

CULPRIT ARTERY CHARACTERISTICS AND SEVERITY OF ANGIOGRAPHIC THROMBUS BURDEN IN PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN PATIENTS PRESENTING WITH ST ELEVATION MYOCARDIAL INFARCTION

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ABSTRACT

Objective: The purpose of study was to characterize culprit artery characteristics in terms of presence of thrombus burden in patients with acute myocardial infarction using prevalent parameters of thrombus estimation.

Study design: Descriptive study.

Place and Duration of Study: Adult cardiology departments of Armed Forces Institute of Cardiology / National Institute of Heart Diseases (AFIC/NIHD) from 1st October 2011 to 31st September 2012.

Patients and Methods: We studied 119 patients treated with primary percutaneous coronary intervention for ST-segment myocardial infarction. Bare metal stents were used in all patients as per hospital protocol. Thrombus burden (TB) was graded (G) as G0 = no thrombus, G1 = possible thrombus, G2 = small [greatest dimension < 1/2 vessel diameter (VD)], G3 = moderate (>1/2 but <2 VD), G4 = large (>2 VD), G5 = unable to assess TB due to vessel occlusion. Patients with G5 were reassessed after passage of guide wire or small balloon for thrombus burden.

Results: Frequency of major adverse cardiac events (MACE)-defined as death, myocardial infarction and infarct-related artery revascularization was recorded for the peri-procedural period which was defined in our study up to 72 hours. Overall, in hospital MACE was 8.4%.

Conclusion: Large thrombus burden is a significant predictor for mortality and MACE.

Keywords: Angiographic thrombus, MACE, Primary percutaneous coronary intervention (PCI) ST segment elevation myocardial infarction (STEMI)

INTRODUCTION

Patients with acute evolving myocardial infarction presenting with electrocardiographic ST-segment elevation or with new onset left bundle branch block are highly likely to have coronary thrombus occluding the infarct-related artery. Given its proven ability to improve survival dramatically, all such patients are candidates for early reperfusion therapy in order to restore flow in the occluded coronary artery and should therefore be rapidly evaluated upon first medical contact in order to ensure

prompt implementation of the best reperfusion strategy^{1,2}. Optimal reperfusion should lead to the early, complete and sustained patency of the infarct-related artery and thus provide efficacious myocardial reperfusion. The timing of flow restoration after symptom onset is critically important because the sooner it is achieved, the greater the chance of salvaging jeopardized myocardium. Primary percutaneous coronary intervention (PCI) for ST-segment elevation myocardial infarction (STEMI) with stenting has been proven to be superior to fibrinolytic therapy in terms of morbidity and mortality^{3,4}. Primary PCI is suitable for the large majority of such patients and importantly has been reported to achieve TIMI III flow in the infarct related artery in more than 90% of cases in a manner

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that is unrelated to the time from the onset of symptoms. Arterial revascularization after primary PCI is complete and stable and the rate of re-occlusion is low^{5,6,9}.

Despite the improvement in treatment strategies for PCI in recent years, patients with acute coronary syndromes, STEMI and angiographic presence of thrombus suffer from increased incidence of in-hospital major adverse cardiac events (MACEs)^{9,10}. Intracoronary thrombus has also been associated with adverse procedural outcomes such as persistent or transient slow or no reflow^{4,5} distal embolization and abrupt closure^{7,8}.

Mechanical treatment of thrombotic lesions by means of manual aspiration, rheolytic thrombectomy and protection devices has been proposed to prevent the complications caused by thrombus and improve the outcome after primary PCI, but the results of available studies are not consistent regarding usefulness^{12,13}.

Various angiographic thrombus classifications have been proposed but have never been clinically validated. In an unselected cohort of patients with STEMI we applied the most frequently used thrombus classification to assess the extent of thrombus burden and their impact on PCI results¹⁴.

MATERIAL AND METHODS

This descriptive study was carried out at adult cardiology departments of Armed Forces Institute of Cardiology / National Institute of Heart Diseases (AFIC/NIHD) from 1st October 2011 to 31st September 2012. Patients presenting with STEMI were included in the study. As per hospital protocol stenting was done with bare metal stents (BMS). All patients underwent primary PCI within 12 hours after the onset of chest

pain as per hospital protocol. All patients were pre-treated with 300 mg Aspirin and 600 mg Clopidogrel. PCI was performed according to standard clinical practice. The choice of stenting technique, thrombus aspiration system used, and the periprocedural pharmacological treatment were at the operator's discretion and were mostly according to international standard guidelines.

Information regarding baseline clinical characteristics, procedural details and in-hospital events was obtained from the patient records maintained at our institution. Written informed consent was obtained from all living patients.

Intracoronary thrombus was angiographically identified and scored in five grades⁹. According to this classification, in thrombus grade 0 (G0), no cineangiographic characteristics of thrombus are present; in thrombus grade 1 (G1), possible thrombus is present, with such angiography characteristics as reduced contrast density, haziness, irregular lesion contour, or a smooth convex "meniscus" at the site of total occlusion suggestive but not diagnostic of thrombus; in thrombus grade 2 (G2), there is definite thrombus, with greatest dimensions $\leq 1/2$ in the vessel diameter; in thrombus grade 3 (G3), there is definite thrombus, but with greatest linear dimension $> 1/2$ but < 2 vessel diameters; in thrombus grade 4 (G4), there is definite thrombus, with the largest dimension ≥ 2 vessel diameters and in thrombus grade 5 (G5), there is total occlusion (unable to assess thrombus burden due to total vessel occlusion).

Two experienced interventional cardiologists reviewing the angiographies together assessed all procedural parameters including thrombus classification. Both

reviewers were blinded to clinical outcomes and consensus was achieved in all patients^{10,11}. No reflow was defined as reduced ante-grade flow (TIMI flow grade < 1) in the absence of occlusion at the treatment site or evidence of distal embolization. Distal embolization was defined as migration of a filling defect distally to occlude the infarct-related artery or one of its branches, or a new abrupt cut-off the distal vessel/branch.

MACEs were defined as any death, repeat non-fatal myocardial infarction (MI) and infarct-related artery (IRA) revascularization. Repeat MI was defined as new clinical symptoms or ECG changes associated with a rise in the creatine kinase level to more than twice the upper normal limit with an increased creatine kinase-MB fraction. Data had been analyzed using SPSS version 17. Descriptive statistics were used to describe the results.

RESULTS

Total 119 patients underwent primary PCI during the study period. 109 patients (91.6%) were male and 10 patients (8.4%) were female. The mean age of the patients was 55.6 years.

LAD was the culprit vessel in 64 cases (53.8%), RCA in 44 cases (37%) and LCX in 9 cases (7.5%). One patient (0.8%) was found to have normal coronary arteries and one patient (0.8%) had minor coronary artery disease. The mean door to balloon time was 55.4 minutes. G5 patients constituted 63% of all cases (n=75). Reclassification was possible in 97.5% of cases. Reclassification into a thrombus category (G0–G4) was achieved in 116 (97.5%) patients; in 78 (65.5%) after some flow achievement with guide-wire crossing and in 38 (31.9%) after small balloon (1.25-1.5 mm) passage or dilatation (mean dilatation

pressure was 7.8 atm and mean duration of dilatation was 15.7 sec). In 3 patients (2.5%) thrombus G5 was sustained (no flow achievement at any stage of the procedure). Finally, thrombus burden was estimated in 116 (97.5%) patients. (Table-1)

Table-1: Description of thrombus grades in patients with acute myocardial infarction (n= 119).

Thrombus grade	Frequency
G0	2 (1.68%)
G1	20 (16.8%)
G2	24 (20.1%)
G3	25 (21%)
G4	45 (37.8%)
G5	3 (2.5%)

No flow was seen in 28 patients (23.5%) and 22 of them required thrombus aspiration and all required intracoronary Glycoprotein IIb IIIa inhibitors. Both Abciximab and Tirofiban were used. Mechanical thrombus aspiration using a thrombuster catheter was used in 36 cases (30.2%).

The mean hospital stay in our cohort was 44 hours. Overall in hospital MACE was 10 patients (8.4%). Two patients died, acute stent thrombosis was seen in 6 patients presenting as re-infarction and requiring revascularization and 2 patient had non-fatal MI.

Of the 10 patients, 5 patients had G4, 3 patients had G3 and 2 patients had G2 thrombus burden. Two patients who died had grade 4 thrombus burden.

DISCUSSION

Majority of patients with coronary thrombotic lesions in the setting of ST-segment elevation myocardial infarction can be safely managed with a combination of standard pharmacological regimen and

percutaneous trans-luminal coronary angioplasty (PTCA) and /or coronary stent implantation but some patients would end up in failure manifested by distal embolization and slow flow that may or may not respond to pharmacological and mechanical approaches. Distal embolization and slow flow can lead to intra-procedural myocardial ischaemia, haemodynamic compromise in selected cases¹⁰. In our study 75 patients (63%) had G5 thrombus i.e., total occlusion of vessel with TIMI 0 flow. In this situation it is difficult to assess thrombus burden. Earlier investigators have proposed the use of angioplasty guide wire or bottle-brushing or pre-dilatation with small (1.5 mm) balloon to establish some ante-grade flow and contrast penetration is adequate to allow thrombus estimation¹⁴. Reclassification was achieved after passage of guide wire or balloon with or without dilatation. Using this technique G5 group was reassessed and thrombus burden after re-classification was G0 2 (1.68%), G1 20 (16.8%), G2 24 (20.1%), G3 25 (21%), G4 45 (37.8%), G5 3 (2.5%). Patrick W. Serruys et al had suggested a new classification based on their observations that patients with thrombus G1-3 had similar procedural and clinical outcomes and therefore there is no value in separating them. They categorized these patients in small thrombus burden (STB) and G4 as large thrombus burden (LTB) group¹⁴. It has been amply demonstrated that the presence of large thrombus burden at the time of primary PCI is associated with worse procedural outcome and worse long term clinical outcomes. It has been speculated that removal of thrombus in the infarct related artery before primary PCI may prevent distal embolization and improve myocardial reperfusion and long term clinical outcomes.

The thrombus aspiration during percutaneous coronary intervention in acute myocardial infarction study (TAPAS) suggested a survival benefit with thrombus aspiration among these patients but recently published trial concluded that routine thrombus aspiration before PCI as compared with PCI alone did not reduce 30 day mortality among patients with STEMI. In our study thrombus aspiration was done in less than 30% of cases, mostly in those who had no reflow or significant thrombus burden. All patients with MACE underwent thrombus aspiration¹³⁻¹⁵.

CONCLUSION

In patients with STEMI, thrombus burden can be assessed by minimal intervention with either guide wire crossing or small balloon dottering or pre-dilatation without modifying thrombotic burden in angiographically occluded vessels. Large thrombus is a significant predictor of mortality and MACE. Thrombus burden should be taken into consideration during PCI treatment of STEMI patients.

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