ECG changes in patient with Non-Insulin Dependent Diabetes Mellitus

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Abstract

Background: Diabetes mellitus (DM) has been known for many years to be associated with poor cardiovascular prognosis. Due to the sensitive neuropathy, the coronary artery disease in diabetic patients is frequently asymptomatic, until the onset of myocardial infarction or sudden cardiac death. Coronary artery disease is the leading cause of morbidity and mortality in patients with diabetes. *Aims and Objectives*: To reduce patient mortality and morbidity, the current analysis was performed on diabetes patients to look for ECG alterations.*Materials and Methods*: The present study include Electrocardiogram of 550 cases with non-insulin dependent diabetes mellitus (NIDDM) who were followed up prospectively for three consecutive years. The study has been conducted in MNR Medical College and Sangareddy, Telangana. *Result & Conclusion*: Left axis deviation (LAD) 16%, Left anterior hemiblock (LAHB) 5.5% Right bundle branch block (RBBB) with or without LAHB 4.2% respectively were the commonest ECG abnormalities observed. Repolarization abnormalities (6.1%) were also observed in these patient with non-insulin dependent diabetes mellitus. Prevalence of silent ischaemia and / or infarction (2.7%) were similar to that reported from west. Follow up revealed further appearance of bundle branch block, silent ischaemia / infarction, and repolarization defects at the end of 12, 24 & 36 months of study. These defects suggest primary involvement of myocardium which progress

irrespective of metabolic status in patients with NIDDM.

Key Words: NIDDM, Bundle branch block, Ischaemia, Infarction, Repolarization defects.

INTRODUCTION

Peoplewith type 2 diabetes have a two-fold higher risk of cardiovascular disease (CVD) compared to the general population [1-3].Myocardial involvement in diabetes mellitus and particularly in non-insulin dependent diabetes mellitus can be consequent to atherosclerosis of the epicardial coronary arteries as well as micro angiopathy of intramural vessels and primary myocardial involvement as a result of metabolic abnormalities of diabetes mellitus. All these can, only have deleterious effect on the cardiac function perse but can also have their brunt on the conduction system and electrical activity of the heart[4]. Although studies on coronary artery diseases (CAD), ventricular dysfunction, cardiac dysautonomia and cardiomyopathy in diabetics flood the literature, very few reports are available on ECG abnormalities [5]. Studies had observed resting ECG abnormalitiesina large number of diabetics [6]. Amongst workers from India had observed as high as 6.1% of conduction defects in patients with diabetes mellitus. Experience regarding such defect in diabetes mellitus pre-clinical and overt cardiomyopathy has been reported from India [7]. But till date there has been hardly any report on ECG changes in patient in NIDDM evaluation on a long term basis. It was therefore decided to observe prospectively ECG changes in patients with NIDDM and follow them up for three consecutive years while on regular treatment and medical supervision.

MATERIAL and METHODS

This study was carried out in the department of medicine/cardiology MNR Medical College and Hospital Sangareddy, Telangana from 2020 to 2023. The institutional ethical committee provided its ethical approval, and each subject provided signed informed permission, only those participants who were willing to engage in the study were enrolled after obtaining written informed consent and explaining its nature and goal.

It's a prospective study done on 550 patients included in the study arediagnosed for non-insulin dependent diabetes mellitus (NIDDM) diagnosed as per the WHO criteria [8]aged between 35-60 years. They were advised to come every month for evaluation of metabolic status and therapeutic advice. The patients whose age were less than 30 years and more than 60 years, patients with diabetics history of less than 3 years, individuals with a history of heart disease, high blood pressure, smoking, or alcoholism are excluded from the study. Pregnant females were also ruled out from the study because of chances of gestational diabetes. A detailed history was taken per the pro forma, which included details on the patient's age, sex, age of onset, and duration of diabetes, as well as any current complaints, history of any prior illnesses, medications used to treat them condition, dosages, and frequency of treatment, as well as personal details such as smoking and alcohol use. ECG recording was conducted by 12-lead ECG instrument, Fasting blood sugar (FBS)/post prandial blood sugar was recorded. ECG was recorded at entry and annually for three consecutive years.

RESULT

Table 1

General information of patients at entry (in percent) [n = 550]

Duration of the Disease		< 1 yr	1-5 yrs	5-10 yrs	>yrs
Distribution of cases		31.2	26.8	21.6	20.4
SEX	Male	21.0	20.7	18.9	14.7
	Female	10.8	6.1	3.3	4.5
Nutritional status (as per BMI)					
	Lean (<19)	9.8	7.7	8.4	4.5
	Std. wt. (19.1-27)	16.2	18.0	15.0	10.8
	Over wt (> 27)	5.7	1.2	0.9	1.8
		31.7	26.9	24.3	17.1
Glycemic status					
	Mild (FBG <120)	8.7	9.6	4.2	4.2
	Mod. (FBG < 180)	10.6	9.6	3.0	5.4
	Severe (FBG < 250)	8.4	5.4	8.4	10.2
	Very Severe (FBG > 250)	4.2	2.1	3.6	2.4
		31.9	26.7	19.2	22.2
Patients with ECG Abnormality: 91 (16.54%) Patients without ECG Abnormality: 459 (83.46%)					

Table 2

ECG Abnormalities at enrolment

QRS Axis		
Left axis deviation(LAD)	88	(16.6%)
Right axis deviation (RAD)	3	(0.5%)
Arrhythmias		
Sinus bradycardia	9	(1.6%)
Sinus tachycardia	9	(1.6%)
Premature ventricular contraction	4	(0.7%)
Wolf Parkinson white syndrome	1	(0.2%)
Repolarization abnormalities		
Tall T (> 10 MM in V_2&V_3)	29	(5.2%)
ST elevation with concavity Upwards	5	(0.9%)
Conduction abnormalities		
LABH	30	(5.5%)
RBBB (Partial & Complete)	12	(2.1%)

RBBB + LAHB	12	(2.1%)
RBBB + LPHB	2	(0.3%)
LPHB	3	(0.5%)
LBBB	3	(0.5%)
Silent coronary (events)		
Myocardial Infarction	15	(2.7%)
(I) Anterior	9	(1.6%)
(II) Inferior	2	(0.3%)
(III) Posterior	4	(0.7%)
Ischemia	14	(2.5%)
Miscellaneous changes		
Left ventricular hypertrophy (LVH)	2	(0.3%)
Giant T inversion ($V_4 - V_5$)	2	(0.3%)

Table 3

Abnormalities noted for the first time at 12 monthly follow-up

RBBB with / without LAHB	8	(3.9%)
LAHB alone	1	(0.4%)
LBBB alone	1	(0.4%)
Silent ischemia	6	(2.9%)
Tall T in V_2, V_3	12	(5.8%)
ST elevation (conv. upwards)	2	(0.9%)
LVH	2	(0.9%)

Table 4

Abnormalities noted for the first time at 24 monthly follow-up

RBBB	3	(1.8%)
LAHB	1	(0.6%)
LPHB	1	(0.6%)
LBBB	1	(0.6%)
Ischemia	4	(2.5%)
Myocardial infarction	2	(1.2%)
Tall T (V_2&V_3)	12	(7.5%)
ST elevation	1	(0.6%)
Supra ventricular premature contraction	1	(0.6%)

Table 5

Abnormalities noted for the first time at 36 monthly follow – up

RBBB + LAHB	3	(4.4%)

RBBB + LPHB	1	(1.4%)
Complete heart block	1	(1.4%)
Myocardial infarction	1	(1.4%)
Ischemia	2	(2.8%)
Tall T (V_2 & V_3)	2	(2.8%)

General information regarding the 550 patients with non-insulin dependent diabetes mellitus included in the study are presented in Table 1. ECG abnormalities were divided into

(a) QRS axis abnormalities,

(b) Arrhythmias,

(c) Repolarization abnormalities, such as tall T > 10 mm V2 V3

and ST elevation with concavely upwards,

(d) Conduction abnormalities,

(e) Silent coronary infarction and other non-specific changes categorized as miscellaneous.

The commonest abnormality was LAD (16%) to be followed by repolarization defect (6.1%), LAHB (5.5%), RBBB with or without LABH (4.2%), silent myocardial ischemia / infarction (5.2%) respectively as depicted the Table 2.

It was observed that repolarization defects, bundle branch blocks, silent ischemia and infarction developed in previously normal non-insulin dependent diabetes mellitus at the end of 12, 24 and 36 months of follow up as given in table 3, 4 and 5 respectively.

DISCUSSION

Non-insulin dependent diabetes mellitus is known to be major risk factor for coronary artery disease. Non coronary involvement of the myocardium in diabetes mellitus is also well established [9]. All these pathologies get reflected in the ECG and thus it becomes a routine investigation as well as monitoring procedure in the clinical management of diabetes mellitus. Non-insulin-dependent diabetes mellitus being an insidious disease, its complications also develop slowly. Besides the myocardial events are often silent as compared to a non- diabetic. Although routine ECG evaluation should be done in every patient with diabetes mellitus at yearly intervals even if they do not have overt cardio vascular complication.

This study was an attempt to elucidate the prevailing patterns of electrophysiological abnormalities in patients with non-insulin dependent diabetes mellitus and whether there is any advantage of follow up of such cases by ECG studies annually.

Interestingly it was observed that five variety of abnormalities other than silent myocardial ischemia or infarction was evident in 8.7 percent of cases with non-insulin dependent diabetes

mellitus while the latter abnormalities were seen only in 7.8 percent (Table 1and 2). This reveals that non-coronary events affecting the myocardium and/ or the conduction tissue of the heart are more prevalent in Indian patients with non-insulin dependent diabetes mellitus than myocardial ischemia / infarction per se. The most dominant lesion being Left axis deviation. Most interestingly there was appearance of such abnormalities in patients who did not have ECG abnormalities at the point of enrollment to this study. The conduction abnormalities always dominated the ECG picture. The involvement of the conduction tissue in diabetes mellitus has been studied and published in literature [10].In our study higher magnitude of conduction abnormalities is seen similar observation is observed by other author [11] also. Similarly high prevalence of repolarization defects are also been observed [12]. Flugelman has reported higher incidence of ECG changes in diabetes mellitus subjects [6]. He particularly emphasized on the frequency of alteration in QRS vector.

It is well appreciated that abiotrophy or premature aging is a sine qua non of diabetes mellitus. Therefore it is very likely that the ECG changes manifesting as conduction defects and repolarization defects are consequents to these subtle pathological process in the myocardium.

CONCLUSION

The process being progressive, although the grade of involvement may vary from individual to individual, routine annual ECG monitoring should be a gold standard investigation procedure for the patients with non-insulin dependent diabetes mellitus.

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