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ORIGINAL ARTICLE

Non-invasive predictors & clinical outcomes of Non ST Elevation myocardial infarction (NSTEMI) with completely occluded coronary artery (OCA)

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ABSTRACT

Background*:* Thrombolysis in Myocardial Infarction (TIMI) score has been used to predict outcomes in patients presenting with non-ST elevation myocardial infarction (NSTEMI) with occluded coronary artery (OCA). Our study assessed other predictors for patients with NSTEMI with OCA undergoing early percutaneous coronary intervention (PCI).

Objective: To assess the independent predictors & clinical outcomes of patient with Non-ST- elevation myocardial infarction (NSTEMI) with occluded coronary artery (OCA).

Methods: A prospective cohort of 100 patients presented with NSTEMI with occluded coronary artery from December 2018 to May 2019 in Cardiology Department, Zagazig University Hospitals and Gamal Abdel-Naser Health Insurance Hospital were recruited. Patients were divided into two groups: group (A): patients with NSTEMI with non-occluded artery and group (B): patients with NSTEMI with occluded artery. Patients underwent PCI during admission. We analyzed the demographic, angiographic data and potential risk predictors for major adverse cardiac events (MACE) and death during in hospital follow up.

Results: Patients with totally occluded culprit lesion were statistically significant younger in age (mean age in years 56.9 ± 8.6) versus (mean age in years 62.4 ± 11.1) in patients with patent culprit vessel, more smoking (seventeen patients, 77.3%) versus (thirty-five patients, 44.9%) in patients with patent culprit vessel. Patients with totally occluded culprit vessel had higher incidence of MACE during hospital stay (six patients, 27.3%) versus (seven patients, 9%) in patients with patent culprit vessel and higher Recurrent ischemic symptoms and decompensated HF. Using the multivariant analysis of the predictors of total occlusion culprit vessel, it was found that only Door to cath-lab could be considered an independent predictor of total occlusion culprit vessel in patients presented by NSTEMI.

Conclusion: A quarter of NSTEMI patients had an occluded culprit coronary artery. They were more likely to be affected by smoking with high troponin and CK-MB. These patients were more prone to occurrence of MACE.

Keywords: *NSTEMI, PCI, OCA.*

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INTRODUCTION

Non-ST Elevation Myocardial Infarction (NSTEMI) is often thought to be due to incomplete occlusion of the culprit artery whilst ST-Elevation Myocardial Infarction (STEMI) is often thought to be due to complete occlusion of the culprit artery [1, 2]. However, studies have shown that about a quarter of NSTEMI are actually due to complete occlusion of the culprit artery, not dissimilar to the findings of STEMI on coronary angiography [3, 4]. Nonetheless, NSTEMIOA is often treated as less urgent than STEMI. There had been minimal data on the differences between NSTEMI with occluded artery (NSTEMIOA) and NSTEMI

with patent artery (NSTEMIPA) in terms of clinical characteristics and outcomes, particularly in the context of early versus late percutaneous revascularisation [5]. The objectives of this study were to investigate the demographics, clinical risk profile, angiographic differences between these two cohorts, and also to investigate theclinical outcomes of patient with NSTEMIOA and NSTEMIPA.

PATIENTS AND METHODS

This prospective cohort study was conducted in Cardiology Department, Zagazig University Hospitals and Gamal Abdelnaser Health Insurance Hospital.

We included 100 consecutive patients with known NSTEMI referred for Coronary Angiography in our Cath Lab, within a time period of six months from December 2018 to May 2019. Patients were divided into 2 groups: group (A): patients with NSTEMI with patent artery (NSTEMIPA) and group (B): patients with NSTEMI with occluded artery (NSTEMIOA). Written consent of acceptance of sharing in the study was taken from all patients. The study was approved by the research ethical committee of Faculty of Medicine, Zagazig University and Gamal Abdelnaser Health Insurance Hospital. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion Criteria: 1. Patients between 18 – 70 years. 2. Rise in cardiac biomarkers of myocardial necrosis (Troponin T) above reference level associated with one of the following: a- ECG changes (ST-segment depression, T wave inversion, Transient ST-segment elevation or normal ECG). b- Any ischemic symptoms as: (chest pain, dyspnea, easy fatigability, etc.). 3.Invasive coronary angiogram should be done during hospital stay.

Exclusion Criteria: 1. Patients with diagnosis of STEMI. 2. Patients with past history CABG. 3. Patients who had an outpatient instead of inpatient coronary angiogram. 4. Known coagulopathy and bleeding tendency. 5. Contraindication to dual antiplatelet therapy.

Methods:

The patients were subjected to full history taking, clinical examination, and imaging studies. Imaging studies included echocardiography, resting 12 lead surface ECG, coronary angiography. Digital coronary angiograms were analyzed offline with an automated edge detection system (Philips Integris 5000, Netherland) by using the dye-filled guiding catheter as a reference. Serum creatinine and blood urea nitrogen were done before coronary angiography while troponin and CK-MB were done every 8 hours for 1st 24 hours then daily for 3 days. TIMI flow following PCI was done and the presence of complications such as coronary dissection, perforation, abrupt vessel closure or others were recorded. All patients were followed-up during the hospital period with special emphasis on all causes of mortality and recurrent ischemic symptoms with or without re-elevation of cardiac enzymes which necessitate second angiography.

Statistical analysis:

Data were analyzed using the Statistical Package for Social Sciences (SPSS) release 16.

Data showing normal distribution were presented as the means and standard deviation. For comparison between the means of two groups, the t-test was used. The non-parametric

values were tested using the Mann–Whitney-U test. Qualitative data are represented by frequency and relative percentage and chi-square test was used for testing the association of the qualitative data. In all analyses, *P* values <0.05 were considered statistically significant.

RESULTS

The differences between NSTEMIPA and NSTEMIOA in terms of medical history are summarized in Table 1. Patients with totally occluded culprit lesion were statistically significant younger in age (mean age in years 56.9 ± 8.6) versus (mean age in years 62.4 ± 11.1) in patients with patent culprit vessel, more smoking (seventeen patients, 77.3%) versus (thirty-five patients, 44.9%) in patients with patent culprit vessel, while there was no significant difference regarding other risk factors (Table 1).

The Cardiac markers are presented in Table 2. There was statistically significant difference between totally occluded culprit vessel group and patent culprit vessel group regarding peak High-sensitivity cardiac troponin and peak CK-MB (it was higher in totally occluded culprit vessel group) (Table 2).

The angiographic data are presented in Table 3. There was statistically significant difference between totally occluded culprit vessel group and patent culprit vessel group regarding Culprit identification, site of Culprit vessel, Pre-dilatation, TIMI flow pre, TIMI flow post and final results (Table 3).

The data of clinical outcomes are presented in Table 4. Patients with totally occluded culprit vessel had higher incidence of MACE during hospital stay (six patients, 27.3%) versus (seven patients, 9%) in patients with patent culprit vessel and higher recurrent ischemic symptoms and decompensated HF (Table 4).

Using the multivariant analysis of the predictors of total occlusion culprit vessel, it was found that only Door to cath-lab could be considered an independent predictor of total occlusion culprit vessel in patients presented by NSTEMI (Table 5).

Table (1): Comparison between the studied groups regarding the demographic data.

Demographic data	Group A	Group B	**Test**	**P-value (Sig.)**
Count	78	22		
Gender				
Male	58 (74.4%)	21 (95.5%)	‡F	0.038 (S)
Female	20 (25.6%)	1 (4.5%)		
Age (years)				
Mean ± SD	62.4 ± 11.1	56.9 ± 8.6	2.152 *	0.034 (S)
Risk factors				
DM	35 (44.9%)	9 (40.9%)	0.109 ‡	0.741 (NS)
HTN	53 (67.9%)	12 (54.5%)	1.355 ‡	0.244 (NS)
Smoking	35 (44.9%)	17 (77.3%)	7.218 ‡	0.007 (S)
Dyslipidemia	34 (43.6%)	11 (50%)	0.285 ‡	0.594 (NS)
Family history	9 (11.5%)	3 (13.6%)	‡F	0.723 (NS)

Table (2): Comparison between the studied groups regarding the cardiac enzymes.

Cardiac enzymes	Group A	Group B	**Test**	**P-value (Sig.)**
Count	78	22		
High-sensitivity cardiac Troponin (µg/L)				
Mean ± SD	0.32 ± 0.50	0.58 ± 0.59	-1.827 •	0.068 (NS)
Peak High-sensitivity cardiac Troponin (µg/L)				
Mean ± SD	0.56 ± 0.59	0.86 ± 0.65	-2.501 •	0.012 (S)
CK-MB (IU/L)				
Mean ± SD	18.3 ± 21.3	23.4 ± 20.6	-1.323 •	0.186 (NS)
Peak CK-MB (IU/L)				
Mean ± SD	29.7 ± 24.0	52.0 ± 34.5	-3.399 •	0.001 (S)

Table (3): Comparison between the studied groups regarding the coronary angiographic data.

Coronary angiographic data	Group A	Group B	**Test**	**P-value (Sig.)**
Count	78	22		
Culprit identification				
Not identified	32 (41%)	0 (0%)	13.273 ‡	<0.001 (HS)
Identified	46 (59%)	22 (100%)		
Culprit vessel				
LAD	26 (56.5%)	4 (18.2%)	10.680 ‡	0.014 (S)
LCX	14 (30.5%)	9 (40.9%)		
RCA	4 (8.7%)	6 (27.3%)		
Ramus	2 (4.3%)	3 (13.6%)		
Other vessels diseased				
LAD	28 (35.9%)	10 (45.5%)	0.665 ‡	0.415 (NS)
LCX	28 (35.9%)	3 (13.6%)	3.976 ‡	0.046 (S)
RCA	29 (37.2%)	2 (9.1%)	6.329 ‡	0.012 (S)
Ramus	3 (3.8%)	0 (0%)	‡F	1.000 (NS)
Pre-dilatation				
No	41 (52.6%)	4 (18.2%)	8.196 ‡	0.004 (S)
Yes	37 (47.4%)	18 (81.8%)		
Number of stents				
No stents	14 (17.9%)	3 (13.6%)	0.550 ‡	0.759 (NS)
One stent	35 (44.9%)	9 (40.9%)		
More than one stent	29 (37.2%)	10 (45.5%)		
TIMI flow pre				
< 2	1 (1.3%)	22 (100%)	94.43‡	<0.001 (HS)
≥ 2	77 (98.7%)	0 (0%)		
TIMI flow post				
< 2	0 (0%)	4 (18.2%)	‡F	0.002 (S)
≥ 2	78 (100%)	18 (81.8%)		
Final result				
Normal coronaries	7 (8.9%)	0 (0%)	14.624 ‡	0.006 (S)
PCI	64 (82.1%)	19 (86.4%)		
Failed PCI	0 (0%)	3 (13.6%)		
CABG	7 (9.0%)	0 (0%)		

Table (4): Comparison between the studied groups regarding MACE incidence.

MACE incidence	Group A	Group B	**Test**	**P-value (Sig.)**
Count	78	22		
MACE incidence				
Over-all MACEs	7 (9%)	6 (27.3%)	‡F	0.035 (S)
Mortality	1 (1.3%)	0 (0%)	15.361 ‡	0.009 (S)
Recurrent ischemic symptoms	0 (0%)	3 (13.6%)		
Decompensated HF	1 (1.3%)	2 (9.1%)		
Stroke	1 (1.3%)	0 (0%)		

Table (5): Multivariate regression analysis for of the predictors of the occluded culprit artery in NSTEMI.

Variable	Adjusted OR	95% Confidence Interval for OR		P-value (Sig.)
		Lower Bound	Upper Bound	
Male gender	3.709	0.345	39.867	0.279
Age (years)	0.982	0.931	1.036	0.510
Smoking	1.874	0.485	7.233	0.362
Door to cath-lab (hours)	0.906	0.838	0.980	0.013
Peak Troponin (µg/L)	0.981	0.402	2.397	0.966
Peak CK-MB (IU/L)	1.011	0.992	1.031	0.248

DISCUSSION

In our study we found that about a quarter of our NSTEMI cohort had occluded arteries, similar to previously conducted studies [3, 6]. From the data that we gathered regarding the patients' demographic and clinical presentation data we were able to identify that NSTEMI patients with occluded arteries were more likely to be affected by smoking and ECG changes such as ST depression on ECG and higher peak High-sensitivity cardiac troponin and peak CK-MB. These findings may help us to suspect NSTEMIOA in our first encounter with NSTEMI patients so that we keep a low threshold to investigate such patients with coronary angiography at the earliest time possible logistically. The longer the occlusive thrombus is left in situ, the harder it becomes to perform PCI subsequently. The information obtained from our study may help in identifying NSTEMIOA patients for future study comparing very early vs delayed PCI for NSTEMIOA patients.

The basic characteristics of the current study patients were concordant with that of **Bahrmann & his colleagues** [4] with exception that **Bahrmann** population were less smoker., 82.5% of patients were hypertensive, 38.2% of patients were diabetic, 41.2% of patients were dyslipedemic & 28.6% were smoker patients.

In the present study, there was statistically significant difference between the two groups regarding TIMI flow. This came in disagreement with **Soon et al.** [5] who found that TIMI risk scores were not statistically significant, although numerically there were more NSTEMIOA with moderate to high TIMI risk score as compared to the TIMI risk score of patients with NSTEMIPA.

In the current study; it was found that patients who suffered MACCE during clinical follow up were more frequently presented by recurrent ischemic symptoms and this agree with the results obtained from **Wang and his colleague** [6].

This can be explained by increased incidence of reinfarction and target vessel revascularization in patients presented by with ischemic symptoms due to tissue hypo perfusion and associated multiple comorbidies [7].

The results obtained in this study revealed that patients complicated by MACE during clinical follow up had more angiographically totally occluded culprit vessel and these results are concordant with that of **Wang and his colleague study** [6] and **Bahrman and his colleague study in** [4] which revealed that MACE in six-month duration had increased incidence in those with totally occluded culprit vessel.

Patients with totally occluded culprit vessel were more liable to major adverse cardiovascular events (MACE) because it was found that they suffered from larger infarct size with higher peak of cardiac enzymes [8].

In our study we also found a higher rate of collateral supply in our totally occluded culprit vessel group. This could help to explain the zero-death rate as the presence of collateral supplies might have improved the outcome of these patients. Also, this may

be due to our inclusion criterion of the presence of an invasive angiogram on index admission. Due to this criterion, older patients presenting with multiple co-morbidities who were not investigated with coronary angiogram would be excluded. Such a subset of NSTEMI patients was likely to have coronary occlusions and poorer prognosis and yet they would be excluded from the study.

CONCLUSION

A quarter of patients presented by NSTEMI had totally occluded culprit vessel. Patients with totally occluded culprit vessel were younger in age and more smokers. These patients were more prone to occurrence of MACE. Patients complicated by MACCE were more liable to recurrent ischemic symptoms in totally occluded culprit vessel compared with those who had patent culprit vessel, revealing that patients complicated with MACCE were more liable to decompensated heart failure in totally occluded culprit vessel.

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