentage
Normal	9	15

Good control FBS 120- 140mg PPBS. 140-180 mg	14	23
Fair control FBS-140-180mg PPBS 180-235mg	2	41
Poor Control FBS > 180mg PPBs > 235 mg	12	20

Fasting hyperglycemia (with FBS> 126 Mg/dl) was noted in 83.3% of patients while post prandial hyperglycemia (PPBS>200Mg/dl) noted in33.3% of patents. **Azotemia** was noted in 5 cases. Serum amylase test was raised in one case. Hemoglobin was normal in all cases. Tridot test for HIV was non reactive in all cases.

Estimation of Glycosylated Haemoglobin:

The values of GlycoHb varies from the assay to assay and lab to lab, However the estimated GlycotHb for indicating the degree of glycemic control in diabetes is further sub divided in our study as follows.

(The normal reference range of Monozyme India Ltd test kit – 4-8 gm%).

Table 8: Levels of HbA1c

Degree of Control	No of Cases	Percentages
Normal (5.5- 6.5%)	1	1.9
Good control (6% to 8%)	6	10
Fair control (8% to 10.0%)	14	23
Poor control (>10.0%)	39	65
Total	60	100

Out of 60 patients, Glycosylated hemoglobin was observed more than 8% In 59 cases.

3. **Electrocardiogram**: Electrocardiogram was normal in 39 cases and evidence of ischemic heart diseases was observed in 16 and left ventricular hypertrophy in 3 cases. C.O.P.D. changes in 2 cases.
4. **Chest X-ray:** Chest X-ray revealed evidence of cardiomegaly in 3 cases. In two cases there was evidence of healed fibrocavity kochs lesion in the Right upper zones. When blood sugar estimation was compared to glycosylated hemoglobin estimation as a measure of diabetic control as outlined above the following results were obtained.

Table 9: Comparison of blood sugar and HbA1c

Degree of control	Blood sugar (No of cases)	Glycosylated hemoglobin (No of cases)
Normal	9 (15%)	1 (1.9%)
Good control	14 (23.3%)	6 (20%)
Fair control	25 (41.6%)	14 (23%)
Poor Control	12 (20%)	39 (68%)

Thus glycosylated hemoglobin showed evidence of poor control more frequently than blood sugar estimation in these patients. The difference between this parameter as a measure of poor control of diabetic was statistically significant.

When these patients were evaluated for their diabetic control status depending on the presence of symptoms of diabetes, regularity or otherwise of the treatment, history of previous hospitalization for the complications, only 8 patients were judged to be under good control.

When these patients were analysed for control status based on blood sugar and glycosylated hemoglobin following observation were made.

Table 10: Total no of cases to be assessed to be good controlled-8

Degree of Control	Blood Sugar (No. of case)	Glycosylated Hemoglobin
Normal	3	-
Good	2	1
Fair	3	1
Poor	-	6

When 46 patients, thought to be 'poorly' controlled diabetics using the same criteria, were further analyzed taking blood sugar and glycosylated hemoglobin criteria into consideration, following observation were obtained.

Table 11: Total no of cases to be assessed well controlled-46

Degree of Control	Blood Sugar (No. of case)	Glycosylated Hemoglobin
Normal	7	1
Good	14	3
Fair	18	12
Poor	7	30
Total	46	46

Thus it can be seen that in those patient who were on regular treatment and asymptomatic for glycosuria, glycosylated hemoglobin estimation revealed evidence of poor control in 6 patients. In contrast, blood sugar estimation revealed acceptable levels for diabetic control in these patients.

Even in those patients who were designated to be 'poorly' controlled diabetics (N=46) estimation of glycosylated hemoglobin revealed supportive evidence of the same more frequently (N=30) than blood sugar estimation (N=7). This difference was highly statistically significant ($P < 0.001$).

Patients with both retinopathy and neuropathy in this study had diabetes mellitus for periods 2 months to 20 years (Mean8.2yrs). Whereas, patients with neuropathy alone had diabetes mellitus which was either detected on admission or was there for periods up to 10 years (Mean 8.2yrs).

Thus it is clear that longer the duration of diabetes, more are the chance for the development of complications of diabetes.

When the 33 patients with both retinopathy and "Neuropathy were analyse the results were as under.

Table 12: Duration

Degree of Control	Blood sugar	Glycosylated Hemoglobin
Normal	5	1
Good control	9	4
Fair control	12	9
Poor control	7	19
Total	33	33

Table 13: Duration

Degree of Control	Blood sugar	Glycosylated Hemoglobin
Normal	3	-
Good	3	5
Fair	10	2
Poor	2	11
Total	18	18

16 patients had abnormal autonomic nervous system function as per the criteria laid down by Ewing and Clarke and two patients showed evidence of diabetic gastropareis. Out of these18 only 2 (11%) patients had blood sugar in the 'poorly' controlled category as compared to 11(61%) patients in whom the glycosylated hemoglobin showed evidence of poor control. This difference was statically significant.

After establishing the efficacy of the estimation of Glycosylated hemoglobin the influence of the other parameters like, age, sex, duration and mode of therapy on its estimation was analyzed. The following observations were made.

Table 14: Age of the patient and estimation of glycosylated hemoglobin value

Age in years	Estimation of glycosylated hemoglobin			
	<6%	6-8%	8-10%	>10%
< 25 yrs	-	1	2	0
26 to 35 yrs	-	-	-	2
36 to 45	-	1	3	10
46 to 55	-	1	2	8
58 to 65	-	2	6	12
66 &>66	1	-	2	7

There were 19 patients aged less than 45 years and 41 patients aged more than 45 years.

Glycosylated hemoglobin estimation indicated poor control in 12 patients, intheformergroupascomparedto27patientsinthelater. This difference was not statistically significant (P> 0.05).

Table 15: Sex of the patients and estimation of glycosylated hemoglobin values

Sex	Estimation of glycosylated hemoglobin values			
	<6	6-8%	8-10%	>10%
Male	1	3	8	24
Female	0	2	7	15

24 out of the 36 male patients had evidence of poor control of diabetes similarly 15 out of the 24 females had evidence of poor control. There was no statistically significant difference between the value of glycosylated haemoglobin. (P>0.05).

Table 16: Duration

Duration of D.M. in years	Estimation of glycosylated hemoglobin			
	<6%	6-8%	8-10%	>10%
< 5	-	3	2	13
6-10 yrs	1	2	11	10
11-15	-	1	1	12
> 15 yrs	-	-	-	4

42 patients had diabetes of less than 10 years duration, of whom 23 patients had evidence of poor control of diabetes. Similarly 16 out of 18 patients with diabetes of more than 10 years duration had evidence of poor control the difference was not statistically significant (P > 0.05)

Table 17: Mode of treatment and estimation of glycosylated hemoglobin valu

Type of Treatment	Estimation of glycosylated hemoglobin			
Type of treatment	<6 %	6-8%	8-10%	>10%
Oral Hypoglycemic agents	-	2	8	14
Both insulin and oral hypoglycemic drugs	-	-	1	9

10 out of 16 patients who were receiving insulin prior to admission had evidence of poor control, 14 out of 24 patients who were on oral hypoglycemic agents had evidence of poor control. The difference between the 2 groups was not statistically significant. (P > 0.05)

Discussion

The exact mechanism in the development of neuropathy in diabetes is uncertain. Whether a poor control of the diabetic state hastens the progression of neuropathy is a question that yet to be answered, One of the earlier study to establish relation between glycemic control and neuropathy performed by **Pirart**, [10]which showed that poor control was associated with a higher incidence of neuropathy. Intensive glycemic control in the DCCT study showed decreased incidence of diabetic neuropathy to 3% in intensively treated patients compared to 10% in group that received convention al treatment. [4] Holman et al, concluded that tight control of diabetes retarded or reversed the progression of the neuropathy.13

On the other hand Service et al, found no such correlations. [14]However majority of the authorities Dyck et al, favour the view that poor control of diabetes is associated with an increased risk of neuropathy.

In the present study the accurate classification regarding control of the diabetic state as laid down by the recommendations of the American Diabetes Association (1988) could not be done. There as on has been elaborated earlier. However patients who could be grossly classified as having poor metabolic control out- numbered those who could be classified as having good control (46 Vs 8) in this study.

Though considerable controversy exists regarding the etiopathogenes is of neuropathy in diabetes. It has been conclusively shown by **Pirart**, [10] that the incidence of neuropathy increases with the duration of the diabetes. Heal so showed that there was a positive correlation between the occurrence of neuropathy and retinopahty. **Tesfaye. S. etal [15]** showed a significant or relation between diabetic neuropathy, age; duration of diabetes, diabetic retinopathy, cigarette smoking and prevalence of cardiovascular disease in IDDM patient. This fact was brought out in this study.

In the present study 33 (55%) neuropathy patients had retinopathy and the duration of diabetes was long. Also 16 neuropathy patients showed evidence of myocardial infarction and smoking habit observedin26 neuropathy patients.

As noted by various autrors (P.K. Thomas and Brown) [16] studies shown that a symmetric distal sensory polyneuropathy is the most common form of diabetic neuropathy this is supported by our study where the incidence of is more than any other type(61.2%) As documented by many workers earlier, the sensory disturbances follow a “Length related pattern” with the lower limb fibres being involved earlier than upper limb fibres.

This has been observed in our study. All patients who exhibited sensory changes did so in lower limbs. No patients showed sensory loss to touch (large fibre neuropathy), and yet to be firmly established. In the present study only one case of proximalmotor neuropathy was observed which associated with DSN.

One of the difficulties encountered in treating IDDM with the older insulinsis the “insulin resistance’ which is defined as the daily requirement of insulin in excess of 200 units. The older insulins contain varying amounts of glucagons, pro-insulin, altered insulin and other peptides which are largely responsible for the insulin-binding antibodies found in the plasma of all patients treated with these insulins. These antibodies are particularly related to the development of insulin resistance. Highly purified mono component insulins prepared from pig and cattle pan creases and human insulin, synthesized by recombinant DNA technology, are now available which are superseding the older preparations. They are less likely to cause insulin allergy and lipodystrophy which prevent the potential hazards of patients non compliance. Example includes Humulin S, Humulin I, actrapid MC, Actrapid HM, Neusilin, etc.

In summary, better method soft treatment like better delivery system and better insulins offer the hope of better control of diabetes and thereby better quality of shows improvement in autonomic neuropathy. In 12 month’s study of trandolapril treatment showed significant improvement in peripheral nerve function, however this role of ACE inhibitors as neuro-protective agents remains to be clearly delineated.

A recent meta-analysis by Nicoluccietal of Randomized control trail involving ARI demonstrated a modest benefit of treatment in only one aspect improving the median nerve motor conduction velocity.

Arecent1yearmulticentre trial of GLA administration to patients with diabetic neuropathy reported improvement in clinical and electrophysiological nerve function. [17] The clinical trials regarding, use of Alphalipoic acid (ALA) in Diabeti neuropathy are undergoing in the USA.The role of r NGF (Recombinant NGF) remains uncertain in treatment of diabetic neuropathy. [18]

During optimal diabetic control the blood sugar concentration was 84 mg per deciliter (range, 70 to 100), and hemoglobin AIc concentration 5.8 per cent (range, 4.2 to 7.6). Hemoglobin AIc concentration appears to reflect the mean blood sugar concentration best over previous weeks to months.

The periodic monitoring of hemoglobin AIc levels provides a useful way of documenting the degree of control of glucose metabolism in diabetic patients and provides a means whereby the relation of carbohydrate control to the development

Whereas in the present study it has been demonstrated that the sequelae of diabetes mellitus especially diabetic neuropathy has been the cornerstone for this study and thus the study indicated that Hba1c levels are directly related to the management of diabetic neuropathy.

Natural Progression of Diabetic Peripheral Neuropathy in the Zenarestat Study Population by Mark J.Brown and Shawn J.Bird et al [19] to report the baseline and natural progression of diabetic peripheral neuropathy over 12 months in a large mild-to-moderate neuropathy population concluded that neurologic decline over 12 months is evident when measured by nerve conduction studies and cool thermal quantitative sensory testing. Other measures vibration QST, neuropathy rating scores, monofilament examination are insensitive to changes over 12 months in a mild-to-moderate affected population of this size.

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Conclusion

1. Longstanding diabetes and poor glycemic control are particularly associated with an increased risk of neuropathy in diabetes mellitus.
2. Estimation of glycosylated hemoglobin is a simple, rapid,and objective procedure to assess diabetic control.
3. It serves both as a screening test for uncontrolled diabetes and as an indicator of the efficacy of various therapeutic regimens.
4. It also provides a conceptual frame work for the pathogenesis of the long term complications of diabetes.
5. Its estimation gives a relatively precise reflection of the state of diabetic control as compared to blood glucose estimation. Therefore it is now possible to estimate more accurately and with greater sensitivity the degree of glucose in tolerance; particularly, incases associated with diabetic complications. It represents an accurate technique to evaluate new ways of controlling blood glucose.
6. Thus, asan integral of diabetic control,glycosylated hemoglobin(HbA1C) estimation is superior to the conventional measures in assessment of control.

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