

# Myocardial Infarction with Non-Obstructive Coronary Arteries

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## ABSTRACT

**Background:** Non-obstructive coronary artery disease affects certain people who are admitted to the hospital for an acute myocardial infarction (MINOCA). It is necessary to create risk categorization tools for these people since their prognosis is not always favorable. The purpose of this research was to examine the prognostic value of the GRACE score in a group of individuals with suspected MINOCA who were hospitalized.

**Methods:** This study was conducted in Bolan Medical College Hospital Quetta Pakistan from 2 June 2019 to July 2020. Total 56 patients with MINOCA were included. Patients' mortality and major adverse cardiac events (MACE) a combination of all-cause mortality and hospitalization from acute myocardial infarction (AMI), heart failure (HF), stroke (ischemic), & acute limb ischemia (ALI) were assessed for a period of one. The Grace score's discriminating power in predicting cardiovascular events was investigated using the Mann-Whitney U test and ROC curves. The level of significance was fixed at 5%.

**Results:** In study of 56 MINOCA patients; 55.4 percent were female (median age 67). After a year, 5.5% of deaths occurred and 9.1% experienced MACE. It was shown that a higher GRACE score increased the probability of mortality ( $p=0.019$ ; AUC 0.90; 95 percent CI 0.812-0.007) and MACE ( $p=0.034$ )

**Conclusion:** The GRACE score is effective for risk classification of patients with MINOCA, since the criteria incorporate a variety of diagnoses and prognosis.

**Key words:** Coronary artery, Diseases, Prognosis, Myocardial infarction, Non- obstructive

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## INTRODUCTION

Over the last few decades, researchers have established a relationship between acute myocardial infarction (AMI) and obstructive coronary artery disease (OCAD), that impacts more than 90% of AMI patients [1]. Patients with AMI who do not have obstructive plaques, account for about 10% of the population, a finding that has been verified in several studies [2,3].

It has long been assumed that a clinical presentation with symptoms, electrocardiographic changes, and laboratory changes indicative of acute coronary syndrome in the absence of obstructive coronary artery disease was false positive [4]. According to the multiple current studies, the prognosis in such cases may be dismal, with mortality and major adverse cardiovascular events (MACE) rates that are equivalent to those of patients with obstructive disease [5]. Patients who have had an AMI but do not have a significant coronary artery disease as a result of their condition are referred as MINOCA (myocardial infarction with non-obstructive coronary arteries) [6]. Acute coronary syndrome (ACS) has many of the same symptoms and indicators with coronary artery disease (CAD) [7]. Given the vast variety of possible diagnoses and

the scarcity of empirical evidence, it is presently impossible to determine the most effective treatment method for these patients. It has been strongly recommended that the underlying problem be investigated, diagnosed, and treated. A similar pattern may be seen in the clinical course and prognosis of MINOCA patients; although the vast majority of patients recover without any cardiac problems, a disconcerting minority of patients have a bad prognosis, with a one-year mortality rate of approximately 5 percent [8]. As a consequence, improved prognostic categorization for persons suffering with MINOCA is essential [9,10].

### OBJECTIVES

In this study, the researchers investigate the characteristics of MINOCA patients who were admitted to a single institution during a four-year time (from 2015 to 2018) and impact of GRACE score in modifying prognosis of MINOCA patients over the period of a year.

### METHODS

The subjects of a retrospective, observational, single-center cohort study conducted in Bolan Medical College Hospital Quetta Pakistan from 2 June 2019 to July 2020. In this study we included 56 consecutive patients hospitalized in a Cardiology unit and diagnosed with MINOCA throughout that period.

Following a study of the patients' medical records, the researchers made the diagnosis of MINOCA based on the criteria established by the European Society of Cardiology (ESC): AMI that meets the fourth Universal Definition of Infarction is defined as the lack of obstructive epicardial coronary artery disease (stenosis less than 50%), as well as the absence of a clinically overt particular reason for the acute presentation.

Heart attacks are more likely to occur in those who have been diagnosed with myocarditis by cardiac magnetic resonance (CMR) or who have had symptoms of myocarditis (pleuritic discomfort, increased inflammation markers, respiratory illness, or gastrointestinal infection during the prior four weeks)(according to ESC Working Group standard) [11].

As specified by InterTAK clinical guidelines in the International Expert Consensus Document on Takotsubo Disease, patients suspected of having the syndrome were not included.

There was a review of patients' medical records that included information on demographics and clinical data, as well as data on electrocardiograms, echocardiograms and angiograms. Diagnosis of dyslipidemia in patients who are not taking a lipid-lowering medicine, or who have LDL cholesterol levels that qualify them for lifestyle modifications and/or pharmacological treatment, was established in the 2019 European Society of Cardiology (ESC) recommendations. While in the hospital, every patient was provided with access to an echocardiogram; whether they had received CMR at any time during their

stay was also observed. Although the exact origin of the infarction could not be confirmed, CMR was deemed diagnostic if it was able to identify or imply an ischemic cause of the MINOCA, even if the site of the infarction could not be determined (discovery of subendocardial or transmural scarring).

Final conclusions of MINOCA were made after analyzing clinical data and comparing with other studies and procedures.

In order to do the one-year follow-up, we examined medical records for the incidence of both all-cause mortality and MACE. Medical records were consulted to ascertain the reasons for readmission. A proven method was used to compute the GRACE 2.0 risk score upon admission.

### Statistical analysis

IBM SPSS-statistics, version 25, was used for the statistical analysis. A sample size of 5% of the total population is required for a finding to be considered statistically significant.

Demographic information was utilized to describe the characteristics of the sample. Categorical variables were represented by percentages. For the quantitative variables, the Kolmogorov-Smirnov test with Lilliefors adjustment was performed to confirm that they were normally distributed.

These variables have a non-Gaussian distribution, and the median and interquartile range was utilized to define this distribution (IQR). A non-parametric technique was used to examine the quantitative variables, which included the Mann-Whitney test and the t test. The discriminating capacity of the GRACE score for the prediction of cardiovascular events was evaluated using a receiver operating characteristic (ROC) curve. In order to find the GRACE score cutoff points that most accurately predicted the occurrence of the primary and secondary outcomes, the maximum Youden index was used.

### RESULTS

In this study 56 patients with acute myocardial infarction who met the inclusion criteria were enrolled which represented 7 percent of all AMI admissions in this institution over the time period under study. The clinical parameters that were evaluated upon admission are listed in Table 1.

Patients had an average age of 67 years (interquartile range: 60.5–76.3), with 55.4 percent of them were female. The most prevalent risk factors were arterial hypertension (69.6 percent), diabetes in (69.6 percent) and dyslipidemia in (71.4 percent). During the study, just 1.8 percent of the patients had previously AMI. The initial ECG was normal in 46.4 percent of patients, but ST-segment elevation was seen in 10.7 percent of those who had it.

**Table 1: Acute myocardial infarction (AMI) patients n=56 with non-obstructive coronary artery disease.**

Total	56
Demographic data	
Average age in years	67
Gender Female %	55.4
Risk factors of Cardiovascular %	
Arterial hypertension	69.6
diabetes mellitus type II	17.9
Dyslipidemia	71.4
Habit of Smoking	16.1
Previous AMI	1.8
Obese	26.8
Family history of early cardiovascular disease	10.7
Alterations in Electrocardiographic results %	
Normal electrocardiogram	46.4
Elevation of ST	10.7
Depression of ST	8.9
Inversion of T wave	30.4
Pathological q wave	8.9
Left bundle branch block	3.6
Grace score 11	
Median (IQ)	113.5

Table 2 summarizes the clinical data collected from patients throughout their hospitalization, including supplementary diagnostic tests and treatment indicated after discharge.

5.4 percent of patients developed heart failure during their stay, 30.9 percent had aberrant echocardiographic findings of segmental contractility, and 8.2 percent had a decreased ejection fraction (50 percent). Patients were administered angiotensin-converting enzyme (ACE) and angiotensin-receptor-blocking (ARB) drugs in conjunction with beta blockers (58.2%), statin drugs (83.6%) or acetylsalicylic acid (61.8%) drugs when they were discharged, with 27.3% receiving double antiplatelet medication.

MINOCA diagnoses with cardiac magnetic resonance

imaging (CMR) results are summarized in Table 2. Table 3 shows the etiology of MINOCA and patients' GRACE scores. Only 12 patients (21.4%) underwent CMR, which was shown to be diagnostic in 50% of the instances. There was a median wait time of 3.3 months (IQR 1.5–10.7) for CMR in the majority of patients since MINOCA. There was a MINOCA etiology observed in 17.9 percent of the 56 cases examined. Ischemic disease of unknown etiology was the most common cause, followed by vasospasm (5.4 percent). There was just one incidence of a cardiac embolic stroke. No one had intravascular ultrasound or optical coherence tomography, so it was impossible to determine if there was any plaque disruption or spontaneous coronary dissection.

**Table 2: Clinical course during hospitalization of patients admitted for MINOCA.**

Clinical course during hospitalization	
Length of hospital stay in days	4 (3-5)
Development of heart failure	5.4
Laboratory data	
High troponin I level	5.02
Echocardiogram % (n)	
Alterations in segmental contractility	30.9
EF < 40%	4.1

EF 40-50%	4.1
EF > 50%	98.1
Result of coronary angiography	
Stenosis of coronary artery	58.9
Stenosis < 50%	41.1
Myocardial bridging	7.1
Thrombus in intracoronary artery	3.6
Slow coronary flow	8.9
Coronary ectasia	3.6
Drugs prescribed at the time of discharge % (n)	
ACE inhibitors	72.7
Spirolactone	1.8
Beta blocker	58.2
Acetylsalicylic acid	61.8
Dual anti platelet activity	27.3
Statin	83.6
*EF: Ejection fraction	

**Table 3: Etiology of MINOCA & respective grace score.**

	% (n)	GRACE ( score)
Cardio embolic stroke	1.8	138
Vasospasm	5.4	131
Plaque disruption	0	
Spontaneous coronary dissection	0	
Ischemic etiology	10.7	110
Without a definite diagnosis	82.1	112

## DISCUSSION

In this study patients with MINOCA diagnoses have comparable characteristics to those published in various worldwide investigations [12-14]. A recent comprehensive examination of patient records revealed a median age of 55 years and a larger proportion of female patients, indicating sex-related or hormone impacts on the disease's pathogenesis. However, contrary to our results, several worldwide researches have shown that these individuals had a decreased incidence of traditional cardiovascular risk factors. A research in Portugal found a similar significant frequency of dyslipidemia and arterial hypertension as in this study. The most frequent risk factors for cardiovascular disease are arterial hypertension (66.9%) as well as dyslipidemia (57.2%), however our sample varies in sex distribution and incidence of tobacco (28.5 percent), diabetes mellitus (31.9 %), and history of AMI (17.9 percent) [15,16].

The prognosis in this group was comparable to that reported in other observational studies. Kang et al.10 also found a 7.8% yearly MACE rate, which was similar to

that seen in a comparison group of acute coronary syndrome patients with one or two vessels disease. Pasupathy et al. reported a 12-month all-cause death rate of 4.7 percent in a comprehensive evaluation of research on MINOCA patients All-cause mortality in the COAPT trial [17] was 3.9 percent, and the composite end point of cardiac death and re-hospitalization after one year was 12.6 percent-much more worrisome data [17].

Previous investigations have documented a heterogeneous clinical course; whereas the majority of patients had a positive outcome with no cardiac function consequences, a considerable number of individuals suffer MACE in the near term. Because it is difficult to establish an etiological diagnosis in all patients and because it is a clinical challenge to determine which patients need closer monitoring and more active secondary prevention medication, prognostic stratification is critical. Women, smoking history, atrial fibrillation, even before AMI and ST-segment elevation upon admission are just some of the variables that have been linked to a poorer prognosis in patients with coronary artery disease [18]. Other variables include the

number of coronary arteries with less than 50% obstruction, LDL and Creatinine levels, ejection fraction, and the number of coronary arteries that have stenosis less than 50% [18]. In these individuals, the GRACE score is an excellent predictive tool. When contrasted to a large variety of difficult-to-integrate signals, the equipment provides for objective risk calculation, making it more practical for doctors. In addition, the application of this risk stratification score in acute coronary syndrome is well-supported by scientific data. In addition, it has been routinely used in clinical practice for risk classification of patients with MINOCA before catheterization.

According to our results, the GRACE score is associated with one-year MACE. In patients without persistent ST-segment elevation, our statistical analysis identified cut-off values similar to those suggested by the ESC for the management of acute coronary syndromes. "Low risk" MINOCA patients have a GRACE score of 109 or less, "intermediate risk" patients have a GRACE score of 109-139 or more, and "high risk" patients have a GRACE score of 140 or more. An AMI patient would thus be classified into a risk group independent of the presence of obstructive coronary artery disease (low, intermediate, or high). Prompt investigation for an accurate diagnosis and adequate treatment is always suggested, regardless of classification. In the diagnosis of MINOCA, the use of CMR is essential.

When the condition is in its early stages, it is best to begin treatment (ideally in the first seven days of presentation) [19]. Cardiologists' diagnoses may be changed in around half of patients who undergo the test, and it helps them formulate the best treatment plan for the remaining patients in up to 87% of cases [20].

The low proportion of patients who received CMR in this research might be due to limited availability of CMR in our location. Similarly, despite the fact that intravascular ultrasonography and optical coherence tomography are critical diagnostic tools for plaque disruption and spontaneous coronary dissection, they are not routinely available in our institution's clinical practice. Secondary preventative treatment was recommended upon discharge in the current trial based on clinical suspicion of illness and current ESC guidelines. ACE inhibitors, ARBs, beta-blockers, and statins were administered to the majority of patients. However, given the paucity of strong scientific data, the use of conventional medicines in secondary prevention in this community of people with various diagnoses is debatable. According to researchers, the MINOCA BAT trial will compare the effects of using ACE inhibitors/ARBs and beta blockers with a placebo on mortality as well as other cardiovascular events in more than 5,600 participants. An observational study of MINOCA patients documented in the SWEDEHEART registry found that these medications were suitable for this population, according to newly released data [21], demonstrating that ACE inhibitors and ARBs, as well as perhaps beta blockers, have long-term positive benefits in avoiding cardiovascular events in these individuals.

## CONCLUSION

This research emphasizes the variety of origins and prognosis of MINOCA, which varies depending on the etiology and is not always benign. The GRACE score upon admission was demonstrated to be a valuable measure for identifying patients with a poor prognosis, with high discriminating capacity in predicting events throughout our sample's follow-up.

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