



A STUDY OF PERIOPERATIVE CARDIOVASCULAR EVENTS IN DIABETIC PATIENTS WITH PREOPERATIVE ELECTROCARDIOGRAPHIC CHANGES

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ABSTRACT

Background: Diabetes is well known for its association with cardiovascular complications. Electrocardiography (ECG) is commonly performed as part of preoperative cardiovascular risk assessment in patients undergoing noncardiac surgery. Predictive value of ECG abnormalities has been questioned in non-diabetic patients. This study is conducted in diabetic patients to assess the predictive value of preoperative ECG in perioperative cardiovascular outcome. **Material And Methods:** It was a prospective observational study. A total of 102 diabetic patients >18 years of age were enrolled from various surgical wards of JNMCH, AMU, Aligarh, between January 2016–November 2017. A 12-lead ECG was done before the surgery. Patients with normal ECG recording were taken as control and abnormal ECG were taken as case. The patients were followed up during hospitalisation and were evaluated for the presence of perioperative cardiovascular events. Various abnormal ECG findings were: Pathological Q wave, ST-T changes, Left Ventricle Hypertrophy, Premature ventricular complexes, Atrial Fibrillation (AF), Prolonged QTc, Right Bundle Branch Block, Left Bundle Branch Block, Left Anterior hemiblock, Sinus tachycardia. Patients were followed up postoperatively, daily for occurrence of any of the following events: Acute Coronary Syndrome (ACS), Congestive Heart Failure (CHF), Arrhythmia, Cardioembolic stroke. The statistical analysis of the data was done using appropriate statistical tests, carried out by IBM SPSS version 20. **Results:** In the present study, 95.75% of patients with preoperative ECG abnormalities were above 45 years of age with males predominance (59.6%). Patients with ECG abnormalities were Q with ST-T changes (11.8%), RBBB (7.8%), LAHB (7.8%), LVH (6.9%). 12% patients developed perioperative cardiovascular events (PCE). 5 out of 12 had Q with ST-T changes ($p < 0.05$). **Conclusion:** The present study shows that the presence of pathological Q wave with ST-T changes suggestive of old myocardial infarction is related to perioperative cardiovascular events during hospital admission. Rest of the ECG abnormalities have low predictive value for perioperative outcome in diabetic patients.

KEYWORDS

ECG, Diabetes Mellitus, perioperative, surgery

INTRODUCTION

Diabetes is the most common endocrinal disease. It is assuming a global epidemic, and 2017 world health organisation (WHO) report on diabetes, estimated the total number of people with diabetes rising from 108 million in 1980 to 422 million in 2014 [1]. The prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014 worldwide, and it is more pronounced in middle to low income country [1].

Diabetes is well known for its association with cardiovascular events [2]. It is one of the largest causes of mortality and morbidity worldwide, increasing the risk of coronary heart disease, ischemic stroke to two to fourfold and 1.5 to 3.6 fold increase in mortality [2]. With the great advances in cardiovascular therapy and prevention, there has been reductions in diabetes-related coronary mortality in developed countries [1]; cardiovascular morbidity and mortality still remains high in the majority of patients with diabetes. Considering the increasing number of cardiovascular event survivors and the global epidemic of Type 2 Diabetes Mellitus (T2DM), it is expected that the number of patients with T2DM at a higher risk of cardiovascular events to rise, posing a great challenge for health care systems worldwide. In such situation, those patients who are undergoing surgeries for various diseases are at risk of developing perioperative and postoperative complications [3]. All patients scheduled for surgery are evaluated by the surgeons, anaesthesiologists and physicians to identify conditions that predispose the patient to adverse perioperative outcomes [4][5][6]. Postoperative cardiovascular morbidity and mortality are accurately predicted by variables determined from the patient history (e.g., the Revised Cardiac Risk Index), yet additional laboratory testing is frequently ordered as a means of identifying the asymptomatic patient at risk [4][5][6].

Electrocardiography (ECG) is commonly performed as a part of preoperative cardiovascular risk assessment in patients undergoing noncardiac surgery [4][5][6]. Predictive value of ECG abnormalities has been questioned, and ECG results appear to exert weak influence on clinician behaviour [6][7][8].

Recent studies suggest that abnormalities detected on the preoperative ECG in patients undergoing higher risk surgery may predict postoperative or long-term cardiovascular death [9][10] (Liu et al, 2002 and Noordzij et al, 2006).

Aims And Objectives

The present study was conducted with following aims and objectives:

To assess perioperative and postoperative cardiovascular events in diabetic patients in relation to preoperative electrocardiographic changes.

MATERIALS AND METHODS

A total of 102 diabetic patients, more than 18 years of age, were enrolled in the study after obtaining an informed written consent from them. These patients were scheduled for surgery in various surgical wards including General surgery, Orthopaedics, Obstetrics and Gynaecology, ENT, and Ophthalmology in JNMCH, AMU, Aligarh, between January 2016–November 2017. Patients undergoing cardiac and vascular surgery were excluded.

The patients were followed up during hospitalisation and were evaluated for the presence of any perioperative cardiovascular events. Postoperatively, patients were followed once a day initially, for a week or if any symptom rose, then once weekly, thereafter. The study had institutional ethics committee's approval, and the procedures followed in the study were in accordance with the institutional guidelines and pre-designed proforma.

Study Design

It was a prospective, observational study. The detailed history and examination was carried out for every subject who entered in study as per a pre-designed proforma. The patients included in the study were subjected to the following investigations:

- Routine blood investigations: Complete Blood Count, Renal Function Test, Urine microscopy, Random blood sugar
- Fasting and postprandial blood sugar
- Electrocardiogram
- Chest X-Ray (PA view)
- HbA1c
- Specific investigations included:
- Echocardiography
- Cardiac biomarkers including troponin I
- Colour Doppler including echocardiographic
- Holter studies (in selected cases)
- NCTT head

All the above investigations were done in JNMCH, AMU, Aligarh. Sample size and sampling procedure The present study is a hospital based study conducted at tertiary centre. A total of 102 patients were enrolled in the study, based on the criteria of convenience

sampling. Consecutive recruitment sampling was used in this study. Recruited participants were interviewed on their socio-demographic details such as age, sex, etc. Physical examination and Electrocardiography was carried out for each participant.

Diagnosis of Diabetes Mellitus was made according to the criteria laid down by American Diabetes Association or the patients who were already on anti-diabetic drugs.

Statistical Analysis

All data were analysed by using SPSS software version 20. Results were expressed as Mean $\pm$ standard deviation and percentages. Comparison of categorical variables between the groups was done by Chi Square test and Fisher's test, while continuous variables were compared using student 't' tests for independent groups. ANOVA or analysis of variance with Scheffe's post hoc analysis was used for comparison of mean between 3 or more groups. A 'p' value of less than 0.05 was considered statistically significant. The statistical analysis of the data was done using appropriate statistical tests, carried out by IBM SPSS version 20.

Table 1: Baseline characteristics of the patients in the study groups

S.N		Case	Control
1	Age (years) (mean $\pm$ SD)	60.7 $\pm$ 10.2	59.7 $\pm$ 10.3
2	Gender(n) (%)		
	Male	28(59.6)	28(50.9)
	Female	19(40.4)	27(49.1)
3	Hypertension(n) (%)	25(53.2)	20(36.4)
4	Smoking(n) (%)	16(34.0)	8(14.5)
5	CAD(n) (%)	8(17.0)	1(1.8)
6	AF(n) (%)	1(2.1)	0(0.0)
7	RCRI(n) (%)		
	I	0	0
	II	28(59.6)	48(87.3)
	III	13(27.7)	7(12.7)
	IV	6(12.8)	0
8	AHA/ACA classification for surgical risk (n) (%)		
	High	0	0
	Intermediate	41(87.23)	48(87.27)
	Low	6(12.76)	7(12.72)
9	HbA1C (n) (%)		
	< 8.5%	27(57.4)	37(67.3)
	>8.5%	20 (42.6)	18(22.7)

SD Standard Deviation
CAD Coronary Artery Disease
AF Atrial Fibrillation
RCRI Revised Cardiac Risk Index
AHA/ACA American Heart Association/ American Cardiac Association

RESULTS

The study included a total of 102 patients with Diabetes Mellitus. 47 patients had abnormal ECG changes (cases) while 55 patients had normal ECG findings (control). 45.1% were females (46) and 54.9% were males (56). Baseline characteristics of the patients in both the groups were comparable as shown in table 1.

Perioperative cardiovascular events (PCE) occurred in a total of 12 patients in the study population. 5 patients developed Congestive Heart Failure (CHF), 3 patients had Acute coronary syndrome (ACS) and Atrial Fibrillation (AF) each. 1 patient developed Acute Ischemic Attack as shown in figure 1.

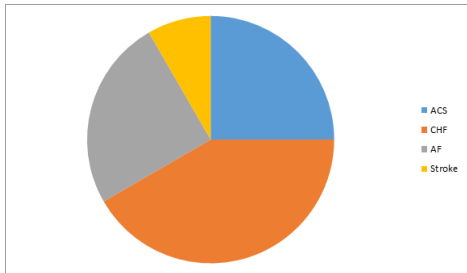


Figure 1: Patients developing Perioperative Cardiovascular Events

(PCS)

Out of total 102 patients, 55 had recorded normal ECG and in 47 patients, it was abnormal. Most patients with abnormal ECG finding had Q with ST-T changes, that was present in 12 patients. 8 patients had RBBB and LAHB each. 7 patients had LVH, T wave inversion was present in 5 patients. 3 patients had ST-T change but without Q wave. 2 patients had LBBB at presentation. 1 patient presented with Atrial fibrillation and prolonged QTc each.

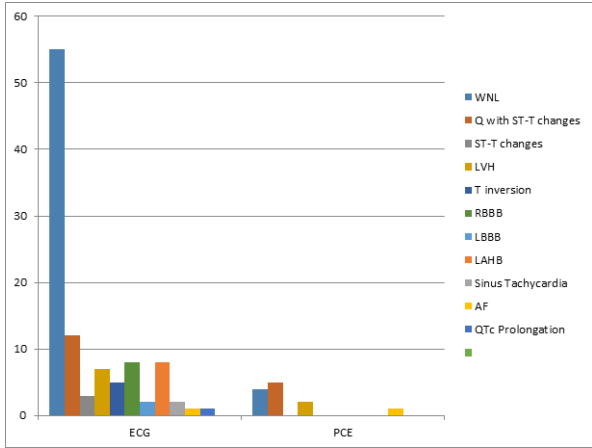


Figure 2: ECG and PCE in the study population.

8 out of 12 patients who developed perioperative CV complications had abnormal ECG. 4 patients had normal ECG who developed complications. However, the result is not statistically significant (p=0.112). This is shown in table 2.

Table 2: ECG and perioperative Cardiovascular events (PCE)

ECG	With PCE(%)	Without PCE(%)
Normal	4(33.3)	51(56.7)
Abnormal	8(66.7)	39(43.3)
Total	12	90

P=0.112

Pathological Q with ST-T changes were present in 5 out of 12 patients who developed cardiovascular events. The result is statistically significant (p=0.005).

LVH was present in 2 patients who developed CV complications. 10 out of 12 had no LVH. The result is not statistically significant. Out of total 12 patients who developed complications, AF was present in just 1 patient. The result is not statistically significant.

There are only a few studies evaluating the predictors of perioperative cardiovascular events in diabetic population. In the present study, ECG changes were present in 47 (46%) out of total 102 patients. Commonly reported ECG abnormalities were pathological Q wave with ST-T changes (12), Bundle branch blocks including RBBB (8) and LAHB (8). Atrial Fibrillation (AF) and prolonged QTc interval were least commonly present with one patient in each. Overall, the study did not show any significant increase in incidence of perioperative cardiovascular events in diabetic patients with abnormal ECG, preoperatively. The present results are comparable to those of Schein et al, 2002 [7] who evaluated the use of routine ECG in patients undergoing cataract surgery. Detailed analysis of preoperative routine ECG revealed no prognostic information for short-term outcome. Liu LL et al, 2002 [10] observed more than one ECG abnormalities in patients more than 70 years of age, undergoing noncardiac surgery but it was not associated with an increased risk of postoperative cardiac complications.

Noordzij PG et al, 2006 [9], retrospectively studied 23,036 patients undergoing various surgical procedures. They showed that the patients with abnormal ECG findings had a higher incidence of 30-day cardiovascular death compared with patients with a normal ECG. Biteker et al, 2012 [11] prospectively studied 660 patients undergoing various surgeries and found significant increase in incidence of perioperative cardiovascular events in patients with preoperative ECG changes during their hospital stay. The findings of the present study

contrast these trials. The present study may not have the robust power to support the result because of small sample size.

However, significant increase in incidence of perioperative cardiovascular events was noticed in the patients with pathological Q wave with ST-T changes. Similar results were obtained by Wolters T et al, 2014 [12] who studied 616 patients. They found that pathological Q wave in preoperative ECG was an independent predictor of perioperative cardiovascular events. WA et al, 2007 also showed a similar result. The authors found that the incidence of postoperative myocardial infarction was higher among the patients with old MI represented by pathological Q wave on electrocardiography.

The present study did not show any adverse events in patients with ST-T changes on ECG other than with pathological Q waves.

The current study also failed to demonstrate any significant increase in perioperative cardiovascular events in patients with prolonged QTc interval, Atrial fibrillation, left ventricle hypertrophy or any bundle branch blocks.

CONCLUSION

The present study is a prospective observational study. Although the proportion of patients developing perioperative cardiovascular events was more among the patients with abnormal ECG but the results were not significant except in the subgroup of patients with pathological Q wave with ST-T changes.

- The presence of pathological Q wave with ST-T changes in the preoperative ECG was related to perioperative cardiovascular events during hospital admission. It may be further concluded that ECG changes except those suggestive of myocardial infarction in the past have low predictive value for perioperative outcome in diabetic patients.

Limitations Of Study

- Small sample size
- Cardiac biomarker, Troponin I was done only in patients with clinical and ECG evidence of perioperative MI and not in all patients.

Compliance With Ethical Standards

1- Conflicts of Interest – Nil

- 2- Research involving Human participants.
- 3- Informed consent taken from participants.

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