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PATTERN OF ELECTROCARDIOGRAPHIC CHANGES IN DIABETES PATIENTS: DATA FROM A RURAL TEACHING HOSPITAL

*¹Dr. Amol Hartalkar, ²Dr. Sheetal Hartalkar, ¹Khushal Choudhary, ¹Krithika Peshwe
¹Dr. Alex Mathew and ¹Dr. Pratik Shete

¹Associate Professor, Department of General Medicine, Rural Medical College

²Consultant Periodontologist, Rural Dental College, Pravara Institute of Medical Sciences (DU), P.O. Loni (Bk) – 413736 Dist. Ahmednagar (M.S.)

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ABSTRACT

Background: Cardiovascular system has been involved in patients with diabetes in various ways. It is very important to know the electrocardiographic changes that can occur in patients with diabetes.

Methods: The electrocardiographic changes were studied in 50 cases with diabetes and compared with 50 healthy age and sex matched controls.

Results: Among the 18 females and 32 males included in the study, only 10 patients had diabetes of more than 10 years duration. The various electrocardiographic changes were poor progression of R waves (18%), Q waves (10%), bundle branch blocks (8%), QT prolongation (8%), ectopics (6%), axis changes (6%), heart blocks (6%), rate abnormalities (8%) and chamber enlargement (6%).

Conclusions: This study reflects that resting ECG should be an integral part of the examination of all patients with diabetes.

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INTRODUCTION

The importance of diabetes mellitus, in the epidemiology of cardiovascular diseases cannot be overemphasized. About one third of patients with acute myocardial infarction have diabetes, the prevalence of which is steadily increasing (Schnell *et al.*, 2009). In diabetes mellitus, the cardiovascular system is involved in various forms, like by microvascular and macrovascular manifestations. In patients with diabetes mellitus, the cardiovascular system involvement can range from ischemic heart disease, hypertensive heart disease and diabetic cardiomyopathy (Voulgari *et al.*, 2010). The 12-lead Electrocardiograph (ECG) is very significant for the diagnosis and triage of patients with suspected coronary heart disease. It is utilized both in the diagnostic and the researcher quest as a detection and screening tool of myocardial injury. In the present study, we attempted to study the ECG changes in terms of their relevance to the physician to help with the day to day diagnosis, screening, and timely decision making and also in terms of their application in the future and ongoing research.

***Corresponding author: Dr. Amol Hartalkar**

Associate Professor, Department of General Medicine, Rural Medical

MATERIALS AND METHODS

This retrospective observational case control study was done on inpatients and outpatients in Department of Medicine, of a rural teaching hospital. The study included a total of 100 subjects (50 cases and 50 controls). The electrocardiographic changes were studied in 50 patients with diabetes mellitus and compared with 50 healthy age and sex matched controls.

Inclusion criteria

- Type 2 Diabetes Mellitus patients either symptomatic or asymptomatic.
- Healthy controls.

Exclusion criteria

- Patients with age above 65 years
- Documented ischemic heart disease
- History suggestive of previous angina, congestive cardiac failure.

- Documented evidence of other cardiac disease like cardiomyopathy, Valvular heart disease, Congenital Heart Disease, Myocarditis
- Alcoholism, as defined by CAGE criteria
- Hypertension
- Chronic obstructive pulmonary disease
- Drugs – β blockers, Digoxin
- Features of hypothyroidism
- Uremia
- Random blood sugar >140 mg% for the controls.

Study design

This retrospective observational case control study was done on inpatients and outpatients in Department of Medicine, of a rural teaching hospital. The study included a total of 100 subjects (50 cases and 50 controls).

Data collection & analysis

A comprehensive case history was recorded on a semi-structured, close-ended proforma. Data were collected in a preformed, pretested case record form which included patients' demographic profile, clinical information, ECG and laboratory investigation values. Data was cleaned, coded and analysed by frequency, mean, percentage and standard deviation.

RESULTS

The electrocardiographic changes studied in 50 cases of patients with diabetes and compared with 50 healthy age and sex matched controls were analyzed as given below.

The study included 50 cases and 50 controls, of which there were 18 females and 32 males, in both cases and controls.

Duration of diabetes

Based on duration of diabetes, there were 21 patients with duration of diabetes less than 3 years, 19 with duration between 3 to 6 years and 10 patients with duration of diabetes more than 6 years both in cases and controls. Both cases and controls were age and sex matched. Most patients were in 51-60 years age group (Table 1). Mean age was 55.52 years.

Table 1. Age distribution of cases and controls (n=100)

Age (years)	Cases	Controls
31 – 40	1	1
41 – 50	13	13
51 – 60	23	23
61 & above	13	13

Table 2. Pattern of ECG changes (n = 100)

ECG changes	Cases	Controls
Present	26	09
Absent	24	41

Among the cases, 52% (26) of them had various ECG changes whereas among the controls, ECG changes were present only

in 18% (9) of patients. (Table 2). This was statistically significant with p value <0.001 based on Pearson's chi square test. Of the 50 cases studied, 18% (9) had ST-T changes, whereas only 2% (1) had ST-T changes among the controls which was statically significant (p<0.001).

Overall all ECG changes were more common among the cases when compared to controls, but few changes which did not have statistical significance but were more common among the cases were Heart Blocks (6% v/s 4%) and chamber enlargement (6% v/s 2%). The presence of Q waves (10% v/s 0%), Poor R wave progression (16% v/s 6%), ectopics (6% v/s 0%), Bundle branch blocks (8% v/s 2%), QT Prolongation (8% v/s 0%), chamber enlargement (6% v/s 2%) and axis deviation (6% v/s 0%) was statistically significant.

Relation between glycosylated hemoglobin (Glyco Hb) and ECG changes

It was also found that among cases those who had higher Glyco Hb values (>8.5) had more ECG changes (38%) where as those with lower Glyco Hb values had less ECG changes (14%). This was found to be statistically significant (p <0.001 of Fischer's exact test).

DISCUSSION

All diabetic patients should be evaluated by meticulous history, physical examination besides resting ECG. Resting ECG is the most essential and initial test that should be done in all asymptomatic diabetics and can be used for screening of all patients with diabetes. Often in research, a more sophisticated and invasive test is done, however our study utilizes a noninvasive and cheaper tool which can be used in all patients in developing countries like India. The mean age of presentation in our study is 55.52 years. Most subjects were in the 51-60 years category. Similar age ranges were found in various Indian studies. 3,4,5 study done Gwalior, Madhya Pradesh.³ The male to female ratio in this study was 1.78:1 which is comparable to the various studies done in India (Singh *et al.*, 2014; Agrawal *et al.*, 2004 and Sinharoy *et al.*, 2008). The presence ECG change in subjects with type 2 diabetes in this study was 52%. Overall all ECG changes were more common among the cases when compared to controls, but few changes which did not have statistical significance but were more common among the cases were heart blocks(6% v/s 4%) and chamber enlargement (6% v/s 2%).

The presence of Q waves (10% v/s 0%), poor R wave progression (16% v/s 6%), ectopics (6% v/s 0%), bundle branch blocks (8% v/s 2%), QT Prolongation (8% v/s 0%), chamber enlargement (6% v/s 2%) and axis deviation (6% v/s 0%) was statistically significant. A study done on the quantitative electrocardiographic and vector-cardiographic changes carried in 113 newly diagnosed diabetics and 125 controls showed statistically significant QT prolongation in the diabetic group (Uusitpa *et al.*, 1988). A study done on 9135 men and 9627 women showed that there was statistically significant relationship between right bundle branch block and elevated fasting plasma glucose. Diabetics have a prolonged PR interval and more leftward frontal QRS axis than their non-diabetic counterparts (Thrainsdottir *et al.*, 1993). Another study

showed no statistically significant difference in QRS duration between diabetics and non-diabetics. There is an increase incidence of intra-ventricular conduction blocks in diabetic patients than that of normal; however this was not statistically significant (Pouroghaddas and Hekmatnia, 2003). Our study had few limitations. Small patient population from single centre was studied. Study patients were not categorised as type 1 or type 2 diabetes mellitus. We have not evaluated monitoring of treatment and outcome.

Conclusion

- This study reflects that a resting ECG should be an integral part of the examination of all patients with diabetes.
- This study emphasizes that presence of ST-T changes, Q waves, Poor R wave progression, ectopics, bundle branch blocks, QT Prolongation, chamber enlargement and axis deviation are more common in diabetic patients.
- The ECG changes were seen more commonly in patients with poorly controlled diabetes, which reinforces the need to have well controlled blood glucose levels in all patients with diabetes to prevent its complications.

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Conflict of interest: None declared

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