Incidence of Autonomic Neuropathy during Assessment in Diabetes Mellitus Patients in PAC

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Authors' contributions

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ABSTRACT

Background: Diabetes mellitus (DM) is a clinical syndrome characterized by hyperglycaemia due to absolute or relative insulin deficiency. Autonomic neuropathy invokes potentially life threatening outcomes especially in poorly controlled diabetic patients.
Objectives: The objective of this study is to assess the incidence of autonomic neuropathy in patients with type 2 diabetes mellitus.
Materials and Methods: The Study was conducted on 80 Type 2 Diabetes Mellitus patients in Pre Anesthetic Clinic of Department of Anesthesiology, Saveetha Medical College and Hospital during the period of March 2021 to August 2021. Informed consent was obtained from all those who met the inclusion criteria and their BP and Heart Rate variability to various manoeuvres were assessed.
Results: According to our study 40% and 30% had borderline and definite autonomic neuropathy respectively.
Conclusion: Autonomic neuropathy is common in patients with poorly controlled Diabetes Mellitus, especially those on oral hypoglycemic agents. As nowadays no therapy is able to effectively reverse this process, prevention with strict glycemic control, multifactorial intervention, and lifestyle modification remains essential.

1. INTRODUCTION

Diabetic autonomic neuropathy (DAN) is among the least diagnosed and understood complications of diabetes in spite of its large poor effect on survival and quality of lifestyles in humans with diabetes [1].One of the subtype of the peripheral polyneuropathies that accompany diabetes, DAN can involve the whole autonomic nervous system (ANS). ANS vasomotor, visceromotor, and sensory fibres innervate each organ. DAN can be both clinically obvious and subclinical. It is manifested by dysfunction of one or more organ systems (e.g., cardiovascular, gastrointestinal [GI], genitourinary, motor, or ocular)[2].Many organs are dually innervated, receiving fibres from the parasympathetic and sympathetic divisions of the ANS. DAN generally happens as a system-wide disorder affecting all components of the ANS. Clinical signs and symptoms of autonomic neuropathy commonly do no longer arise till long after the onset of diabetes. Whereas signs and symptoms suggestive of autonomic dysfunction can be common, they are often because of different reasons in preference to actual autonomic neuropathy. Subclinical autonomic dysfunction can, however, arise inside a year of diagnosis in type 2 diabetes sufferers and inside two years in type 1 diabetes sufferers[3]. It's because of its association with a number of destructive effects which includes cardiovascular deaths, cardiovascular autonomic neuropathy (CAN) is the most clinically essential and well-studied form of DAN. Available research have highlighted a range of things to be related to CAN and imply that its occurrence will increase with age of diabetic patient, period of diabetes, and bad glycaemic control[4].

Hypotheses regarding couple of aetiologies of diabetic neuropathy encompass a metabolic insult to nerve fibres, neurovascular insufficiency, autoimmune damage, and neurohormonal growth factor deficiency [5].

2. METHODOLOGY

This is a descriptive study that was conducted at the Department of Anesthesiology, Saveetha Medical College and Hospital, Thandalam, from March 2021 to August 2021. Datawas collected on a structured proforma. Eighty cases of type 2 DM of at least 6 years duration were selected through non-probability sampling. Patients suffering from cardiac failure, renal failure, liver cirrhosis, diabetic retinopathy, patients receiving sympatholytic and vasodilator drugs were excluded from the study. Patients with diabetic retinopathy were not included because Valsalva manoeuvre aggravates the condition. Random blood glucose and fasting blood glucose levels of more than 200 and 126 mg/dl were taken as abnormal. A detailed relevant history was taken from the patients. Enquiry was made about the duration of Diabetes mellitus and insulin or oral hypoglycaemic agents therapy. Resting heart rate was measured to evaluate resting tachycardia under basal conditions; values of more than 100 beats per minute (bpm) were considered abnormal. Heart rate variation with respiration was also checked for loss of sinus arrhythmia. Patients were instructed to take six deep breaths per minute, while being monitored by ECG for a period of one minute. Maximum R-R interval and minimum R-R interval were calculated and expressed in beats per minute. A R-R variation with respiration of >15 beats per minute, 10-15 beats per minute and <10 beats per minute were taken as normal, borderline CAN and definitive CAN respectively.Valsalva manoeuvre was performed in which the patients were asked to blow against a mercury manometer up to 40 mmHg for 15 seconds, which was monitored by ECG. Valsalva ratio was calculated as the ratio of longest R-R interval (during bradycardia) to the shortest R- R interval (during tachycardia). Normal Valsalva ratio is 1:2 or more; values less or equal to 1 were taken as evidence of CAN. Values between 1 to 1.2 were taken asborderline.5 the symptoms of DAN like postural hypotension, bladder dysfunction, gastro paresis, and impotence were sought. Postural hypotension was measured, when the patient was lying down and 2minutes after patient was standing. A fall of >30 mmHg was taken as abnormal, and a fall between 10-29 mmHg taken as borderline. If the findings on any two or more of the above tests in a patient were abnormal, the patient was diagnosed as positive for CAN. The data was analysed and the frequencies and percentages were calculated for qualitative variables such as gender and age group and chi-square test was used to compare the proportions. Mean ± SD was calculated for numerical variables like age in years, pulse rate (lying/supine, standing), blood pressure (lying/supine, standing and after hand griping), random blood sugar level (RBS) and HbA1c.

3. RESULTS

Eighty patients of type 2 DM were studied. The mean age was 49.62 ± 9.70 years, with males more than females. The mean value for known

duration of diabetes was 10±3.5 years. Definitive and borderline CAN was noted in 30% and 40% patients respectively (Table1). Variability of heart rate with respiration was significantly related to duration but not to the control of diabetes (p < 0.05). The median postural hypotension, and changes of heart rate by respiration were 20 mmHg, and 6 bp/m respectively (p < 0.05). BP variation with standing was significantly related to the control and known duration of diabetes. The variability of heart rate was significantly related to the duration but not to the control of the diabetes (p < 0.05). Other signs and symptoms related to autonomic neuropathy were sought and noted like; 24 (30%) having resting tachycardia (Table 1), and 27 (34%) having postural hypotension. Out of 27 patients, 15 were having definite postural hypotension and remaining 12 having

borderline values. 34 (42%) were having hyperhidrosis, 14 (18%) constipation, 18 (23%) diarrhoea, 27 (34%) gastro paresis, 36 (45%) hypertension, 40 (50%) paresthesia and 16 (20%) were having history of cataract (Table 4). The mean HbA1c calculated was 10.35±3.6 mg/dl, with 3 (4%) patients having values of <7%, 16 (20%) having <9%, 37 (46%) had values between 9-12%, 24 (30%) patients had values >12% (Table 2). Pulmonary tuberculosis was noted in 8 diabetic patients, and 9 cases having diabetic foot. Seventy five were on oral hypoglycaemic therapy, and five patients were receiving insulin therapy. All the patients with DAN symptoms showed at least three abnormal Cardiovascular Autonomic Tests and 70% of them were of diabetic duration of more than 9 years (Table 3).

Table 1. R-R variation and heart rate (n=80)

Parameter	Normal	Borderline	Abnormal
R-R variation	24 (30%)	32 (40%)	24 (30%)
Heart rate	Normal heart rate 56 (70%)	Resting tachycardia 24 (30%)	

Table 2. HbA1c values

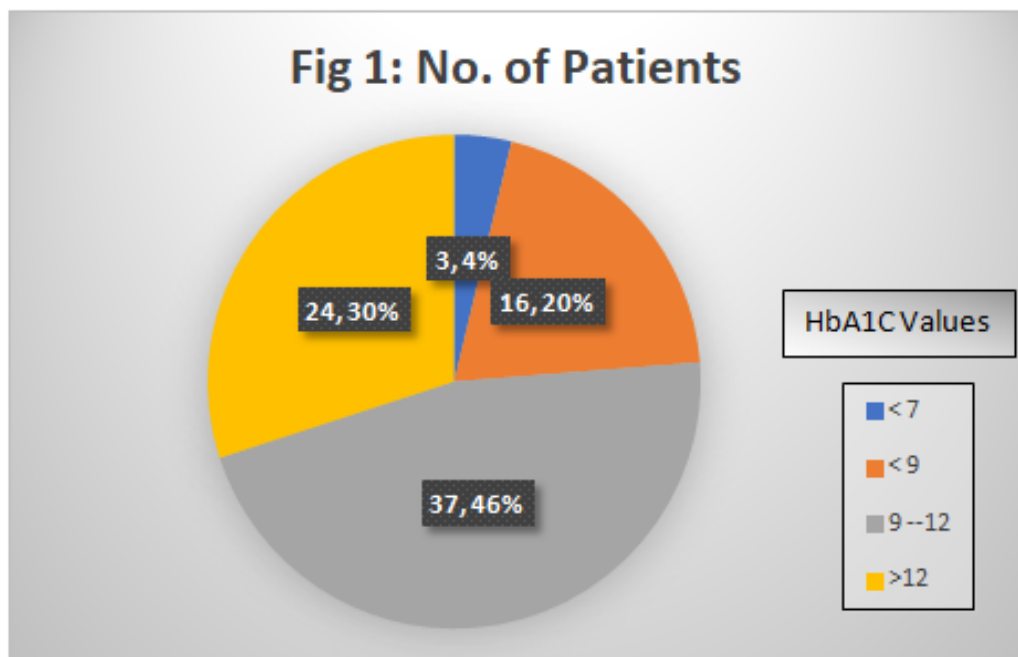| HbA1c values	Number of patients	Percentage (%)
< 7	3	4
< 9	16	20
9-12	37	46
>12	24	30

Fig. 1. No. of Patients

Table 3. Correlation of DAN with duration of diabetes mellitus

Diabetic Autonomic Neuropathy	Duration of diabetes			
	5-7 years	8 – 10 years	11 – 13 years	>13 years
Present	3	20	24	17
Absent	10	4	1	1

Table 4. Miscellaneous autonomic neuropathy signs and symptoms (n=80)

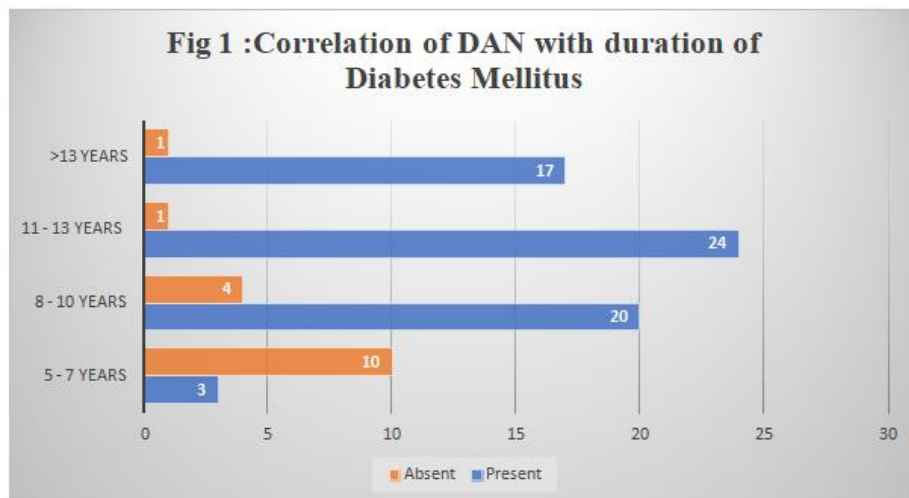| Symptoms	Number of patients	Percentage (%)
Postural hypotension	27	34%
Hyperhidrosis	34	42%
Constipation	14	18%
Diarrhoea	18	23%
Gastro paresis	27	34%
Hypertension	36	45%
Paraesthesia	40	50%
Cataract	16	20%

Fig. 2. Correlation of DAN with duration of diabetes mellitus

4. DISCUSSION

The reported prevalence of diabetic CAN varies, with community-based studies lower rates than clinic-based and hospital-based studies, in which the prevalence may be as high as 100%. Prevalence of CAN, based on assessment of abnormal cardiovascular autonomic tests, is variable (5-90%) [6].

In a Hungarian study involving 36 type 1 and 28 type 2 long-standing diabetics, definite and early CAN was found in 44% and30% patients respectively, while 26% patients did not have it [7].

Another study showed CAN in26% of similar patients [8]. In this study, definitive and borderline form of CAN was present in 70% of the patients.

These results of CAN are comparable with those mentioned in the literature.

Longer duration of diabetic illness and lack of glycaemic control are the main reasons for these results [9].

The Disease duration over 10 years resulted in Etc. prolongation in a significant numbers of cases with type 1 and type 2 diabetes [10].

Barthelemy et al. found reduced heart rate variability in 51.8% of type 2diabetics, whose duration of diabetic illness was11.8±6.8 years [11].

Of patients with symptomatic CAN, 25-50% die within 5-19 years of diagnosis[12].

The 5-year mortality rate in patients with diabetic autonomic neuropathy is three times higher than in patients without autonomic involvement [13].

Definite CAN as one of the late complications of diabetes mellitus suggests poor prognosis [14].

Abnormal predominance of sympathetic activity predisposes these patients to development of cardiac events [15].

Lack of heart rate variability during deep breathing or exercise is a sign of CAN and is associated with a high risk of coronary heart disease [16].

Resting tachycardia is an early sign, as is loss of heart rate variation during deepbreathing.24 Reduced 24-hour heart rate variability, a newer test, is believed to be more sensitive than standard reflex tests and can detect CAN [17].

Most of the symptomatic patients had more than three abnormal CATs and prolonged duration of diabetes (more than 10 years) indicating that presence of autonomic symptoms indicate necessarily a severe form of DAN. This is in relation to the findings of Smith [18].

Gastro paresis when symptomatic, difficult to treat and may even impair the glycaemic control when the delayed gastric emptying causes alteration in meal absorption [19].

The high prevalence of DAN among patients with sensory peripheral neuropathy has encouraged some researchers to recommend screening such patients with bedside tests to pick early signs of DAN and that might benefit from improving their glycaemic control [20].

In this study, other autonomic symptoms were present in 22(44%) of type 2 DM patients, and symptomatic autonomic neuropathy has been shown to have poor prognosis, revealing a 10-year mortality rate of 27%.26 [21].

Most of the patients in this study had very bad glycaemic status as evidenced by HbA1c values. The public health sector must carry campaigns in this regard to make awareness about diabetes mellitus and its complications. The behaviour of public needs to be modified with an emphasis on compliance with therapy.

5. CONCLUSION

Diabetes-associated CAN causes huge morbidity and mortality and is not unusual in each type 1 and type 2 DM. The pathophysiological mechanisms leading to CAN are multifactorial and requires additional studies. CAN in DM are often subclinical or present with a wide variety of symptoms, starting from resting tachycardia to orthostatic hypotension. Although CAN in DM is tough to diagnose in the hospital setting, a couple of assessments of autonomic characteristics are available in the outpatient setting for screening and definitive diagnosis. CAN in DM can result in huge morbidity and contains a elevated danger of silent ischemia and perioperative mortality. The current remedy of CAN is specifically confined to glycaemic management to slow progression and symptomatic remedy of orthostatic hypotension.

CONSENT

Informed consent was obtained from all those who met the inclusion criteria and their BP and Heart Rate variability to various manoeuvres were assessed.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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