

**A case control study to assess Cardiac Autonomic Neuropathy among adult with  
Type 2 Diabetes Mellitus in selected tertiary hospital, Kanchipuram district,  
Tamilnadu, India**

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**Abstract:** Diabetes mellitus (DM) is a global epidemic affecting 8.3% of the global population and 371 million people worldwide with a significant proportion (50%) were remaining undiagnosed. It is estimated that almost one in six people are currently at risk of developing diabetes-related complications. The cardiac autonomic neuropathy is one among the early complications of diabetes mellitus. The prevalence of CAN varies from 1% to 90% in patients with type 1 diabetes and from 20% to 73% in patients with type 2 diabetes. It is estimated that almost one in six people are currently at risk of developing diabetes-related complications. The aim of the study was to assess the cardiac autonomic neuropathy among adult with type 2 diabetes mellitus. A quantitative approach, case control design was used. By using purposive sampling technique 50 samples in case group and 50 samples in control group were selected. Structured interview schedule and EWING's criteria was used as tool for this study. The collected data were analyzed using descriptive and inferential statistics. The findings of the study reveal that mean age of adults in case group ( $45.9 \pm 5.69$  years) whereas the mean age in control group ( $38.8 \pm 2.41$  years). The majority of the adults in case group (58%) were male and 42% of adults were female whereas (68%) of adults were male and 32% of adults were female in control group. In case group 40% of adults having severe CAN, 34% of adults having early CAN, 24% of adults were normal and 2% of adults having definite CAN whereas in control group majority of adults (94%) were normal and only (6%) of adults having early CAN. Mann Whitney U test was followed to compare the factors of CAN and it reveals that R-R interval ( $Z= 6.956$ ), 30:15 ratio ( $Z= 7.021$ ), BP response to standing ( $Z= 5.882$ ) and BP response to sustained handgrip ( $Z= 6.880$ ) statistically significant at  $p<0.05$  level. So the adults who are having type 2 diabetes mellitus were predominantly affected with cardiac autonomic neuropathy than adults without type 2 diabetes mellitus. Based on the objectives of the study, there was a significant association in the prevalence of cardiac autonomic neuropathy among type 2 diabetes mellitus with the adult's occupation, history of not doing regular exercise, history of alcohol

consumption, duration of diabetes mellitus. The adult's duration of diabetes mellitus (OR= 4.74) and history of taking regular medication for diabetes mellitus (OR= 4.27) have strong significant association with the prevalence of cardiac autonomic neuropathy at 0.05 level. Thus the study proved that the assessment of cardiac autonomic neuropathy among adults with type 2 diabetes mellitus had the beneficial effect in treating and prevent the progression of complication there by reducing the risk of occurring cardiovascular diseases which can be included in the patient's education about the prevention of all complications especially cardiac autonomic neuropathy of type 2 diabetes mellitus. So as nurses have to educate the patients during the visit regarding the aspects of prevention of complication of type 2 diabetes mellitus.

**Key words:** Case control study, Assess, Cardiac autonomic neuropathy, Adult, Type 2 Diabetes mellitus.

## I. Introduction

Diabetes has no geographical boundaries and the disease, once ascribed to more affluent countries, is now known to profoundly affect developing nations. Diabetes mellitus (DM) is a global epidemic affecting at least 8.3% of the global population and 371 million people worldwide with a significant proportion (50%) were remaining undiagnosed. It is estimated that almost one in six people are currently at risk of developing diabetes-related complications.<sup>1</sup>

Cardiac autonomic neuropathy (CAN) is the most neglected, yet one of the most serious complications of diabetes. It is a form of peripheral neuropathy, i.e. damage to parasympathetic and/or sympathetic nerves in people with diabetes, and excluding other causes of neuropathy.<sup>2</sup>

The prevalence of CAN varies from 1% to 90% in patients with type 1 diabetes and from 20% to 73% in patients with type 2 diabetes. The great diversity of data is a result of inconsistencies in the criteria used for the diagnosis of DAN, as well as major differences in the groups of patients included in the research, particularly in relation to risk factors (e.g., patient age, sex, duration of diabetes).<sup>3</sup>After extensive analysis of published papers, the Consensus Panel on Diabetic Neuropathy has concluded that the prevalence of confirmed cardiovascular autonomic neuropathy (CAN) in an unselected group of patients with type 1 and type 2 diabetes is about 20%, but can be up to 65%with increasing age and diabetes duration .<sup>4</sup>

The importance of this diabetic complication is best illustrated by the fact that the mortality rate in patients with CAN is 5-6 times higher in the period of 5-6 years than the mortality in patients with diabetes but without CAN in the same period.<sup>5</sup> DAN results in significant morbidity and may lead to mortality in some patients with diabetes. Longitudinal studies have shown that the 5-year mortality rates of people with CAN are 16%-50% in patients with type 1 and type 2 diabetes, most often due to sudden cardiac death. A meta-analysis of 15 studies, reported a relative risk of mortality of 3.45 in patients with CAN. It is known that CAN significantly increases the risk of life threatening arrhythmias and sudden death with the contribution from other risk factors such as hypoglycemia, drug side effects, hypokalemia, hypotension, ischemia, etc.<sup>6,7</sup>

Risk factors for cardiac autonomic neuropathy are age, duration of diabetes, glycemic control, microvascular complications (polyneuropathy, retinopathy and nephropathy) and other factors such as hypertension, dyslipidemia, smoking, obesity and alcohol consumption. One of the important factors among the listed is glycemic control. The results of the Diabetes Control and Complication Trial (DCCT) showed that tight glycemic control resulted in 50% reduction of the incidence of CAN during 6.5-year follow up. This protective effect persisted for 14 years after the end of the study despite the disappearance of HbA1c differences that were reached between the groups during the randomized phase.<sup>8</sup> Steno-2 study in patients with type 2 diabetes and microalbuminuria has shown that intensive pharmacological treatment of hypertension, hyperlipidemia and microalbuminuria together with lifestyle changes significantly diminishes not only the risk of DAN, but the risk of cardiovascular disease as well, and reduces overall diabetic patient mortality.<sup>9</sup> Diabetic nephropathy, retinopathy and polyneuropathy are considered clinical predictors for DAN, which is understandable because all diabetic microvascular complications share a common pathogenic mechanism and the same risk factors.<sup>10,11</sup>

## **Objectives**

- To identify the prevalence of cardiac autonomic neuropathy among adult with and without type 2 diabetes mellitus
- To compare the factors of cardiac autonomic neuropathy among adult with and without type 2 diabetes mellitus
- To associate the degrees of cardiac autonomic neuropathy among adult with and without type 2 diabetes mellitus with selected demographic variables.

## **II. Methods**

A Quantitative approach, Case control design was selected for this study and conducted in General medicine OPD, Chettinad Hospital and Research Institute, Kelambakkam, Kanchipuram district, Tamilnadu, India. A pilot study was conducted prior to the main study with 10 samples and feasibility and practicability of tools and methods was identified. The main study was conducted using 100 adults by purposive sampling technique. 50 adults who were diagnosed with type 2 diabetes mellitus selected in case group and 50 adults who were without type 2 diabetes mellitus selected in control group. The objective of the study was explained and Informed consent was obtained from both the groups. Demographic data was collected by using structured interview. Then the adults were assessed for biophysical parameters and cardiac autonomic neuropathy by using EWING'S criteria. Validity of the aneroid sphygmomanometer instrument was done by comparing the blood pressure measurements for four individuals with standard instrument used by the physician and found to be the same during each measurement. The tool was tested for reliability by using Test retest method.

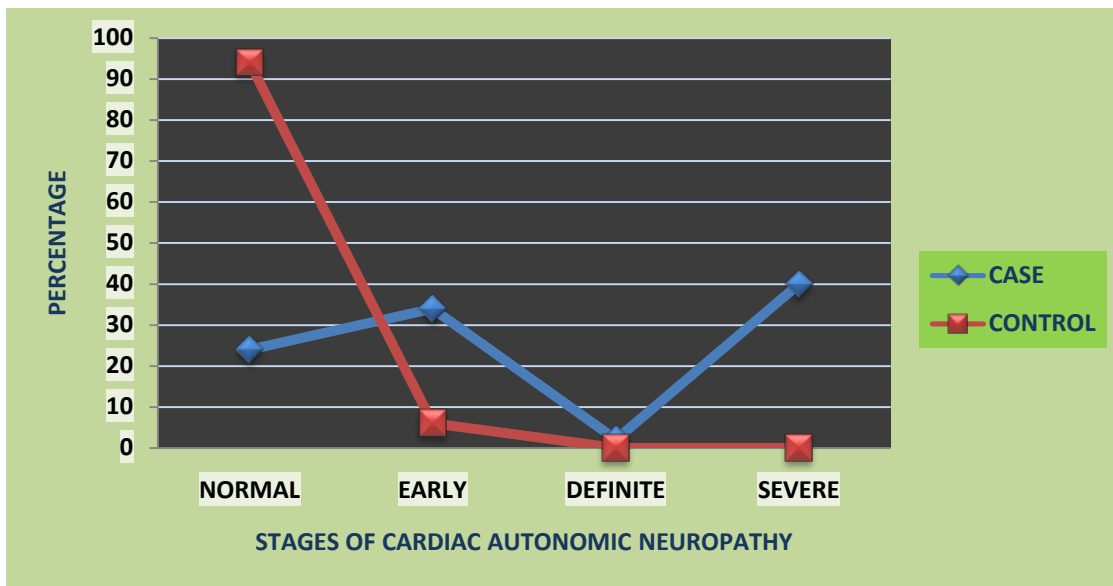
## **III. Data Collection and Analysis**

The study was approved by the Institutional Human Ethical Committee prior to the conduction of study. The aim of the study was explained to the study participants and informed consent was obtained by explaining in their own vernacular language. Descriptive statistics like mean, frequency, percentage were used for demographic data. Inferential statistics like Mann Whitney U test to compare of factors of cardiac autonomic neuropathy among adult with and without type 2 diabetes mellitus and Chi square test and Odd's ratio to associate the stages of cardiac autonomic neuropathy with demographic variables and  $P < 0.05$  was considered as statistically significant.

#### IV. Results and Discussion

The majority of adults 32% of age 51-55 years, 58% were males, 26% were completed high school, 70% were moderate worker, 82% were not doing regular exercise, 78% were non smoker, 82% were non user of tobacco, 78% were non alcoholic, 40% are having diabetes mellitus for the duration of past four years, 36% were overweight category, 96% were normal category in waist to hip ratio in case group whereas in control group the majority of adults 32% of age 36-40 years, 68% were males, 24% were completed high school, 62% were moderate worker, 68% were not doing regular exercise, 82% were non smoker, 82% were non user of tobacco, 84% were non alcoholic, 32% were normal category in BMI classification, 94% were normal category in waist to hip ratio classification.

**Figure 1: Percentage distribution of sample according to their degree of Cardiac Autonomic Neuropathy (CAN).**



Result shows that majority of adults 40% had severe CAN, 34% of samples had early CAN, 24% of adults were normal and 2% of adults had definite CAN in case group. It shows majority of adults 94% were normal and only 6% of adults had early CAN in control group.

A similar study was conducted to assess the prevalence of cardiac autonomic neuropathy in adults with diabetes mellitus by using EWING's criteria. This study concluded that 100 adult had CAN however 69 of these adults could not be categorized. Another descriptive study was conducted to assess the prevalence and risk factors for CAN. The prevalence of CAN was 60%. Significant risks for CAN

among patients with diabetes were coexistent peripheral neuropathy, prolonged QTc, higher age and disease duration over 10 years<sup>12</sup>. This study result supports the present study.

**Table 1: Comparison of factors of cardiac autonomic neuropathy among adult with and without type 2 diabetes mellitus.**

**N=50+50**

Factors of cardiac autonomic neuropathy		Normal		Borderline		Abnormal		Z
		f	%	f	%	f	%	
<b>R-R Interval</b>	Case	11	22	17	34	22	44	6.956*
	Control	46	92	3	6	1	2	
<b>30:15 ratio</b>	Case	12	24	6	12	32	64	7.021*
	Control	47	94	1	2	2	4	
<b>BP respond to standing</b>	Case	17	34	13	26	20	40	5.882*
	Control	46	92	2	4	2	4	
<b>BP respond to sustained handgrip</b>	Case	11	22	8	16	31	62	6.880*
	Control	46	92	1	2	3	6	

**\* Highly significant at P < 0.05 level.**

The study result shows that Mann Whitney U test of R-R interval (Z= 6.956), 30:15 ratio (Z= 7.021), BP response to standing (Z= 5.882) and BP response to sustained handgrip (Z= 6.880) is greater than the table value (1.44) at 0.05 level in cardiac autonomic neuropathy, hence Ho is rejected and the research hypothesis is accepted. The adults in case group were predominantly affected with cardiac autonomic neuropathy than the adults in control group.

A similar study was conducted by Veglio M et al with the objective to compare the diabetic and non diabetic with five cardiovascular tests (deep breathing test, 30/15 ratio test, lying to standing test, cough test, and postural blood pressure test) for the diagnosis of diabetic autonomic neuropathy (DAN) in 168 subjects. A significant comparison between the DAN score of autonomic cardiovascular test results ( $r = 0.34$ ,  $p < 0.0001$ ) was observed. The calculated specificity, sensitivity, positive and negative predictive values were 89%, 15%, 70% and 37%, respectively<sup>13</sup>.

The study result depicts the association of prevalence of cardiac autonomic neuropathy among adults with type 2 diabetes mellitus with selected demographic variable. The result shows that the adult's occupation ( $x^2 = 13.95$ ), regular exercise ( $x^2=11.68$ ), alcohol ( $x^2=18.89$ ), duration of diabetes mellitus ( $x^2=15.6$ ) have significant association with the prevalence of cardiac autonomic neuropathy at 0.05 level. The other variables had no significant association with the prevalence of cardiac autonomic neuropathy.

The result shows that the adult's duration of diabetes mellitus (OR= 4.74) and history of taking regular medication for diabetes mellitus (OR= 4.27) have strong significant association with the prevalence of cardiac autonomic neuropathy at 0.05 level. The other variables had no significant correlation with the prevalence of cardiac autonomic neuropathy among adult with type 2 diabetes mellitus.

A similar study was conducted by Bandi Hari Krishna et.al to assess the cardiovascular autonomic function in type 2 DM in 30 cases and 30 controls, aged between 30-50 years, including both genders, by using Deep breathing test (DBT), Valsalva Maneuver (VM), Cold Pressor Test (CPT), Lying to standing test (LST) and its correlation with duration of diabetes. The duration of DM was negatively correlated with delta heart rate (-0.908), valsalva ratio (-0.926), rise in diastolic pressure during hand grip test (- 0.747) and cold pressor test (-0.888) and study concluded that, the duration of diabetes has more effect of CAN<sup>14</sup>.

## **V. Implications for Nursing Practice and Research**

The present study will enable, nurses to apply theory into practice as provide health education on the aspects of prevention of complications of type 2 diabetes mellitus to the patients and they can conduct continuing nursing education to identify the cardiac autonomic neuropathy in adults with type 2 diabetes mellitus and use this in their daily practice. Nurses can conduct more research studies on prevalence of cardiac autonomic neuropathy in other diseases, and also publish articles in the journal

explaining the importance of early detection and prevention of CAN in type 2 diabetes mellitus. There is a need for extensive and intensive research in this area to provide evidence based care since the researches about this are in scarce.

## VI. Conclusion

In conclusion the discussion of the study findings shows that the prevalence of cardiac autonomic neuropathy among adults with type 2 diabetes mellitus was definite and severe. The early detection and prevention of complication of type 2 diabetes mellitus will sustain the better health. So it is insisting that the primary responsibility of the nurse has to educate the patients during the health visit regarding the aspects of prevention of complication of type 2 diabetes mellitus.

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