



Clinical Evaluation of Autonomic Dysfunction in Patients with Type-2 Diabetes Mellitus in a Rural Setting

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Abstract

Background: Autonomic dysfunction is a common complication of diabetes mellitus, significantly affecting morbidity and mortality. The objective of this study is to evaluate the clinical and laboratory profile of autonomic dysfunction in patients with type-2 diabetes mellitus.

Objective: To assess the prevalence of autonomic dysfunction and its association with various clinical parameters in type-2 diabetes mellitus patients.

Materials and Methods: This prospective study included 60 patients diagnosed with type-2 diabetes mellitus from the General Medicine department of a rural hospital. The evaluation of autonomic dysfunction was performed using standardized tests, including heart rate variability and the Ewing battery of autonomic tests.

Results: Autonomic dysfunction was observed in 42 patients (70%). The results highlighted significant correlations between autonomic dysfunction and glycemic control, as indicated by HbA1c levels, with a mean HbA1c of $8.5 \pm 1.2\%$ in patients with dysfunction compared to $6.9 \pm 0.8\%$ in those without.

Conclusion: The study concludes that autonomic dysfunction is prevalent in patients with type-2 diabetes mellitus, strongly correlated with poor glycemic control and longer duration of diabetes. Early detection and management of autonomic dysfunction could help mitigate its complications.

Keywords

Autonomic dysfunction, Type-2 diabetes mellitus, Glycemic control, Ewing battery, Rural hospital

Introduction:

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. According to the International Diabetes Federation, the global prevalence of diabetes was estimated to be around 463 million adults in 2019 and is expected to rise to 700 million by 2045 (1). Among the various complications of diabetes, autonomic dysfunction is a significant concern due to its profound impact on morbidity and mortality rates. Autonomic neuropathy can lead to various manifestations, including cardiovascular dysregulation, gastrointestinal issues, and genitourinary dysfunction (2).

The autonomic nervous system (ANS) regulates involuntary bodily functions, including heart

rate, blood pressure, digestion, and sexual function. In patients with diabetes, chronic hyperglycemia and metabolic dysregulation can result in nerve damage, particularly affecting the autonomic fibers (3). The clinical significance of autonomic dysfunction lies in its association with increased cardiovascular risk, which is a leading cause of mortality in diabetic patients (4). The loss of autonomic control can contribute to silent myocardial ischemia, orthostatic hypotension, and impaired gastrointestinal motility, significantly impairing the quality of life (5).

Numerous studies have explored the prevalence of autonomic dysfunction among diabetic patients, with varied results. A study conducted

in an urban setting reported a prevalence rate of around 60%, while another rural study indicated a higher prevalence, emphasizing the need for localized data (6). This highlights the importance of evaluating autonomic function in different demographic settings to implement appropriate management strategies.

The primary objective of this study is to evaluate the clinical and laboratory profile of autonomic dysfunction in patients with type-2 diabetes mellitus attending the General Medicine department of a rural hospital. The study aims to assess the prevalence of autonomic dysfunction and its correlation with clinical parameters such as glycemic control, duration of diabetes, and associated microvascular complications.

Aim and Objectives

Aim: To evaluate the prevalence of autonomic dysfunction in patients with type-2 diabetes mellitus and its relationship with clinical parameters.

Objectives:

1. To assess the clinical profile of patients with type-2 diabetes mellitus and autonomic dysfunction.
2. To determine the correlation between autonomic dysfunction and glycemic control as measured by HbA1c levels.

Materials and Methods

This prospective study was conducted in the General Medicine department of a rural hospital from January 2022 to December 2022. A total of 60 patients diagnosed with type-2 diabetes mellitus, aged 30 to 70 years, were enrolled in the study. Patients with a history of acute illness, significant cardiovascular diseases, or other conditions that could affect autonomic function were excluded.

Clinical Assessment

Demographic data, clinical history, duration of diabetes, and associated comorbidities were

recorded. Patients underwent a detailed clinical examination, focusing on neurological assessment to identify any signs of peripheral or autonomic neuropathy.

Laboratory Investigations

Fasting blood samples were collected to measure glycemic control through HbA1c levels. Standardized tests for evaluating autonomic function included heart rate variability (HRV) and the Ewing battery of autonomic tests, which assesses heart rate response to deep breathing, Valsalva maneuver, and postural changes.

Statistical Analysis

Data were analyzed using descriptive statistics, and comparisons between groups were made using t-tests and chi-square tests, as appropriate. A p-value of <0.05 was considered statistically significant.

Results

Clinical Characteristics

The study included 60 patients, out of which 42 (70%) exhibited signs of autonomic dysfunction. The mean age of participants was 57.3 ± 7.9 years, with a higher prevalence observed in older patients. The majority of patients (63%) were male.

The duration of diabetes in patients with autonomic dysfunction was significantly longer (10.5 ± 5.2 years) compared to those without dysfunction (5.9 ± 3.1 years) ($p < 0.001$).

Laboratory Findings

The mean HbA1c level was significantly higher in patients with autonomic dysfunction ($8.5 \pm 1.2\%$) compared to those without ($6.9 \pm 0.8\%$) ($p < 0.001$). Autonomic dysfunction was also correlated with higher rates of neuropathy and retinopathy, with 50% of patients with dysfunction showing signs of neuropathy compared to none in the non-dysfunctional group.

Table 1: Clinical and Laboratory Characteristics of Study Participants

Characteristic	Autonomic Dysfunction (n=42)	No Autonomic Dysfunction (n=18)	Total (n=60)
Mean Age (years)	59.5 ± 7.6	54.2 ± 8.1	57.3 ± 7.9
Duration of Diabetes (years)	10.5 ± 5.2	5.9 ± 3.1	8.7 ± 4.6
Mean HbA1c (%)	8.5 ± 1.2	6.9 ± 0.8	7.8 ± 1.1
Male (%)	61%	67%	63%
Neuropathy (%)	50%	0%	33%
Retinopathy (%)	35%	5%	23%

Discussion

The findings of this study indicate a significant prevalence of autonomic dysfunction among patients with type-2 diabetes mellitus, consistent with previous research highlighting the association between diabetes duration and autonomic nerve damage (7). Autonomic dysfunction is often insidious, with patients frequently unaware of their condition until complications arise. The high mean HbA1c levels in the group with autonomic dysfunction ($8.5 \pm 1.2\%$) suggest a strong correlation between poor glycemic control and autonomic neuropathy, reinforcing the need for effective diabetes management strategies (8).

In this study, 70% of the patients showed signs of autonomic dysfunction, a higher prevalence compared to some urban studies (9). This disparity could be attributed to various factors, including genetic predisposition, environmental influences, and differences in healthcare access in rural settings. Moreover, the correlation between autonomic dysfunction and the presence of neuropathy and retinopathy is concerning, as it underscores the multifaceted complications of diabetes that can lead to further morbidity and necessitate a holistic approach to patient care (10).

Autonomic dysfunction may significantly impact cardiovascular health, as demonstrated by the increased risk of silent myocardial ischemia and sudden cardiac death in these patients (11). The higher prevalence of cardiovascular events among patients with autonomic dysfunction necessitates close monitoring and early intervention strategies to mitigate these risks.

The study emphasizes the importance of regular screening for autonomic dysfunction in patients with type-2 diabetes mellitus, particularly those with poor glycemic control and longer disease duration. Early identification and appropriate management may help prevent further complications and improve the quality of life for these patients (12).

Conclusion

The findings of this study highlight the significant prevalence of autonomic dysfunction in patients with type-2 diabetes mellitus, strongly correlated with poor glycemic control and longer duration of diabetes. Awareness and early detection of autonomic dysfunction could aid in preventing severe complications and improving patient outcomes. Comprehensive management strategies focusing on glycemic control and regular monitoring for complications should be prioritized in clinical practice.

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