Frequency of Non-ST Segment Elevation Myocardial Infarction (NSTEMI) in Acute Coronary Syndrome Patients with Normal Electrocardiograms: A Study from a Tertiary Care Hospital in Peshawar

Dr kiflain Hassan
Cardiology department DHQ teaching hospital kda kohat
Email: Kiflain.hassan@gmail.com

Dr Atiq Ur Rehman
Govt city hospital lakki marwat
Email: doctoratiq033@gmail.com

Dr Amber Ashraf
Khyber teaching hospital Peshawar
Email: CardiologistAmber@hotmail.com

Dr Majid Rashid
Khyber Teaching Hospital Peshawar
Email: Majidrashid876@gmail.com

Abstract

This study aimed to determine the frequency of Non-ST Segment Elevation Myocardial Infarction (NSTEMI) among patients presenting with acute coronary syndrome (ACS) and normal electrocardiograms (ECGs) at a tertiary care hospital in Peshawar.A cross-sectional study conducted at the Department of Cardiology, Khyber Teaching Hospital, Peshawar.The research was carried out from October 24, 2021, to April 24, 2022. 106 patients, ages 25 to 60, who had ACS but a normal ECG at admission were included in the study. Individuals with cardiomyopathy, valvular heart disease, or ST-segment elevation were not included. To find NSTEMI cases, clinical and demographic information was gathered, and cardiac troponin I levels were assessed. IBM SPSS version 23 was used for statistical analysis, and the chi-square test for stratified data was used, with a significance threshold of p ≤ 0.05. The mean age of participants was 52.73 ± 14.24 years, and 66% were male. The frequency of NSTEMI in ACS patients with a normal ECG was 26.4%. Other significant findings included a mean BMI of 28.3 ± 5.2 kg/m² and an average symptom duration of 15.40 ± 8.72 hours. The study found a notable prevalence of NSTEMI among ACS patients with normal ECGs, emphasizing that a normal ECG should not rule out myocardial infarction. Comprehensive clinical evaluation and cardiac biomarkers are essential for accurate diagnosis.

Keywords: **NSTEMI, Acute Coronary Syndrome, Normal ECG, Troponin I, Cardiac Biomarkers.**

INTRODUCTION

About 315 million people worldwide suffer from coronary artery disease, one of the main causes of morbidity and mortality.[1] coronary artery disease (CAD) can have various manifestations of which chest pain is among the most frequently reported conditions worldwide. Chest pain can be further classified by cardiac chest pain having chest pain that exacerbates on exertion and relieved on rest or nitroglycerine. Possible cardiac chest pain has two of the described features while non-cardiac chest pain has one of

the features to that of cardiac Chest pain.[2] A strong correlation has been reported in chest pain with typical findings and myocardial ischemia. Chest pain of cardiac can be further evaluated by doing an electrocardiogram (ECG) and cardiac enzymes. Cardiac-origin chest pain can be further classified as either ACS or stable angina based on the ECG and cardiac enzyme levels. Chest discomfort that lasts a certain amount of time and is not significantly detected by an ECG or enzyme study is known as stable angina. When coronary artery blood flow is decreased, a portion of the heart muscle is deprived of oxygen, which hinders the heart muscle's ability to contract correctly, called acute coronary syndrome (ACS).[3] ACS is a medical emergency that requires immediate attention. Heart enzyme levels such as troponin as well as CK-MB are measured while the ECG readings upon admission are utilized to categorize it. Based on troponin levels and ECG results, it is separated into ST-elevation ACS (STE-ACS) and non-ST-elevation ACS (NSTE-ACS).[4] The two additional subtypes of NSTE-ACS are unstable angina (UA) with normal troponin levels and non-ST segment elevation myocardial infarction (NSTEMI) with elevated troponin levels.[5] Various Studies have depicted that a significant number of Individuals who present with cardiac-origin chest pain might have normal ECG which makes the ECG a nondiagnostic tool for ACS.[6] Nonetheless, it has been shown that cardiac patients with normal ECGs had lower rates of death and morbidity.[7] To rule out myocardial damage from ischemia and enable timely treatment of any potential repercussions, all ACS patients with a normal ECG should have a thorough assessment, which should include a test of cardiac enzyme levels i.e. Troponin T and I. To provide information that emphasizes the potential for underlying myocardial damage as indicated by elevated Troponin I levels, this research attempts to assess the incidence of NSTEMI in patients with ACS who present with a normal ECG. There are various studies conducted on this subject showing significant variation in the results. One study found that 17% of individuals with ACS presented with normal ECG while another study revealed the proportion of about 24.67%.[6] This significant variability in the occurrence requires further addition in to the literature on this subject.[8] The burden of NSTEMI in ACS cases with normal ECG readings will be further examined in this research, emphasizing the need to evaluate cardiac biomarkers in patients with normal ECG to guarantee accurate diagnosis and treatment.

METHODOLOGY

To determine the incidence of NSTEMI in patients with ACS who had normal electrocardiograms, cross-sectional research was conducted at the Department of Cardiology, Khyber Teaching Hospital (KTH), Peshawar, between October 24, 2021, and April 24, 2022. The Institutional Review Board (IRB) approved the research protocol. The World Health Organization (WHO) sample size calculation was used to determine the final sample size, which came out to be 106 patients with a 95% confidence level, an 8% margin of error, and an expected frequency of NSTEMI of 22.8%. Participants aged 25 to 60 years, regardless of gender, who presented with ACS according to the operational definition, were included. The research excluded patients with cardiomyopathy, valvular heart disease, chronic liver disease, or ST-segment elevation on the ECG. All participants gave their informed permission. Age, gender, and body mass index . length of symptoms, and medical history pertaining to smoking, diabetes mellitus, and hypertension were among the many clinical and demographic data that were collected. Electrocardiograms were performed to assess ST-segment elevation, and troponin T levels

were evaluated, with levels of 0.5 ng/ml or higher considered indicative of myocardial infarction. The frequency of NSTEMI was recorded based on the operational definition using a specially designed proforma. Using IBM SPSS version 23, data was analyzed to determine means and standard deviations for numerical variables and frequencies and percentages for qualitative variables. To account for possible confounding variables, stratification was used. The chi-square test was then used; a p-value of ≤0.05 was deemed statistically significant.

RESULTS

The participants' ages ranged from 22 to 92 years old, with a mean age of 52.73 ± 14.24 years. The average length of complaints was 15.40 ± 8.722 hours, and the average Body Mass Index (BMI) was 28.3 ± 5.2 kg/m². Among the 106 patients, 70 (66.0%) were male and 36 (34.0%) were female. The frequency of patients with a BMI over 25 kg/m² was 45 (42.5%), while 61 (57.5%) had a BMI of 25 kg/m² or below. Additionally, 56 (52.8%) of the patients presented with complaints lasting 12 hours or below, and 50 (47.2%) had complaints lasting more than 12 hours. NSTEMI was recorded in 28 (26.4%) of the patients (Table 1) (Figure 1).

Table 1.
Demographic and Clinical Characteristics of Patients

Characteristic	Mean ± SD	Frequency (%)
Patient Age (Years)	52.73 ± 14.24	
Patient BMI (Kg/m²)	28.3 ± 5.2	
Duration of Complaints (Hours)	15.40 ± 8.722	
Gender		
Male		70 (66.0)
Female		36 (34.0)
BMI Categories		
25 kg/m² or below		61 (57.5)
More than 25 kg/m²		45 (42.5)
Duration of Complaints		
12 hours or below		56 (52.8)
More than 12 hours		50 (47.2)
NSTEMI Status		
Yes		28 (26.4)
No		78 (73.6)

Table 2.
Clinical Characteristics of Patients

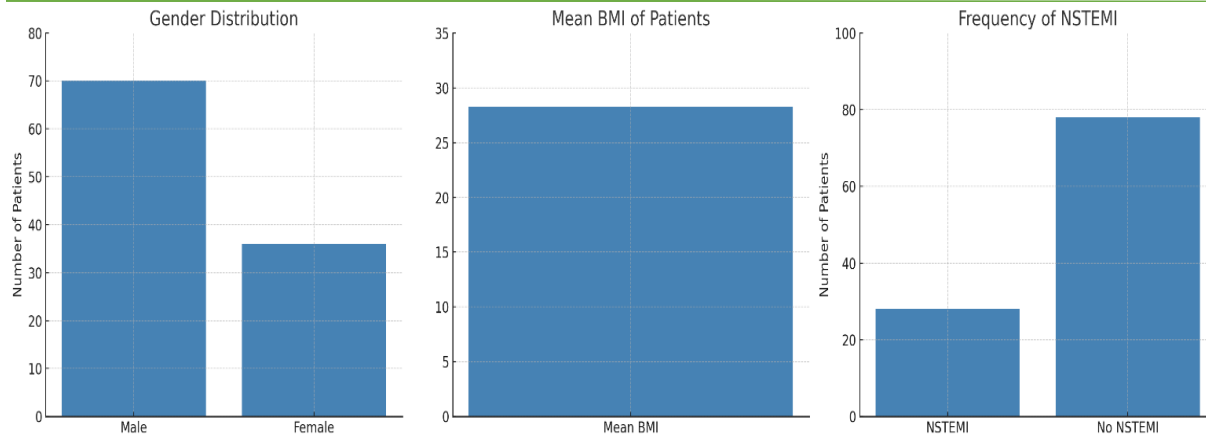| Variable	Frequency	Percentage (%)
Diabetes	32	28.5
Hypertension	45	40.1
Smoker	29	25.8

Figure 1.

DISCUSSION

ECG is a vital investigation to stratify patients according to their severity in the emergency department. Studies conducted over the last 20 years have shown that clinical evaluation and ECG results during ED presentation can frequently be used to identify low-risk patients. Generally speaking, a normal ECG is associated with a decreased risk of heart issues and death.[6]. It is important to understand that ECG has limitations in identifying ischemia, especially in specific regions like the true posterior left ventricular region, the distribution of the left circumflex coronary artery, and in individuals who have experienced an acute myocardial infarction (AMI).[9]. Further complicating the clinical picture at the time of patient presentation is the possibility that ischemic changes on the ECG are temporary.[10] It has been noted that many NSTEMI patients present with normal ECGs, depicting that ECG might not be diagnostic of ACS in a significant number of cases presenting in the ER.[2] In general, the incidence of morbidity and mortality from cardiac issues is low in patients with chest pain and a normal ECG.

However, even though these issues are minor, they shouldn't be disregarded.[5] Although cardiac complications in patients with normal ECG in the backdrop of NSTEMI have been reported, compared to individuals who experience ECG changes in NSTEMI, it has been linked to positive outcomes. Our study reported Normal ECG in patients with NSTEMI in 28 patients (26.4%).A similar study conducted within the same province by Iltaf reported that approximately 24.67% of NSTEMI patients presented with a normal ECG.[6] This finding aligns with our data, suggesting a consistent prevalence of normal ECG presentations among NSTEMI patients in this region. Another study conducted by Turnipseed revealed that 17% of patients with normal ECGs had ACS.[11] Other studies have documented an incidence of AMI ranging from 3% to 10% in patients with Normal ECG in the ER .[12,13] 17% of patients have a normal ECG at presentation, according to a study by Singer et al. using creatine phosphokinase-myocardial band (CPK-MB) as a diagnostic for myocardial infarction.[14] Among 1,912 patients with chest pain and a normal ECG, Forest et al. observed a 2% AMI rate in a large cohort. Remarkably, Chase et al.'s recent study assessing cardiac troponin enzymes discovered that 2.8% of ED patients with normal or nonspecifically changed ECGs nevertheless had AMI.[6] Our findings demonstrate a higher occurrence as compared to these studies. This disparity could result from the fact that some of the patients in our research were released after a negative test and then underwent exercise

treadmill testing immediately after a single negative cardiac marker was assessed. Risk stratification has a big impact on patient care and is a crucial part of managing ACS. Over the past ten years, various risk scores have been created in the medical literature to aid in more accurate clinical decision-making.[15]

Although electrocardiograms (ECGs) are essential for evaluating electrophysiological abnormalities and underlying heart diseases, doctors need to be mindful of their limitations. For instance, a study noted that 22% of patients with a normal ECG subsequently developed an NSTEMI.[16] In a multihospital observational study, Welch et al. (2001) examined the predictive value of normal or nonspecific initial electrocardiograms (ECGs) in patients with acute myocardial infarction (AMI). Those who presented with normal or nonspecific initial ECGs had lower in-hospital mortality rates than patients with diagnostic ECGs.In particular, the study found that the in-hospital mortality rate was 5.7% for patients with normal initial ECGs and 8.7% for patients with nonspecific initial ECGs. Because of the surprisingly high death rates found, this study emphasizes the significance of careful evaluation and management of AMI patients, even those with normal or nonspecific initial ECGs.[17]

Another research, titled the *DIFOCCULT Study*, has shed light on the limitations of current ECG interpretations for non-STEMI patients. The study, led by Aslanger et al., found that 28.2% of non-STEMI patients were re-classified as having acute coronary occlusion (ACO) when their ECGs were carefully reviewed. This subgroup demonstrated a higher rate of myocardial damage and increased in-hospital and long-term mortality compared to the broader non-STEMI population. This highlights the importance of refining ECG analysis methods to better identify high-risk patients and guide treatment strategies more effectively.[18] This observation also underscores the necessity for clinicians to perform a thorough clinical and biochemical assessment, as a normal ECG does not always exclude severe consequences, we think that ischemia ECG alterations are dynamic and could be difficult to spot.[19]

This study has significant limitations despite our findings. The study only included one study center and had a small sample size, which limits how broadly our findings may be applied. Future research with larger sample sizes is needed to better understand the diagnostic and prognostic capabilities of the ECG. A similar study conducted within the same province by Iltaf reported that approximately 24.67% of NSTEMI patients presented with a normal ECG (Iltaf, Year).[6] This finding aligns with our data, suggesting a consistent prevalence of normal ECG presentations among NSTEMI patients in this region. Furthermore, evaluating cardiac enzymes on time in hospitals with a large patient influx may not always be feasible. Therefore, factors such as associated costs and practical constraints should also be considered in clinical decision-making.

CONCLUSION

According to our research, there is a high prevalence of normal ECG in individuals with ACS who had non-ST elevation myocardial infarction. It means that a normal ECG does not rule out AMI and should be further examined to avoid more AMI-related problems.

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