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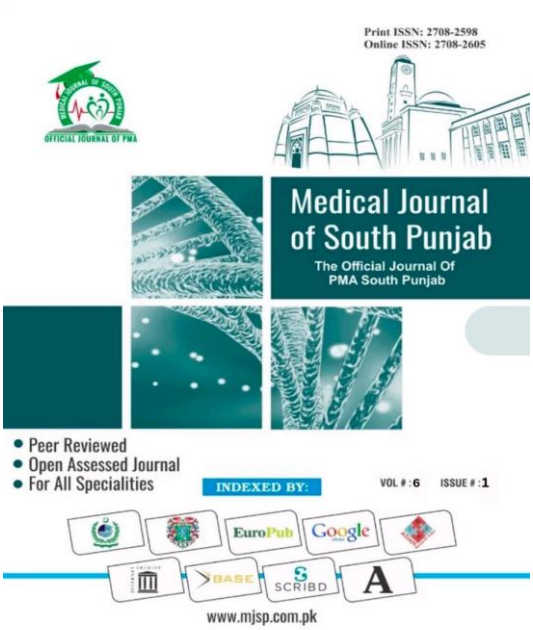

Comparison of small versus large Intracoronary Thrombus burden on Angiographic and short-term outcomes in patients undergoing primary pci

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Original Article

Comparison of small versus large Intracoronary Thrombus burden on Angiographic and short-term outcomes in patients undergoing primary pci

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ABSTRACT

Objective: To compare the angiographic and short-term clinical outcomes of small vs. large intracoronary thrombus in patients undergoing Primary PCI.

Methods: Three hundred thirty patients with STEMI were enrolled, and the thrombus burden was analysed. Patients with thrombus grades of 0-2 were labelled as small thrombus burden (STB), and those with ≥3 were considered large (LTB). The primary outcome variables were TIMI III flow (procedural success), 30-day mortality and 30-day re-infarction. Qualitative data was compared using the Chi-square test, and quantitative data with an independent t-test.

Results: Out of 330 patients, there were 160 (48.5%) with STB and 170 (51.5%) with Large TB. No significant differences were observed in STEMI types (anterior wall: 58.1% vs. 60.0%, p=0.809; inferior wall: 32.5% vs. 29.4%) or culprit vessels (left anterior descending: 61.9% vs. 64.7%, p=0.765; right coronary artery: 32.5% vs. 31.2%). Mortality was higher in the STB group (11.9% vs. 5.9%, p=0.05), while re-infarction rates were comparable (8.8% vs. 7.1%, p=0.569). Procedural success (TIMI III flow) was significantly higher in STB (95.6% vs. 88.8%; p=0.022).

Conclusion: Although the angiographic differences for thrombus burden were insignificant, small thrombus burden was associated with relatively more procedural success, 30-day mortality and 30-day reinfarction.

Keywords: Acute Myocardial Infarction, Intracoronary Thrombus, No-reflow, Primary Angioplasty, Thrombus, ST-elevation.

1. INTRODUCTION

Acute ST elevation Myocardial Infarction (STEMI) typically results from the disruption of an atherosclerotic plaque, which is succeeded by thrombus formation, culminating in the complete occlusion of a major epicardial coronary artery [1,2]. Thrombus is observed in 91.6% of patients with STEMI based on angiographic evidence [3]. Intracoronary thrombus of significant size has been observed in 16.4% of individuals diagnosed with acute coronary syndrome (ACS) [4]. Large thrombus burden significantly predicts adverse outcomes, including MACE [5]. Residual intracoronary thrombus after PCI is associated with worse cardiovascular outcomes, such as increased reinfarction rates during hospitalisation and at 1-month follow-up, although long-term consequences may not differ significantly [6].

Ischaemic heart disease is a significant issue in Pakistan, with STEMI in 30% of ACS patients over 45 years of age [7]. The prevalence of total coronary occlusion was around 7% in STEMI patients after undergoing thrombolysis, depicting the higher prevalence of large thrombus [8]. Managing substantial thrombus burden during primary PCI is complicated by resource constraints and variations in hospital infrastructure. A study conducted at Lady Reading Hospital in Peshawar highlighted the significant impact of thrombus load on patient outcomes, revealing a 24% mortality rate among STEMI patients after initial PCI [9]. These findings emphasise the necessity of context-specific research to inform clinical decision-making and optimise therapeutic strategies in Pakistani healthcare.

Despite progress in interventional cardiology, a deficiency in data exists comparing the outcomes of minor versus high intracoronary thrombus burden in patients undergoing primary PCI, particularly within the Pakistani demographic. Understanding the varying effects of thrombus size on angiographic success and short-term clinical outcomes is crucial for developing risk-stratification instruments and guiding therapeutic strategies. This work aims to address the knowledge gap by systematically evaluating the impact of thrombus load on procedural effectiveness and patient outcomes, thereby enhancing evidence-based treatments tailored to the regional context. So, this study compared the angiographic and short-term clinical outcomes of small vs. large intracoronary thrombus in patients undergoing Primary PCI.

2. METHODOLOGY

After the institutional ethical approval (ERB# 121, dated 9th April 2024), a prospective comparative (observational) study was conducted at the CPEIC, Multan cardiology department, from 10-04-2024 to 31-10-2024. A total number of 330 patients were enrolled as the minimum sample size required was 308 (154 in each group) calculated using the Openepi calculator, where the power of the study was 80%, level of significance 5%, and angiographic complication in large Vs small thrombus burden (26.6% vs 13.7%) [10]. After obtaining informed consent, patients with STEMI (according to the 4th universal definition of MI) undergoing primary PCI of the culprit vessel within 12 hours after the onset of symptoms, without prior thrombolytic therapy, were enrolled. Patients with an unassessable thrombus burden, those with chronic kidney disease (eGFR <30), and individuals with a history of contrast allergy were excluded from the study. The Thrombus burden was analysed in at least two projections, which allows an adequate measure of thrombus length without overlap or shortening. Thrombus burden was scored in 6 grades, where Grade 0 was no image suggestive of thrombus, to Grade 5 as total occlusion according to TIMI grading for thrombus burden [12]. Patients with 0-2 thrombus grade were labelled as small

thrombus burden (STB), and those with ≥3 grade thrombus were considered large (LTB).

After informed written consent, a minimum of 310 patients fulfilling the inclusion criteria were included in the study. Baseline characteristics, including age, gender, duration of chest pain, DM, HTN, and type of STEMI, were noted. After baseline investigations, all the patients underwent coronary angiography and PCI of the infarct-related vessel through the trans-femoral or trans-radial route according to the standard protocol as per ACC/ESC guidelines. The culprit vessel was identified during angiography, and the thrombus grade was measured. Then the culprit vessel was stented using DES, and lesion diameter, stent length and diameter were noted. Following Stent deployment, the stent was post-dilated using the non-compliant balloon. After the stenting, TIMI flow was noted. Those having no-reflow (<3 TIMI flow) were managed using Tirofiban, Nitroglycerin, Adenosine or Adrenaline, as directed by an interventional cardiologist according to the hospital protocol. After this, the final TIMI flow will be noted and based on this, angiographic success was reported. After Primary PCI, patients were admitted to the Cardiac Coronary Unit for follow-up and post-PCI care. During hospital stay, patients underwent echocardiographic evaluation for LV-systolic dysfunction. Post-discharge patients were called on the 30^{th} day for follow-up, for 30-day mortality and 30-day re-infarctions.

Data was analysed using SPSS v.26. Qualitative variables, such as gender, DM, HTN, smoker, types of STEMI, culprit vessel, thrombus burden (large or small), 30-day mortality, 30-day re-infarctions, and procedural success, were measured in frequency and percentages. Quantitative variables like age, duration of chest pain, TIMI flow grade, Thrombus burden grade, BMI and LVEF were measured in terms of mean and standard deviation. The patients were divided into two groups based on thrombus grade. Qualitative variables in both groups were compared using the Chi-square test, and quantitative variables with an independent t-test, and a p-value of ≤0.05 were considered significant.

3. RESULTS

The study enrolled 330 patients into STB (n=160, 48.5%) and LTB (n=170, 51.5%). Baseline characteristics revealed no significant differences in age (STB: 51.73±10.50 vs. LTB: 53.07±10.79 years, p=0.243), gender distribution (male: 61.9% vs. 70.0%, p=0.119), or comorbidities, including diabetes mellitus (36.9% vs. 32.4%, p=0.388) and hypertension (40.6% vs. 48.2%, p=0.164). Smoking prevalence (52.5% vs. 58.8%, p=0.248) and duration of chest pain (6.64±2.95 vs. 6.91±3.11 hours, p=0.434) were also comparable. (Table. I). No significant differences were observed in STEMI types (anterior wall [AWMI]: 58.1% vs. 60.0%, p=0.809; inferior wall [IWMI]: 32.5% vs. 29.4%) or culprit vessels (left anterior descending [LAD]: 61.9% vs. 64.7%, p=0.765; right coronary artery [RCA]: 32.5% vs. 31.2%). However, thrombus grades differed markedly (p<0.001), with STB lesions predominantly associated with lower grades (Grade 0: 9.4%, Grade 1–2: 90.6%) and LTB lesions exclusively presenting higher grades (Grade 3–5: 100%). (Table. II).

Table- I:Demographics and baseline profile of both groups

Variable	STB 160 (48.5%)	LTB 170 (51.5%)	p-value
Age (years)	51.73±10.50	53.07±10.79	0.243
Male	99 (61.9%)	119 (70.0%)	0.119
Female	61 (38.1%)	51 (30.0%)	
Diabetes mellitus	59 (36.9%)	55 (32.4%)	0.388
Hypertension	65 (40.6%)	82 (48.2%)	0.164
Smoking status	84 (52.5%)	100 (58.8%)	0.248
Duration of Chest pain (hours)	6.64±2.95	6.91±3.11	0.434
The chi-square test was applied. For mean and S.D., Student's t-test was used.			

Table-II:Comparison of the STEMI Type, Culprit vessel and thrombus grades between groups

Variable	STB 160 (48.5%)	LTB 170 (51.5%)	p-value
Types of STEMI			
AWMI	93 (58.1%)	102 (60.0%)	0.809
IWMI	52 (32.5%)	50 (29.4%)	
Other	15 (9.4%)	18 (10.6%)	
Culprit vessel			
LAD	99 (61.9%)	110 (64.7%)	0.765
RCA	52 (32.5%)	53 (31.2%)	
LCX	9 (5.6%)	7 (4.1%)	
The chi-square test was applied.			

Table-III:Comparison of 30-day mortality and refraction among the groups

Variable	STB 160 (48.5%)	LTB 170 (51.5%)	p-value
30-day mortality	19 (11.9%)	10 (5.9%)	**0.05**
30-day re-infarction	14 (8.8%)	12 (7.1%)	0.569
TIMI III flow (Procedural success)			
No reflow	7 (4.4%)	19 (11.2%)	**0.022**
TIMI III flow	153 (95.6%)	151 (88.8%)	
The chi-square test was applied.			

Mortality trended higher in the STB group (11.9% vs. 5.9%, p=0.05), while re-infarction rates were comparable (8.8% vs. 7.1%, p=0.569). Procedural success (TIMI III flow) was significantly higher in STB (95.6% vs. 88.8%), with LTB exhibiting more frequent no-reflow complications (11.2% vs. 4.4%, p=0.022) (Table III).

4. DISCUSSION

The formation and spread of coronary thrombus involve dynamic processes, including platelet adhesion, aggregation, fibrin production, and fibrinolysis, influenced by both intrinsic and extrinsic factors [13]. The main criterion for classifying thrombi is the length of the thrombus in relation to the diameter of the vessel, as assessed by conventional coronary angiography. The total thrombus volume may be greater in larger vessels; however, microvascular clearance is improved, prompting most studies to adjust thrombus length according to the reference vessel diameter. [14,15]. Additional techniques, including optical coherence tomography and dual quantitative angiography, yield more precise evaluations of thrombus volume. However, their availability is still restricted, and widespread use in primary PCI is not expected [16,17].

In our study, the incidence of large thrombus burden was present in almost 51.5% of cases. In a recent Indian study, the incidence of large thrombus burden was 76% [18]. In other studies, the reported incidence is around 42-52%, with more thrombus burden in areas where primary PCI centres are distant and in those where early ACS medications were not given [17,19]. In a study by Rajesh in Pakistan, the thrombus burden was as high as 68%, validating prior reasons [20].

In our study, the enormous thrombus burden was associated with a higher incidence of no reflow (11.2%) and a higher incidence of distal embolisation. A study reported the incidence of no reflow in patients with high thrombus burdens as high as 17%, but it can be reduced to 5.8% if thrombus aspiration is performed [21]. In our study, patients with STB undergoing primary PCI can show slightly higher or similar 30-day mortality compared to LTB cases, despite LTB intuitively seeming worse. In a study by Marti et al. [17], STB had high mortality. This could be due to underestimated microvascular damage, as the plague is still evolving and patient-related risk factors. However, in long-term follow-ups, LTB has a higher mortality rate [22]. Our study has a few limitations, such as being centre study with observational study design. More advance studies with longer follow up are suggested.

5. CONCLUSION

Our study concluded that small and large thrombus burden are present in almost equal ratios. Although the angiographic differences for thrombus burden were insignificant, small thrombus burden was associated with relatively more procedural

success, 30-day mortality and 30-day reinfarction **.**

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