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EVALUATION OF ELECTROCARDIOGRAM IN PATIENTS ATTENDINGMEDICINE OUT PATIENT DEPARTMENT IN A TEACHING HOSPITAL IN WESTERN INDIA

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Conflicts of Interest: Nil

ABSTRACT:

INTRODUCTION: The Electrocardiogram (ECG)as an investigation of the cardiovascular system with established diagnostic and prognostic value, is easy to perform, has low cost and great clinical utility. The 12-lead electrocardiogram (ECG) is a widely available and a time-tested modality showing the electrical activity of the heart and contributes significantly to identifying heart related diseases in both symptomatic and asymptomatic individuals. ECG abnormalities are found to be predictors of silent ischemia and other cardiovascular disorders in asymptomatic persons. There is ample evidence to show that ECG abnormalities can occur in asymptomatic individuals. If picked up early, appropriate interventions can be life-saving.

MATERIAL AND METHODS: ECG was performed on the patients attending Out Patient Department (OPD) of our medicine department. A total of 355 patients without any prior history of cardiovascular symptoms and whose clinical evaluation showed no cardiopulmonary involvement or any major co-morbidities were randomly selected and underwent 12 lead ECG recording. Standard criteria were used for the interpretation of ECGs. All possible number of abnormal findings was recorded per ECG. ECG findings were analysed and divided into broad categories with impact on patient management: like Normal ECG, , abnormalities of rate, abnormalities of rhythm, abnormalities of QRS axis, chamber hypertrophy, bundle branch blocks, IVCD(Intraventricular Conduction Delay), ST–T-wave changes, either non-specific, or suggestive of ischaemia or infarction, PR interval, QT interval and others. Socio-demographic data like age, sex, socioeconomic status (SES), social background, and occupation and smoking habits was collected.

RESULTS: Of the 355 patients enrolled in the study 23 (6.47%) patients had abnormalities in their ECG findings. No patients were earlier diagnosed for hypertension or diabetes or any other cardiovascular illnesses. The average mean age of the patients was 48±21.42. Of the total 355 enrolled patients 183 (51.54%) were male and 172 (48.45%) were female. Mean age of male patients was 49±22.87 and female patients was 46±19.54. The age range was 18-71 years. There were 243 patients up to age of 40 years and 112 were above the age 40 years. No female was smoker while 28 out of 183 (15.3%) males gave a positive history of smoking. Out of 183 males 19 (10.38%) were having positive history of CAD(Coronary Artery Disease) in the family while out of 172 females 14 (8.14%) gave positive history of CAD in the family. Out of 23 patients showing abnormal ECGs 15 (65.21%) were males and 8 (34.78%) were females. Thus, overall 15 out 183 males (8.2%) and 8 out of 172 females (4.65%) showed abnormal ECGs. Sinus bradycardia was seen in 19 (5.35%) subjects, out of which 15 were males. RBBB was seen in 2 (0.56%) and both were males. ST-T changes were seen in 16 (4.5%), out of which 10 were females. 4 out of 16 subjects with ST-T changes were attributable to ischaemia. Also, 13 out of 16 patients with ST-T changes were above the age of 40 years (P value 0.0001).Prolonged QT was seen in 6 (1.69%) out of which 5 were above the age of 40 (P value 0.0005). **CONCLUSION:** Sinus bradycardia and RBBB were common amongst males, while sinus tachycardia and non-specific ST-T changes were common amongst females. Prolonged QT and ST-T changes were common above the age of 40.The interpretation of ECG is important in managing patients. Patients with no symptoms or family history of CAD may show abnormal ECG pattern. Compared with women, men tend to have more abnormalities on the resting ECG.

Introduction

The 12-lead electrocardiogram (ECG) was introduced more than 100 years ago and it plays a vital role in the diagnosis of cardiovascular disorders both in symptomatic and asymptomatic subjects. There is ample evidence to show that electrocardiographic abnormalities may occur in healthy individuals. Data derived from four large epidemiological studies published in 2000 from

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Belgium showed that abnormal ECG findings were present in 5.5% of the apparently healthy 47,358 working men and women between ages of 40 and 64 years[1].In another study published in 2012 which pooled data from 62 Phase I studies, 25.5% of the 3978 healthy subjects showed morphological abnormalities in ECG[2]. A systematic analysis of Global Burden of Disease Study 2010shows that heart disease continues to be the leading killer worldwide[i] and another analysis published in 1998 shows that sudden cardiac death (SCD) accounts for at least 50% of cardiovascular deaths [3].

ECG is an investigation of the cardiovascular system with established diagnostic and prognostic value, is easy to perform, and has low cost and great clinical utility. Recent developments of electrocardiographic recording and transmission equipment, incorporating miniaturized and resistant electronic circuits, has led to the development of digital ECG that can be connected to the internet, enables the transmission of the signal in real time for remote analysis [4]. The 12-lead electrocardiogram (ECG) is a widely available, and a time-tested modality showing graphical record of the electrical activity of the heart and contributes significantly to identifying heart related diseases [5].ECG signal consists of components like waveforms, segments, and intervals, that are studied and evaluated based on the morphology, size, and time [6].

Most of the ECG changes are seen in cardiac patients. As the heart rate(HR) increases, oxygen demand increases independent of the underlying disease and the consequent ST-segment depression is directly proportional to the increasing demand so heart rate adjustment of the ST depression was shown as a more sensitive and specific marker of underlying CAD [7].

In diabetic patients ischemic chest pain is blunted and myocardial ischemia or infarction may be associated without any symptom or very mild symptoms. Silent infarctions (asymptomatic) are more common in diabetics (39%) as compared to non-diabetics (22%) [8,9]. ECG can help pick up silent ischaemia in asymptomatic persons.

The respiratory and circulatory systems are so intimately related that changes in one may cause changes in the other. The various respiratory diseases like COPD may secondarily cause changes in the heart, which may be detected by the ECG. However, COPD patients probably are not usually assessed by electrocardiogram in routine medical practice particularly in developing countries like India except in tertiary care setting [10,11,12].

While there is a data about ECG abnormalities in military and sports personnel, and Phase I clinical study volunteers, there is paucity of data on ECG findings in the general population. The main aim of this study was to evaluate the ECG findings in the patients attending the Medicine OPD who did not have any cardiovascular symptoms and whose clinical evaluation did not show any cardio-pulmonary involvement or significant co-morbidities.

MATERIAL AND METHODS

Present study was conducted over a period of six months at the Medicine OPD of a teaching tertiary care hospital. In the present study, patients attending medicine OPD of a tertiary care teaching hospital who had no cardiovascular symptoms, whose clinical evaluation did not show any cardio-pulmonary involvement or any major co-morbidity, were randomly selected. A standard 12 lead ECG was recorded on the selected subjects. A total of 355 patients without any prior history of cardiovascular disorders or any major disorders were enrolled in the study. Standard criteria were used for the interpretation of ECGs. All possible number of abnormal findings was recorded per ECG. Evidence of ECG interpretation in the form of documentation by senior physician was sought from both the recorded ECG sheets and the clinical notes. ECG findings were analysed and divided into broad categories with impact on patient management like: Normal ECG, abnormalities of rate, abnormalities of rhythm, abnormalities of QRS axis, chamber hypertrophy, bundle branch blocks, IVCD (Intraventricular Conduction Delay), ST–T-wave changes, either non-specific, or suggestive of ischaemia or infarction, PR interval, QT interval and others

Socio-demographic data like age, sex, socioeconomic status (SES), social background, and occupation and smoking habits was collected.

Statistical analysis was done using the Statistical Package for the Social Science (SPSS 23) using

unpaired t-test and chi-square test. A P value of <0.05 was consider as statistically significant.

OBSERVATIONS AND RESULTS

Of the 355 patients enrolled in the study 23 patients had abnormalities in their ECG findings. No patients were earlier diagnosed for hypertension or diabetes or any other major illnesses. The average mean age of the patients was 48±21.42.

Table 1: Socio-demographic data of enrolled patients

variable	Male (n=183)	%	Female (n=172)	%	Total (n= 355)	%
Age (mean± SD)	49±22.87		46±19.54		48±21.42	
Smoking habit	28	15.30	nil	0	28	7.9
Family history of CAD	19	10.38	14	8.14	33	9.3
Abnormal ECG findings	15	8.20	8	4.65	23	6.47

SD: standard deviation
CAD: Coronary Artery Disease

Of the total 355 enrolled patients 183 (51.54%) were male and 172 (48.45%) were female. Mean age of male patients was 49±22.87 and female was 46±19.54. Total mean age was 48±21.42. No female was smoker while 28 males gave the positive history of smoking. Out of 183 male 19 (10.38%) were having positive history of CAD in the family while out of 172 female 14 (8.14%) gave positive CAD family history.

Of the total 355 patients in which ECG was done 23 (6.47%) showed abnormal findings in the ECG out of which 15 (8.20%) were male and 8(4.65%) were female.

Table 2

ECG Diagnosis	**Criteria**
Sinus Tachycardia	Sinus Rhythm with heart rate > 100bpm
Sinus Bradycardia	Sinus Rhythm with heart rate < 50bpm
Atrial Premature Complex	Premature beat with P morphology different from sinus P wave, unchanged QRS morphology unless functional BBB, incomplete compensatory pause and may be unifocal or multifocal in origin
Ventricular Premature Complex	Premature beat with abnormally wide QRS accompanied by secondary ST-T changes, full compensatory pause, may be associated with retrograde P waves due to retrograde ventriculo-atrial conduction and may be unifocal or multifocal in origin
Ectopic Atrial Rhythm	Abnormal P waves with heart rate between 50-100bpm
Atrial Fibrillation	Irregularly irregular rhythm with absent P waves and rapid fibrillatory waves seen with varying shape, size and timing
First Degree AV Block	PR interval >0.2 sec and each P wave followed by QRS complex
Incomplete Right Bundle Branch Block	QRS duration between 0.11 to 0.12 sec with secondary R' wave in right precordial leads V1 or V2 with rsr', rsR', rSR' morphology
Right Bundle Branch Block	QRS duration > 0.12 sec with secondary R' wave in right precordial leads V1 or V2 with rsr', rsR', rSR' morphology and wide S wave in I, V5, V6.
Left Anterior fascicular Block	Frontal plane QRS axis between -45 to -90, QRS duration <0.12 sec, qR morphology in I, aVL and rS in leads II, III and aVF.
Intraventricular Conduction Delay	QRS duration >0.11 sec and criteria for right or left bundle branch block are not met.
Left Ventricular Hypertrophy (Voltage)	Any one of the following for subjects >40yrs Amplitude of S wave in V1 + R in V5 or V6 >3.5mV Amplitude of R in aVL>1.1mV

	Amplitude of R in aVL + S in V3 >2.8mV in men, >2.0 mV in women
Left Atrial Enlargement	P wave duration >0.12 sec in lead II, terminal negativity of P wave in lead V1 >0.04mV-sec
Right Atrial Enlargement	Tall peaked P waves in lead II with amplitude >0.3 mV
Left Axis Deviation	QRS axis $>-30^0$ to $<-90^0$
Right Axis Deviation	QRS axis $>+90^0$ to <+180
Non-specific ST-T changes	ST-T deviations not fulfilling criteria for ischemia
ST-T changes suggestive of Ischemia	ST depression with T wave inversion in >2 contiguous leads Symmetrical and/or deep inversion of T waves in >2 contiguous leads
Old Myocardial Infarction	Pathological Q waves in >2 contiguous leads
Prolonged QT	If corrected QT >0.43 sec in men and >0.45 sec in women

Table 3: Abnormal ECG Findings: Male Female Distribution

Abnormal ECG Finding	Total Patients N=355(%)	Males N=183(%)	Females N=172(%)	P value
Sinus Tachycardia	2 (0.56%)	0	2 (1.16%)	-
Sinus Bradycardia	19(5.35%)	15(8.2%)	4(2.32%)	0.0140
Ventricular Premature Complex	2(0.56%)	1(0.54%)	1(0.58%)	0.9598
Ectopic Atrial Rhythm	7(1.97%)	4(2.18%)	3(1.74%)	0.7657
Left Axis Deviation	3(0.84%)	2(1.09%)	1(0.58%)	0.5999
Left Ventricular Hypertrophy (Voltage)	4 (1.12%)	2(1.09%)	2(1.16%)	0.9502
First Degree AV Block	8 (2.25%)	6(3.27%)	2(1.16%)	0.1807
Incomplete Right Bundle Branch Block	1(0.28%)	1 (0.54%)	0	-
Right Bundle Branch Block	2(0.56%)	2(1.09%)	0	
Intraventricular Conduction Delay	9(2.53%)	7(3.8%)	2(1.16%)	0.092
Left Anterior Fascicular Block	1(0.28%)	1(0.54%)	0	-
Non-Specific ST-T Changes	12(3.38%)	3(1.63%)	9(5.23%)	0.0608
ST-T Changes suggestive of Ischemia	4(1.12%)	3(1.63%)	1(0.58%)	0.3484
Prolonged QT	6(1.69%)	4(2.1%)	2(1.16%)	0.4871

Table 4: Abnormal ECG Findings: Age Distribution

Abnormal ECG Finding	Total Patients N=355(%)	Age≤40yrs N=243(%)	Age>40yrs N=112(%)	P value
Sinus Tachycardia	2 (0.56%)	2(0.82%)	0	-
Sinus Bradycardia	19(5.35%)	16(6.58%)	3(2.67%)	0.1286
Ventricular Premature Complex	2(0.56%)	1(0.41%)	1(0.89%)	0.5743

Ectopic Atrial Rhythm	7(1.97%)	5(2.05%)	2(1.78%)	0.8649
Left Axis Deviation	3(0.84%)	0	3(2.67%)	-
Left Ventricular Hypertrophy (Voltage)	4 (1.12%)	0	4(3.57%)	-
First Degree AV Block	8 (2.25%)	2(2.05%)	6(5.35%)	0.0955
Incomplete Right Bundle Branch Block	1(0.28%)	1(0.41%)	0	-
Right Bundle Branch Block	2(0.56%)	0	2(1.78%)	-
Intraventricular Conduction Delay	9(2.53%)	7(2.88%)	2(1.78%)	0.3317
Left Anterior Fascicular Block	1(0.28%)	0	1(1.78%)	-
Non-Specific ST-T Changes	12(3.38%)	3(1.23%)	9 (8.03%)	0.0001
ST-T Changes suggestive of Ischemia	4(1.12%)	0	4(3.57%)	-
Prolonged QT	6(1.69%)	1(0.41%)	5(4.46%)	0.0005

Diagnostic Criteria for ECG[14]

Sinus tachycardia 2(0.56%) was common among females, whereas sinus bradycardia 19 (5.3%) was significantly higher in males (15 out of 19 were males, P value 0.01) (Table 3).

ST-T changes were seen in 16 out of 355(4.5%) subjects. Out of these 4 were attributable to ischaemia. Non-specific ST-T changes 12 (3.38%) were more common among females (Table 3). Also, ST-T changes were significantly higher in patients above the age of 40 (13 out of 16 were above the age of 40 P value 0.0001).

RBBB was seen in 2 (0.56%) and both were males. 6 patients had prolonged QT(1.69%) out of which 5 were above the age of 40(Table 4).

Thus, while sinus bradycardia and RBBB were common amongst males, sinus tachycardia and non-specific ST-T changes were common amongst females. Prolonged QT and ST-T changes were common above the age of 40.

DISCUSSION

The 12-lead ECG is an excellent investigation to identify abnormalities of heart rhythm, silent ischemia in otherwise asymptomatic patients.

The 12-lead ECG continues to be a useful tool for identification of patients at increased risk of sudden cardiac death (SCD) and ischemic heart diseases (IHD). Also it can be used for diagnosing and assessing risk in patients with primary and inherited arrhythmia syndromes. Several ECG markers have also been associated with an increased risk of more common forms of SCD, for example that associated with CAD or diabetes [13].

In our study abnormal ECG findings were seen in 23 (6.57%) of the total patients evaluated for ECG and 93.43% were having normal ECG. In a study by Hingorani P etal. morphological abnormalities were seen in 25.5% of the cases, ST-T wave changes 3.1%, nonspecific T wave changes (2.5%). Zègre et al [14] in their study showed that 9.3% of patients activating “911” for symptoms of acute coronary syndrome had completely normal ECG findings in the ambulance, and that these patients had significantly lower incidence of adverse hospital outcomes, shorter length of stay, and less long-term mortality. In our study prolongation of QRS was seen in 9(2.53%) while in a study by Hingorani P et al it was 2.3%[2]. In a study by D De Bacquer et al[1] it was observed that major ECG findings were observed in 6.0% of all men and 4.3% of women, resulting in a significant adjusted sex ratio of 1.66 (95% confidence interval 1.46 to 1.88). The prevalence of minor ECG changes was slightly higher among men (10.4% v 9.5% in women). There was higher prevalence of Q/QS patterns, left ventricular hypertrophy, left axis deviation, arrhythmias, and atrial fibrillation or flutter in men than in women (9.0% v 9.8%).

In our study ST-T changes were observed in 16(4.5%) cases, out of which 4 were attributable to ischemia (clinically silent). In a cohort study by Rose G, reported non-specific ST segment changes were seen in 2.6 to 3.6 per cent of subjects and T wave abnormalities in 3.4 and 5.9 percent [15]. In a study by Chase et al [16] patients with either normal *or* non-specific ECG findings and with/without active chest pain/anginal equivalent symptoms during initial ECG acquisition. 80% of patients with ACS symptoms had a normal/nonspecific ECG. Of the whole group with normal/nonspecific ECG and with or without active symptoms, 2.8% was diagnosed with AMI (Acute myocardial infarction) 11% with ACS, and 5% experienced a 30-day follow-up event.

Left ventricular hypertrophy (LVH) by voltage was seen 4 (1.12 %) subjects with male preponderance. In a study by Vitelli LL et al. LVH is more prevalent in African Americans and ranged from 0.6 to 0.9 per cent [17].

In diabetes there is coronary artery disease, chronic heart failure or arrhythmias due to diabetic cardiomyopathy. Most diabetic CVD are asymptomatic (silent or painless ischemia) due to autonomic neuropathy [18]. In a study by Gupta S et al 20 [19] 26% asymptomatic diabetics had ECG abnormalities. One of the study in Spain showed that the presence of ECG abnormalities could predict the occurrence of future cardiovascular event in patients with diabetes more accurately than any other risk-factor alone [20] .

Simiao Liu in his study showed the utilisation of ECG in the Emergency Department and observed the normal sinus rhythm in 113 patients, abnormal rhythm or rate in 40, ST–T changes in 46, bundle branch block in 16, and others, including old Q-waves, axis deviation, and evidence of ventricular hypertrophy, in 19. In our study the rate of rhythm abnormalities was quite low as this study was done on the normal patients with no prior history of IHD or major illness and in non emergency settings. ECGs were shown to have a wide application beyond the screening role for ACS, in managing other conditions, including drug overdoses and the generally unwellpatients[21].

Exercise (stress) electrocardiography is sometimes helpful in diagnosing coronary artery disease in selected patients. But it may give both false-positive and false-negative results. 10% of men without evidence of coronary obstructions and an even higher percentage of healthy women may have false-positive exercise tests.

In our study 16(4.5%) of the patients were having ST depression but no symptoms. ST depression can also be seen in patients who are on digoxin and in patients who have hypokalaemia, left ventricular hypertrophy (LVH), ventricular conduction disturbances [22].

CONCLUSION

This study shows that ECG abnormalities are not uncommon in asymptomatic population. Certain ECG abnormalities have specific gender predilection. Sinus bradycardia and RBBB were common amongst males, while sinus tachycardia and non-specific ST-T changes were common amongst females. Prolonged QT and ST-T changes were common above the age of 40.The interpretation of ECG is important in managing patients with suspected ACS or other conditions with cardiac effects. All ECGs performed should be reviewed and interpretedpromptly. Patients with no symptoms or family history of CAD may show abnormal ECG pattern. Compared with women, men tend to have more abnormalities on the resting ECG

REFERENCES

1. D De Bacquer, G De Backer,MKornitzer. Prevalences of ECG findings in large population based samples of men and women. Heart 2000;**84**:625–633.
2. Hingorani P, Natekar M, Deshmukh S, Karnad DR, Kothari S, Narula D, Lokhandwala Y. Morphological abnormalities in baseline ECGs in healthy normal volunteers participating in phase I studies. Indian J Med Res 2012;135:322-30.
3. Zipes DP, Wellens HJ.Sudden cardiac death.Circulation. 1998 Nov 24; 98(21): 2334-51.
4. Hjelm NM, Julius HW.Centenary of tele-electrocardiography and telephonocardiography.J TelemedTelecare. 2005;11(7):336-8.
5. Goldberger JJ, Cain ME, Hohnloser SH, Kadish AH, Knight BP, Lauer MS, Maron BJ, Page RL, Passman RS, Siscovick D, Stevenson WG, Zipes DP, American Heart Association., American College of Cardiology Foundation., Heart Rhythm Society. American Heart Association/American College of Cardiology Foundation/Heart Rhythm Society Scientific Statement on Noninvasive Risk Stratification Techniques for Identifying Patients at Risk for Sudden Cardiac Death.A scientific statement from the American Heart

Association Council on Clinical Cardiology Committee on Electrocardiography and Arrhythmias and Council on Epidemiology and Prevention.J Am CollCardiol. 2008 Sep 30; 52(14):1179-99.

6. Pan J, Tompkins W.A real-time QRS detection algorithm. IEEE Trans Biomed Eng. 1985 Mar; 32(3):230–6Pan J, Tompkins W. A real-time QRS detection algorithm. IEEE Trans Biomed Eng. 1985 Mar; 32(3):230–6.
7. Okin P.M., Kligfield P. Computer-based implementation of the ST-segment/heart rate slope. Am J Cardiol. 1989;64(14):926–930.
8. Sani FB, Anumah FEO.Electrocardiographic abnormalities in persons with type 2 diabetes in Kaduna, Northern Nigeria. Int J Diabetes Metabol. 2009;17:99–103.
9. Sainani GS, Sainani RG.Diabetes mellitus and cardiovascular diseases.in: Current concepts in diabetes mellitus. Indian College of Physician. 1992:73–87.
10. Carid FI and Wilcken DEL. ECG in chronic bronchitis with generalised obstructive lung diseases - Its relation to ventilatory junction. Am J Card 1962; 10:5.
11. Scott RC.The electrocardiogram in pulmonary emphysema and chronic corpulmonale.Amer Heart J 1961; 61:843.
12. Calatayud JB, Abad JM, Khoi NB et al. P-wave changes in chronic obstructive pulmonary disease. Amer Heart J 1970; 79:444.
13. Narayanan K, Chugh SS. The 12-lead electrocardiogram and risk of sudden death: current utility and future prospects. Europace. 2016; 17Suppl 2(Suppl 2):ii7-13.
14. [i]Zègre-Hemsey JK, Sommargren CE, Asafu-Adjei JK, Drew BJ. Normal prehospital electrocardiography is linked to long-term survival in patients presenting to the emergency department with symptoms of acute coronary syndrome. J Electrocardiol. 2015;48(4):520-6.
15. Rose G, Baxter PJ, Reid DD, McCartney P. Prevalence and prognosis of electro-cardiographic findings in middle-aged men.Br Heart J. 1978 Jun; 40(6):636-43.
16. Chase M, Brown AM, Robey JL, Pollack CV Jr, Shofer FS, Hollander JE.Prognostic value of symptoms during a normal or nonspecific electrocardiogram in emergency department patients with potential acute coronary syndrome.AcadEmerg Med. 2006 Oct; 13(10):1034-9.
17. Electrocardiographic findings in a healthy biracial population. Atherosclerosis Risk in Communities (ARIC) Study Investigators. Vitelli LL, Crow RS, Shahar E, Hutchinson RG, Rautaharju PM, Folsom AR. Am J Cardiol. 1998 Feb 15; 81(4):453-9.
18. Mc-Guire K-D. Braunwald's Heart Disease.A Textbook of Cardiovascular Medicine. 9th Edn,.Chapter 64. Philadelphia: WB Saunders; 2011. Diabetes and the cardiovascular system. In Braunwald E, Zipes DP, Libby P, Bonow R (Eds.) pp. 1392–407.
19. Gupta S, Gupta RK, Kulshrestha M, Chaudhary RR.Evaluation of ECG Abnormalities in Patients with Asymptomatic Type 2 Diabetes Mellitus. J ClinDiagn Res. 2017;11(4):OC39-OC41.
20. de Santiago A, García-Lledó A, Ramos E, Santiago C.Prognostic value of ECGs in patients with type-2 diabetes mellitus without known cardiovascular disease].Rev EspCardiol. 2007 Oct; 60(10):1035-41.
21. Simiao Liu, Boyang Liu, Han B Xiao.The utilisation of ECG in the Emergency Department.Br J Cardiol 2014;21:159.
22. https://www.sciencedirect.com/topics/medicine-and-dentistry/normal-ecg