IN HOSPITAL MORTALITY AND ADVERSE EVENTS IN HIGH-RISK PATIENTS UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION FOR ST ELEVATION MYOCARDIAL INFARCTION

Abstract:

Objective: To determine frequency of in hospital mortality and adverse events in high-risk patients undergoing primary percutaneous coronary intervention (PCI) for ST Elevation Myocardial Infarction (STEMI).

Study Design: Descriptive case series study

Setting: The Department of Adult Cardiology, National Institute of Cardiovascular Diseases, Karachi.

Duration: From 5[th]January 2019 To 4[th]July 2019

Material and Methods: All the patients of age between18 to 80 years, patients diagnosed with Acute Myocardial Infarction, patients undergoing Primary PCI and either gender were included. Study outcomes such as in-hospital mortality, cardiogenic shock, heart failure, no reflow phenomenon, and ventricular arrhythmia were recorded. Data was collected via study proforma and analysis was done by using SPSS version 26.

Results: There were 81.9% male and 18.1% female. 16.7% were found with diabetes mellitus, 42.7% with hypertension, 38% with family history, 24.7% with smoking and 74% with obesity. Mortality was 14.7%, cardiogenic shock was 12.0%, heart failure was 18.7%, no reflow phenomenon was 28% and ventricular arrhythmia was 16%. Significant association of mortality was found with age and obesity. Cardiogenic shock with gender. Heart failure with hypertension. Ventricular arrhythmia with gender

Conclusion: Mortality rate was high among STEMI patients who underwent primary PCI. No reflow phenomenon was the most observed event among these patients.

Keywords: Frequency, In Hospital Mortality, Adverse Events, High Risk Patients, Primary PCI, ST Elevation Myocardial Infarction (MI).

INTRODUCTION

Cardiovascular disease is a major global health issue that has reached pandemic levels. Low and middle-income nations, such as India and Pakistan in South Asia, play a large role in burden of cardiovascular disease as a the leading cause of mortality worldwide, around 78% of all mortality rate and 86.3% of all disability-adjusted life years.[1,2] Acute myocardial infarction is one of the most common causes of death and morbidity around the world.[3] It has been suggested that early mechanical or pharmacological reperfusion should be performed in patients who present with occurrence of ST-segment elevation of MI during twelve hours of the onset of sign and symptoms and those having persistent ST-segment elevation or new or newly assumed left bundle-branch block.[4]

Primary PCI has replaced thrombolysis as the preferred modality of reperfusion for acute STEMI, it has shown benefits in terms of recurrent myocardial infarction, and mortality.[5-7] The thrombolysis in Myocardial Infarction (TIMI) risk score, that is a simple evaluation basis on clinically data during arrival of the cases at hospital and provides valuable predictive information by allowing correct assessment of high-risk cases, can be used to risk stratify STEMI patients.[8,9] High risk patients are those

having TIMI risk score of ≥ 5.[10,11]Despite primary PCI showing greatest benefit in high risk patients, [10,12] it has been seen that the risk of death and adverse events increase as risk factors increase. [13-15] The importance of early reperfusion in reducing ischemia damage to the myocardium had long been acknowledged by cardiologists. The time from door to balloon is a crucial factor of care quality. In developing countries like Pakistan, financial restrictions and big time spending in judgement due to patients' and relatives' lack of understanding of the time' importance in management of critical illnesses like myocardial infarction have demonstrated to be significant obstacles to following door-to-balloon time suggestions.[16-18] González-Pacheco H et al found out that the incidence of mortality and adverse complications among high risk cases with TIMI > 5 undergoing primary PCI were mortality 14.8%; heart failure 15.3%; development of cardiogenic shock 10.9%; ventricular arrhythmias 14.8%; and no-reflow phenomenon 22.4%.[11] After a robust literature search it has been found that there is paucity of local data on the incidence of mortality and adverse events in high risk patient undergoing primary PCI in our community, and with one study finding out that there are hindrances in our society that limit patients in achieving optimum quality of care.[16] We expect the results in our society to be different from that of other part of world, moreover the findings of this study will further help us in allocation of resources so as to further organize our system. This gives a compelling case for doing research in our population.

MATERIAL AND METHODS

This descriptive case series study was conducted in the Department of Adult Cardiology, National Institute of Cardiovascular Diseases, Karachi. Study duration was **Six** months from 5th January 2019 to 4thJuly 2019. All the patients of age between18 to 80 years, patients diagnosed with Acute MI, cases underwent PCI and both genders were included. Patients with a past history of Acute MI, those who have had any cardiac surgery, and those who refuse to give consent were all excluded. Prior to enrollment, all participants were informed regarding the study's goal and benefits, and the primary investigator obtained verbal informed permission from all the cases. Demographic detail age (years), height (cm), weight (kg), and gender were obtained and history regarding diabetes mellitus, hypertension, obesity, family history and smoking status was taken. All primary PCI interventions were carried out by a senior cardiologist having minimum experience of >5 years. all of the study subjects were monitored during hospital stay (at most for one week) and study outcomes such as in-hospital mortality, cardiogenic shock, heart failure, no reflow phenomenon, and ventricular arrhythmia were recorded by the principal investigator. By closely adhering to inclusion and exclusion criteria as well as stratification, confounding variables and bias were avoided. Only authorized people had access to information regarding patients, which was maintained secure. Data were entered and analysis using SPSS version-21.

RESULTS

The incidence of in-hospital death and complications among high-risk cases following primary PCI for ST elevation MI were investigated in a total of 150 cases aged 18 to

80 years who met the study's inclusion criteria. Out of 144 patients, 81.3% were male and 18.7% were female. Patients' average age was 58.41±13.51 years. Mean height, weight and BMI was 156.70±6.35 cm, 73.20±11.57 kg and 29.71±3.67 kg/m^2. Among 150 patients, 16.7% had diabetes mellitus, 42.7% were hypertensive, 38% with family history,24.7%with smoking and 74% with obesity. In this study cardiogenic shock was 12%, heart failure was 18.7%, no reflow phenomenon was 28%, ventricular arrhythmia was 16% and mortality was 14.7% as presented from Table-1

Stratification with respect to age, gender, diabetes mellitus, hypertension, family history, smoking and obesity was done to observe effect of these modifiers on outcomes (mortality, cardiogenic shock, heart failure, no reflow phenomenon and ventricular arrhythmia). There was a significant association of mortality with age (p=0.001) and obesity, cardiogenic shock with gender (p=0.030), heart failure with hypertension (p=0.001), and ventricular arrhythmia with gender (p=0.010), results shown in table-2 to table-4.

TABLE: 1. Descriptive statistics of the demographic characteristics and outcome (n=150)

Variables		Frequency (%)
Age		58.41±13.51 years
Height		156.70±6.35
Weight		73.20±11.57
BMI		29.71±3.67
Gender	Male	122(81.3%)
	Female	28(18.7%)
Diabetes mellitus	Yes	25(16.7%)
	No	125(83.3%)
Hypertension	Yes	64(42.7%)
	No	86(57.3%)
Family history	Yes	57(38.0%)
	No	93(62.0%)
Smoking	Yes	37(24.7%)
	No	113(75.3%)
Obesity	Yes	111(74%)
	No	39(26%)
Outcome	**Cardiogenic shock** Yes	18(12.0%)
	No	132(88.0%)
	Heart failure Yes	28(18.7%)
	No	122(81.3%)
	No reflow phenomenon Yes	42(28.0%)
	No	108(72.0%)
	Ventricular arrhythmia Yes	24(16.0%)
	No	126(84.0%)
	Mortality Yes	22(14.7%)
	No	128(85.3%)

TABLE – 2. Cardiogenic shock and heart failure according to demographic characteristics (n=150)

Variables		Cardiogenic Shock		P-Value	Heart Failure		P-Value
		Yes	No		Yes	No	
Gender	Male	18	104	0.030*	26	96	0.083**
	Female	00	28		2	26	
Age group	≤60 years	9	73	0.672**	12	70	0.164**
	>60 years	9	59		16	52	
Diabetes Mellitus	Yes	3	22	1.000**	6	19	0.453**
	No	15	110		22	103	
Hypertension	Yes	9	55	0.502**	20	44	0.001*
	No	9	77		8	78	
Family History	Yes	8	49	0.548**	9	48	0.479**
	No	10	83		19	74	
Smoking	Yes	4	33	0.798**	7	30	0.964**
	No	14	99		21	92	
Obesity	Yes	15	96	0.336**	24	87	0.117**
	No	03	36		4	35	

*Significant at 0.05 levels
** Not Significant at 0.05 levels

TABLE – 3. Frequency of no reflow phenomenon & ventricular arrhythmia according to demographic characteristics (n=150)

Variables		No Reflow		P-Value	Ventricular Arrhythmias		P-Value
		Yes	No		Yes	No	
Gender	Male	31	91	0.140**	24	98	0.010*
	Female	11	17		00	28	
Age group	≤60 years	24	58	0.704**	10	72	0.163**
	>60 years	18	50		14	54	
Diabetes Mellitus	Yes	9	16	0.329**	4	21	1.000*
	No	33	92		20	105	
Hypertension	Yes	18	46	0.977**	11	53	0.732**
	No	24	62		13	73	
Family History	Yes	20	37	0.130**	8	49	0.607**
	No	22	71		16	77	
Smoking	Yes	11	26	0.787**	7	30	0.577**
	No	31	82		17	96	
Obesity	Yes	32	79	0.703**	14	97	0.056**
	No	10	29		10	29	

TABLE – 4. Mortality according to according to demographic characteristics (n=150)

Variables		MORTALITY		TOTAL	P-Value
		Yes	No		
Gender	Male	19	103	122	0.512**

	Female	3	25	28	
Age group	≤60 years	5	77	82	0.001*
	>60 years	17	51	68	
Diabetes Mellitus	Yes	6	19	25	0.148**
	No	16	109	125	
Hypertension	Yes	8	56	64	0.518**
	No	14	72	86	
Family History	Yes	9	48	57	0.761**
	No	13	80	93	
Smoking	Yes	5	32	37	0.819**
	No	17	96	113	
Obesity	Yes	11	100	111	0.005*
	No	11	28	39	

*Significant at 0.05 levels

** Not Significant at 0.05 levels

DISCUSSION

The goal of this study was to find out how often in-hospital mortality and adverse events were in high-risk patients undergoing primary PCI for ST-Elevation Myocardial Infarction (STEMI). Multivessel disease is a well-known factor linked to a greater risk of CS in STEMI patients who have primary PCI. The prevalence of CS in individuals with STEMI has been linked to the extent and severity of coronary artery disease. In our all-comers cohort, cardiac mortality was relatively high (>7%) within the first month, as one might predict. Cardiogenic shock, cerebral anoxia after cardiac arrest, and malignant arrhythmias were the leading causes of death in the aftermath of the index event. However, cardiac mortality dropped significantly after the first month (to 1.5 percent per year), suggesting that individuals whose survived the initial phase of a STEMI managed by primary PCI have a good long-term prognosis, and that late cardiac mortality in unselected all-comers is equivalent to that of earlier selected cases,[19] and 20 deaths in the catheterization laboratory or within 24 hours of hospital admission occurred in 7.9% and 29.3% of patients, respectively, in research. Re-infarction (1.9%) or repeat emergency PCI were seen in a limited percentage of patients (3.8 percent). In roughly one-third of patients, recurrent in-hospital cardiac arrest occurred following primary PCI (32.7 percent).[12] The shock trial found that early revascularization improves survival in CS patients who have had primary PCI116, but the best revascularization method for shock patients with MVD is unknown. This is especially important because MVD affects up to 87 percent of CS12 patients and is linked to a higher mortality rate.[21-23] There is certainly a case to be made for more comprehensive revascularization in MVD patients with CS who are resistant to IRA intervention. Despite advancements in reperfusion and adjunctive therapy, independent predictors of death from any cause and any reinfarction have not

changed appreciably, according to a study. The GUSTO-I and TIMI trials found that Killip class at presentation was a predictor of death in the fibrinolysis era.[24,25] Similar results were seen throughout the BMS era (CADILLAC) and more recently in the HORIZONS-AMI trial, which compared early-generation paclitaxel-eluting stents against BMS.[26-28] Killip class remains the best predictor of all mortality cause and any reinfarction, regardless of function of left ventricular or the amount of coronary artery disease at baseline. This represents the severity of haemodynamic impairment in these cases, that can be easily detected clinically. Age, left ventricular ejection fraction (EF), hypertension, final TIMI flow, and CK peak value, which have been consistently identified in the previous reports as predictors of the mortality and reinfarction in the cases of STEMI treated by the fibrinolysis along with primary PCI, also were observed to be predictors of the mortality and reinfarction.[29] They showed that an increasing in the TIMI risk score for STEMI is related with a higher incidence of in-hospital death and has a strong predictive value for mortality that is comparable to the CADILLAC risk score in the same group of patients who received primary PCI. The CADILLAC risk score is said to have a better predictive value regarding death at thirty days and a year compared to other risk scores of primary angioplasty since it combines angiographic data like as as the occurrence of three-vessel disease and final TIMI flow, and also the ventriculography-determined left ventricle EF.[11] The success made in lowering in-hospital mortality in STEMI patients emphasises the significance of anticipating other post-procedural problems that could have a significant impact on patient outcomes.[11] Overall mortality and other adverse events such as nonfatal reinfarction, stroke, and haemorrhage were less common in the primary PCI group than in the thrombolysis group, according to Keeley et al's meta-analysis. The highest benefit of primary PCI, according to Kent et al., is found in high-risk patients.[30] Four key characteristics at the time of presentation were identified by Negasso et al. in a decision-tree structure predictive classification for acute MI underwent PCI to observed the in-hospital complications and cardiogenic shock, heart failure, ageing, and diabetes are all factors to consider after intervention.[31] Although the TIMI risk score was designed to predict the death rate, it also observed as a group of the high-risk cases having TIMI risk 5, with frequent in-hospital mortality and complications rate like cardiogenic shock, heart failure, no-reflow phenomenon and the ventricular arrhythmias (p=0.001). There was no difference in the incidence of reinfarction and stroke between the high-risk and low-risk groups.[11] The advanced age, diabetes, previous history of stroke, Killip class >2, and the ischemic duration have all been linked to the development of the no-reflow phenomena in 25% of patients following primary PCI.[32,33] They report an overall prevalence of 16.4 percent in a study, with a substantially greater prevalence in the high-risk group (22.4 percent vs. 13.6 percent, p=0.01) than in the low-risk group (22.4 percent vs. 13.6 percent, p=0.01).[11] Despite the fact that the high-risk group had all of the risk indicators listed above, it was discovered that a considerable proportion of patients had poor reperfusion despite achieving TIMI 3 flow. This has been linked to the no-reflow phenomena and distal embolization,[34] prompting the use of GpIIb/IIIa antagonists as an additional therapy. There was a significant association between the risk profile and the benefit of adjunct

GpIIb/IIIa antagonists in lowering death at 30 days in a meta-analysis by De Luca et al. of STEMI patients undergoing primary PCI.[35] The frequency of using a GpIIb/IIIa antagonist was lower in the high-risk group, as was the lack of embolectomy, which has been shown to be beneficial. The majority of patients suffered cardiogenic shock during their hospital stay[36], and Lindholm et al. found that initial PCI does not prevent it.[37] Patient selection bias is a limitation of the current investigation because it is a nonrandomized, observational registry. Nonrandomized outcomes can potentially be influenced by unidentified confounding variables. The small sample size of our study was the most significant drawback. A single-center experience and a nonrandomized study design are further drawbacks of the current investigation. Because it was conducted in an urban setting, the results may not be applicable to broader populations.

CONCLUSION

The study results showed that among cases underwent primary PCI due to ST-elevation MI having higher in Hospital mortality rate. Further, among adverse events, no reflow phenomenon was the most observed event followed by heart failure, ventricular arrhythmia, and cardiogenic shock. After primary PCI in patients with STEMI, mortality was more observed in male gender, age more than 60 years, and diabetic patients. The TIMI risk score, which is used to identify a subset of STEMI cases undergoing primary PCI, identified a subset of cases who are at higher risk for not only increased in-hospital mortality rate but also longer lengths of stay in the hospital including other adverse events as heart failure, no-reflow, ventricular arrhythmias and the cardiogenic shock.

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

REFERENCES

1. Rehman H, Samad Z, Mishra SR, Merchant AT, Narula JP, Mishra S, et al. Epidemiologic Studies Targeting Primary Cardiovascular Disease Prevention in South Asia. Indian Heart J. 2018 Jan 31.
2. Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I, et al. Global Burden of Disease Study 2013 Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015;386(9995):743-800.
3. Rosselló X, Huo Y, Pocock S, Van de Werf F, Chin CT, Danchin N, et al. Global geographical variations in ST-segment elevation myocardial infarction

management and post-discharge mortality. Int J Cardiol. 2017 Oct 15;245:27-34.

4. Authors/Task Force Members, Van de Werf F, Bax J, Betriu A, Blomstrom-Lundqvist C, Crea F, et al. Management of acute myocardial infarction in patients presenting with persistent ST-segment elevation: The Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology: Euro Heart J. 2008 Oct 30;29(23):2909–45.

5. De Luca G, Suryapranata H, Marino P. Reperfusion strategies in acute ST-elevation myocardial infarction: an overview of current status. ProgCardiovasc Dis. 2008 Mar 1;50(5):352-82.

6. Zijlstra F, HoorntjeJC, de Boer MJ, Reiffers S, Miedema K, Ottervanger JP, et al. Long-term benefit of primary angioplasty as compared with thrombolytic therapy for acute myocardial infarction. N Engl J Med. 1999 Nov 4;341(19):1413-9.

7. Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials. Lancet. 2003;361:13–20.

8. Morrow DA, AntmanEM, Charlesworth A, Cairns R, Murphy SA, de Lemos JA, et al. TIMI risk score for ST-elevation myocardial infarction, a convenient, bedside, clinical score for risk assessment at presentation: an intravenous nPA for treatment of infarcting myocardium early II trial substudy. Circulation 2000;102:2031–2037

9. Lev EI, Kornowski R, Vaknin-Assa H, Porter A, Teplitsky I, Ben-Dor I, et al. Comparison of the predictive value of four different risk scores for outcomes of patients with ST-elevation acute myocardial infarction undergoing primary percutaneous coronary intervention. Am J Cardiol. 2008 Jul 1;102(1):6-11.

10. Thune JJ, Hoefsten DE, Lindholm MG, Mortensen LS, Andersen HR, Nielsen TT, et al. Simple risk stratification at admission to identify patients with reduced mortality from primary angioplasty. Circulation. 2005 Sep 27;112(13):2017-21.

11. González-Pacheco H, Arias-Mendoza A, Álvarez-Sangabriel A, Juárez-Herrera U, Damas F, Eid-Lidt G, et al. The TIMI risk score for STEMI predicts in-hospital mortality and adverse events in patients without cardiogenic shock undergoing primary angioplasty. Arch Cardiol Mex. 2013;82:7–13

12. Kent DM, Schmid CH, Lau J, Selker HP. Is primary angioplasty for some as good as primary angioplasty for all? Modeling across trials and individual patients. J Gen Intern Med. 2002;17:887–94

13. Hafiz AM, Jan MF, Mori N, Gupta A, Bajwa T, Allaqaband S. Contemporary clinical outcomes of primary percutaneous coronary intervention in elderly versus younger patients presenting with acute ST-segment elevation myocardial infarction. J IntervCardiol. 2011;24:357–65

14. Jensen LO, Maeng M, Thayssen P, TilstedHH, Terkelsen CJ, Kaltoft A, et al. Influence of diabetes mellitus on clinical outcomes following primary percutaneous coronary intervention in patients with ST-segment elevation myocardial infarction. Am J Cardiol. 2013 Mar 1;109(5):629-35.

15. De Luca G, van't Hof AWJ, Ottervanger JP, HoorntjeJC, Gosselink AT, DambrinkJH, et al. Time-to-treatment significantly affects the extent of ST-segment resolution and myocardial blush in patients with acute myocardial infarction treated by primary angioplasty. Eur Heart J. 2004; 25: 1009-13.

16. Shaikh AH, Siddiqui MS, Hanif B, Malik F, Hasan K, Adhi F. Outcomes of primary percutaneous coronary intervention (PCI) in a tertiary care cardiac centre. J Pak Med Assoc. 2009 Jul;59(7):426–9.

17. Khan MS, JafaryFH, Faruqui AM, Rasool SI, Hatcher J, Chaturvedi N, et al. High prevalence of lack of knowledge of symptoms of acute myocardial infarction in Pakistan and its contribution to delayed presentation to the hospital. BMC Public Health. 2007 Dec;7(1):284.

18. Who EC. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004 Jan 10;363(9403):157

19. Nielsen PH, Maeng M, Busk M. Primary angioplasty versus fibrinolysis in acute myocardial infarction: long-term follow-up in the Danish Acute Myocardial Infarction 2 trial. Circulation 2010;121:1484–91.

20. Mehran R, Lansky AJ, Witzenbichler B. Bivalirudin in patients undergoing primary angioplasty for acute myocardial infarction (HORIZONS-AMI): 1-year results of a randomised controlled trial. Lancet 2009;374:1149–59.

21. HochmanJS, Sleeper LA, Webb JG. SHOCK investigators. Early revascularization in acute myocardial infarction complicated by cardiogenic shock. Should we emergently revascularize occluded coronaries for cardiogenic shock. N Engl J Med 1999;341:625–34

22. Lindholm MG, Køber L, Boesgaard S, Torp-Pedersen C, Aldershvile J, Trandolapril Cardiac Evaluation study group. Cardiogenic shock complicating acute myocardial infarction; prognostic impact of early and late shock development. Eur Heart J 2003;24:258–65.

23. van der Schaaf RJ, Claessen BE, Vis MM. Effect of multivessel coronary disease with or without concurrent chronic total occlusion on one-year mortality in patients treated with primary percutaneous coronary intervention for cardiogenic shock. Am J Cardiol 2010;105: 955–9.

24. Sanborn TA, Sleeper LA, Webb JG. Correlates of one-year survival in patients with cardiogenic shock complicating acute myocardial infarction: angiographic findings from the SHOCK trial. J Am CollCardiol 2003;42:1373–9.

25. Morrow DA, AntmanEM, Charlesworth A, Cairns R, Murphy SA, de Lemos JA, et al. TIMI risk score for ST-elevation myocardial infarction: A convenient, bedside, clinical score for risk assessment at presentation: An intravenous nPA for treatment of infarcting myocardium early II trial substudy. Circul. 2000;102:2031-7.

26. Lee KL, WoodliefLH, TopolEJ, Weaver WD, Betriu A, Col J, et al. Predictors of 30-day mortality in the era of reperfusion for acute myocardial infarction. Results from an international trial of 41,021 patients. GUSTO-I Investigators. Circul.1995;91:1659-68.

27. Halkin A, Singh M, Nikolsky E, Grines CL, Tcheng JE, Garcia E, et al. Prediction of mortality after primary percutaneous coronary intervention for acute myocardial infarction: the CADILLAC risk score. J Am CollCardiol. 2005;45:1397-405.

28. Claessen BE, Dangas GD, Weisz G, Witzenbichler B, Guagliumi G, Mockel M, et al. Prognostic impact of a chronic total occlusion in a non-infarct-related artery in patients with ST-segment elevation myocardial infarction: 3-year results from the HORIZONS-AMI trial. Eur Heart J. 2012;33:768-75.

29. Caixeta A, Lansky AJ, Mehran R, BrenerSJ, Claessen B, Genereux P, et al. Harmonizing Outcomes With Revascularization and Stents in Acute Myocardial Infarction (HORIZONS-AMI) trial investigators. Predictors of suboptimal TIMI flow after primary angioplasty for acute myocardial infarction: results from the HORIZONS-AMI trial. EuroIntervention 2013;9:220-7.

30. Park HW, Yoon CH, Kang SH, Choi DJ, Kim HS, Cho MC, et al. KAMIR/KorMI Registry. Early- and late-term clinical outcome and their predictors in patients with ST-segment elevation myocardial infarction and non-ST-segment elevation myocardial infarction. Int J Cardiol 2013;169:254-61.

31. Kent DM, Schmid CH, Lau J. Is primary angioplasty for someas good as primary angioplasty for all? Modeling across trials andindividual patients. J Gen Intern Med 2002;17:887–94

32. Negassa A, MonradES, Srinivas VS. A simple prognostic classificationmodel for postprocedural complications after percutaneouscoronary intervention for acute myocardial infarction (from theNew York State Percutaneous Coronary Intervention Database).Am J Cardiol 2009;103:937–42.

33. Morishima I, Sone T, Okumura K. Angiographic no-reflowphenomenon as a predictor of adverse long-term outcome inpatients treated with percutaneous transluminal coronary angioplastyfor first acute myocardial infarction. J Am CollCardiol2000;36:1202–9.

34. Jaffe R, Charron T, Puley G. Microvascular obstruction andthe no-reflow phenomenon after percutaneous coronary intervention.Circulation 2008;117:3152–6.

35. De Luca G, Van't Hof AW, Ottervanger JP. Unsuccessfulreperfusion in patients with ST-segment elevation myocardialinfarction treated by primary angioplasty. Am Heart J2005;150:557–62.

36. De Luca G, Navarese E, Marino P. Risk profile and benefits fromGpIIb/IIIa inhibitors among patients with ST-segment elevationmyocardial infarction treated with primary angioplasty:a meta-regression analysis of randomized trials. Eur Heart J2009;30:2705–13

37. Babaev A, Frederick PD, Pasta DJ. Trends in managementand outcomes of patients with acute myocardial infarction complicatedby cardiogenic shock. JAMA 2005;294:448–54.