

Initial ECG as a Diagnostic Tool for Identification of Low Risk Patients with Chest Pain.

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ABSTRACT

Large number of admissions to Intensive Coronary Care Unit (ICCU) for chest pain evaluation not only drains resources, but cause congestion and adds to the burden on hospital staff. The decision whether to admit or not to admit a patient to hospital requires accurate assessment of patients at ICCU. To study value of initial ECG to identify patient with low risk for developing AMI, thus avoiding unnecessary admissions. In this prospective cross-sectional study, patients admitted to ICCU were included and their initial electrocardiogram (ECG) was recorded after taking a detailed history and classified into four categories as Category I (normal ECG, no ischemia or infarction), Category II (abnormal ECG with vague suspicion of AMI), Category III (abnormal ECG with strong suspicion of AMI), and Category IV (abnormal ECG with AMI). Serial ECGs were taken for all patients for 48 hours. Category I: 132 patients in this category, Only one patient (0.80%) evolved to AMI as Category IV. Category II: 18 patients were included. 3 patients (22.20%) evolved to AMI after 24 hours. Category III: 30 patients were admitted in this group, of whom, 20 (66.70 %) had AMI on second day of admission. Category IV: 246 patients included in this group had AMI. The present study showed that there is a safety margin between low risk and high risk group for AMI. Patients with initial normal ECG may be admitted in step down care to avoid ICCU congestion and for better care for those in need.

INTRODUCTION

Coronary artery disease is the leading cause of death globally. One fifth of all deaths are due to coronary artery disease. By the year 2020, it will account for one third of all deaths. There are an estimated forty five million patients of coronary artery disease in India ^[1]. Early and accurate diagnosis of coronary disease is very essential as it is associated with significant morbidity and mortality ^[2,3].

There has been a great effort done by medical fraternity supported by government welfare programmes, NGOs and private enterprises and media in creating awareness about myocardial infarction, in population at large. Therefore, patients having chest pain which is most common and important symptom out of Coronary Vascular Disease rush to hospital for admission "to rule out acute myocardial infarction" (ROMI) - this was popular term coined to describe this phenomenon⁴. Approximately, 10 to 20% are eventually diagnosed with acute myocardial infarction (AMI) ^[2,3]. Thus a high percentage of patients not requiring admission are also admitted.

Corporate hospitals offer detailed evaluation and management of chest pain and welcome all admissions. In India, most of the population is either lower or middle class who still heavily rely on government hospitals. Large number of admissions to ICCU for chest pain evaluation not only drains the resources but also cause congestion adding burden on hospital staff. The decision whether to admit or not to admit a patient to hospital requires accurate assessment of patients at ICCU ^[4]. Apart from clinical evaluation, a quick and reasonably accurate diagnostic tool to identify patients with low risk or high risk for AMI would be highly valuable.

ECG is a basic investigation which is widely available, cost effective and easy to perform. It identifies the patients who are at high risk and low risk for AMI and its complications, thus improving diagnostic accuracy in evaluation of patients with chest pain [5].

This study was under taken to evaluate utility of initial ECG as diagnostic tool to identify low risk group for developing AMI, thus avoiding unnecessary admissions.

MATERIALS AND METHODS

This was a prospective, cross-sectional study conducted for three months between November to January 2011 at Bapuji Hospital, Davangere, Karnataka, India. Ethical clearance was obtained from the Institutional Ethical Committee. Informed consent was taken from the patients or relatives. All patients admitted to ICCU with history of chest pain were selected for the study. Patients with old myocardial infarction (MI) and those with rheumatic heart disease were excluded. All the subjects who were included for the study were evaluated in detail about h/o chest pain, type, location, radiation and associated symptoms like diaphoresis, palpitation and giddiness. Details of clinical examination were recorded.

History of chest pain was classified as typical and atypical. Heberden [6] provided first description of typical ischaemic chest pain in 1978, "a painful sensation in the breast accompanied by strangling sensation, anxiety and occasional radiation of pain to the left arm". Jones observed an association with exertion and relief with rest [7]. Chest pain symptoms that do not fall into this typical category were termed atypical [8]. Cardiac biomarkers were estimated.

Initial ECG was taken at the time of admission and serial ECGs were taken during hospitalisation, every 12 hours. Based on ECG findings, patients were classified into four categories, given by Prasanna challa [9] and Karlsons [10].

Category I: Normal ECG with no indication of ischemia.

Category II: Abnormal ECG with no indication of ischemia, with presence of sinus tachycardia, bradycardia, supraventricular ectopics, right bundle branch block (RBBB), left bundle branch block (LBBB), chamber hypertrophy etc.

Category III: Abnormal ECG with strong suspicion of AMI with ST segment elevation, single lead T wave inversions, concave ST elevation and ST depression in one or two leads.

Category IV: Abnormal ECG with evidence of MI, ST segment elevation or ST segment depression or appearance of Q waves.

Sensitivity, specificity, positive predictive value and diagnostic accuracy were calculated for both initial ECG and Second ECG, taken after 24 hours, using SPSS version 16 software.

RESULTS

619 patients were admitted in ICCU during November 2012 to January 2013. 193 patients were excluded. Among 426 patients studied, 297 were men and 159 were women. The average age of patients in Category I was 54 years, in Category II was 50 years, in Category III was 58 years, and in Category IV was 56 years (Table 1).

Table 1: Demographic data of all the patients in each category

| Category | No. of patients | Mean age (in years) | Gender | |
|----------|-----------------|------------------------|--------------|-------------|
| | | | Male | Female |
| I | 132 (30.98%) | 54.7±14.9 | 72 (54.5%) | 60 (45.5%) |
| II | 18 (4.22%) | 50.9±13.7 | 7 (38.9%) | 11 (61.1%) |
| III | 30 (7.04%) | 58.2±13.1 | 20 (66.7%) | 10 (33.3%) |
| IV | 246 (57.74%) | 56.6±15.1 | 168 (68.30%) | 78 (31.76%) |

Category I: 132 patients had normal ECG with no evidence of ischemia or infarction. The average age of the patients in this category was 54 years. All patients were admitted with chest pain. 100 patients had atypical pain and 32 had typical chest pain. 25 of them had palpitations, sweating and giddiness. CPK-MB was normal. Serial ECGs were taken for all patients for 48 hours. Only one patient (0.80%) evolved to AMI i.e., to Category IV (Table 2, Table 3).

Category II: 118 patients were included in this group who had vague suspicion of ischemia. Their mean age was 50 years. 7 patients had typical chest pain and 11 had atypical chest pain. 5 of them had associated symptoms. CPK-MB was raised in 3 patients (16.70%) who evolved into AMI after 24 hours (Table 2, Table 3).

Category III: 30 were admitted under this group with strong suspicion of AMI. Their average age was 58 years. 9 patients had typical chest pain and 21 had atypical chest pain. 3 of them had associated symptoms. CPK-MB was raised in 4 patients. 5 (16.70 %) patients on second day of admission had AMI (Table 2, Table 3).

Category IV: 246 patients were included in this group. Mean age of the patients was 56 years. 101 patients had classical cardiac chest pain while 145 gave history of atypical chest pain. CPK-MB was raised in all patients (Table 2, Table 3).

Table 2: Comparison of clinical presentation of patients in each category

| Category | Type of chest pain | | Associated Symptoms | Total |
|----------|--------------------|--------------|---------------------|-------|
| | Typical | Atypical | | |
| I | 32 (24.30%) | 100 (75.80%) | 25 (18.9%) | 132 |
| II | 7 (38.90%) | 11 (61.10%) | 5 (27.8) | 18 |
| III | 9 (30.00%) | 21 (70%) | 3 (10%) | 30 |
| IV | 101(41%) | 145 (58%) | 42 (17%) | 246 |

Table 3: Number of patients who evolved into myocardial infarction

| ECG categories | No. of patients who evolved into acute MI during hospital stay |
|----------------|--|
| I | 1 (0.80%) |
| II | 3 (16.70%) |
| III | 5 (16.70%) |

Initial ECG had a sensitivity of 97.45% and a specificity of 5.29%. Its positive predictive value was 53.33% and diagnostic accuracy 64.79%. ECG taken after 24 hours, had sensitivity of 65.21% and specificity of 53.33%. The positive predictive value of ECG taken after 24 hours was 97.45% and diagnostic accuracy of 66.79%.

DISCUSSION

A great effort is made by medical fraternity supported by private enterprises and media to create awareness about heart diseases. As a result, many patients with chest pain rush to hospital to rule out myocardial infarction, resulting in congestion of ICCUs and Emergency Rooms.

It is universally accepted that chest pain history is very important in determination of coronary artery disease. However, there is conflicting data about the utility of history as diagnostic tool in identifying patients with or without AMI [8]. The authors reviewed the literature to identify the components of chest pain history that may be most helpful to the clinicians and to identify its limitations. In their opinion "there is no single element of chest pain history which is a powerful enough predictor of non-ACS or non-AMI to allow the clinician to make decisions according to it alone." [8] In this context, initial ECG is evaluated as a determinant for ICCU admission for patients presenting with chest pain.

In Category I, patients had low risk for MI. One patient (0.80%) had AMI on second day, and was treated as Category IV patient. These patients were followed for one month and had no cardiovascular events. Brush and his colleagues [11] in 1985 showed that normal and near normal ECG findings on admission were associated with low risk of complications. The complication rate was 0.6% among patients with normal ECG, and was 14% among patients with abnormal ECG.

In Prasanna Challa's [9] series, 75 patients had normal ECG on admission. One patient (1.3%) was subsequently diagnosed with MI by Troponin I elevation alone, confirming our study findings. Karson [10] et al studied 7,157 patients admitted in Emergency Department (ED). 2910 (41%) had normal ECG. 279(6%) had AMI. In patients who were considered to have no suspicion of AMI, 1% developed confirmed AMI suggesting that, only a low percentage of patients with normal ECG may later evolve into AMI. Their study confirms our findings that initial ECG is a good diagnostic tool predicting low risk for AMI.

Patients with normal ECGs have low risk of AMI and have a benign disease. This is further supported by Koukkunen et al [5] study. They evaluated 250 patients admitted in ED on basis of history, clinical examination, ECG and cardiac biomarkers. They found that patients with normal initial ECG had lower cardiovascular morbidity at 4 weeks to 6 months compared to patients who were admitted for acute coronary syndrome (ACS).

Hector Pope et al ^[12] study analysed clinical data of 10689 patients. They found that 19(2.1%) had AMI and 22(2.3%) had unstable angina but were mistakenly discharged as normal patients. Their findings suggest that failure to hospitalise patients with AMI or unstable angina who presented to ED is serious medical lapse, but these findings were statistically not significant. In their study 55% of patients had normal ECG at the time of admission, 6% of them evolved into AMI following admission to ICCU. With growing pressure to reduce unnecessary hospitalisation and to improve diagnosis, triage setting is very important.

Our study confirms the findings of above authors. There is a safety margin between low risk and high risk group. Patients with normal initial ECG may be admitted to step down care to avoid congestion and give better care for those who are in need. This cans the burden of ICCU and its staff.

ECG continues to be an invaluable tool in initial evaluation of patients with chest pain. The plethora of data available on ECG changes correlating with myocardial injury allows clinicians to make faster and better decisions than ever before ^[13]. Henry Marriot wrote that ECG is “the single most often used ,most cost effective and most diagnostic test in cardiology” and also most frequently misinterpreted” ^[14].

CONCLUSION

ECG is an invaluable tool for evaluation of patients with chest pain and identification of low and high risk patients for AMI. Very few patients were found to evolve into AMI after initial normal ECG; hence these patients can be admitted and treated at step down care. As there is a significant burden of heart diseases on health care system,there is an urgent need to develop surveillance and prevention of the diseases and promotion of health in the country¹⁵. Hence, if one could frame guidelines based on initial ECG it can minimise ICCU admissions and lessen the burden on health resources.

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