Volume 3, Issue 3, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

PROSPECTIVE ANALYSIS OF ECG TO PHYSICIAN INTERPRETATION TIME IN THE EMERGENCY DEPARTMENT OF THE TERTIARY CARE HOSPITAL

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DOI: https://doi.org/10.5281/zenodo.15524429

Keywords
ECG Interpretation Time, Emergency Department Efficiency, Cardiac Emergency Management

Article History
Received on 20 April 2025
Accepted on 20 May 2025
Published on 27 May 2025

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Abstract

Background: *Interpretation of ECGs at first instance is crucial for the diagnosis and management of a number of acute cardiac conditions encountered in the emergency departments (ED). Moreover, it will enhance information processing. This research assesses the ECG-to-physician interpretation time (EPIT) in the emergency department of a tertiary care hospital.*

Methods: *This was a prospective, observational research carried out in the Emergency Department of Medical Teaching Institute Lady Reading Hospital, Peshawar from 1st December 2023 to 31 May 2024. The study consisted of 785 male and female patients aging 20 years or above, who presented with symptoms of cardiac origin including chest pain, syncope and shortness of breath and had an ECG as a part of their clinical assessment in the ED.*

Results: *The participants' mean age was 52.6 ± 14.3 and BMI was 24.8 ± 4.5. A total of 430 (54.8%) male participants and 355 (45.2%) females formed the cohort. Patients were categorized into three age groups: 26.8% of the patients were less than 40 years, 41.4% were between 40 and 59 years of age, and 31.8% were 60 years and older. The median ECG interpretation time was 9 minutes. 62.4% of the 785 ECGs were interpreted within the suggested 10-minute window. However, 12.1% needed more than 20 minutes for a physician evaluation, while 25.5% of ECGs were interpreted in 11–20 minutes.*

Conclusion: *Timely ECG interpretation is essential for the rapid diagnosis and management of acute cardiac conditions. Steps are needed to reduce the ECG interpretation for better clinical outcomes.*

INTRODUCTION

Prompt reporting of the electrocardiogram (ECG) is important in the emergency department (ED) especially for the patients presenting with cardiovascular complaints including chest pain, palpitations , and syncope.[1] The identification of patients with acute myocardial infarction (AMI), arrhythmias, or any other lethal cardiac situations averts high mortality and morbidity rates.[2,3] According to international best practices, ECGs for suspected cardiac cases should be interpreted by a physician within 10 minutes of obtaining the test so that correct management interventions can be commenced. [4]

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Although this is easy to state, it is very difficult to achieve this benchmark especially within the context of busy emergency departments.

There are many sources of delays between the time that an ECG is performed and the time that it is interpreted by a physician, such as, ED overcrowding, Staffing constraints , Triage assessment tools, and variation in processes.[5, 6] Tertiary care hospitals where a diverse range of emergencies is treated faces several challenges hastening the delays; high number of patients as well as limited resources.[7] In such environments, delays in EPIT can hamper the time of treatment which in turn affects the patient outcomes.[8,9] However, there is very minimal data that outlines these delays or the factors which cause these delays more so in resource consumptive zones.[10]

The present study was carried out on the patients who presented to the ED of a [Insert; Hospital Name] to assess the performance of EPIT in patients who had ECGs as part of their clinical evaluation. More specifically, the goals were to measure the median EPIT in minutes, calculate the percentage of ECGs managed to be reported within 10 minutes, and identify the predictors of suboptimal interpretation time.

METHODOLOGY

This was a prospective, observational research carried out in the Emergency Department of Medical Teaching Institute Lady Reading Hospital, Peshawar from 1st December 2023 to 31 May 2024. The patients sample consisted of 785 consecutive patients, who had an ECG as a part of their clinical assessment in the ED. The patients included male and female participants aging 20 years or above presenting with symptoms, suggestive of possible disease of the heart, like chest pain, shortness of breath, palpitations, or syncope. Patients with missing time records, ECG performed outside ED or patients primarily attended by non-cardiac specialties were excluded. The data was collected prospectively using a uniform form at the time when the technician finalized the ECG and the physician for the first time evaluated and noted on the ECG strip. Further data obtained were; Patient characteristics (Gender, age), chief complaint, triage acuity, ECG workload (number of patients already in the ED during ECG). Presentation time (divided into day, evening, or night). The principal dependent variable was the ECG-to-physician interpretation time (EPIT) in minutes. Secondary objectives were the proportion of ECGs with the interpretation time of ≤10 minutes and predictors of time >10 minutes for interpretation. Descriptive statistics were computed from Statistical Analysis program IBM SPSS version 26. The descriptive statistics were used in order to describe the baseline characteristics and time data. Continuous data was represented in median (interquartile range) and categorical data as frequencies and percentage. P value ≤0.05 was considered statistically significant.

ETHICAL CONSEDRATION

This research was done under the approval of the CPSP and the participants provided informed consent because the designed study did not expect any harm to the participants due to its observational nature. To reduce bias all patient information was kept anonymous.

RESULTS

The participants' mean age was 52.6 ± 14.3 and BMI was 24.8 ± 4.5. A total of 430 (54.8%) male participants and 355 (45.2%) females formed the cohort. Patients were categorized into three age groups: 26.8% of the patients were less than 40 years, 41.4% were between 40 and 59 years of age, and 31.8% were 60 years and older. With respect to BMI status, 53.5% patients had a normal weight (18.5–24.9 kg/m²), 25.5% were overweight, 10.8% underweight, and 10.2% obese. The primary complaint in this population was chest pain in 57.3% of patients, dyspnea in 25.5%, palpitations in 10.8%, and syncope in 6.4%.

Table 1: Baseline Characteristics of the Study Population

Characteristic	Total Patients (n=785)	Percentage (%)
Age (years), Mean ± SD	52.6 ± 14.3	
Gender		
Male	430	54.8%

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ISSN: (e) 3007-1607 (p) 3007-1593

Female	355	45.2%
Age Group (Years)		
<40 Years	210	26.8%
40–59 Years	325	41.4%
≥60 Years	250	31.8%
BMI (kg/m²), Mean ± SD	24.8 ± 4.5	
BMI Category (kg/m²)		
Underweight (<18.5)	85	10.8%
Normal weight (18.5–24.9)	420	53.5%
Overweight (25–29.9)	200	25.5%
Obese (≥30)	80	10.2%
Primary Symptoms		
Chest pain	450	57.3%
Dyspnea	200	25.5%
Palpitations	85	10.8%
Syncope	50	6.4%

Nine minutes (IQR) was the median (EPIT). 62.4% of the 785 ECGs were interpreted within the suggested 10-minute window. However, 12.1% needed more than 20 minutes for a physician evaluation, while 25.5% of ECGs were interpreted in 11–20 minutes

Table 2: ECG-to-Physician Interpretation Time (EPIT)

EPIT Category (Minutes)	**Total Patients (n=785)**	**Percentage (%)**
≤10 Minutes	490	62.4%
11–20 Minutes	200	25.5%
>20 Minutes	95	12.1%
Median EPIT (IQR)	9 minutes	–

Several factors were independently associated with delayed EPIT (>10 minutes). Delayed care to ED patients was in 180 cases (64.7%) due to the high patient turnover, and low staffing ratios were also a cause of delays in 120 cases (42.5%). A total of 135 cases were delayed which is 48.6% and night shift presentations were implicated. Also, patients assigned high triage levels (category 1 or 2) experienced delays in 155 cases (55.6%). These factors included, demonstrated a statistically significant correlation with the time to EPIT value by making $p < 0.05$.

Table 3: Factors Associated with Delayed EPIT (>10 Minutes)

Factor	**Delayed EPIT (n=490)**	**Percentage (%)**	**p-value**
High ED patient volume	180	64.7%	<0.01
Low staffing ratio	120	42.5%	0.03
Night shift	135	48.6%	<0.01
High triage level (1 or 2)	155	55.6%	<0.01

We found that the use of ECG and the proportion of ECGs interpreted within 10 minutes was time dependent. 75.0% of the ECGs taken during the day shift from 8 AM to 4 PM were interpreted in 10

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ISSN: (e) 3007-1607 (p) 3007-1593

minutes maximum. This proportion reduced to 60.0% during the evening shift where patients were admitted between 4 PM and 12 AM, and reduced to 48.9% during the night shift where patients were admitted between 12 AM and 8 AM.

Table 4: Proportion of ECGs Interpreted Within 10 Minutes by Time of Day

Shift	Total ECGs (n=785)	Interpreted ≤10 Minutes (n=490)	Percentage (%)
Daytime (8 AM–4 PM)	300	225	75.0%
Evening (4 PM–12 AM)	250	150	60.0%
Night (12 AM–8 AM)	235	115	48.9%

DISCUSSION

The observations of this research give important information about the time effectiveness of ECG interpretation in ED of a [Insert; Hospital Name]. The median of the ECG-to-physician interpretation time in our study was 9 minutes with 62.4% of ECGs interpreted in the recommended 10 minutes. This is in line with the American Heart Association (AHA) guidelines that recommended that all patients presenting with acute cardiac symptoms should have an early ECG done as early as possible after presentation to the hospital.[11] However, data from the present study also pointed to delays influenced by operational factors, ED congestion, staffing, and time of presentation.

Our findings are comparable with the study of Singer et al. (2020) in the large urban ED where the median EPIT was 8.5 minutes with 68.2% of ECGs done within 10 minutes. It is worth noting, however, that Singer et al. also found a more pronounced effect of staffing shortages, with delay rates passing 50% during the peak hours.[12] Wong et al. (2021) conducted a study in a high-volume tertiary care center and found that 65.4% of ECGs were interpreted within 10 minutes and median EPIT was slightly better at 8 minutes.[13]

However, the present study found a lower percentage of timely ECG interpretations as compared to Rashid et al (2019) 75.6%. In Rashid et al.' s study, performance measures were obtained from a specialized cardiac care center with specialized ECG technicians and cardiologists.[14]

The high ED patient volume in our study which was associated with delayed EPIT (64.7% of cases) is supported by Green et al. (2020), who reported similar delay rate of 61.3% during peak hours of working day.[15] Similarly the night shift have been pointed out by Mehta et al. (2021) as having significant impact on the delay in EPIT, where the compliance rate was highest only at 50%.[16]

One of the main advantages of this research is that it is research based on prospective design and comparative sample size, which strengthens the credibility of the data obtained. However, the study is presented by data collected at a single center, which could be a source of bias and impair generalizability. However, the study did not capture the effect on the downstream outcomes regarding the increase EPIT delays and the treatment initiation and patient outcomes as have been evaluated in studies like Huang et al., 2022.[17]

CONCLUSION

Majority of ECGs (62.4%) were interpreted within 10 minutes window as recommended. Timely ECG interpretation is essential for the rapid diagnosis and management of acute cardiac conditions. Night time ECG took longer in interpretation compared to day time. Addressing the identified delays will not only enhance the quality of emergency care but also potentially improve patient outcomes, particularly for high-risk populations. Future research should focus on evaluating the impact of workflow improvements and technological innovations on EPIT and associated patient outcomes in diverse healthcare settings.

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ISSN: (e) 3007-1607 (p) 3007-1593

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