**ADDIS ABABA UNIVERSITY**

**COLLEGE OF HEALTH SCIENCEs**

**SCHOOL OF MEDICINE**

**DEPARTMENT OF EMERGENCY MEDICINE**

# Evaluation of emergency and critical care medicine residents' accuracy in Electrocardiogram Interpretation in Addis Ababa Ethiopia: A cross-sectional study

**Principal investigator**: MERON TESFAYE AKALU, MD

**Advisors:** **Dr. TIGIST ZEWDU**, (Assistant professor of emergency and critical care medicine)

**Dr. DEMELASH GEZAHEGN,** (Assistant professor of emergency and critical care medicine)

A thesis submitted to the Emergency medicine and critical care department college of health science, Addis Ababa University; in partial fulfillment of the requirement for a specialty certificate of Emergency medicine and critical care

October 2021
Addis Ababa, Ethiopia

# Evaluation of emergency and critical care medicine residents' accuracy in Electrocardiogram Interpretation inAddis Ababa Ethiopia

**By:** MERON TESFAYE, MD (ECCM resident)

**Advisors: Dr. TIGIST ZEWDU**, (Assistant professor of emergency and critical care medicine)

**Dr. DEMELASH GEZAHEGN,** (Assistant professor of emergency and critical care medicine)

October 2021
Addis Ababa, Ethiopia

# Declaration

I, Meron Tesfaye, declare that this study has been done originally by me and all of the materials I used are properly acknowledged.

Name: Meron Tesfaye, MD

Email: meritensu@gmail.com

Signature …….

Date of submission: oct22,2021

Place: Addis Ababa, Ethiopia

# ACKNOWLEDGEMENT

I am very grateful to the almighty God for giving me the strength to develop this thesis.

My deepest gratitude goes to my advisors **Dr. Tigest Zewdu** and Dr. **Demelash Gezahagne** for their support and constructive comments in developing this thesis.

I would like to thank my husband **Dr. Tensae Nebiyou** for his continuous support in data entry and analysis.

I would like to thank **Professor Akliliu Azazh** and **Dr. Kefelegne** for helping me standardize the ECGS and their support.

I would also like to thank my dear friend **Dr kalkidan yibeltal** for her advice in data analysis and writing this thesis.

I am also grateful to Addis Ababa University and Saint Paul millennium medical college emergency and critical care residents for participating in this study.

Finally, I would like to acknowledge Addis Ababa University and the department of emergency and critical care medicine for giving me this opportunity.

# LIST OF ABBREVATIONS

| | |
|---|---|
| AAU | Addis Ababa University |
| AV | Atrioventricular |
| ECG | Electrocardiography |
| ED | Emergency Department |
| ECCM | Emergency and Critical Care Medicine |
| PEA | Pulseless Electrical Activity |
| SPMMC | Saint Paul Millennium Medical College |
| STEMI | ST Elevation Myocardial Infarction |
| TASH | Tikur Anbessa Specialized Hospital |
| LBBB | Left Bundle Branch Block |
| RBBB | Right Bundle Branch Block |
| WPW | Wolf Parkinson White |
| VTACK | Ventricular Tachycardia |
| VFIB | Ventricular Fibrillation |

# Table of Contents

# LIST OF TABLES AND FIGURES

# Summary

**Background:** Electrocardiogram is the diagrammatic representation of the heart's electrical activity. Which can detect life-threatening conditions within minutes. It's one of the major investigative modalities that emergency physicians should be accurate at. The accuracy of emergency residents varies from country to country with improvement in interpretation as the year of residency increases. there are no published papers in ECG interpretation among emergency residents up until now but a study which was done on graduating medical students show low competency.

**Objective:** To assess the accuracy of Emergency and Critical Care Medicine residents in ECG interpretation in Tikur Anbessa Specialized Hospital and Saint Paul Millennium Medical College.

**Methods:** A cross-sectional study was conducted on emergency and critical care medicine residents of Tikur Anbessa specialized hospital and Saint Paul millennium medical college. Data were collected from April 2021 to September 2021 by using a structured questionnaire. Data were entered, cleaned, edited, and analyzed by using SPSS version 26.0 statistical analysis software. Descriptive statistics and bivariate and multivariate binary logistic regression were used to analyze the data.

**Results:** Fifty-seven emergency and critical care medicine residents were able to participate in this study out of which 33 (57.9%) were from Addis Ababa University and 24 (42.1%) were from saint Paul millennium medical college. The average score of EMCC residents on the interpretation of the ECGs was 29.5%. Only ten residents (17%) were able to correctly interpret >50% of the ECGs. most of the residents who participated in this study were year 1 residents (49.1%) followed by year 2 residents (31.2%). Out of 15 ECG abnormalities, the commonly identified ones were polymorphic ventricular tachycardia (64.9%), normal sinus rhythm (49.1%), and double chamber pacemaker (45.6%). Year of residency (AOR 3.34, 95% CI: 1.1,10.2) was found to be significantly associated with higher performance in ECG interpretation.

**Conclusion** According to this study emergency medicine and critical care residents have low accuracy in interpretation of ECG which is comparable to a study which was done in South Africa and Australia.



**Keywords** Accuracy, electrocardiogram interpretation, emergency, and critical care residents.

# 1. INTRODUCTION

## 1.1 Background

The electrocardiogram is the diagrammatic representation of the heart's electrical activity which is one of the lifesaving investigative modalities that should be available at the emergency department (1).

ECG findings might be the only information available at hand to diagnose life-threatening rhythm abnormalities, electrolyte imbalances, toxicological abnormalities, and myocardial infarction (2). The other significant use of ECG is identifying the arrest rhythm in cardiac arrest patients and leading physicians to the subsequent management of the patient (3).

Since ECG is easily available, non-invasive, can be interpreted within minutes; it has an unmeasurable value in saving lives in the emergency department which demands emergency physicians to be experts in interpreting the findings and applying them to clinical use (4).

Emergency and Critical Care Medicine is one of the new specialty programs which is currently available at Addis Ababa university college of medicine and health science (TASH), SPMMC, Jimma University, and Haramaya medical college. The program is challenged by a lack of investigative modalities and difficulty of disposing patients (5). Thus, in this resource-limited setting, the availability of ECG and its proper use for proper emergency patient management is invaluable.

Even though there are no studies conducted in Ethiopia on ECCM resident competencies and accuracy of interpretation of ECG findings; previous studies conducted in Australia and South Africa showed that level of accuracy increases as seniority increases(2,4).

## 1.2 Statement of the problem

Ethiopia is a developing country and ECCM is one of the evolving specialty training which is currently being given only in four teaching hospitals throughout the country. In most of the working hours, both consultants and residents are available at the emergency department but during the duty hours, residents are the most senior physicians available. Even though there are no papers published on the common emergency department (ED) presentation of patients in Tikur Anbessa specialized hospital (TASH), according to research done in Turkey in 2019 cardiovascular complaints were one of the commonest presentations (6). Among the common ECG findings of acute myocardial ischemia both ST-segment and T wave abnormalities were miss-interpreted

according to the journal of internal medicine published in 1992 (7).ECG is only as good as the physician who interprets it. The correct interpretation of ECG abnormality is one of the crucial skills that every ECCM resident should be able to acquire. Inability to do so can affect patient outcomes negatively and might also have fatal outcomes.

Until now there are no published papers in Ethiopia regarding the evaluation of competencies of emergency medicine residents on ECG interpretation. However, studies on evaluating competencies of ECG interpretation on graduating medical students showed low competency (3).

## 1.3 Significance of the study

Evaluation of accuracy in ECG interpretation among ECCM residents will help to give insights in understanding available gaps in the prioritization of patients. The study will also have a significant impact on patient disposition and avoid emergency department overcrowding.

This study is expected to give more information on the accuracy of emergency medicine residents in interpreting common ECG abnormalities they face in the emergency department. The study will also give a recommendation to the respective department heads on how to improve residents' ECG interpretation skills.

The main purpose of this study is to assess emergency resident accuracy in ECG interpretation in two medical colleges and to identify the gaps and also try to find the causes of the gaps.

# 2 LITERATURE REVIEW

## 2.1 Worldwide

Generally speaking, ECG can provide unremarkable help to emergency residents and general practitioners in the management and diagnosis of patients where a cardiologist is not available.
In the developed world this ECG interpretation can be done through a computer by the detection of the on and offs of the P, QRS, and T waves. Since there are several detection methods the results are also different. This interpretation of ECG has decreased the time required to interpret the ECG by a cardiologist by 70%(8).

The American College of physicians in their article about training and competency evaluation for interpretation of 12 lead electrocardiograms, proposed that ECG interpretation is a skill that requires an understanding of the general disease's condition which results in the ECG abnormality and correlates the patient with the ECG abnormality. They also suggested that although interpretation errors are significant among cardiologist and non-cardiologist (4% to 33%) fatality from these errors are around 1% (9).
According to a prospective cross-sectional double-blinded study which was done in Australia in Victoria University on emergency medicine residents to assess whether ECG interpretation accuracy improves with advancing years of emergency medicine training, which enrolled 122 trainees in total,48(39%) were senior trainees and 74(60.6%) were other trainees and the overall accuracy of ECG interpretation was 67.5% (95% CI 63.2%-71.8%) for the senior trainees and 49.6% (95% CI 45.2-53.9% ) for the other trainees. This study concluded that ECG interpretation improves in accuracy with advancing years of training(2).

In a prospective study which was done in France which included four emergency departments and a total of 39 residents to assess ECG interpretation skills in emergency department residents using an update and e-learning as a resource to improve skills, residents were assigned randomly to the above groups and they were assessed by a pre-course test at the start of the study and a post-course test after the e-learning. The result of the pre-course test showed an average score of 40% in ECG interpretation. nineteen residents assigned to the e-learning course and twenty residents assigned to the lecture-based course showed remarkable improvement. Finally, this study concluded that ECG interpretation skill was insufficient and e-learning teaching method can be very helpful in solving this (10).

In a study which was done in the united states Virginia university department of emergency medicine to assess the electrocardiogram interpretation, training, and competency in emergency medicine residency program, which used an interactive survey instrument posted on the internet using software and emailed to program directors(PDS ) which used 125 officially recognized council for graduate medical education -approved U.S.EM residency programs,99 ( response rate 79.2% ) completed the online survey. instructions, (99%), case-based lectures (98%), educational lectures (98%) were the commonest methods to teach interpretation of ECG succeeded by, computer-based instruction (34%) and ECG laboratory (12%). and finally, most of the PDS were comfortable with the resident's capacity to interpret ECG (96%) by the third year and (91%) by the fourth year of residency. Lastly, the PDS of EM concluded that the EM residency program is sufficiently preparing graduates for ECG interpretation (11).

In a study done in New York, Albert Einstein university college of medicine to assess competency, accurate interpretation of ECGS among internal medicine and emergency residents, a study which enrolled 120 participants,87 internal medicine and 33 emergency residents, they took a test interpreting 12 lead ECGS and recorded their diagnosis and certainty, after which 2 cardiologists established the correct diagnosis. The result of the study showed that there was no significant difference in overall competency between emergency medicine and internal medicine residents. They finally concluded that even though there was an improvement with clinical experience the overall competency was low (12).

## 2.2 Africa

A prospective cross-sectional study in South Africa was conducted on emergency residents enrolling 55 candidates from which 49 completed the assessment (49%) and it showed that the average ECG interpretation score was 46.4% {95% confidence interval (CI) 41.5 -51.2%}. The improvement with ECG interpretation was higher as seniority increased. The junior group had an overall averagescore of 42.2% (95% CI 36.9-47.5%) while the senior group scored an average of 52.2% (95%CI 43.4-61.5%). Overall, this study concluded that the average score of 46.4% obtained in the study was lower than the score obtained from international countries where emergency medicine is a well-established sub-specialty (4).

## 2.3 Ethiopia

A cross-sectional study which was done on graduating medical students at Addis Ababa University and Haramaya University to assess the competency of ECG interpretation which included 202 participants showed that 61.3% (95% CI 56.3-66.3%) were capable of correctly interpreting the primary ECG parameters such as rate, rhythm, and axis. The arrest rhythms, asystole, Pulseless electrical activity (PEA) Ventricular tachycardia (VTACH), and ventricular fibrillation (VFIB) were recognized by 32.75% on average (95%CI 28.25-37.25%). Only 19.3% were able to correctly interpret common life-threatening emergency conditions including myocardial infarction, electrolyte abnormalities and, AV-BLOCKS.

This study finally concluded that graduating medical students have low competency in ECG interpretation. (3)

# 3. OBJECTIVE

## 3.1General objective

To assess ECCM residents' accuracy and its associated factors in ECG interpretation in Tikur Anbessa SpecializedHospital and Saint Paul Millennium Medical College.

## 3.2 Specific objective

To assess ECG interpretation accuracy and performance of Emergency and critical care medicine residents in TASH and SPMMC.

To identify factors associated with the performance of ECG interpretations in Emergency and critical care medicine residents in TASH and SPMMC.

# 4. CONCEPTUAL FRAMEWORK

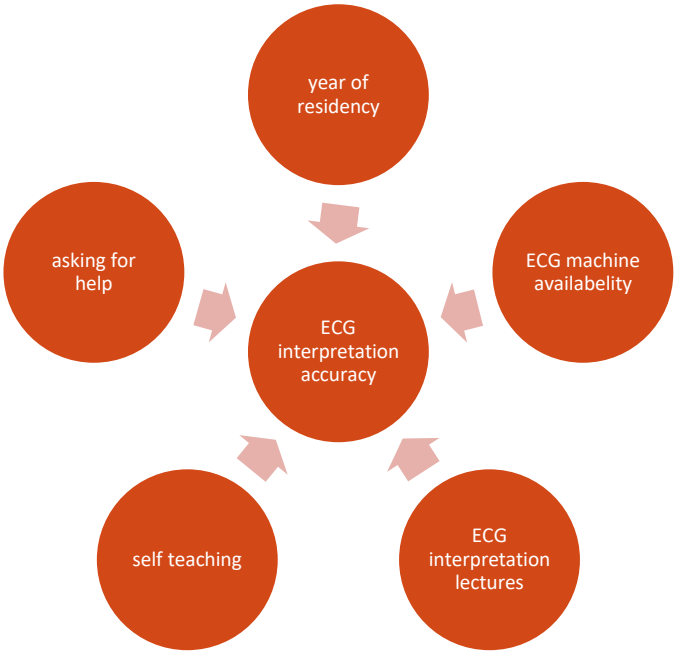



Figure 1the relationship between the various independent variables with the outcome variable

# 5. METHODS AND MATERIALS

## 5.1 Study Setting

The study will be conducted in Addis Ababa, at AAU (TASH) and SPMMC. AAU was established in 1950 and the school of medicine was founded in 1972. According to the official website of the University the College currently offers eight undergraduate and over 70 postgraduate programs. The Tikur Anbessa Specialized Hospital (TASH) is the teaching hospital of the College. TASH is the largest hospital in Ethiopia with over 700 beds. department of emergency medicine was formed at Tikur Anbessa specialized hospital (TASH) in collaboration with AAU, the University of Wisconsin, and the University of Toronto. The department launched three years residency program and two years EMCC nursing program after being approved by the senate of AAU in October 2010. And the first four emergency and critical care specialists graduated in October 2013(13).

St Paul's millennium medical college was formed in 2010. It's governed by a board under the federal ministry of health (14). According to the colleges' website, the college has more than 2800 clinical, academic, and support staff with an average inpatient capacity of 700 beds. The college sees an average of 1200 emergency and outpatient clients daily. Saint Paul university established an emergency department in the year 2011 (15).

## 5.2 Study design

A cross-sectional study of emergency medicine residents was conducted in 2021 from july2021-august 2021

## 5.3 Source Population

The source population in this study were emergency and critical care medicine residents.

## 5.4 Study population

Emergency and critical care medicine residents of AAU and SPMMC who were available at the time of thestudy.

## 5.5 Sample size

The sample size formula for cross-sectional study design is given by the single population proportion formula denoted by:

$$n = \frac{\left(Z\,{}^{\alpha}/_{2}\right)^{2} p(1-p)}{d^{2}}$$

Here n is the minimum required sample size, Zα/2 is the value under the standard normal table for a given confidence interval (1.96 for 95% CI), p is the best estimate of prevalence since we don't have a previously done study in our country, we took 50% to increase the strength of the study, and d is the margin of error (0.05).

$$n = \frac{(1.96)^{2}0.5(1-0.5)}{0.05^{2}} = 384$$

Since our source population is 100, we used the correction formula where n is the sample size we calculated (384), N is our total population (100),

Corrected sample size = $\frac{n \times N}{n+N}$ ≈80

Adding 10% non-response the sample size calculated is 88. since there is no significant difference between the calculated sample size and the study population All ECCM residents that are currently on training at AAU and SPMMC and those who are available and at the time of the study were enrolled.

## 5.6 Inclusion and exclusion criteria

**Inclusion criteria**

All emergency and critical care medicine residents who were attending their residency program at SPMMC & TASH.

**Exclusion criteria**

Residents who were not willing or unable to participate

## 5.7 Variables

**Dependent variable**

Accuracy in ECG interpretation

**Independent variables**

- Year of residency
- ECG interpretation lectures
- Self-teaching
- Availability of ECG machine
- Asking for help

## 5.8 Operational definition

**Accuracy** is defined from a previous GMS study on ECG interpretation which is 80%.

**Performance** -The total score of the participants out of the 15 ECGs, is changed into percentage and higher performance (score) is scored as correctly interpreting >50% of the ECGs and lower performance (score) is scored as incorrectly interpreting >50% of the ECGs (which is 8 ECGs and above.

**Senior resident** - Residents who are on the 3rd year of their study and year 2 residents who completed the first 6 months of their year 2

**Junior resident** - Residents who are on their first year of residency and year 2 residents before the first 6 months of year 2.

**ECG training** - either online or in-person training on ECG interpretation

**ECG interpretation** - Correctly interpreting a given ECG

## 5.9 Data collection tool and procedure

ECGs were selected from previous south African study, from ECG web blogs, and standard ECG textbooks and the questionaries from the previous study were modified and structured. The questionaries included basic information of the residents and ECGs focusing on common life-threatening events which occur in the emergency department. A cardiologist, emergency medicine consultant, and interpretation from the blogs and books were used to standardize the ECG interpretation, and two similar answers were used as the correct answer of the ECG reading. Thus, based on this criterion out of the selected 20 ECGs 15 of the images fulfilled the criteria and were presented to the residents for reading. The primary investigator was the data collector and the completeness of the data was checked before completion of data collection.

## 5.10 Data processing

The completed questioner was coded, manually checked, and entered into Excel, and exported to SPSS version 26 for cleaning and analysis by the principal investigator.

Descriptive statistics, proportion, mean and median were calculated presented using tables and charts to characterize the study population using socio-demographic and background characteristics. The first association between each independent variable and the dependent variable

was assessed in bivariate analysis. Then, those independent variables with P-value <0.2 were transported to multivariate logistic regression to control the confounders and to identify predictors of competency in ECG interpretation. Hosmer-Lemeshow goodness-of-fit test was used to check the model fitness and a p-value of >0.05 was taken as fit. In the multivariate logistic regression, a P-value of <0.05 was used as a criterion for the statistically significant association. Adjusted odds ratio with 95% CI was calculated to determine the presence and strength of association.

## 5.11 Ethical consideration

A formal letter was taken from Addis Ababa University College of health sciences, Department of Emergency and Critical care medicine to get approval to conduct this study. Participation of the participants in the study was voluntary after taking written informed consent. Privacy of the participants was kept by not writing their names in the questionnaire.

## 5.12 Dissemination of results

The findings of this study will be disseminated to Addis Ababa university college of health science and also to saint Paul millennium medical college. It will be presented at symposiums and conferences. And the publication of the study will be considered at the end.

# 6. RESULTS

## 6.1Returns

The non-response rate in this study was 28.75 %.at the time of the study there were 98 eligible participants and 80 questionaries were distributed and only 57 of them were returned to the primary investigator (71.25%).

## 6.2 Characteristics of Study Participant

In this study,57 emergency and critical care medicine residents (male: n=42 ,73.7%, females; n=15 ,23.3%), with a mean age of 28.77±2.77 (R= 25-42) years from both AAU (57.4%) and SPMMC (42.6%), participated and completed the questionnaires.as shown in figure 1.

-

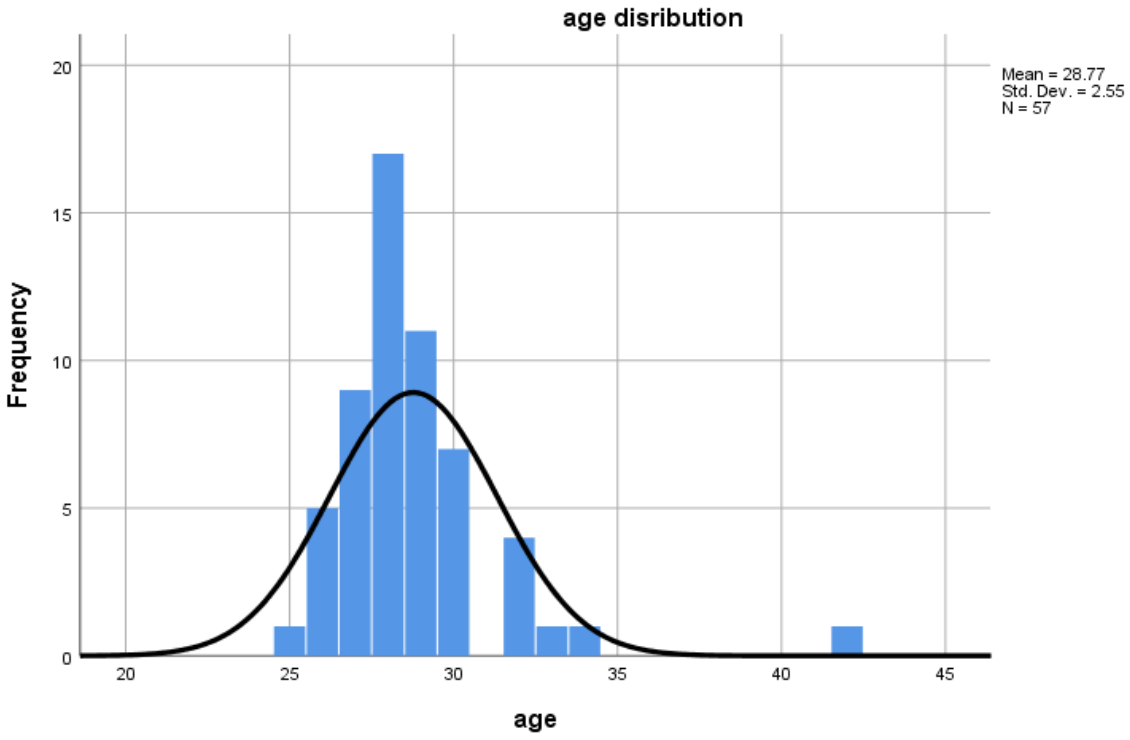



Figure 2 **age distribution of participants**

Most of the residents who participated in this study were year 1 residents (n=28 ;49.1%) followed by year 2 residents (n=18; 31.6%) and lastly year 3 residents (n= 11; 19.3 %).

Thirty-three of the participants (57.9%) were from AAU whereas the remaining 24 (42.1%) were

from SPMMC as shown in figure 2.

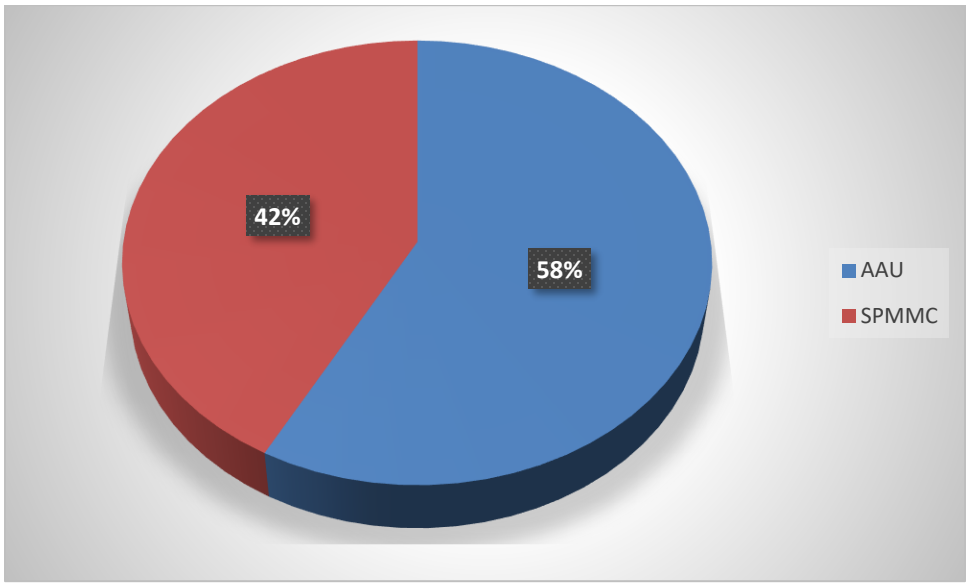



Figure 3- **Place of post graduating specialty training**

Twenty-four (42.1%) of the residents worked as a general practitioner for 1-2 years and 21(36.8%) of them worked for more than 2 years and the remaining12(21%) worked for less than a year.

All of the residents had ECG class in the first year of their residency from which 49 (87.5%) of the residents attended all classes. Out of the 57 residents, 45 (80.4 %) of them said the ECG class was not enough.

Twenty-nine (50.9%) of the residents felt that on average 25-50 % of ED patients require ECG as a diagnostic tool per day.

Most of the residents 32 (58.2%) rated their confidence level of ECG interpretation as neutral and 14 (25.5%) of the residents rated as confident as shown in figure 3.

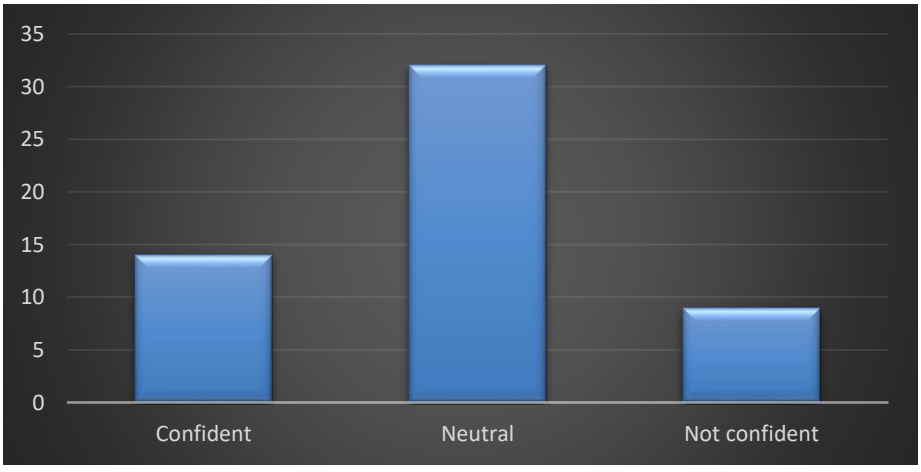


Figure 4- **Participants' level of confidence rating**

Forty-seven (82.5 %) of the residents usually ask for help during ECG interpretation and senior residents were mentioned as a source of help in 40 (78.4%) of the participants.

All of the study participants said that nothing bad has ever happened because of their ECG interpretation.

Most of the residents 35 (61.4 %) said they update their ECG knowledge whenever they have an assignment and a case, and the source for most of them were textbooks and online lectures (82.5% and 56.1% respectively).

Thirty-four (60.7 %) of the residents labeled their satisfaction with the current ECG training as fair, the others equally labeled their satisfaction as poor and good.

The majority of the residents recommended to have frequent lectures and case-based discussions, available ECG machines to improve the current teaching method.

Most of the residents (n=2;49.1%) work their general practitioner year at a primary hospital and the majority of them claimed (n=35;61.4%) ECG machine was not available at the time of their practice.

## 6.3 ECG findings interpretation

In general, no resident scored 80% (12 and above) in the interpretation of the ECGs. Thus, the accuracy of emergency and critical care medicine residents in interpreting ECGs was found to be poor. The highest score was 11(73.3%), the lowest score was 0 and the average score was 4.42(29.4%) as shown in table 1.

Table 1- **Score of ECG interpretation by ECCM residents**

| Score | Frequency | Percent |
|---|---|---|
| 0 | 5 | 8.8 |
| 1 | 5 | 8.8 |
| 2 | 6 | 10.5 |
| 3 | 7 | 12.3 |
| 4 | 7 | 12.3 |
| 5 | 7 | 12.3 |
| 6 | 6 | 10.5 |
| 7 | 4 | 7 |
| 8 | 5 | 8.8 |

| | | |
|---|---|---|
| 9 | 4 | 7 |
| 11 | 1 | 1.8 |
| Total | 57 | 100 |

Ten residents scored higher scores as defined by >50% (8 and above) and the rest 47 residents scored lower scores <50% (7 and below) as shown in figure 4 below.

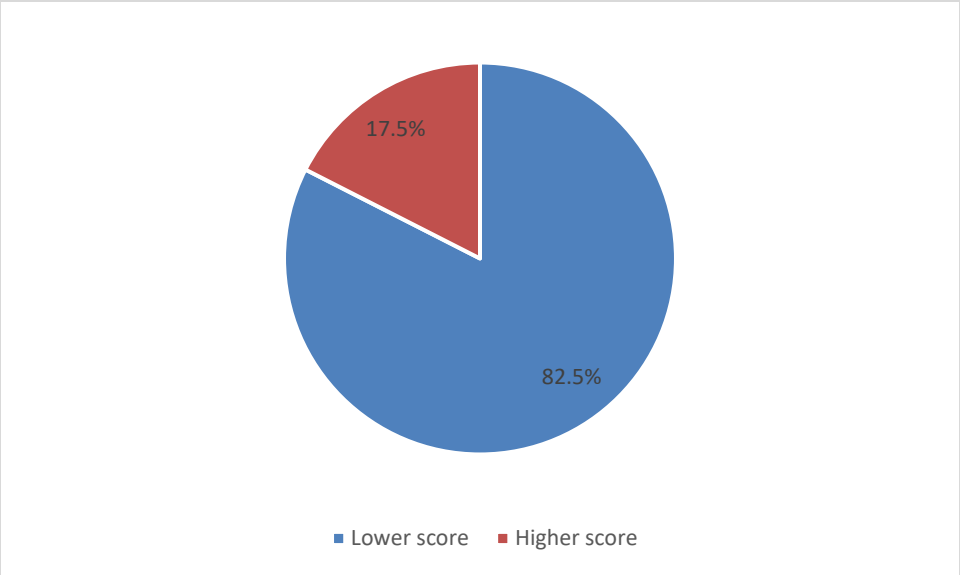



Figure 5- **High and low scores of participants**

In this study out of 57 participants, only 5 participants (8.8%) were able to identify pathological Q waves in the inferior leads.

Thirty-two of the participants (56.1%) were incorrect in identifying inferolateral MI.

sixteen (28.6%) of the participants were able to identify Wellens syndrome correctly.

forty-three of the participants (75.4%) incorrectly interpret pacemaker failure (failure to capture) in a paced rhythm.

thirteen of the study participants (22.8%) were correct in interpreting prolonged QT interval.

out of the 57 participants 20 of them (35.7%) were correct in identifying LBBB and.

Fifteen (26.8%) of the participants correctly identified Mobitz type 2 AV block. And 32 (57.1%) were incorrect. Forty-eight (87.3%) of the participants were incorrect in accurately identifying WPW with AFIB and only 5 (9.1%) of the participants were correct.

twenty-six (46.4%) of the participants were correct in identifying Paced rhythm.

only 5(8.8%) participants correctly identified ECG findings of pericarditis and 41 (71.9%) of the participants were incorrect. twenty-four (43.6%) of the participants were correct in identifying pulsus alternans and low voltage rhythm.

only 9 (16.4%) of the participants identified inferior wall MI with RV infarction and 39 of the participants (70.9%) were incorrect. Twenty-eight (50%) of the participants were able to correctly identify normal sinus rhythm. Twenty-six (45.6%) of the participants were able to identify RBBB. Thirty-seven (64.9%) of the participants identified polymorphic VTACH correctly.

Table 2- **ECG findings and interpretation by participants**

| **ECG findings** | **Interpretation** | |
|---|---|---|
| | Correct | Incorrect |
| Pathological Q wave | 5 (8.8%) | 52 (81.2%) |
| Inferolateral MI | 17 (29.8%) | 40 (70.3%) |
| Wellens syndrome | 16 (28.6%) | 41 (71.3%) |
| Pacemaker failure | 6 (10.5%) | 51 (89.5%) |
| Prolonged QT interval | 13 (22.8%) | 44 (81.2%) |
| LBBB | 20 (35.1%) | 37 (64.9%) |
| Mobitz type2 AV block | 15 (26.8%) | 42 (73.2%) |
| WPW with AFIB | 5 (8.8%) | 52 (91.2%) |
| Double chamber pacemaker | 26 (45.6%) | 31 (54.4%) |
| Pericarditis | 5 (8.8%) | 52 (91.2%) |
| Pulses alternans | 24 (42.1%) | 33 (57.9%) |
| Inferior wall MI with RV infarction | 9 (16.1%) | 48 (83.9%) |
| Normal sinus rhythm | 28 (49.1%) | 29 (50.9%) |
| RBBB | 26 (45.6%) | 31 (54.4%) |
| Polymorphic V TACH | 37 (64.9 %) | 20 (35.1%) |

When we see participants' scores and year of residency, all of the first-year residents scored below 50% which is defined as a low score while out of the second and third-year residents 66.6%and 63.6% scored low score respectively (figure 5).

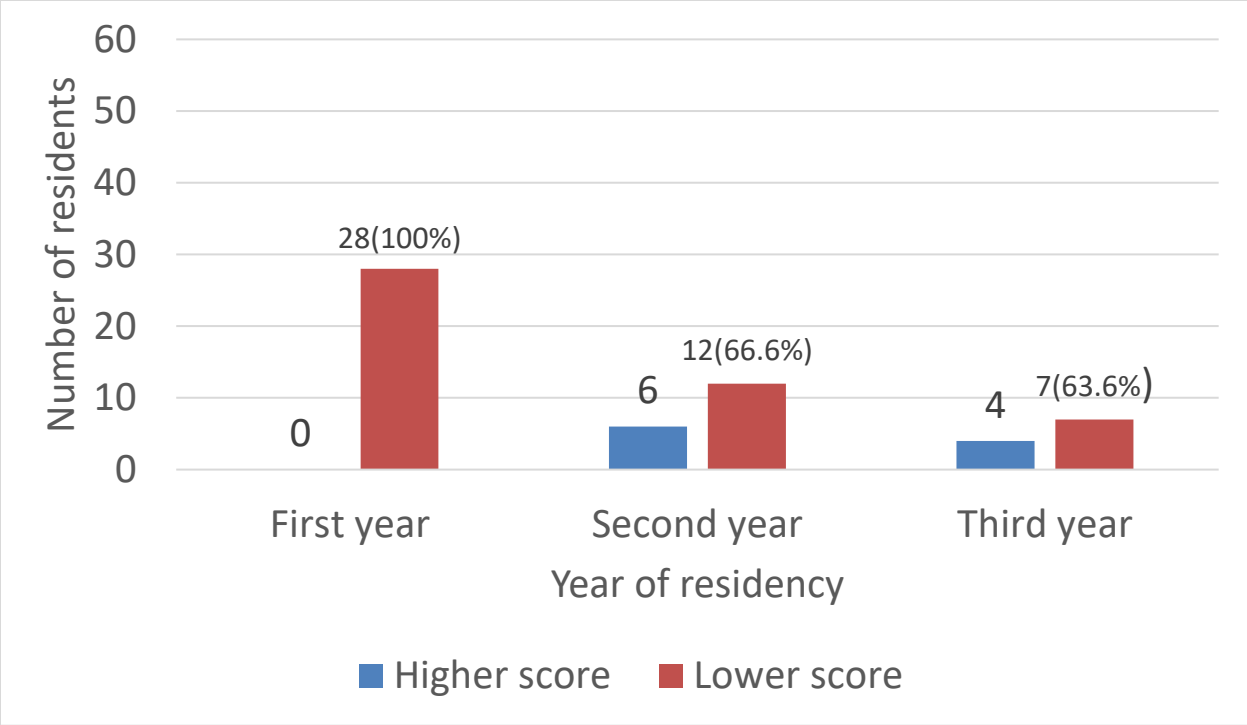


Figure 6 year of residency and performance level

## 6.4 Associated factors

Bivariate logistic regression was performed to assess the association of each independent variable with the outcome variable (high and low score), the three variables that showed a P-value of <0.2 were year of residency, updating oneself on ECG interpretations, and asking for help during ECG interpretation.

In multivariate logistic regression, increment in year of residency showed statistically significant association with higher performance in interpreting ECGs after controlling for other variables (AOR = 3.34(1.1, 10.2)) at p-value < 0.05. (table 3)

Table **3 factors associated with higher performance in ECG interpretation**

| Variable | Bivariate Logistic Regression | | Multivariate Logistic regression | |
|---|---|---|---|---|
| | COR (95% CI) | P-Value | AOR(95%CI) | P-value |
| **Increment in year of residency** | 4.3 (1.56, 11.87) | 0.005 | 3.34(1.1, 10.2) | 0.03* |
| **Asking for help** | 0.16 (0.03, 0.8) | 0.03 | 0.2 (0.03, 1.43) | 0.1 |
| **Frequent updating oneself on ECG** | 0.36 (0.01, 1.2) | 0.1 | 0.36 (0.01, 1.34) | 0.13 |

COR – reported Crude odds ratios; AOR- adjusted odds ratio CI – confidence interval; *statistically significant variable.

# 7. DISCUSSION

Overall, no participant in this study group was accurate in the interpretation of ECG. (Score >=80%).

Even though there is no specific number of ECGs that needs to be interpreted to define competency in emergency physicians, American Heart Association recommends the median number of ECGS that needs to be interpreted by a general internist is 100 and by a cardiologist should be750 to define competency(16).

Being able to accurately interpret ECGS is one of the mandatory and critical skills of emergency physicians. much of the ECG readings interpreted by residents occur at the bedside, thus it is only reasonable that interpretation skills grow as the year of experience increases.

A previous study which was done on graduating medical students of Addis Ababa University and Haromaya a university showed that ECG interpretation competency of graduating medical students to be insufficient (3).

This study showed that only 29.8% of the study participants and 16.4% of the participants identified ST-elevation myocardial infarction of inferolateral wall and ST-elevation myocardial infarction of the inferior wall with RV infarction respectively. In a previously done study which compares competency of ECG interpretation among cardiologists and emergency physicians, especially in determining ST-segment elevation myocardial infarction results had shown that they have a comparable skill, concluding that emergency physicians have a high rate of accuracy in interpreting ST-elevation myocardial infarctions in patients with chest pain(3).

In this study, the average score of ECG interpretation was 4.42(29.4%) out of 15 ECGs (95%, CI

0-73.3%). A study which was done in South Africa published in 2010 showed that the overall average of ECG interpretation was 46.4% (95% CI 41.5%-51.2%) (2). A study which was done in Australia published in 2007 to assess emergency physicians' accuracy in interpretation of ECG also showed that the average score of accuracy was 56.6% (2). A study which was also done in the U.S published in 2005 to assess competency in ECG interpretation among emergency medicine residents and internal medicine residents showed that the average score of ECG interpretation was 60% and the study also showed that there was no significant difference whether being an emergency resident or internal medicine resident in ECG interpretation (12).

Compared to other studies our study showed significantly lower performance in ECG interpretation possible explanations for this can be not having enough ECGs to practice on due to lack of ECG machines at the ED and not having continuous lectures and case-based discussions are some of reasons the participants mentioned.

In this study, it showed that there is a statistically significant association between residency and performance level (p-value <0.05) which is comparable to a study which was done in South Africa, Australia, and in the U.S (2,4,12) which showed that there is a significant improvement in identifying ECG abnormalities as a year of residency increases.

## 8. LIMITATIONS

The limitation of this study is that the sample size was small and also it doesn't include other ECCM residency program places in Ethiopia and the sampling technique was a convenience sampling method which makes it predisposed to selection bias.

## 9. CONCLUSION

In summary, this study was the first to be conducted on the accuracy of ECCM residents in ECG interpretation and shows that the general accuracy of ECCM residents in interpreting critical ECG is low. And the performance of the residents improves as a year of residency increases. And most of the participants felt that the ECG is class was not enough and they don't practice on more ECGS and this needs to be changed.

# 10. RECOMMENDATION

Based on this study outcome frequent ECG lectures should be included throughout the whole year of residency and rotation to cardiac intensive care unit should be included as it improves skill and also patient outcome.

The availability of ECG machines should also be given a great concern.

More case-based discussions and assignments should also be included in the teaching program.

Other studies should be done to assess the accuracy of ECCM residents involving all teaching centers.

# REFERENCE


1. S.Thalar M. The only EKG book you'll ever need. 7th ed. Vol. 1. LIPPINCOTT WILLIAMS & WILKINS, a WOLTERS KLUWER business;

2. Hoyle RJ, Walker KJ, Thomson G, Bailey M. Accuracy of electrocardiogram interpretation improves with emergency medicine training. Emerg Med Australas. 2007 Apr;19(2):143–50.

3. Getachew M. Addis Ababa University College of Health Sciences School of Medicine Department of Emergency and Critical Care Medicine. :45.

4. de Jager J, Wallis L, Maritz D. ECG interpretation skills of South African Emergency Medicine residents. Int J Emerg Med. 2010 Oct 28;3(4):309–14.

5. Sultan M, Debebe F, Azazh A. THE STATUS OF EMERGENCY MEDICINE IN ETHIOPIA, CHALLENGES AND OPPORTUNITIES. :6.

6. Dundar ZD, Ayranci MK. Presenting symptoms of older emergency department patients: a single-center experience of 10,692 patients in Turkey. Acta Clin Belg. 2020 Nov 1;75(6):405–10.

7. Jayes RL, Larsen GC, Beshansky JR, D'Agostino RB, Selker HP. Physician electrocardiogram reading in the emergency department—Accuracy and effect on triage decisions. J Gen Intern Med. 1992 Jul 1;7(4):387–92.

8. WH-1989-Aug-Sep-p21-23-eng.pdf.

9. Hoyle RJ, Walker KJ, Thomson G, Bailey M. Accuracy of electrocardiogram interpretation improves with emergency medicine training. Emerg Med Australas. 2007;19(2):143–50.

10. Barthelemy FX, Segard J, Fradin P, Hourdin N, Batard E, Pottier P, et al. ECG interpretation in Emergency Department residents: an update and e-learning as a resource to improve skills. Eur J Emerg Med. 2017 Apr;24(2):149–56.

11. Pines JM, Perina DG, Brady WJ. Electrocardiogram Interpretation Training and Competency Assessment in Emergency Medicine Residency Programs. Acad Emerg Med. 2004;11(9):982–4.

12. Berger JS, Eisen L, Nozad V, D'Angelo J, Calderon Y, Brown DL, et al. Competency in electrocardiogram interpretation among internal medicine and emergency medicine residents. Am J Med. 2005 Aug 1;118(8):873–80.

13. EmergencyMedicineanditsdevelopmentinEthiopia.pdf.

14. About – Saint Paul's Millennium Medical College [Internet]. 2021 [cited 2021 Feb 8]. Available from: https://sphmmc.edu.et/about/

15. Fisch C, Ryan TJ, Williams SV, Achord JL, Akhtar M, Crawford MH, et al. Clinical Competence in Electrocardiography. Circulation. 1995 May 15;91(10):2683–6.

16. Fisch C, Ryan TJ, Williams SV, Achord JL, Akhtar M, Crawford MH, et al. Clinical Competence in Electrocardiography. Circulation. 1995 May 15;91(10):2683–6.

Evaluation of Emergency & Critical Care Residents Accuracy on ECG Interpretation

Dear Participant,

My name is Dr. Meron Tesfaye and I am a 3rd year Emergency & Critical Care Medicine resident. I am currently doing my research on "Evaluation of Emergency & Critical Care Residents Accuracy on ECG Interpretation in Addis Ababa, Ethiopia." The purpose of this study is to explore the accuracy of ECG interpretation among Emergency & Critical Care residents. The questionnaire is designed to collect data regarding your experience with ECG interpretation and it is strictly for academic purposes. The data collected will only be used for the purpose of this study. Confidentiality will be strictly protected and none of your response will affect you in any way. Your participation is vital for the success of this study but is purely voluntary. You may decline to participate in the study at any point if you choose to do so. I would like to thank you in advance for your participation. If you have any questions or need to get in touch with the researcher, please use the following contact information.

Respectfully,

Dr. Meron Tesfaye
+251-904-302183
meritensu@gmail.com

signature

## Annex I. Questionnaires

**Directions: Please place a mark on the given spaces, encircle choices, and write comments accordingly. You can skip any questions that you feel are not applicable to you. Thank you!**

1. Age _____

2. Sex

A. Male B. Female

3. Which post graduating specialty training are you in?

A. AAU B. SPMMC

4. Year of residency?

A. 1 B. 2 C. 3

5 For how long did you work as a general practitioner?

A. less than a year B.1-2 years C. more than 2 years

6. Did you have any ECG class in your residency program?

A. Yes B. No

7. If your answer is **yes** for Q. No 6, when did you take the ECG class? (write your year of study)

8. If your answer is **yes** in Q. No 6, did you attend all class?

A. Yes B. No

9. Do you think the ECG class was enough?

A. Yes B. No

10.On average how many of the patients in the ED require ECG /day

A. <25%  B. 25-50%  C. >50%

11. How confident are you on interpretation of those ECGs?

A. Confident  B. Neutral  C. Not confident

12 How frequently do you ask for help in interpreting those ECGs?

A. Always  B. Most of the time  C. I never ask for help

13. From whom do you ask for help?

A. from senior resident  B. from consultant  C. cardiologist

14 Did something bad happened to your patient because of your ECG interpretation?

A. Yes  B. No

15 If your answer is yes to question number 14 what was the incident that happened?

16 how often do you update yourself on ECG interpretation?

A. All the time

B. Monthly interval

C. Whenever I have an assignment and a case

D. Never

17 If you update yourself what are your sources? (Multiple answer is possible)

A. Online lectures

B. morning rounds

C. text books

D practice with ECG quizzes

18 what is the role of your teachers regarding your ECG learning ?

A they give us continuous supervision and assignments

B they give us lectures

C they teach us at the bed side

D they are not involved at all

1 how do you label your satisfaction with the current ECG teaching

excellent

B very good

C good

D poor

20 What do you suggest would improve the current teaching practice regarding ECG?

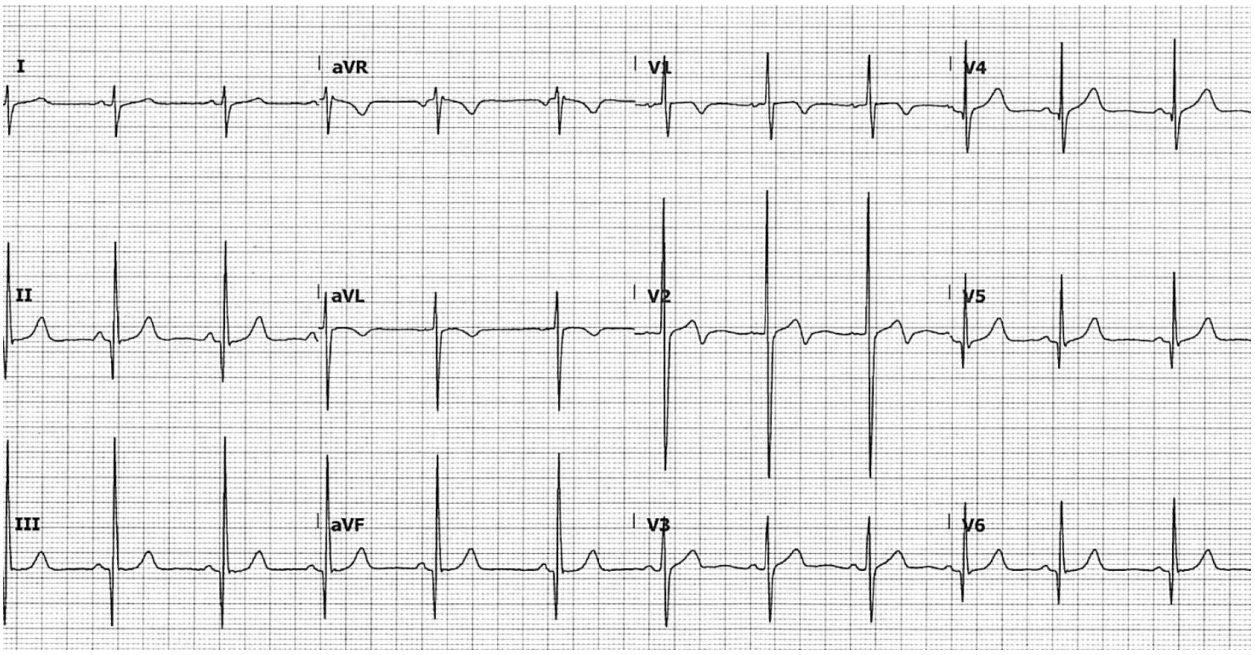
21. Where did you work as a GP? (Primary hospital, referral hospital….)

22. Was ECG machine available in your hospital while you were working as a GP?

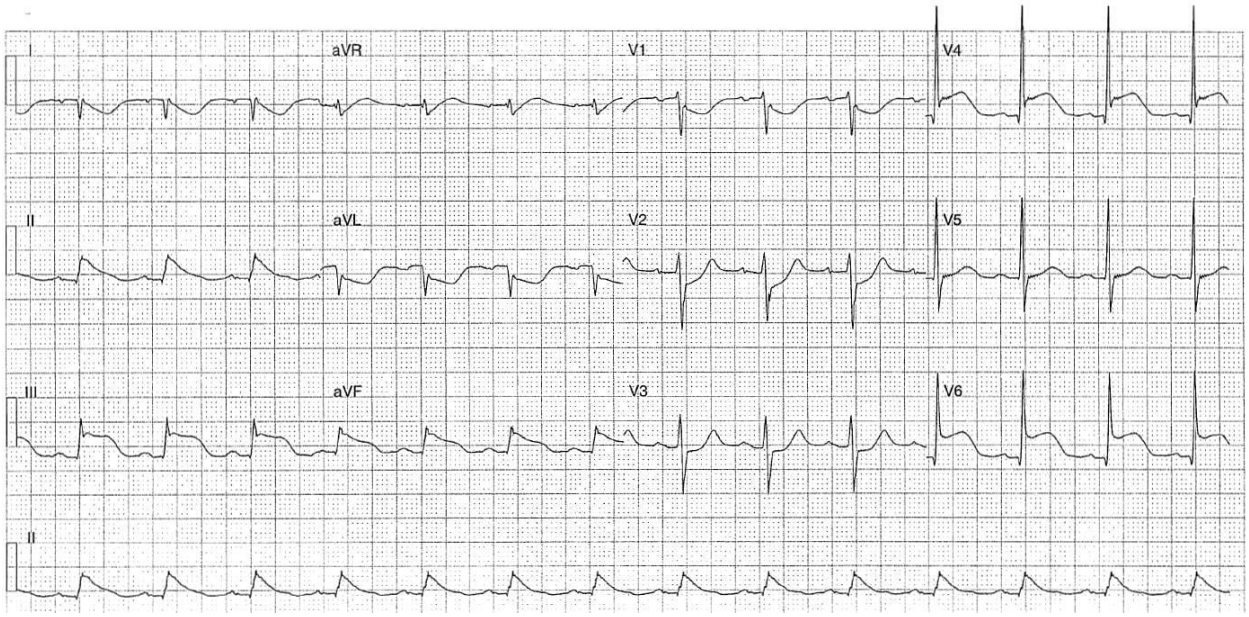
II. ECG quiz

please see those ECGS below and write your answers

1 A 24-year-old female presents following a syncopal episode in the context of alcohol consumption. She describes a prodrome of 10-15 seconds of lightheadedness.

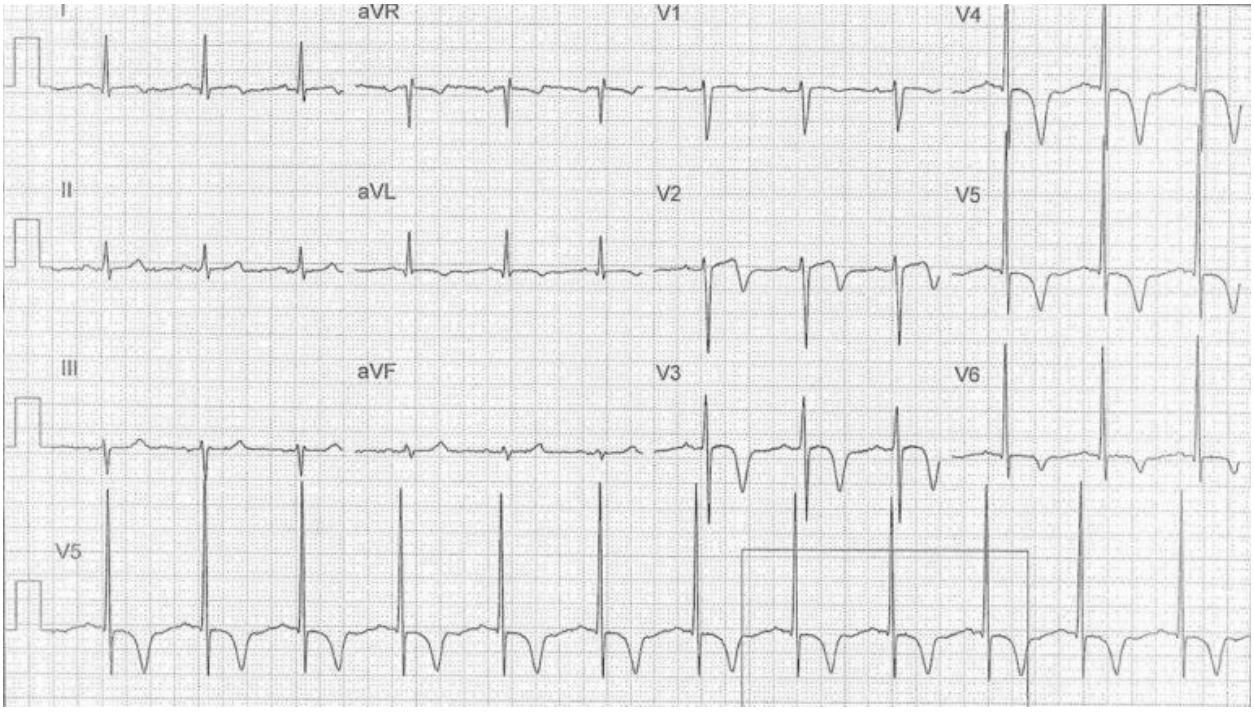



2 65-year-old male who was brought to the Emergency Department following an out-of-hospital cardiac arrest. ROSC was achieved prehospital following an episode of VT.

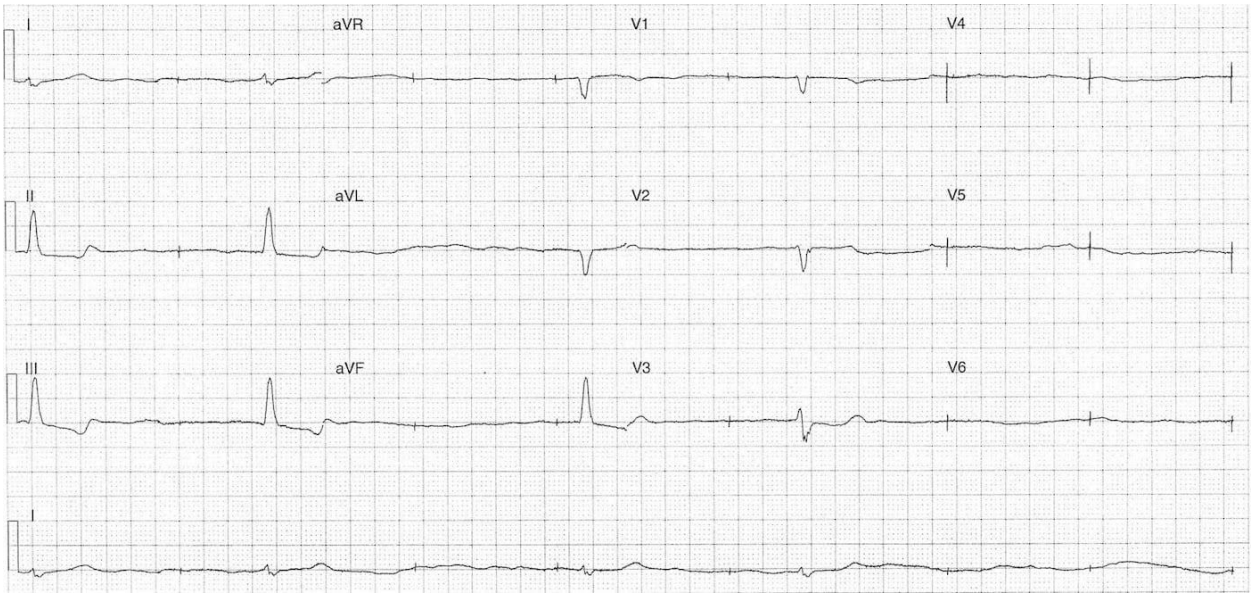



3 A 40 years old male who presented with a 60-minute history of central chest pain.

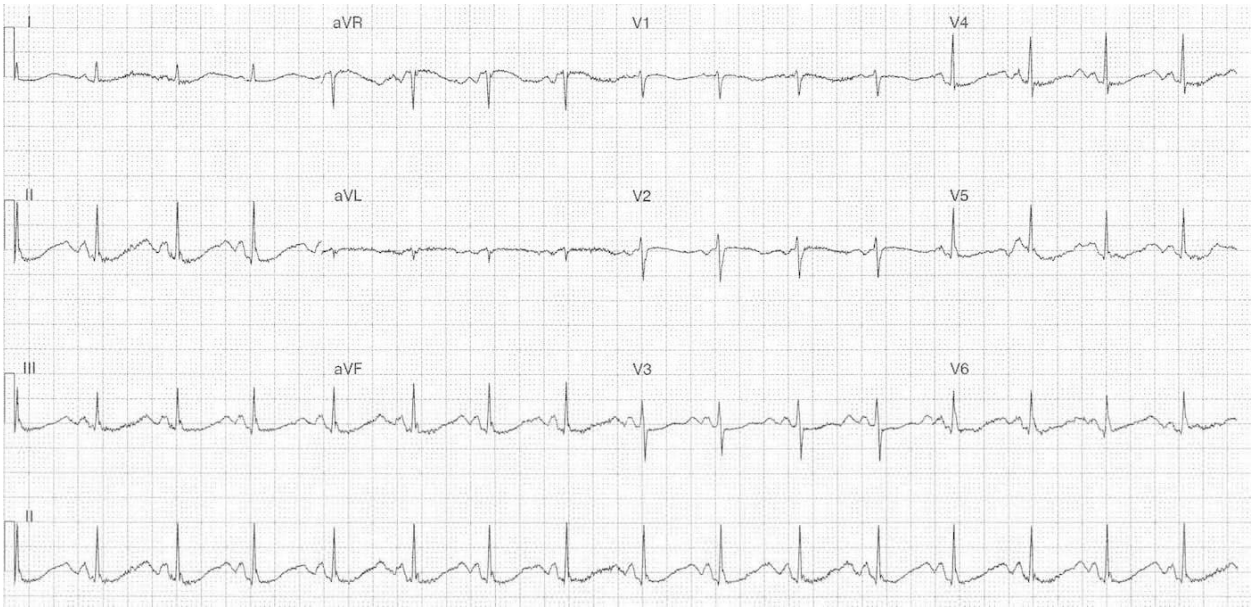
On arrival to the Emergency Department, he was pain free (ECG 1). Four minutes later he developed further intense chest pain and a repeat ECG was performed (ECG 2).



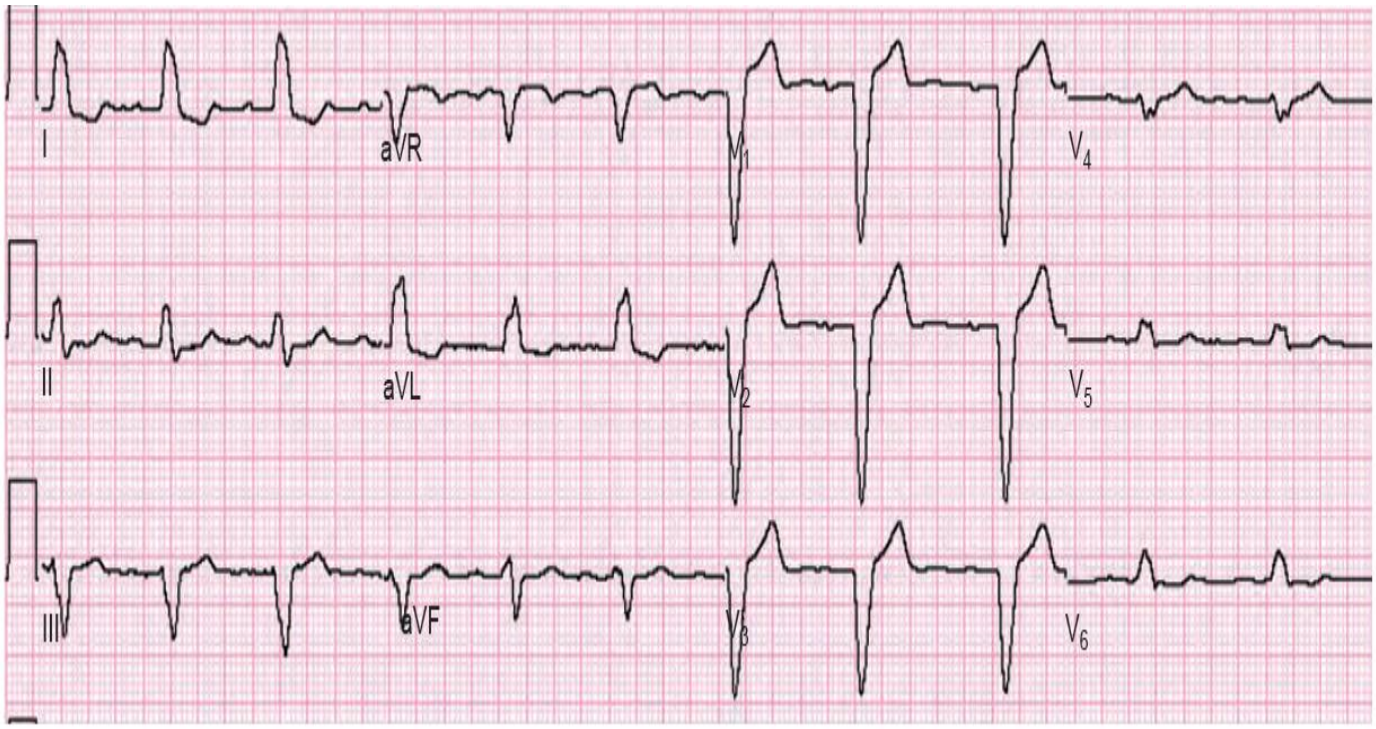
4 86 years old male referred by his General Practitioner with worsening renal failure. He has a history of atrial fibrillation with bradycardia for which he had a PPM inserted. His medications include metoprolol.




5 51 -year-old female who presented with chronic vomiting. She has a history of rheumatoid arthritis and paroxysmal atrial fibrillation. Her medications include sotalol and rivaroxaban.

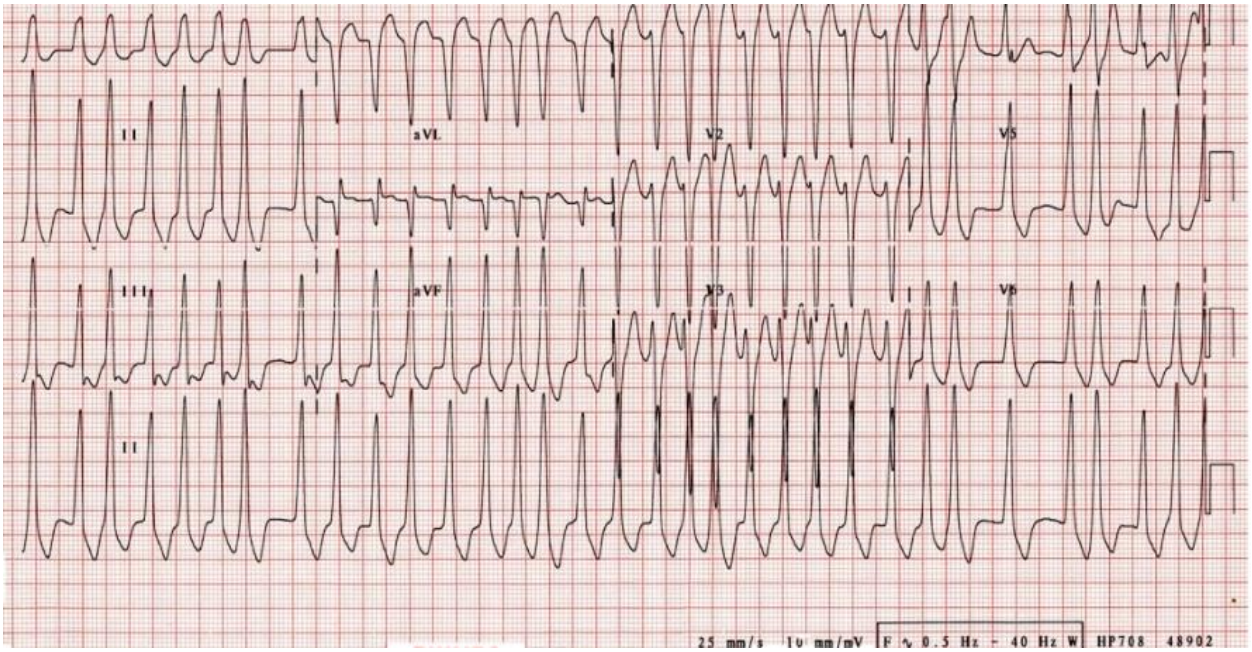


6 50 years old male came with chest pain

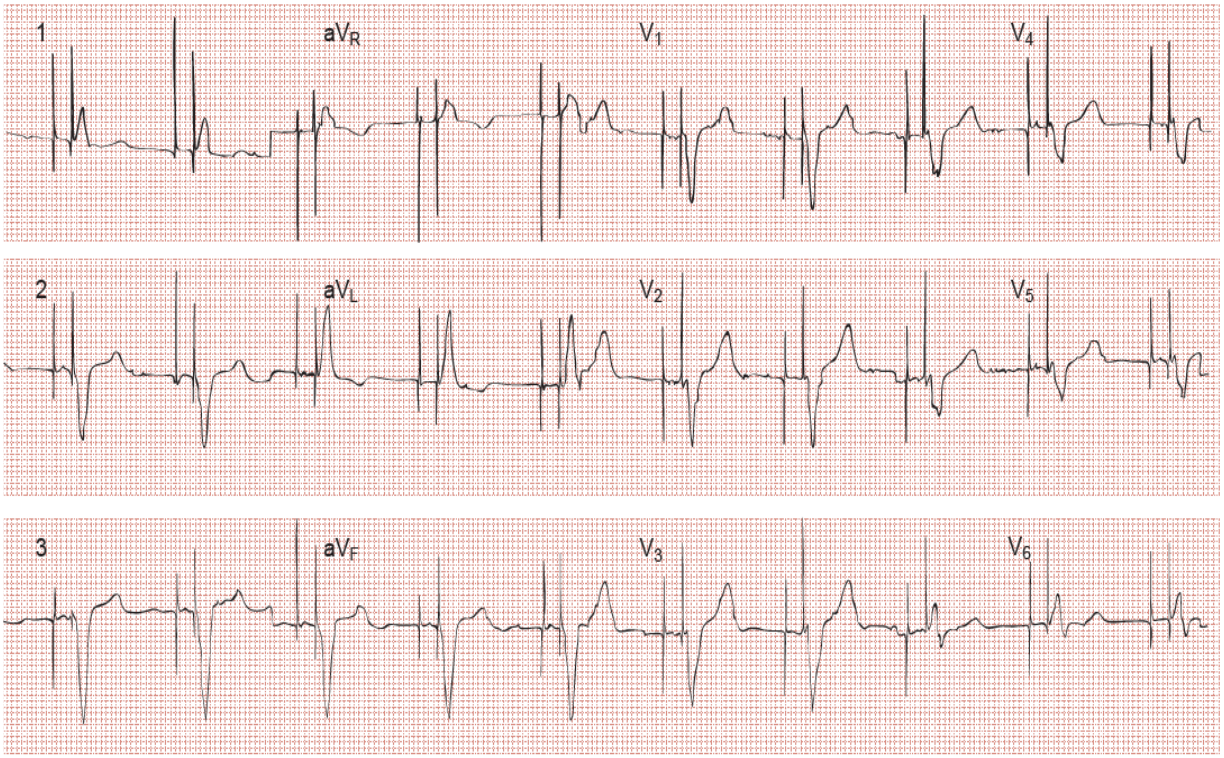



7 55 years old patient presented with light headedness and easy fatigability

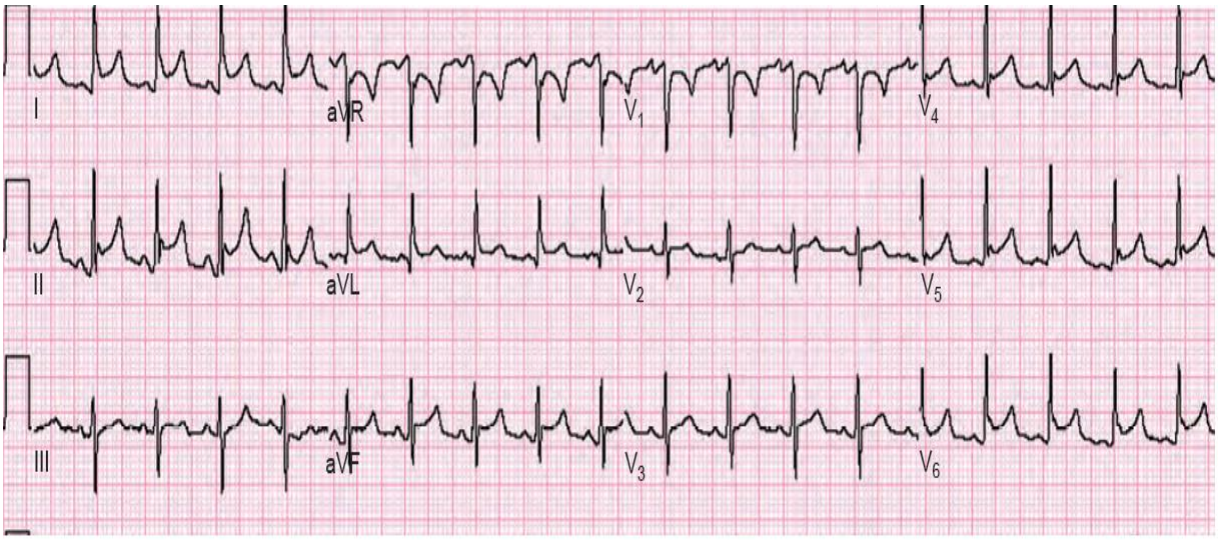

8 32 years old female presented with palpitation



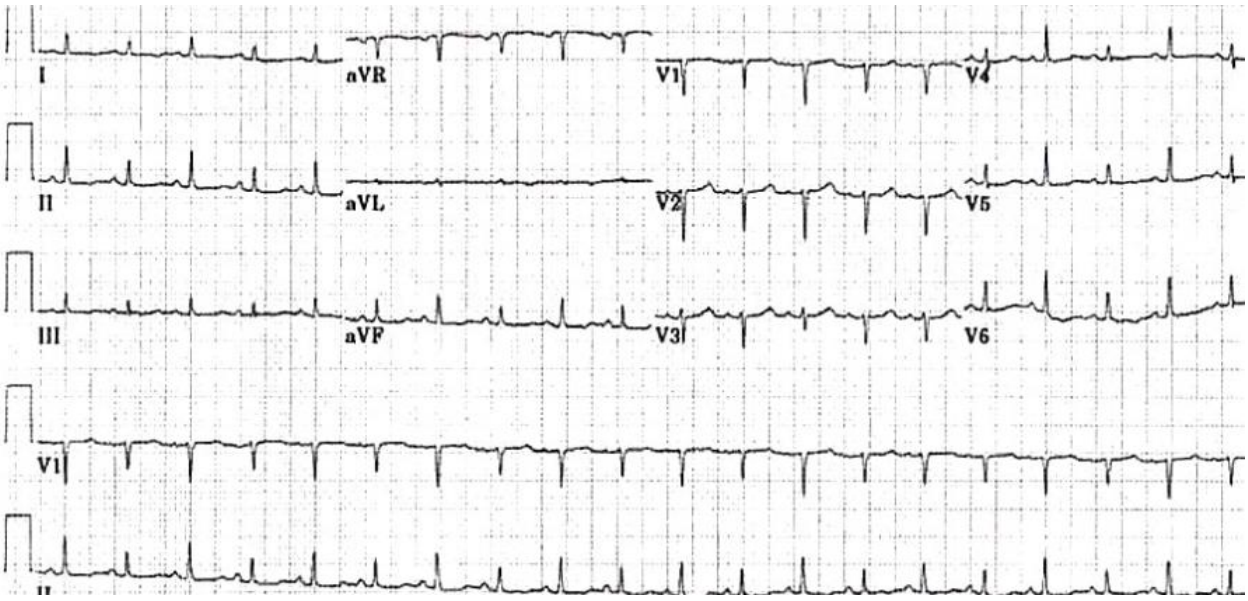

9 A 70 years old presented with easy fatigability



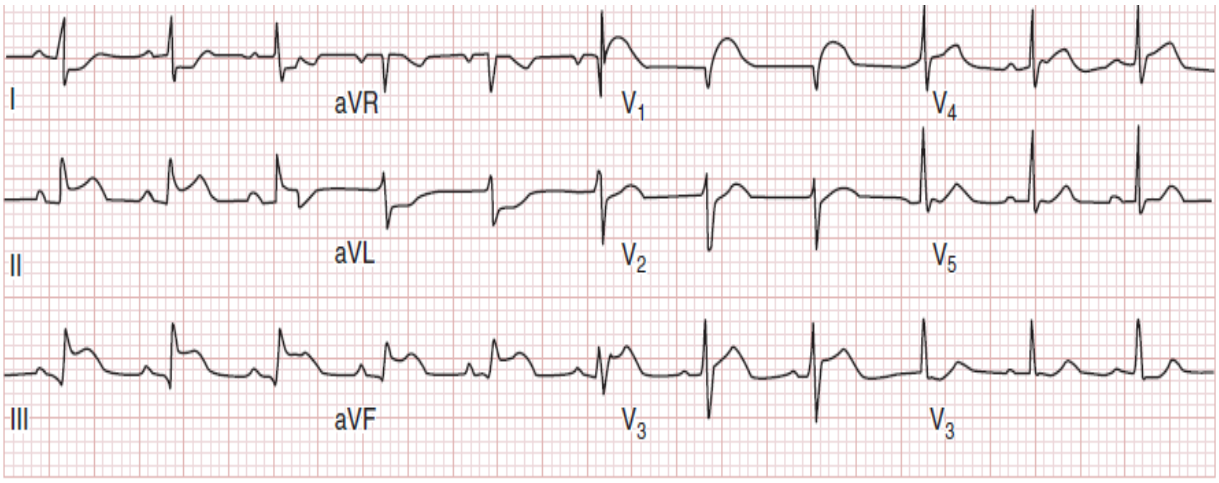

10 A 60 years old male patient presented with chest tightness and easy fatigability



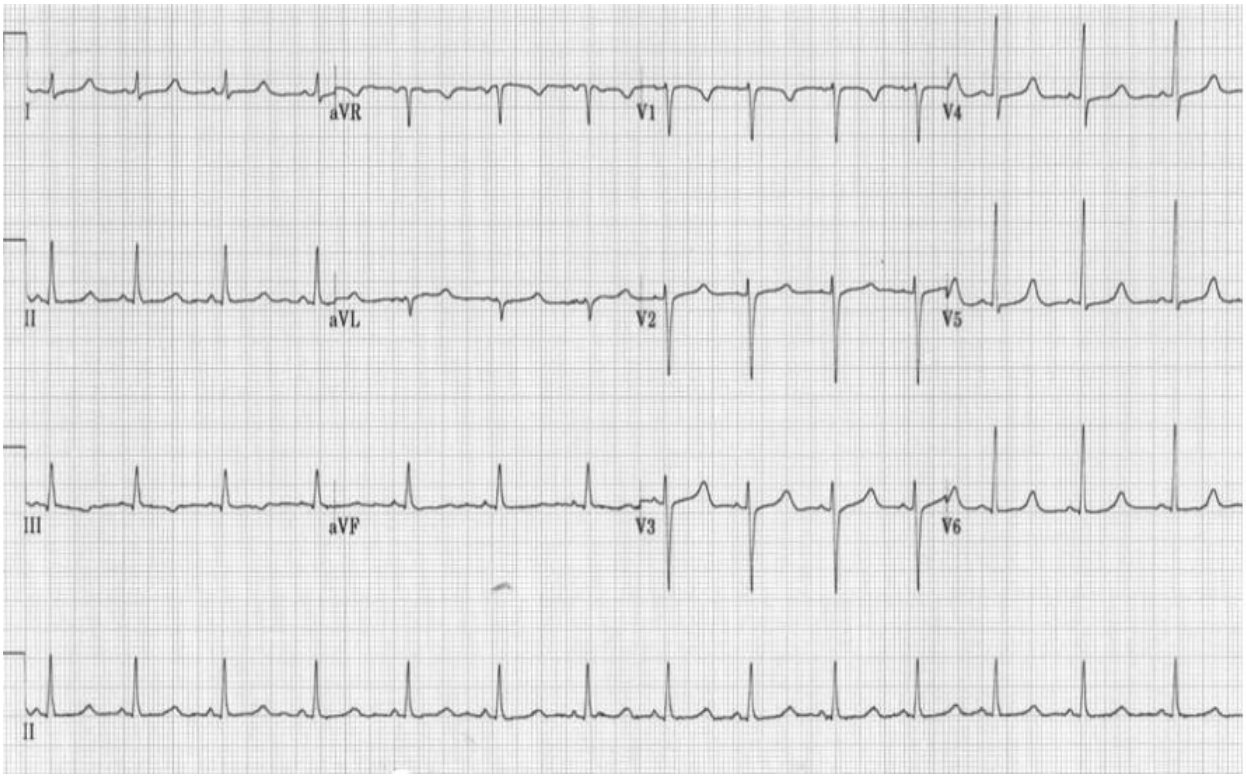

11 A 40 years old male patient presented with worsening of SOB with associated easy fatigability



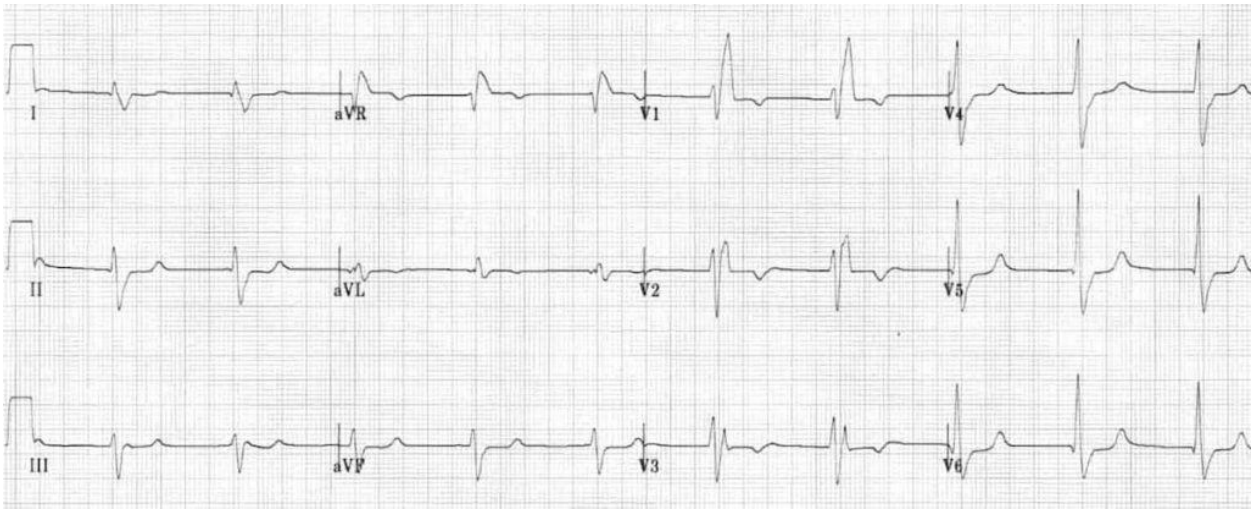

12 40 years old presented with chest pain and vomiting




13 20 years old presented with nausea and vomiting




14 A-55 years old known copd patient presented with sob and easy fatigability




15 A 20 years old female presented with palpitation and easy fatigability