



ECG CHANGES IN DIABETIC PATIENT

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Dedication :

To persons who support and help me from the first day of my life;who made me what I am(my parents).

To my caring, loving, and supportive(my husband).

To Dr. Qassim , my friend, and to all people who had help me to do this research.

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Abstract

Back ground:

Diabetes mellitus is the most common metabolic disorder encountered in clinical practice. It is a major risk factor for cardiovascular disease and ECG changes.

Aim:

To detect the types of ECG changes in Iraqi diabetic patient.

Patient and methods:

Our study is a cross sectional study on 25 patients from medical ward and consultant clinic in AL-imamain al-kadhimain medical city ,and several

information was taken from them including(age ,sex, duration of DM since diagnosis ,treatment ,hba1c readings and ECG reading).

Result:

regarding age groups : 2(16%) were in age group 20-29, 6 (24%) were in the age group 30-39, 5(20%) were in age group 40-49, 7(28%) were in age group 50-59 and 3(12%) were in age group 60-69 years old.

Regarding gender 11 patients (44%) were males and 14 patients (56%) were females

Regarding the types of diabetes: 4(16%) were type1 and 21(84%) were type2.

Regarding ecg changes 10 patients (40%) have normal ecg readings and 15 patients(60%) have abnormal ecg readings

Regarding the ECG changes : 6 patients have sinus tachycardia,2 patients have LVH, 2 patients have prolonged QT interval, 2 patients have T wave inversion, 2 patients have silent MI and 1 patient has ectopic beats.

conclusion

ECG STUDY may be a tool to detect those cases with a higher risk of future cardiovascular events, in addition to the presence of other risk factors. This could be of practical interest to select populations in whom prevention should be more aggressive.

Introduction and review of literatures

-Diabetes mellitus:

is a Greek word meaning ‘a passer through; a siphon’, and mellitus derives from the Greek word for ‘sweet’. The Greeks named it thus due to the excessive amounts of urine produced by sufferers which attracted insects because of its glucose content. The ancient Chinese tested for diabetes by observing whether ants were attracted to a person’s urine.

Diabetes mellitus is the most common metabolic disorder encountered in clinical practice. It is strongly linked to obesity. Diabetes mellitus is characterized by abnormal carbohydrate and lipid homoeostasis, leading to elevation in plasma glucose, or hyperglycaemia, and abnormality of serum lipids, or dyslipidaemia. Glucose homoeostasis is modulated mainly by the release of insulin from the islet cells (β cells) of the pancreas. Diabetes develops as a result of a variable combination of absolute insulin deficiency as a result of pancreatic islet cell dysfunction and tissue insulin resistance due to reduced cellular responsiveness to insulin(1)

Etiology and pathophysiology

:

In both of the common types of diabetes, environmental factors interact with genetic susceptibility to determine which people

However, the underlying genes, precipitating environmental factors and pathophysiology differ substantially between type 1 and type 2 diabetes.

Type 1 diabetes was previously termed ‘insulin-dependent diabetes mellitus’ (IDDM) and is invariably associated with insulin deficiency requiring replacement therapy. Type 2 diabetes was previously termed ‘non-insulin-dependent diabetes mellitus’ (NIDDM) because patients retain the capacity to secrete insulin, and measured insulin levels are often higher than those seen in people without diabetes.

In type 2 diabetes, though, there is an impaired sensitivity to insulin (insulin resistance) and, initially, affected individuals can usually be treated without insulin replacement therapy. However, 20% or more of patients with type 2 diabetes will ultimately develop insulin deficiency requiring replacement therapy, so IDDM and NIDDM were misnomers.(2)

-clinical manifestation:

In type 1 DM, clinical deterioration can be quite rapid, and patients can transition from being completely asymptomatic to having rampant polyuria, polydipsia, and polyphagia with weight loss and blurred vision over a matter of days to weeks. Affected individuals generally have fairly widely fluctuating blood sugars. Diabetic ketoacidosis can occur when one or more insulin doses

are missed or with physiologic stress. Hypoglycemia is quite common as a complication of insulin therapy in type 1 diabetes. In type 2 DM, patients may be completely asymptomatic for years. Some present with classic symptoms of microvascular or macrovascular complications. More often, subtle symptoms may be present for years, including fatigue, recurrent cutaneous infections, and intermittent nocturia. If hyperglycemia is allowed to progress unchecked, life-threatening problems, such as diabetic ketoacidosis or hyperosmolar states, can develop.(3)

	Type1	Type2
Ketosis prone	yes	no
Insulin requirement	Yes(absolute insulin deficiency)	Often later in disease(insulin resistance+-deficiency)
Onset of symptoms	acute	Often insidious
obese	uncommon	common
Age at onset	Usually<30	Usually>30
Family history of diabetes	10%	30%
Concordance in monozygotic twin	30-50%	90-100%

Table 1:clinical differences between type1 and type2 diabetes

Diabetes mellitus (DM) has been known for many years to be associated with poor cardiovascular prognosis (Kannel *et al.* 1986). As the development of macrovascular changes can take a relatively long time, twelve leads resting electrocardiogram (ECG) fails very often in diagnosis of coronary artery disease in diabetic patients suffering from DM of type 1(4). Therefore in addition to the standard ECG other electrocardiographic procedures started to be studied in order to find some typical signs of myocardial damages caused by DM. Apart

from cardiovascular morbidity DM is also associated with microvascular complications including autonomic neuropathy (5). The impaired parasympathetic control of heart rate was observed but no differences in vascular sympathetic control were detected (6). The relatively increased sympathetic control in patients with autonomic neuropathy is associated with the higher risk of sudden cardiac death (7). In these patients the heart rate is accelerated and cardiac response to the different stimuli is pathological as far as autonomic neuropathy produces some abnormalities in heart electrical field (8).Regardless of the fact if DM is or is not complicated with autonomic neuropathy some general abnormalities in electrocardiograms were repeatedly reported in DM patients. Typically impairments of ECG parameters associated with the DM were found in QT region of electrocardiogram.

The QT interval on the electrocardiography reflects the total duration of ventricular depolarization and repolarization, and its measurement has been proposed as a simple and noninvasive method for the cardiovascular mortality in various conditions, including DM (9). Since the QT interval differs inversely with heart rate, heart rate-corrected QT (QTc) interval is preferably used. In patients with DM, QTc prolongation and autonomic dysfunction are closely correlated, and QTc prolongation is considered to be a specific sign of autonomic cardiac dysfunction and high mortality risk (10). The lengthening of QTc in the ECG was observed in patients with diabetes mellitus type 1 (DM 1) both with and without autonomic neuropathy suggesting that autonomic dysfunction does not contribute to hypoglycemia-induced QTc prolongation(11).

Physiologically, QTc interval prolongation reflects prolonged total duration of ventricular myocardial repolarization. It has been reported that not only hypocalcaemia and medication, but also heart failure and ischemic heart disease are involved in QTc interval prolongation (12). The abnormalities in cardiac repolarization can indicate an increased risk of ventricular tachycardia or even ventricular fibrillation (13) and moreover, a prolonged QTc interval was found to increase the rates of all causes of death (14).An increase in the QT interval and its dispersion were also proved to be caused by the insulin hypoglycemia in DM 1 patients (15).

Aim

To detect the types of ECG changes in Iraqi diabetic patients

Patient and methods

Across sectional study was carried out during the period from October 2018 -march 2019.the study was conducted in the out patient and in patient of medical ward and consultant clinic in al imamain al-kadhimain medical city ,including 25 iraqi patients(11 males and 14 females).

Data was collected using a structured questionnaire form , constructed by supervisor and filled by direct interview with each patient after his/her consent was taken.

A 25 patients aged from 20-65 years with history of diabetes only without comorbidities , were participate in the study.

All patients were inquired about their age , diagnosis whether type1 or type2,duration ,hba1c reading ,drug used and ECG readings, with Exclusion criteria included(hypertensive disease, coronary artery disease, chronic renal failure, heart failure , thyroid disease ,drug use like(digoxin, amiodarone and sympathomimetics drugs).

The statistic used is p value to measure the degree of significance.

Result

In the present study the total number of patients is 25. regarding age groups : 2(16%) were in age group 20-29, 6(24%) were in the age group 30-39, 5(20%) were in age group 40-49, 7(28%) were in age group 50-59 and 3(12%) were in age group 60-69 years old.as shown in the figure1

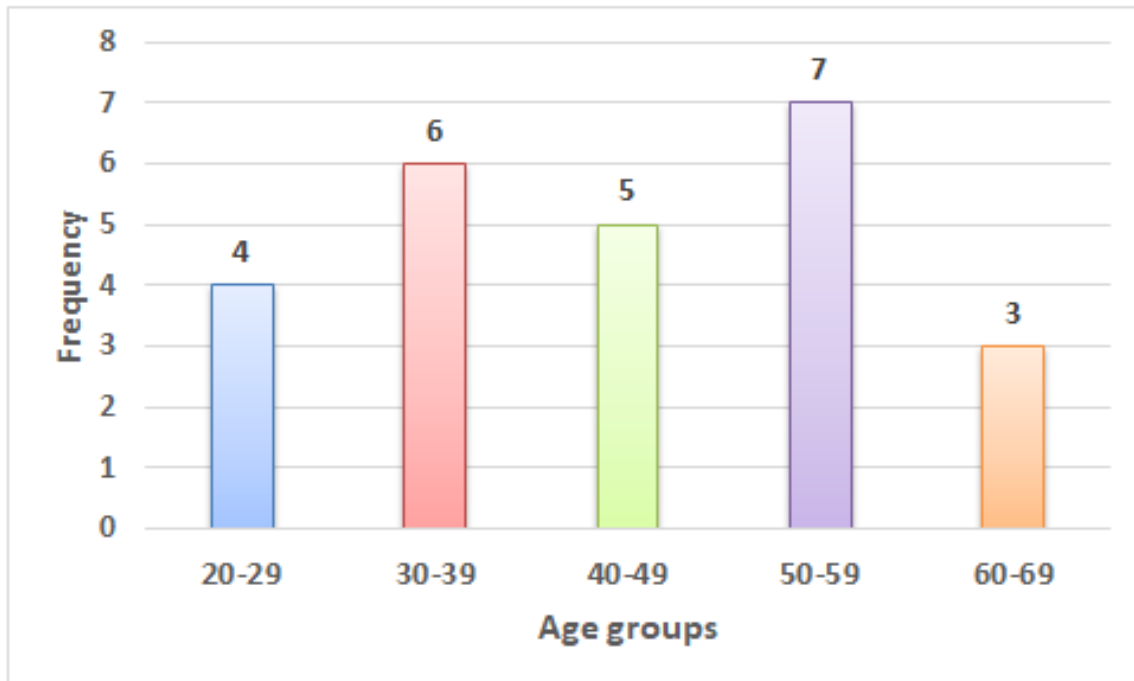


Figure1 :bar chart showing the age groups in present study

Regarding gender 11 patients (44%) were males and 14 patients (56%) were females as shown in the figure 2 .

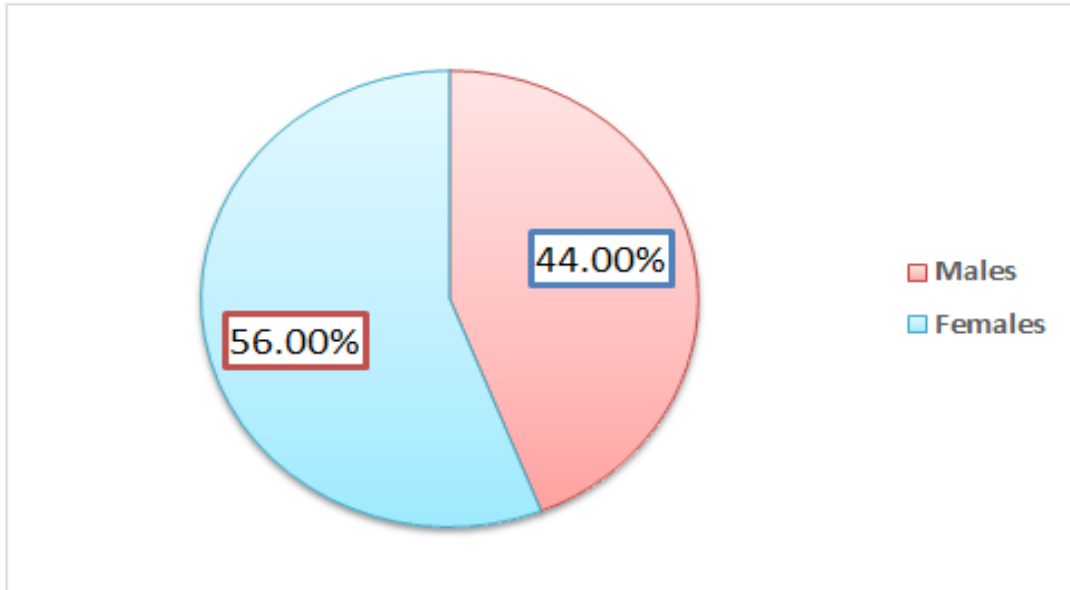


Figure 2 :pie chart showing the percentage of males and females

Regarding the types of diabetes: 4(16%) were type1 and 21(84%) were type2.as shown in the figure 3 .

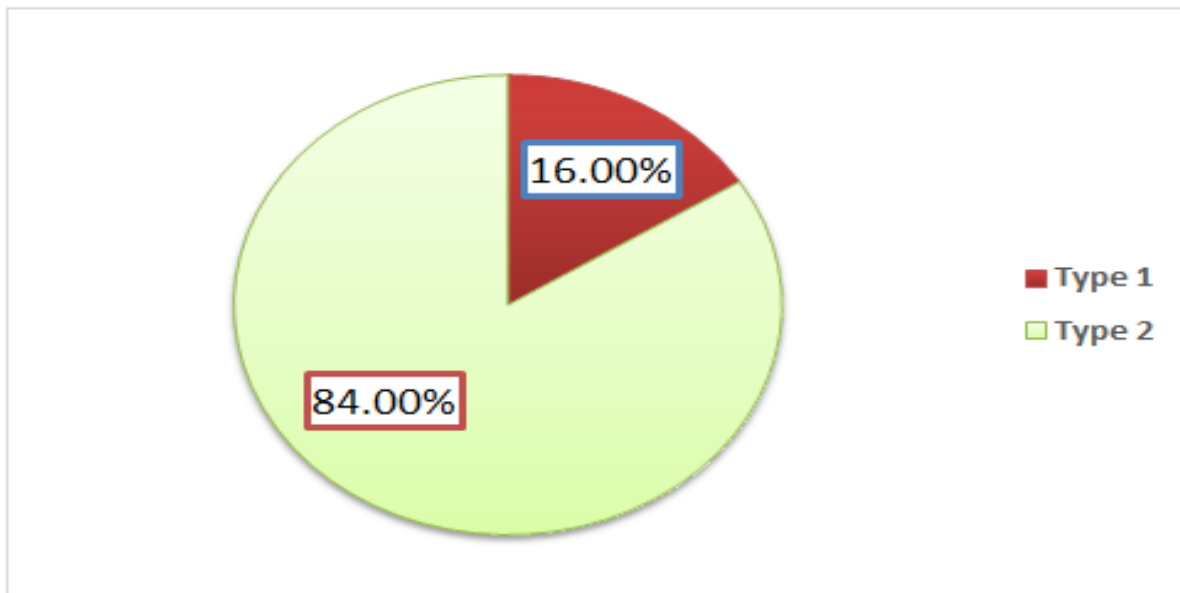


Figure3 :pie chart showing the percentage of type1&2 diabetes

Regarding ECG changes 10 patients (40%) have normal ecg readings and 15 patients(60%) have abnormalECG readings as shown in the figure 4 .

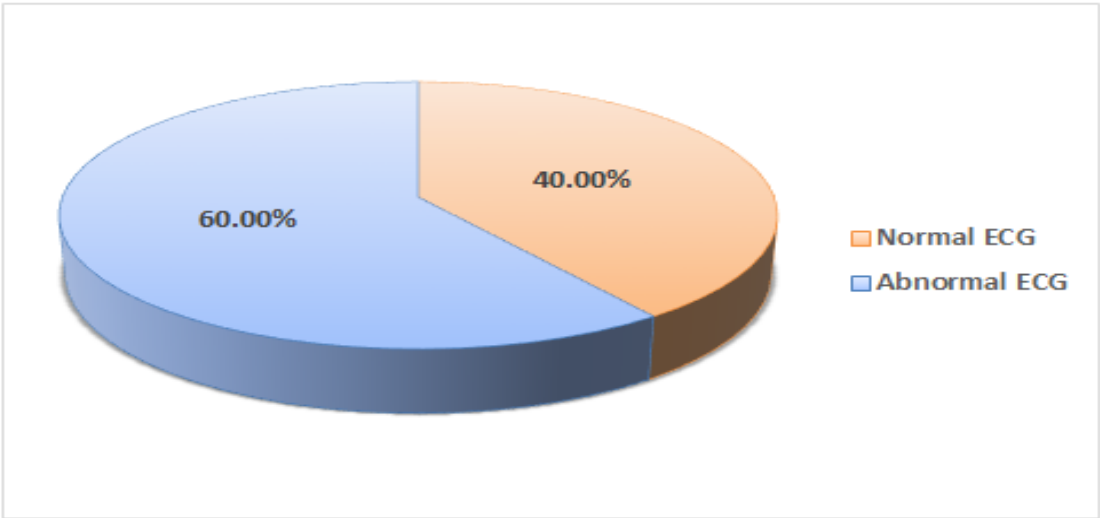


Figure4 :pie chart showing the normal and abnormal ecg in the study

Regarding the ECG changes : 6 patients(24%) have sinus tachycardia ,2 patients(8%) have LVH, 2 patients(8%) have prolonged QT interval, 2 patients (8%) have T wave inversion, 2 patients(8%) have silent MI(antero septal infarction) and 1 patient(4%) has ectopic beats.as shown in the figure(5) .

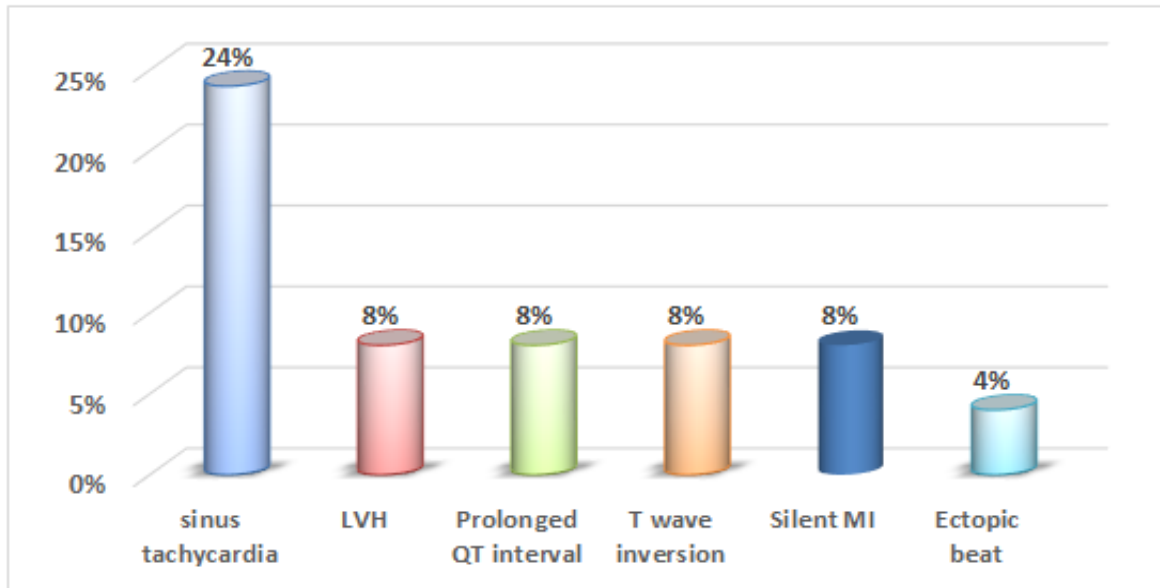


Figure5 :bar chart showing the percentage of each ECG change in the study.

Patients who have abnormal ECG readings,9(60%) of them had <40 years and 6 (40%) of them had age >40.

Patients who have normal ECG,5(50%) of them <40 years and 5(50%) Of them >40 years old as shown in table 5

p.value=0.622 which is >0.05 so its in significant.

variables	Normal ECG (N=10)	Abnormal ECG (n=15)	Total
Age<40	5(50%)	9(60%)	14
Age >40	5(50%)	6(40%)	11
total	10	15	25

Table2:showing the relation between age and ECG changes

Patients who have abnormal ECG readings,9(60%) of them are males and 6 (40%) of them are females. Patients who have normal ECG,4(40%) of them are females and 6(60%) Of them are males as shown in table 3

p.value=0.327 which is >0.05 so its in significant.

variables	Normal ECG (n=10)	Abnormal ECG (n=15)	Total
male	6(60%)	9(60%)	15
Female	4(40%)	6(40%)	10
total	10	15	25

Table 3:showing the relation between the gender and ECG changes.

Patients who have abnormal ECG readings,2(13,33%) of them are type1 and 13 (86.67%) of them are type2.

While Patients who have normal ECG,2(20%) of them are type1 and 8(80%) Of them are type2 as shown in table 4

p.value=0.656 which is >0.05 so its in significant.

variables	Normal ECG (n=10)	Abnormal ECG (n=15)	total
DM type1	2(20%)	2(13.33%)	4
DM type2	8(80%)	13(86.67%)	21
total	10	15	25

Table 4: showing the relation between the types of diabetes and ECG changes.

Patients who have abnormal ECG readings, 4(26.67%) of them are below 5 years duration and 11 (73.33%) of them are above 5 years duration.

While Patients who have normal ECG, 8(80%) of them are below 5 years and 2(20%) of them are above 5 years as shown in table 5

p.value=0.009 which is <0.05 so its significant.

variables	Normal ECG (n=10)	Abnormal ECG (n=15)	total
Duration <5years	8(80%)	4(26.67%)	12
Duration >5years	2(20%)	11(73.33%)	13
total	10	15	25

Table 5: showing the relation between the duration of diabetes and ECG changes.

Patients who have abnormal ECG readings, 4 (26.67%) of them have HBA1C below 7 and 11 (73.33%) of them are above 7.

While Patients who have normal ECG, 7 (70%) of them have HBA1C below 7 and 3 (30%) of them are above 7 as shown in table 6

p.value=0.032 which is <0.05 so its significant.

variables	Normal ECG (n=10)	Abnormal ECG (n=15)	Total
HBA1c% ≤ 7	7(70%)	4(26.67%)	11
HBA1c% >7	3(30%)	11(73.33%)	14
total	10	15	25

Table6: showing the relation between HBA1c readings and ECG changes

Discussion

Diabetes is an important risk-factor for CVD. Diabetes is associated with premature atherosclerosis due to endothelial vasomotor dysfunction, vascular effects of advanced glycation products, adverse effect of circulating free fatty acids and increased systemic inflammation [16]. These commonly present like coronary artery disease, chronic heart failure or arrhythmias due to diabetic cardiomyopathy. Most diabetic CVD are asymptomatic (silent/painless ischaemia) due to autonomic neuropathy [16]. Hence, the main aim of this study was to observe the cardiovascular involvement in asymptomatic diabetics (patients without cardiovascular complaints).

In the present study of 25 diabetic patients, most of them were between the age of (50-59) Similar age ranges were found invarious Indian studies study done Gwalior ,Madhya Pradesh(22)

Regarding the gender :patients who have abnormal ECGchanges,9male and 6female and the p value is non significant,this can be explained that there is no correlation between gender and abnormal ECG changes.

Regarding the age: patients who have abnormal ECGchanges,9of them<40 and 6 of them >40and the p value is non significant,this can be explained that there is no correlation between age and abnormal ECG changes.

Regarding the glycemic control of disease: patients who have abnormal ECG changes, 4 of them have HbA1c below 7 and 11 of them have HbA1c above 7, the p value is significant, this can be explained that there is correlation between glycemic control and abnormal ECG readings in relation to other study that 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 (18)

Regarding the duration of disease: patients who have abnormal ECG changes, 4 of them have duration below 5 years and 11 of them have duration above 5 years, the p value is significant, this can be explained that there is correlation between duration of disease and abnormal ECG readings in relation to other study These results were consistent with other similar studies [19,20].

Regarding ECG reading: 6 patients have sinus tachycardia, 2 patients have LVH, 2 patients have prolonged QT interval, 2 patients have T wave inversion, 2 patients have silent MI (antero septal infarction) and 1 patient has ectopic beats. My results go with other study that ECG abnormalities among older diabetics were high and included prolonged QTc, LVH, IHD and conduction defects [21]

Conclusion

In patients with DM without known cardiovascular disease, the appearance of ECG abnormalities regardless to age, gender and types of disease whether type 1 or 2.

ECG STUDY may be a tool to detect those cases with a higher risk of future cardiovascular events, in addition to the presence of other risk factors. This could be of practical interest to select populations in whom prevention should be more aggressive

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.

Limitations

- Small sample size
- Wide exclusion criteria
- Duration of taking sample was short and not more enough

Recommendations

All patients with diabetes regardless to the type should do early ECG study to prevent further complications in future

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