In-hospital outcome of primary percutaneous coronary intervention for the management of acute ST-segment elevation myocardial infarction in a Bangladeshi population

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Summary
Objective: This study aims to describe the different clinical outcomes of ST-Segment Elevated (STEMI) Myocardial Infarction patients of a tertiary care cardiac hospital in Bangladesh who went through Primary Per-cutaneous Coronary Intervention (PCI).
Methods: This study was conducted in the Department of Cardiology, National Heart Foundation Hospital and Research Institute, Dhaka, Bangladesh. Participants of the study were 80 patients with a diagnosis of acute STEMI. Information was collected on their demographic characteristics and clinical history. Relevant physical examination and laboratory investigations were performed. Percutaneous transluminal coronary angioplasty (PTCA) ± stent implantation was done in the culprit vessel. Coronary angiograms were done before and after the procedure. They were followed up thoroughly during the hospital stay.
Results: According to the 12 lead surface ECG, 25% had an extensive anterior MI, 20% anteroseptal MI, 35% an inferior MI, 10% an anterior MI, 7.5% an inferior with right ventricular infarction and 2.5% a lateral MI. The mean door to balloon time was 95.6 ± 33.4 min. LAD was the most common (51.2%) culprit vessel followed by RCA (38.5%) and LCX (10.2%).We compare, (1) ECG changes (return of ST segment towards isoelectric line in mm). (2) Improvement of TIMI flow. (3) Improvement of LV function (LVEF measured by echocardiography). (4) Complications (general, vascular). There was significant improvement in ECG changes (return of ST segment towards isoelectric line in mm). Pre and post-procedural mean ST elevation was 6.6 ± 2.7 mm and 0.5 ± 0.8 mm. Examining improvement of TIMI flow after the PCI, 87.5% had

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TIMI-3 flow, 7.5% had TIMI-2 flow, 2.5% had TIMI-1 and 2.5% had TIMI-0 flow ($P < 0.001$). The pre-procedural mean left ventricular ejection fraction (LVEF) was $41.6 \pm 4.2\%$ and the post-procedural mean LVEF was $51.8 \pm 5.1\%$ ($P < 0.01$). There were, 7.7% with post-procedural general complications and no vascular complications in any of the patients. In-terms of major adverse cardiac events (MACE), only 2(2.5%) patients died, one was due to a cardiac arrest 8 h after the procedure, and another was due to ventricular fibrillation followed by asystole 2 h after the procedure.

Conclusion: The study results show that with limited facilities and financial abilities, patients receiving Primary PCI had good in hospital outcomes which is similar to other studies done in different countries. So primary PCI may be the preferred method of reperfusion for the management of STEMI in the current Bangladeshi setting.

Introduction

It is projected that both global morbidity and mortality rates from coronary heart disease (CHD) will double between 1990 and 2020 [1]. Approximately 82% of these anticipated increases in mortality rates and 89% of the anticipated increases in morbidity will be seen in developing countries [1]. Bangladesh, a small South Asian country, is passing through an epidemiological transition and various projections indicate that over the next 10 years the rates of CHD will rise substantially in Bangladesh. There are insufficient population-based data on CHD in Bangladesh. One report from World Health Organization (WHO) estimated that the prevalence of CHD in the Bangladesh population is about 2.2% [2]. This means in absolute numbers nearly 3.6 million people in Bangladesh have CHD. While CHD mortality has declined in several developed countries during the past 40 years, [3,4], they have increased substantially in many developing countries including Bangladesh [5] (see Tables 1−5).

Acute myocardial infarction (AMI) is the most important form of CHD and the leading cause of death and disability worldwide. Despite impressive advances in diagnosis and management over the last four decades, ST-segment elevation myocardial infarction (STEMI) continues to be a major public health problem worldwide [6]. Management of STEMI in a developing country like Bangladesh is a multifaceted challenge. The major method to treat STEMI is reperfusion of the infarct-related artery. Growing evidence has revealed that primary PCI is the most effective treatment for AMI, even if a patient has to be transported to another hospital to undergo this treatment.

In Bangladesh, the first primary PCI was performed at the National Institute of Cardiovascular Diseases (NICVD) in 1999, in a 37-year old patient who presented with acute inferior and right ventricular myocardial infarction (Momenuzzaman et al., 1999). Since then primary PCI is being performed in different cardiac hospitals in a non-uniform manner. Bangladesh is a low-income country and thus in the Bangladeshi context primary PCI is expensive for most patients. Bangladesh does not have an established health insurance system. Therefore, most healthcare expenditures are paid directly by the patient. Thus, it is very difficult to perform primary PCI on a regular basis in Bangladesh, and in most cases primary PCI is delayed due to these and other factors.

From November 2006, the National Heart Foundation Hospital and Research Institute in Dhaka has started to use primary PCI as the more preferred reperfusion strategy for STEMI. Since then they have performed primary PTCA on a regular basis with limited resources. This study aims to describe the clinical outcomes of 80 STEMI patients treated at the National Heart Foundation Hospital and Research Institute who underwent primary PCI. Bangladesh does not have a primary PCI registry, nor has any study been conducted in the Bangladeshi population to determine primary PCI outcomes. It is hoped that the results from the present study will provide evidence and encouragement to policy planners and healthcare professionals to establish a more uniform and regular use of primary PCI.

Methods

This study was conducted in the Department of Cardiology of the National Heart Foundation Hospital and Research Institute, Dhaka, Bangladesh during the period of November 2006 to October 2007. A total of 80 patients were included in this study.

Inclusion criteria

Patients (<75 years) with STEMI admitted to the National Heart Foundation Hospital and Research Institute, who presented within 12 h of symptom onset and who agreed to a primary PCI.

Exclusion criteria

1. Patients > 75 years old.
2. Patients with comorbidities, such as malignancy, CRF, coagulation or bleeding disorder, which make a PCI unadvisable.
3. Valvular heart disease with STEMI.

Acute STEMI was diagnosed according to the criteria of the Joint ESC/ACCF/AHA/WHF Task Force, 2007. Informed written consent was obtained from each patient or his or her

Table 1 Demographic characteristics and risk factor profile of study population.

	(n = 80)
Age	53.10 ± 12.56
Sex	
Women	18 (22.5)
Men	62 (77.5)
Family history of CAD	
Present	50 (62.5)
Absent	30 (37.5)
Diabetes	
Present	32 (40)
Absent	48 (60)
Hypertension	
Present	44 (55)
Absent	36 (45)
Smoking	
Smoker	35 (45)
Nonsmoker	18 (22.5)
Ex-smoker	26 (32.5)
Dyslipidemia	
Present	34 (42.5)
Absent	46 (57.5)

Table 2 Pre-procedural laboratory findings.

Parameters	(n = 80) (mean ± SD)
CK-MB (I/U)	130.75 ± 54.76
RBS (mmol/L)	8.54 ± 4.38
Serum creatinine (mg/dl)	1.38 ± 0.25
Serum electrolyte (mEq)	
Sodium	139.51 ± 4.70
Potassium	3.75 ± 0.38
Chloride	102.99 ± 2.33
Lipid profile (mg/dl)	
TC	209.90 ± 43.38
LDL	127.54 ± 44.42
HDL	38.77 ± 2.09
TG	216.28 ± 83.24

Table 3 Pre- and post-procedural ECG finding (n = 80).

ECG	Mean ± SD
ST elevation (mm)	
Pre-procedure	6.46 ± 2.68
Post-procedure	0.49 ± 0.82
P value	0.0001

Table 4 Status of pre-procedure and post-procedure TIMI flow.

TIMI flow	No. (%) Pre-procedure	No. (%) Post-procedure	df	P value
0—1	74 (92.5)	4 (5)	1	0.001
2—3	6 (7.5)	76 (95)		

Table 5 Comparison of mean left ventricular ejection fraction (LVEF) before and after procedure.

LVEF (%)	(n = 80) (mean ± SD)
Pre-procedure	41.62 ± 4.27
Post-procedure	51.82 ± 5.13
P value	0.0001

attendant. Baseline clinical data including demographic characteristics, clinical history, and risk factors were recorded on the case report form. Relevant physical examinations were performed on all patients. ECG, echocardiography, blood sugar level, lipid profile, Troponin-I, CK-MB, serum electrolyte, blood urea, and serum creatinine, were obtained in all patients. A coronary angiogram (CAG) was performed, followed by suction of thrombus as needed, then PCI was performed in the culprit vessel followed by stent implantation where necessary. Post-PCI another CAG was performed to visualize the flow across the diseased vessel (TIMI flow). All patients were followed thoroughly during their hospital stay, with clinical follow-up on the day of their discharge from the hospital, including hemodynamic parameters (pulse, systolic and diastolic blood pressure), heart failure status (Killip classification), ECG (ST changes), and echocardiogram (LVEF). Any complications were noted.

All necessary approval to perform the study was obtained from the Academic Council of the National Heart Foundation Hospital and Research Institute, Dhaka, Bangladesh.

The collected data were checked and coded manually and then entered into a computer. The analysis was done after necessary data cleaning. For the presentation of demographic characteristics, clinical findings, and laboratory investigation reports, descriptive statistics were used. We also use descriptive statistics to present clinical outcomes (hemodynamic parameters, ECG changes, TIMI flow and LVEF) of the primary PCI. To compare the pre- and post-procedural clinical features, Fisher's exact test or *t* tests was used.

Results

A total of 80 patients with STEMI who underwent reperfusion therapy with primary PCI were studied. Their mean age was 53.1 ± 12.6 years. The most common age group was 51—60 years (37.5%). Hypertension was the most common risk factor, found in 36 (45%) of study patients. Other risk factors were diabetes mellitus in 32 (40%) patients, cigarette smoking in 36 (45%) patients, former smoker 26 (32.5%) patients, and dyslipidemia in 34 (42.5%) patients. A family history of coronary artery disease (CAD) was found in 62.5% of patients, 10% had a history of a myocardial

infarction, and none had undergone a previous PCI and none had heart failure.

The infarction location, based on a 12-lead surface ECG, was extensive anterior MI in 25%, anteroseptal MI, in 20%, inferior MI in 35%, anterior MI in 10%, inferior with right ventricular infarction in 7.5%, and in 2.5% it was a lateral MI. The mean door-to-balloon time was 95.6 ± 33.4 min. The most common culprit vessel, based on CAG, was the left anterior descending (LAD) in 51.2% of patients, followed by the right coronary artery (RCA) in 38.5% and the left circumflex (LCX) in 10.2%.

Acute heart failure (AHF) status was significantly improved in the 10% of study patients who had pre-procedural Killip IV heart failure; of whom, 33.3% improved to Killip I, 33.3% Killip II and 33.3% Killip III heart failure.

Of the 12% of patients who had pre-procedural Killip III heart failure, post-PCI 80.0% improved to Killip I and 20% to Killip II heart failure. Of the 5% of patients with pre-procedural Killip II heart failure, post-PCI all improved to Killip I stage. Of the 72.5% of patients with pre-procedural Killip I heart failure, post-PCI 93.1% remained in Killip I and 6.9% improved to Killip III stage heart failure.

In this study, we compared: (1) ECG changes (return of ST-segment towards isoelectric line in mm), (2) improvement of TIMI flow, (3) improvement of LV function (LVEF measured by echocardiography) and (4) complications (general, vascular).

There was significant improvement in ECG changes (return of ST-segment towards isoelectric line in mm) post-procedure ($P < 0.001$). Pre- and post-procedural mean ST-elevation was 6.6 ± 2.7 mm and 0.5 ± 0.8 mm, respectively. Post-procedure TIMI flow was significantly improved: 87.5% had TIMI-3 flow, 7.5% had TIMI-2 flow, 2.5% had TIMI-1, and 2.5% had TIMI-0 flow ($P < 0.001$). Left ventricular ejection fraction was significantly improved from the pre-procedural mean LVEF of $41.6 \pm 4.2\%$ to the post-procedural mean LVEF of $51.8 \pm 5.1\%$ ($P < 0.01$). No patients had any post-procedure vascular complications, and 7.7% had general complications. Major adverse cardiac events (MACE) occurred in only two patients (2.5%). One patient died from cardiac arrest at 8 h post-procedure, and one patient died due to ventricular fibrillation followed by asystole at 2 h post-procedure.

Conclusion

These study results show that despite the limited facility and financial limitations in Bangladesh, patients who underwent primary PCI had good in-hospital outcomes, nearly similar to outcomes seen in studies conducted in other countries. Thus, primary PCI may be the preferred reperfusion strategy for the management of STEMI in the current Bangladesh setting.

References

[1] Murray CJL, Lopez AD. The global burden of disease in 1990: final results and their sensitivity to alternative epidemiological perspectives, discount rates, age-weights and disability weights. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020;1996:247—93.

[2] Strategic plan for surveillance and prevention of non-communicable diseases in Bangladesh 2007—2010. Dhaka: Directorate General of Health Services, Ministry of Health and Family Welfare; 2007.

[3] Ford ES, Ajani UA, Croft JB, Critchley JA, Labarthe DR, Kottke TE, Giles WH, Capewell S. Explaining the decrease in US deaths from coronary disease, 1980—2000. N Engl J Med 2007;356(23):2388—98.

[4] Unal B, Critchley JA, Capewell S. Explaining the decline in coronary heart disease mortality in England and Wales between 1981 and 2000. Circulation 2004;109(9):1101—7.

[5] Yusuf S, Reddy S, Ounpuu S, Anand S. Global burden of cardiovascular diseases: part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization. Circulation 2001;104(22):2746—53.

[6] Elliott MA, Braunwald, E. ST-elevation myocardial infarction: pathology, pathophysiology and clinical features. In: Zipes DP, editor. Braunwald's heart disease. 7th ed. Philadelphia: Saunders Elsevier Inc.; 2006. p. 1141—66.