



## Comprehensive Study of Culprit Lesions in Non-ST Elevation Myocardial Infarction (NSTEMI) Through invasive Coronary Angiography: A Cross-Sectional Study

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### Declaration

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### ABSTRACT

**Background:** Non-ST elevation myocardial infarction is the leading cause of morbidity and mortality. It is essential to identify and explain the culprit lesions in NSTEMI patients for treatment and successful outcomes. **Objective:** The aim of this study was to comprehensively study culprit lesions in Non-ST elevation myocardial infarction through invasive coronary angiography. **Materials and method:** "The present cross-sectional observational study was carried out at the department of cardiology Hayatabad medical complex Peshawar over a period of six months from March 2024 to August 2024 after taking permission from the ethical committee of the institute." Consecutive non probability sampling technique was used and sample size of 139 was calculated using WHO calculator. Individuals of both genders and different age groups (ranged 18-80 years) diagnosed with NSTEMI were included. After obtaining informed consent, eligible patients were admitted to the study. Patients were subjected to invasive Coronary Angiography in order to ascertain the details of angiographic findings. Data was analyzed using SPSS version 23. Mean + SD/Median (IQR) was calculated for quantitative variables like age, duration of symptoms and BMI. Frequencies and percentages were calculated for gender, residence, social class, occupation status and characteristics of culprit lesions. Characteristics of culprit lesions were stratified by age groups, gender, social class, occupation status, residence and BMI to see effect modifiers. Post stratification chi square test or Fischer Exact Test were applied keeping P value < 0.05 as significant. All the results were presented in tables and or graphs. **Results:** A total of 139 individuals with NSTEMI were included in this study out of which 103(74.10%) were male and 36(25.90%) were females. The mean age of the study participants was  $67.2 \pm 11.8$  years. Mean BMI of the individuals was  $30.2 \pm 7.1$ kg/m<sup>2</sup>. 80% of the participants had hypertension. Coronary angiography revealed a Culprit lesion in 120 cases (86%). Culprit lesions were most prevalent in the left anterior descending in 50 cases (41.6%) followed by left circumflex artery (LCX) in 35 cases (20.1%). The major types of culprit lesion were thrombotic lesions 45%. Out of all the cases of culprit lesions stenosis was seen in 16.6% individuals. Characteristics of culprit lesions were stratified by age groups, gender, social class, and risk factors. Culprit lesions increased with age and female gender and was statistically significant (P value < 0.05). **Conclusion:** The present study concluded that invasive coronary angiography is a major diagnostic tool in the study of culprit lesions in Non-ST elevation myocardial infarction. Coronary angiography revealed a culprit lesion in 86% of the study population.

### INTRODUCTION

One serious cardiovascular disease associated to significant morbidity and mortality is non-ST elevation myocardial infarction (NSTEMI). For optimal treatment and better results, it is essential to identify and explain the culprit lesions in NSTEMI patients. One common diagnostic procedure for evaluating coronary artery

disease is invasive coronary angiography (ICA) and a thorough investigation concentrating on the NSTEMI's pathophysiology might provide important insights.<sup>1</sup> Cardiovascular disorders (CVDs) continue to be a leading cause of morbidity and mortality worldwide. Significantly contributing to this burden is non-ST elevation myocardial infarction (NSTEMI). The hallmarks

of NSTEMI are myocardial ischemia without the traditional ST-segment elevation on the electrocardiogram, as well as modest or vague symptoms.

The management of NSTEMI still presents clinical difficulties in spite of advancements in diagnostic and treatment techniques need a subtle understanding of the underlying cardiovascular pathophysiology in order to develop successful treatment methods.<sup>2</sup> In order to tailor interventions and optimize results, it is essential to identify and characterize the culprit lesions in NSTEMI individuals. Culprit lesions, which are defined as the coronary lesions that caused the ischemic event, include a variety of anatomical, morphological, and hemodynamic characteristics that affect how the disease progresses and how well treatment works. The gold standard for evaluating and visualizing coronary artery occlusions is still invasive coronary angiography (ICA), which helps identify the responsible lesions and provides a comprehensive map of the coronary vasculature.<sup>3</sup> Invasive coronary angiography in patients with non-ST elevation myocardial infarction (NSTEMI) varies; some studies show that in more than 10% of patients with NSTEMI and multi-vascular disease, the culprit lesion was ambiguous.<sup>4</sup> Although a number of studies have looked at the pathophysiology of NSTEMI, there is a noticeable lack of research on a thorough examination of the culprit lesions utilizing ICA. In order to close this gap, our study uses invasive coronary angiography to thoroughly examine the characteristics of the culprit lesions in NSTEMI patients. By methodically analyzing the location, severity, morphology, and hemodynamics of lesions. So the main objective of this study was to examine culprit lesions in non-ST elevation myocardial infarction through invasive coronary angiography.

## MATERIALS AND METHOD

The present cross sectional observational study was carried out at the department of cardiology Hayatabad medical complex Peshawar over a period of six months from March 2024 to August 2024 after taking permission from the ethical committee of the institute. Consecutive non probability sampling technique was used and sample size of 139 was calculated using WHO calculator by taking 10% prevalence of unclear culprit lesions in NSTMI with multi vessel disease at 95% confidence interval and 5% margin error. Individuals of both genders and different age groups (ranged 18 -80 years) diagnosed with NSTEMI were included while individuals with coronary artery bypass graft (CABC) surgery, recurrent chest pain ,hemodynamic instability, shock or sever hypotension were excluded. As per inclusion criteria patients from OPD of cardiology department from our hospital were enrolled. Baseline demographics such as age, gender, residence and social class and clinical data such as hypertension, diabetes and smoking history was recorded. Informed consent was obtained from all participants. Anonymity and confidentiality of patients' data was maintained throughout the study. After obtaining informed consent eligible patients were admitted to the study. After admission, patients were subjected to invasive Coronary Angiography in order to ascertain the details of angiographic findings, including location of culprit lesions,

severity of stenosis were recorded. Data was recorded by the researcher under the supervision of consultant interventional cardiologist having at least three years post fellowship experience. All the above information was recorded on a predesigned proforma. Data was analyzed using SPSS version 23. Mean + SD/Median (IQR) was calculated for quantitative variables like age, duration of symptoms and BMI. Normality of data was checked by Shapiro Wilk Test. Frequencies and percentages were calculated for gender, residence, social class, occupation status, sedentary lifestyle and characteristics of culprit lesions. Characteristics of culprit lesions were stratified by age groups, gender, social class, occupation status, residence, sedentary life style, duration of symptoms and BMI to see effect modifiers. Post stratification chi square test or Fischer Exact Test were applied keeping P value < 0.05 as significant. All the results were presented in tables and or graphs.

## RESULTS

A total of 139 individuals with NSTEMI were included in this study out of which 103(74.10%) were male and 36(25.90%) were females. The mean age of the study participants was  $67.2 \pm 11.8$  years. Mean BMI of the individuals was  $30.2 \pm 7.1\text{kg/m}^2$ . 80% of the participants had hypertension, sixty (43.1%) had a history of smoking, 84 (60%) had hyperlipidemia, and 103 (74%) had diabetes mellitus. Majority of the individuals belong to urban areas and middle class families as presented in **table 1**. Coronary angiography revealed a Culprit lesion in 120 cases (86%). The failure to identify the culprit lesion was associated with the presence of calcifications, bifurcation lesions, and three-vessel disease. In 19 patients (14.0%), angiography was unable to identify the underlying lesion as presented in **figure 1**. Culprit lesions were found in the left anterior descending (LAD) in 50 cases (41.6%), left circumflex artery (LCX) in 35 cases (20.1%), right coronary artery (RCA) in 30 cases (25%), left main artery (LM) in 2.5%, and ramus intermediate in 2 cases (1.6%).The major types of culprit lesion were thrombotic lesions 54(45%) followed by, calcified lesions 45(37.5%) and complex lesions 21(17.5%). out of all the cases of culprit lesions stenosis was seen in 20 (16.6%) individuals. Characteristics of culprit lesions were stratified by age groups, gender, social class, and risk factors. Culprit lesions increased with age and female gender and was statistically significant (P value < 0.05) as presented in **table 3**."

**Table 1**

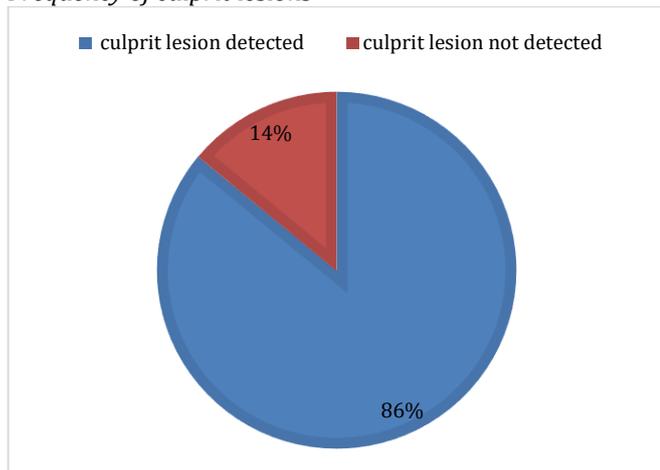
*Demographic features of the study participants N=139*

Features	Frequency /percentage
<b>Gender</b>	
Male	103(74.10%)
Female	36(25.90%)
Mean age in years	$67.1 \pm 12.0$
Mean BMI	$30.2 \pm 7.1\text{kg/m}^2$
Diabetes mellitus	103(74%)
Hyperlipidemia	84(60%)
Hypertension	112(80%)
Smoking history	60(43.1%)
<b>Residence</b>	
Urban	103(74%)
Rural	36(26%)
<b>Economic status</b>	

Poor	42(30.2%)
Middle class	50(35.9%)
High class	47(33.8%)

**Figure 1**

Frequency of culprit lesions

**Table 2**

Locations and types of culprit lesions detected through invasive angiography

Location	Frequency/ percentage
Left anterior descending artery	41.6%
Left circumflex artery	20.1%
Right coronary artery	25%
Left main artery	2.5%
Ramus intermedius	(1.6%)
<b>Types of lesions</b>	
Thrombotic lesions	54(45%)
Calcified lesions	45(37.5%)
Complex lesions	21(17.5%)

**Table 3**

Stratification of culprit lesion by various demographic features (n=120)

Features	Frequency /percentage	Value of P
<b>Gender</b>		
Male	25(24%)	< 0.05
Female	18(50%)	
<b>Age</b>		
18-48	11(10%)	< 0.05
40-80	109(90%)	
Diabetes mellitus	40(74%)	0.07
Hyperlipidemia	35(60%)	0.07
Hypertension	34(80%)	
Smoking history	37(43.1%)	
<b>Residence</b>		
Urban	60(50%)	0.8
Rural	60(50%)	
<b>Economic status</b>		
Poor	42(30.2%)	.07
Middle class	40(35.9%)	
High class	38(33.8%)	

## DISCUSSION

The coronary stenosis thought to be the cause of acute coronary syndrome (ACS) is referred to as a culprit lesion and its early detection allows patients with MVD to receive the proper treatment.<sup>5</sup> Typical characteristics of unstable plaque, including intraluminal filling defects that resemble thrombus, plaque ulceration, irregularity, dissection, and reduced flow, are frequently present in this culprit lesion.<sup>6</sup> In individuals with NSTEMI, it may be difficult to accurately identify the culprit lesion with invasive

angiography.<sup>6</sup> In the present study we examined Culprit lesions in non-ST elevation myocardial Infarction through invasive Coronary Angiography. A total of 139 individuals with NSTEMI were included in this study out of which 103(74.10%) were male and 36(25.90%) were females. The mean age of the study participants was  $67.2 \pm 11.8$  years. Mean BMI of the individuals was  $30.2 \pm 7.1\text{kg/m}^2$ . 80% of the participants had hypertension, sixty (43.1%) had a history of smoking, 84 (60%) had hyperlipidemia, and 103 (74%) had diabetes mellitus. Majority of the individuals belong to urban areas and middle class families. Similar demographic feature were reported in the study conducted by Balbi et al in which they evaluated culprit lesion in NSTEMI individuals.<sup>6</sup> in our study 80% of the participants had hypertension, 43.1% had a history of smoking, 60% had hyperlipidemia, and 74% had diabetes mellitus. Similar risk factors were seen in the study of Sial et al.<sup>8</sup> This study precisely assess the identification of culprit lesions in patients who present with NSTEMI. Culprit lesion was identified by angiographic features such as thrombus, ulceration, plaque irregularity, or dissection with impaired TIMI flow  $\leq 2$ , corresponding to ECG/echo findings. Coronary angiography revealed a Culprit lesion in 120 cases (86%). The failure to identify the culprit lesion was associated with the presence of calcifications, bifurcation lesions, and three-vessel disease. In individuals with, culprit lesion identification can be difficult; in individuals with non-ST elevation myocardial infarction up to one-third of cases, the culprit is unclear via angiography.<sup>9</sup> culprit lesion was detected in 86% of the individuals through invasive angiography. these results are consistent with the study of Balbi et al in which they reported 85%.<sup>7</sup> The diagnosis of the culprit lesion was less obvious in our series due to lesion complexity, which included calcifications and bifurcations. Theoretically, unstable features could be concealed by lesion complexity, particularly when thrombus development is absent. Our study revealed that these lesions were found in the left anterior descending in 50 cases (41.6%), left circumflex artery in 35 cases (20.1%), right coronary artery in 30 cases (25%), left main artery in 2.5%, and ramus intermediate in 2 cases (1.6%) respectively. Similar results were recorded in the previous study in which the lesions was most prevalent in left anterior descending artery followed by left circumflex artery and right coronary artery respectively.<sup>7</sup> thrombotic lesions were more common in the present study (45%) followed by, calcified lesions 37.5% and complex lesions 17.5%. similar types of lesions were reported by Park et al<sup>10</sup> which support the present study. Characteristics of culprit lesions were stratified by age groups, gender, social class, and risk factors. Culprit lesions increased with age and female gender and was statistically significant (P value < 0.05). Our study findings are similar to the study conducted by Moustafa et al in which old age group and female gender revealed up surge in lesions formation.<sup>11</sup>

## Limitation of the study

The main limitations of our study were single-center study nature, non-probability sampling, short study duration and absence of intracoronary imaging.

## CONCLUSION

The present study concluded that invasive coronary angiography is a major screening tool in the study of

culprit lesions in Non-ST elevation myocardial infarction. Coronary angiography revealed a culprit lesion in 86% of the study population.

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