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**ORIGINAL ARTICLE**

# Predictors of No-Reflow in Patients undergoing Primary Percutaneous Coronary Intervention for Acute ST Elevation Myocardial Infarction at Tabba Heart Institute Karachi

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## ABSTRACT

**Aim:** To determine the predictors of no-reflow in patients undergoing Primary Percutaneous Coronary Intervention (PPCI) for acute ST elevation myocardial infarction (STEMI) at Tabba Heart Institute Karachi.
**Study duration:** The study was carried out from September 2020 to September 2021.
**Methods:** An observational study that was conducted at Tabba heart Institute Karachi. All patients with acute ST elevation myocardial infarction (STEMI) presenting within 12 hours of symptoms who undergoing primary PCI were included in the study. The patients were categorized Angiographically as no –reflow (with Thrombolysis in Myocardial Infarction (TIMI) <3 and reflow (TIMI-3) flow groups. The data regarding age and gender, type of MI, time from symptoms onset, co-morbid conditions like diabetes mellitus, hypertension, smoking, baseline Thrombolysis In Myocardial Infarction Trials (TIMI flow), infarct related artery (IRA), diameter of stent used, and the TIMI flow in IRA after the completion of procedure but before the use of intracoronary adenosine if needed, was recorded on a pre-designed proforma. The data was analyzed using SPSS 20.0.
**Results:** Total 296 patients who underwent primary PCI after acute MI were enrolled in the study. Mean age of the study population was 57±11 years. No reflow was present in 31.4% of patients. No reflow was more common in patients with age more than 60 years, females, symptom onset to primary PCI time of more than 6 hours, LAD infarct, and baseline TIMI flow < 2.
**Conclusion:** During primary PCI, no reflow occurs in a significant percentage of patients and is predictable by a number of factors which should be kept in mind to minimize the incidence of no reflow.
**Key words:** No reflow, acute myocardial infarction, primary PCI

## INTRODUCTION

The standard care in an ST elevation Myocardial Infarction (STEMI) has been urgent reperfusion since long[1]. No-reflow has been referred to as "sub optimal myocardial perfusion"of coronary artery segment with no angiographic evidence of obstruction[2]. No-reflow is thought to be related to abnormal tissue perfusion, due to microvascular obstruction. The persistent no-reflow has shown and associated with poor clinical outcomes[3]. No- reflow leads, poor in-hospital and post discharge long term survival.[4] It has been found to occur in 5 to 25 percent of cases[5]. In comparison to patients with adequate reflow after PCI, patients with no-reflow are more prone to develop complications like congestive heart failure early .[6] The ongoing or persistent no-reflow is also linked to high mortality and an increased incidence of recurrent myocardial infarction.[7] Patients with no-reflow also have relatively increased likelihood of early death (13% versus 6% p<0.003)[8].

In the modern age of sophisticated interventional gadgets and techniques, no-reflow has still been shown to occur in 0.6% to 3.2% of PCI cases[9]. On Angiography the no-reflow has been referred to as "less than TIMI 3 flow" that occurs in 2% of all PCIs. TIMI grade-flow has been developed to ensure a standard reliable way of recording epicardial perfusion on coronary angiography. The ultimate finding of myocardial infarction reperfusion no-reflow would be consistent with a TIMI flow of less than 3. The findings from a study indicated that TIMI 2 flow is associated with a no-reflow zone of substantial size; therefore, only TIMI 3 flow indicates reperfusion success[10].

In view of the above background, it is of prime importance to identify the patients at risk as well as intra-procedural factors linked or predisposing to no-reflow after primary PCI to minimize the risk of complications as well as mortality in this population guiding management aiming to prevent, early intervention and active treatment strategy to prevent no-reflow occurring.

This study has been designed to determine the predictors of no-reflow in patients under-going primary PCI for acute myocardial infarction at Tabba Heart Institute Karachi.

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The objective of the study was to determine the predictors of no-reflow on angiography, in patients undergoing primary PCI for acute ST Elevation myocardial infarction at Tabba Heart Institute Karachi.

## MATERIALS AND METHODS

It was an observational study conducted at Tabba heart Institute Karachi after permission from Ethical Committee. All patients presenting with STEMI treated with PPCI were included in the study. They were divided into groups those who suffered no-reflow while others who did not have evidence of no-reflow.
No-reflow was defined as: Angiographically TIMI <3
Grading system describes it as :

1. TIMI **Grade 0** (no perfusion)
2. **Grade 1**:Contrast beyond obstruction but does not opacify the entire distal area
3. **Grade 2**: Contrast opacification distal to the obstruction however the rate of clearance is perceptibly slower
4. **Grade 3** (complete perfusion): Prompt antegrade flow distal to the obstruction1.1

**Inclusion:** All patients in all age groups with ST elevation myocardial infarction presenting within 12 hours of symptoms undergoing primary PCI were included in the study.

The Angiographic no –reflow (Thrombolysis in Myocardial Infarction (TIMI) <3 and reflow TIMI -3 flow was recorded.
**Exclusion**: Patients with presentation > 12 hours after symptoms, prior MI, prior CABG, cardiogenic shock at presentation, > 70% narrowing in the infarct related artery distal to the culprit lesion, or taking oral anti-coagulants for any reason were excluded from the study.

Convenience sampling was used to enroll the patients. All patients presenting in one year who fitted the inclusion criterion were included. The sample size of the study to detect 25.9% incidence of no reflow in primary PCI, with 95% power and error rate of 0.05 was 296 patients for a large STEMI population.
**Data Collection:** The data was collected on a pre-designed proforma. It included patient demographics including age and gender, type of MI, time from symptoms onset, co-morbid conditions like diabetes mellitus, hypertension, and smoking. Angiographic and procedural parameters that were included are:

baseline TIMI flow, infarct related artery, diameter of stent used, and the TIMI flow in IRA after the completion of procedure but before the use of intracoronary adenosine if needed. Coronary angiography images were read and evaluated by two cardiologists with more than 10 years' experience.

**Data Analysis:** Data was analyzed using SPSS 20. The categorical variables are presented as frequency and percentages. The continuous variables are presented as mean and standard deviation. The Chi square test was used to compare categorical variables and Student's *t*-test was used for comparisons between means (continuous variables). Significance will be assumed at $p<0.05$.

## RESULTS

There were 296 patients who underwent primary PCI after acute MI were enrolled in the study from September 2020 to September 2021. Mean age of the study population was 57±11 years. Study population comprised of 221(74.7%) males and 75(25.3%) females. No reflow was present in 93 patients (Fig-1). No reflow is more common in patients with age more than 60 years, females, symptom onset to primary PCI time of more than 6 hours, LAD infarct, baseline TIMI flow < 2, and baseline Killip Class > II. The patient characteristics in the two groups are shown in Table 1.

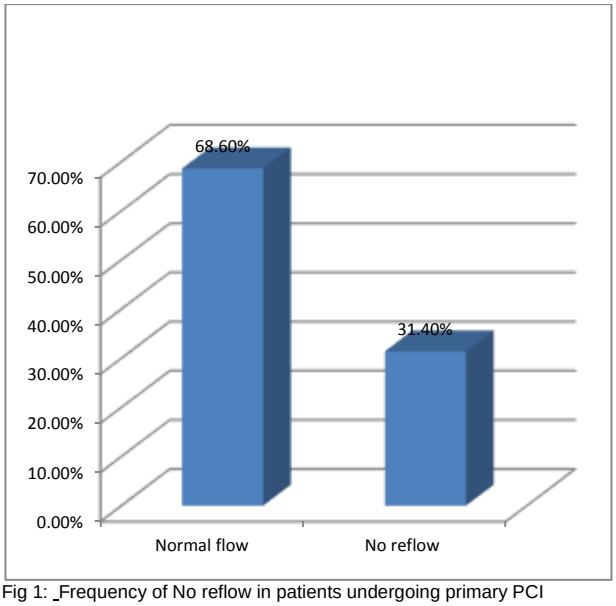


Fig 1: Frequency of No reflow in patients undergoing primary PCI

Table 1: Characteristics of the patients undergoing primary PCI with and without no-reflow

| | Total | Normal flow (203) | | No reflow (93) | | *p* Value |
|---|---|---|---|---|---|---|
| | | No. | % | No. | % | |
| Age > 60 years | 93 (31.4%) | 03 | 1 | 90 | 96.8 | <0.05 |
| Female gender | 77 (26%) | 29 | 14.2 | 48 | 51.6 | <0.05 |
| Symptoms > 6hrs | 157 (53%) | 66 | 32.5 | 91 | 97.8 | <0.05 |
| DM | 85 (28.7%) | 61 | 30 | 24 | 25.8 | >0.05 |
| HTN | 75 (25.3%) | 55 | 27.1 | 20 | 21.5 | >0.05 |
| Smoking | 175 (59.1%) | 124 | 61.1 | 51 | 54.8 | >0.05 |
| Baseline TIMI flow < 2 | 76(25.7%) | 28 | 13.8 | 48 | 51.6 | |
| LAD infarction | 176 (59.5%) | 103 | 50.7 | 73 | 78.5 | <0.05 |
| LCX infarction | 25 (8.4%) | 21 | 10.3 | 04 | 4.3 | |
| RCA infarction | 84 (28.4%) | 71 | 34.9 | 13 | 13.9 | |
| Stent Diameter > 3 mm | 91 (30.7%) | 07 | 3.4 | 84 | 90.3 | >0.05 |

## DISCUSSION

In the recent era, primary PCI has emerged as the main stay of treatment of acute myocardial infarction. [12]No reflow is a well-known complication that occurs during primary PCI and is attributable to a number of factors including injury to the epithelium, neutrophil accumulation and distal thrombo-embolism.[13]No reflow has gained importance because it results in adverse short term and long term outcomes.

The main findings in our study are: (1) No reflow is encountered more frequently in people aged > 60 years. (2) female patients undergoing primary PCI are more likely to develop no reflow. (3) More time from symptom onset to primary PCI raises the chances of no reflow. (4) Baseline TIMI I/II flow raises the possibility of no reflow. (5) Primary PCI to LAD has more chances to encounter no reflow. (6) No reflow is more likely when larger diameter stent (>3 mm) is used in primary PCI.

Our findings are completely in accordance with the already existing data. Sabin et al[5,13] in 2017 has revealed the incidence of no reflow in primary PCI to be 25.9%. Our study showed somewhat higher percentage of no reflow in primary PCI (31.4%). The finding of higher occurrence of no reflow in people aged > 60 years, females[15] more time to reperfusion, poor baseline TIMI flow[16] and LAD infarction are the same as in previous studies[5,13,14] However we used a new parameter during our study which was stent diameter. It was found that stent diameter > 3 mm was associated with higher likelihood of no reflow. Similar reports have also been reported[15,17].

No reflow primarily affects endothelium and microvasculature, both negatively impact the presence of long-term systemic hypertension[18,19] Hence, hypertension makes myocardial vasculature more susceptible and prone to No-reflow. However this was not very significant amongst the two groups in our study. The reason behind differences could be ethnicity consistent with the published data, patients with no-reflow had worse outcomes[20].

The limitation of our study was that we used random sampling, which may have led to selection bias. Secondly the study is a single center study and the sample size was not very large.

## CONCLUSION

The no-reflow is a known complication arising in primary PCI with various risk factors leading to morbidity and mortality. Prior Identification and management strategy significantly reduces the disease burden. The predictors in this study are almost similar to other ethnic groups in other parts of the world. They are easy to identify and we can use this factors for risk stratification.

**Conflict of interest:** Nil

## REFERENCES

1. Caiazzo G, Musci RL, Frediani L, et al. State of the Art: No-Reflow Phenomenon. Cardiol Clin. 2020 Nov;38 (4):563–573
2. Bandeshah AL, Rind LA, Saeed A, Mehmood A, Niaz MA. Immediate Procedural Success of Primary Percutaneous Intervention in Patients with Acute ST Segment Elevation Myocardial Infarction. Ann Pak Inst Med Sci. 2021; 17(3):271-276.doi.10.48036/apims.v17i3.56
3. J. Mazhar, Mashicharana, A. Farshid. Predictors and outcome of no-reflow post primary percutaneous coronary intervention for ST elevation myocardial infarction. IJC Heart Vasc, 10 (2016), pp. 8-12
4. Bulluck H, Sirker A, Loke YK, D.Hausenloy DJ. Clinical benefit of adenosine as an adjunct to reperfusion in ST-elevation myocardial infarction patients: an updated meta-analysis of randomized controlled trials. Int J Cardiol, 201 (202) (2016), pp. 228-237

5. Sabin P, Koshy AG, Gupta PN et al. Predictors of no reflow during primary angioplasty for acute myocardial infarction, from medical college hospital, Trivandrum. Ind Heart J 2017;69:p. S34-45
6. Fajara JK, Heriansyahc T, Rohman MS. The predictors of no reflow phenomenon after percutaneous coronary intervention in patients with ST elevation myocardial infarction: A meta-analysis. Indian Heart Journal 70 (2018) S406–S41
7. Rezakalla S H,Stankowski R,Hanna V, Kloner RA. Management of No-Reflow Phenomenon in the Catheterization Laboratory. JACC: cardiovascular interventions vol. 10, no. 3, 2017 february 13, 2017:215 – 2
8. Rossington JA, Sol E, Masoura K, et al. No-reflow phenomenon and comparison to the normal-flow population post primary percutaneous coronary intervention for ST elevation myocardial infarction: case–control study (NORM PPCI). Open Heart 2020;7:e001215. doi:10.1136/ openhrt-2019-001215
9. Ramajane K,Han L, Jin C.The diagnosis and treatment of the no-reflow phenomenon in patients with myocardial Infarction Unffdergoing Percutaneous Coronary Intervention Exp Clin Cardiol. 2008 Fall; 13(3): 121–128.
10. Predictors of no-reflow phenomenon in Tunisian patients undergoing primary percutaneous coronary intervention for ST-elevation myocardial infarction. Panel. Jomma W, Jnifene. Chamtouri I, Hamda, KB,Maatouk F. JACC: Cardio-Vascular Interventions .Volume 12,Issue 4,Supplement,25 Feb 2019,PgS9.
11. Sarkar A, Grigg WS, Lee JJ. TIMI Grade Flow. [Updated 2022 Apr 28]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482412/
12. Dernt M & Weidinger F. Managing no-reflow during percutaneous coronary intervention. Interv. Cardiol. (2012) 4(4)
13. Yang L , Cong H, Lu Y, Chen X, Liu Y. Prediction of no-reflow phenomenon in patients treated with primary percutaneous coronary intervention for ST-segment elevation myocardial infarction. Medicine (2020) 99:26
14. Zhang XT, Lin ZR, Chen L L. MELD-XI score predict no-reflow phenomenon and short-term mortality in patient with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention. BMC Cardiovascular Disorders (2022) 22:113.
15. Wang Y, Zhao H W ,Wang CF et al. Incidence, Predictors, and Prognosis of Coronary Slow-Flow and No-Reflow Phenomenon in Patients with Chronic Total Occlusion Who Underwent Percutaneous Coronary Intervention .Therapeutics and Clinical Risk M
16. Avci E, Yildirim T, Aydin G, Kiris T, et al.*Combining clinical predictors to better predict for the no-reflow phenomenon* .Eur Rev Med Pharmacol Sci Year: 2018 Vol. 22 - N. 15 Pages: 4987-4994 DOI: 10.26355/eurrev_201808_15639
17. Kim MC, Cho JY, Jeong HC et al. Long-Term Coronary Clinical Outcomes of Transient and Persistent No Reflow Phenomena following Percutaneous Intervention in Patients with Acute Myocardial Infarction. Korean Circ J. 2016 Jul;46(4):490-498. https://doi.org/10.4070/kcj.2016.46.4.490
18. Zhao SR , Huang R, Liu F, Xing U et.al. Study on Correlation between Type 2 Diabetes and No-Reflow after PC. Hindawi Disease Markers Volume 2022, Article ID 7319277, 7 pages https://doi.org/10.1155/2022/7319277.
19. Caiazzo G, Musci RL, Frediani L, et al. State of the Art: No-Reflow Phenomenon. Cardiol Clin. 2020 Nov;38 (4):563–573
20. R.A. Kloner, C.E. Ganote, R.B. Jennings. The ‘no-reflow’ phenomenon after temporary coronary occlusion in the dog. J Clin Invest, 1974; 54: p. 1496-1508.