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# Factors affecting TIMI (Thrombolysis In Myocardial Infarction) flow grade in patients undergoing primary PCI (Percutaneous Coronary Intervention).

**Muhammad Hussain[1], Ali Ammar[2], Samina Aslam[3], Riaz ul Haq[4], Zain Nazeer[5], Samina Akhtar[6]**

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**ABSTRACT… Objective:** To determine the causes of normal blood flow in coronary arteries in patients presenting with STEMI and receiving pPCI. **Study Design:** Observational study conducted retrospectively. **Setting:** National Institute of Cardiovascular Disease (NICVD) Karachi, Cath Lab. **Period:** August 17 2020 to November 2020. **Material & Methods:** Data was obtained from patients presented to the emergency department with STEMI and experienced primary PCI in last two years from January 2016 to Decemebr 2018.Social Sciences (SPSS) version 19 was used analyze these data.Th in those patients who had suboptimal coronary blood flow. Young patients <40 years of age had more (14%) normal coronary blood flow as compared to elders i.e >40 years. Diabetes mellitus, Hypertension, and smoking had no significant impact on coronary blood flow in these patients. **Conclusion:** In this study, it was found that most of the coronary arteries had abnormal blood flow during primary PCI. Multiple factors are affecting the blood flow in coronaries. The onset of symptoms and the time presented in the hospital was the main factors. Further studies are required to find more reasons for having normal blood flow in coronaries in STEMI.

**Key words:** Coronary Blood Flow, Coronary Artery Disease, Primary PCI, STEMI, TIMI.

## INTRODUCTION

In 2020 cardiovascular diseases were the main cause of morbidity and mortality all over the world. Among CVD coronary artery disease is one of the major causes of death.[1] Multiple treatment options are available to treat coronary artery disease, elective and primary PCI are the main options of interventions there are different treatments. When the patient is presenting with ST elevation MI, pPCI has a better outcome as compared to other options.[2] Primary PCI was superior to fibrinolysis in DANAMI-2 trial.[3] Coronary blood flow in patients with pPCI has different angiographic blood flow grades. Most of the coronary arteries have suboptimal blood flow, some are even totally occluded and others have limited flow. Few coronary arteries have been found to have normal blood flow; sometimes this is because to spontaneous revascularization or because of medications like aspirin, GPIIb IIIa inhibiter, and anticoagulants taken before the procedure. It has been observed that patients with normal blood flow prior to pPCI have a better result and lower risk of heart failure than those with inadequate coronary blood flow.[6,7,8] In ASSENT-4 it has been observed that those patients who have normal coronary blood flow before PCI have less chance of slow flow and no flow after PCI and they had a better outcome after 90 days.[9] About 10-30% of patients may have normal coronary blood flow in STEMI.[10,11] This study was done to see different causes of normal coronary blood flow in STEMI. To find more causes of normal coronary blood flow in STEMI further studies are required.

## MATERIAL & METHODS

After getting approval from the ethical review committee (ERC number = 36-2020), a retrospective observational study was conducted from August 17 2020 to November 2020.

1. MBBS, FCPS, Assistant Professor Cardiology, Abwa Medical College, Faisalabad.
2. MBBS, FCPS, Assistant Professor Cardiology, NICVD, Karachi.
3. MBBS, FCPS, Assistant Professor Cardiology, Abwa Medical College, Faisalabad.
4. MBBS, Cardiac Surgeon, Abwa Hospital and Research Center.
5. MBBS, Resident Medicine, Abwa Hospital and Research Center.
6. M.Phil Public Health, Senior Research Coordinator Community Health Science, AKU, Karachi.

**Correspondence Address:**
Dr. Muhammad Hussain
Department of Cardiology
Abwa Medical College, Faisalabad.
syedmhg@gmail.com

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Already two years cath data that was collected from Januray 2016 to Dcemeber 2018 were used. Interventional cardiologists collected the datat after getting informed consent from the participants having STEMI and going for pPCI. On a predefined performa, data on all variables, including demographics, coronary artery risk factors, the time from the symptoms onset to hospital arrival, time from door to balloon, number of vessels implicated and culpit's vessel and so on,were collected.

TIMI coronary blood flow grading is divided into four grades i.e TIMI 0-III.
TIMI 0 flow- There is no blood flow after coronary artery occlusion.
TIMI I flow- There is incomplete distal coronary blood flow.
TIMI II flow- There is slow blood flow although the distal coronary are filled completely.
TIMI III flow-There is normal blood flow in the coronary arteries.
This data was interpretation was done in SPSS 19 version and mean ± standard deviation, percentages were computed as descriptive statistics. Bivariate analysis and Chi-square test and t-test / Mann-Whitney U test were applied to analysed the factors associated with patency of coronary arteries. P-value < 0.05 was significant. Statistically.

## RESULTS

Total number of patinets enrolled in this study wrere 8018, they has presented with STEMI and underwent primary PCI.

Demographic and other basic variables are mentioned in Table-I.

The most of the patients were male (80.9%) and they were between 51 to 60 years of age. The leading (54.1%) risk factor for coronary artery disease was Hypertension. Other risk factors include diabetes mellitus (DM) and smoking 30.7% and 27.9% respectively. More than 50% of the patients (67.2%) came to the hospital 2 hours after the onset of symptoms.

Most of the coronary arteries (57.1%) were completely occluded while 11.04 % had TIMI III blood flow.

| Characteristics | No. (%) |
|---|---|
| Gender | |
| Male | 6489 (80.9%) |
| Female | 1529 (19.1%) |
| Age Mean (S.D.) 54.85 (11.42) | |
| Up to 40 years | 929 (11.6%) |
| 41 to 50 years | 2275 (28.4%) |
| 51 to 60 years | 2726 (34%) |
| Above 60 years | 2088 (26%) |
| Symptom onset to hospital emergency time Mean (S.D.) 218.01 (133.91) | |
| ≤ 120 minutes | 2630 (32.8%) |
| > 120 minutes | 5388 (67.2%) |
| First medical contact (FMC) to device time Mean (S.D.) 75.91 (55.26) | |
| ≤ 90 minutes | 6089 (75.9%) |
| > 90 minutes | 1929 (24.1%) |
| Pre-procedural TIMI flow | |
| 0 | 4579 (57.1%) |
| I | 1212 (15.1%) |
| II | 1309 (16.3%) |
| III | 918 (11.4%) |
| Infarct related artery | |
| LAD | 4383 (54.7%) |
| RCA | 2635 (32.9%) |
| LCX | 886 (11.1%) |
| LM | 16 (0.2%) |

**Table-I. Clinical, Demographic, and angiographic characteristics of patients (n=8018)**

TIMI flow rate that was divided into two groups according to their demographic, clinical, and angiographic characteristics have been presented in Table-II. Participants in the first group had TIMI 0-II flow, while those in the second group have TIMI III flow. Participants aged 40 had a higher TIMI III flow rate than those aged beyond 40, with 14.1 % vs. 11.8% respectively; (p value 0.024).

The duration between the symptoms onset and hospital arrival had an effect on TIMI blood flow. Those patients who presented to the emergency within 2 hours of the symptoms onset had more TIMI III flow as compared to those who were late i.e 12.6% and 10.9% respectively; (p value 0.026). Diabetes mellitus, Hypertension, and smoking have not significantly affected TIMI blood flow. There are Some other factors which are also

responsible for TIMI flow, FMC to device time is one of the major factors which is affecting the TIMI flow rate. Those patients who had FMC to device time <90 minutes have more TIMI 0-II than those who have more than 90 minutes,at 11.2% and 12.4%,respectively. LCX exhibits a greater rate of TIMI III flow (12.2%) than other arteries (p value <0.001).

| Characteristics | TIMI Flow Rate (%) | | |
|---|---|---|---|
| | TIMI 0-II | TIMI III | P- Value |
| Gender | | | |
| Male | 5750 (88.6%) | 739 (11.4%) | 0.725 |
| Female | 1350 (88.3%) | 179 (11.7%) | |
| Age | | | |
| < 40 years | 798 (85.9%) | 131 (14.1%) | 0.024* |
| 41 to 50 years | 2007 (88.2%) | 268 (11.8%) | |
| 51 to 60 years | 2441 (89.5%) | 285 (10.5%) | |
| More than 60 years | 1854 (88.8%) | 234 (11.2%) | |
| Risk factors | | | |
| Diabetes Mellitus | 2174 (88.2%) | 290 (11.8%) | 0.549 |
| Hypertension | 3858 (88.9%) | 482 (11.1%) | 0.294 |
| Smokers | 1969 (88.0%) | 268 (12.0%) | 0.353 |
| Time from onset of symptoms to Emergency arrival | | | |
| ≤ 120 minutes | 2299 (87.4%) | 331 (12.6%) | 0.026* |
| > 120 minutes | 4801 (89.1%) | 587 (10.9%) | |
| First medical contact to device time | | | |
| ≤ 90 minutes | 5410 (88.8%) | 679 (11.2%) | 0.137 |
| > 90 minutes | 1690 (87.6%) | 239 (12.4%) | |
| Infarct related artery | | | |
| LAD | 3902 (89.0%) | 481 (11.0%) | <0.001* |
| RCA | 2335 (88.6%) | 300 (11.4%) | |
| LCX | 778 (87.8%) | 108 (12.2%) | |
| LM | 14 (87.5%) | 2 (12.5%) | |

**Table-II. The relationship between TIMI flow rate and patient demographic,clinic and angiographic characteristics (n=8018)**

## DISCUSSION

The study showed that participants presenting with STEMI and who underwent pPCI had different flow rates in coronary arteries. It was observed that 11.4 % of patients have TIMI III flow that was less than that of previous studies i.e 14-22%.[12,13,14] The main pathophysiology of STEMI is due to the plaque rupture in the coronary artery causing myocardial infarction.[15] Multiple factors are responsible for thrombus formation which can be endogenous and exogenous. The formation of a thrombus is because of an imbalance between the anticoagulation and coagulation pathways.[16] Spontaneous revascularization occurs when the endogenous fibrinolytic system dominates and the culprit vessel has TIMI III blood flow.[17,18] Internal factors such as hepsin, cathepsin, and tissue plasminogen activators u-PA, t-PA are released by various cells such as leukocytes and endothelial cells. These products are responsible for autolysis and spontaneous revascularization.[19] The current study found that participants with FMC to device time of more than 90 minutes had a higher normal flow rate than those with less than 90 minutes. It was due to anti-thrombotic medications i.e aspirin, clopidogril, ticagrelor prasugrel, heparin, and some endogenous materials.[20,21] Tirofiban and clopidogril were given before pPCI and it was found that these patients have more spontaneous revascularization as compared to others who had not received these drugs.[22]

The time duration between antithrombotic therapy and pPCI is very important, it is directly related to TIMI flow rate, Antiplatelet therapy especially clopidogril requires 2-4 hours to achieve their peak therapeutic values however ticagrelor and prasugril are rapid in onset.[23] Some other factors contributing to TIMI flow rate i.e Age and gender were studied and it was found that younger patients have higher TIMI III flow rates as compared to old patients and younger females had less coronary artery disease with a high flow rate.[24] In this study, gender had no impact on coronary blood flow rate however younger patients had higher TIMI flow as compared to elder. Smoking has also affected coronary blood flow, smokers have better coronary blood in STEMI patients as compared to nonsmokers[25] however in this smoking has no significant impact on coronary blood flow. Some other studies have shown that diabetes mellitus has also affected coronary blood flow[26] but this study showed DM has not affected coronary blood flow rate. Another important factor that has a significant impact on coronary blood flow rate in STEMI is the time duration from symptoms onset to arrival in the emergency department, patients who visited the hospital in less time had

a higher rate of coronary blood flow than those who arrived late in hospital and it was proven by other studies as well.[27,28] Coronary anatomy has also influenced TIMI flow rate; LCX has a higher TIMI III flow rate than other coronary arteries.[29,30] In this study, it was discovered that the length of the lesion had a direct effect on the coronary blood flow rate, with longer lesions having higher TIMI III flow than short lesions.

## LIMITATIONS

This is a retrospective study and we studied limited factors that have affected coronary blood flow. To explore other factors that affects poor coronary blood flow in STEMI and its impact on morbidity and mortality, further studies are required.

## CONCLUSION

It is concluded from this study multiple factors are affecting coronary blood flow rate in STEMI. Age, the time duration from symptoms onset to hospital presentation, and FMC to device time have affected the coronary blood flow rate in patients admitted for pPCI.



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## AUTHORSHIP AND CONTRIBUTION DECLARATION

| No. | Author(s) Full Name | Contribution to the paper | Author(s) Signature |
|---|---|---|---|
| 1 | Muhammad Hussain | Author | |
| 2 | Ali Ammar | Data collection. | |
| 3 | Samina Aslam | Manuscript writing. | |
| 4 | Riaz ul Haq | Data analysis. | |
| 5 | Zain Nazeer | Manuscript writing. | |
| 6 | Samina Akhtar | Manuscript writing and rephrasing. | |