Outcome of early coronary intervention for acute ST elevation myocardial infarction in a tertiary care cardiac centre in Sri Lanka

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Abstract

Objectives To describe the outcomes of early percutaneous coronary intervention (PCI) for the treatment of acute ST elevation myocardial infarction (STEMI) in a tertiary care cardiac centre in Colombo, Sri Lanka.

Methods Medical records of 139 consecutive patients presenting to Cardiology Unit 5, National Hospital of Sri Lanka from March 2013 to June 2014 with acute STEMI, and treated with early PCI as a mode of reperfusion were reviewed. These patients were then followed up for 6 months to determine survival, target-vessel revascularization, in-stent thrombosis and other major adverse cardiac events (MACE).

Results Of 139 patients, 116 (83.5%) were male. Mean age was 52.3±SD11.1 years. Eighty eight (63.3%) patients underwent primary PCI and 51 (36.7%) underwent rescue PCI. There were six deaths (4.3%). One occurred on-table and three occurred after discharge. Four patients who died had cardiogenic shock. Mean door-to-balloon (DTB) time was 147 minutes for the primary PCI patients who were transferred from ETU. At six months, of 106 patients who attended follow up, two had been re-hospitalised for heart failure but none underwent coronary artery bypass grafting (CABG).

Conclusions This report from the national tertiary care cardiology referral centre in Sri Lanka, found that the study population was relatively younger, similar to other Asian countries. There was high rate of initial success (98.6%) and good short-term survival (95.7%), particularly in the subset presenting without cardiogenic shock (98.4%) despite the long DTB time. Loss to follow up at 6 months in this centre was 23.7% (33 patients).

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Introduction

Cardiovascular diseases, including myocardial infarction (MI) and heart failure, are the leading causes of death in developed as well as in low-and middle-income countries (LMICs) [1]. Myocardial infarction is the leading cause of death in Sri Lanka and risk factors such as diabetes, hypertension, smoking and obesity are becoming commoner [2]. Although considered primarily a disease of the middle and old age, recent trends in Asia suggest increasing prevalence of MI in the young [3]. When treated promptly the outcome of younger patients with ST elevation myocardial infarction (STEMI) is better than in older patients [4].

The aim of acute treatment of STEMI is restoration of myocardial perfusion by recanalisation of the occluded vessel. Early reperfusion is associated with a better outcome [5,6]. Many studies have shown that early coronary intervention reduces mortality and morbidity compared to thrombolysis alone [7-9].

Fibrinolytic therapy has been an important means of establishing reperfusion for decades. However, there are many limitations to the use of thrombolytic therapy due to high rates of recurrent ischaemia and re-occlusion [9]. Even with best thrombolytic agents such as tenecteplase and alteplase, 20% of occluded arteries are not reperfused leading to persistent ischaemia. However streptokinase, which is currently the only widely available fibrinolytic agent in Sri Lanka has a much lower rate of re-perfusion (40-50%) leading to higher rates of persistent myocardial damage and heart failure which contribute to increased morbidity and mortality [10]. Therefore, use of percutaneous coronary intervention (PCI) is the preferred re-perfusion strategy, either as primary PCI or PCI secondary to thrombolysis, depending on resource availability [7]. Evidence from high income countries

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(HICs) suggests that primary PCI should be the preferred method of treatment for STEMI, provided that the procedure could be performed within 90 minutes of initial patient contact, subject to the availability of skilled interventional cardiologists, equipped centres and surgical backup [11]. Although PCI has been available for many years in Sri Lanka there is a paucity of data related to patient outcome [12].

The aim of this study was to describe the outcome of early PCI for acute STEMI in a tertiary care cardiac centre in Colombo, Sri Lanka.

Methods

This was a cohort study conducted at Cardiology Unit, National Hospital of Sri Lanka (NHSL). Consecutive patients presenting with an acute STEMI who underwent primary or rescue PCI during the study period from March 2013 to June 2014 were recruited at the time of PCI and followed up for a period of six months. Those who received prior thrombolysis at the first contact point for the current event, underwent rescue PCI, while those who did not receive prior thrombolysis at the first contact point underwent primary PCI. STEMI was diagnosed when there was chest pain and ST elevation in two consecutive leads or new onset LBB (left bundle branch block) in the electrocardiogram (ECG) [13]. ST elevation in ECG was diagnosed when there was ST elevation at the J point in at least two contiguous leads of ≥ 2 mm (0.2 mV) in men or 1.5 mm (0.15 mV) in women in leads V2-V3 or 1 mm (0.1 mV) in other contiguous chest leads or the limb leads [14]. Rescue PCI was carried out after failed thrombolysis in patients who had poor (<50%) ST resolution in 90 minutes, persistent chest pain or cardiogenic shock.

Data were extracted prospectively from patient notes using data sheets. Follow up data were extracted from clinic records at two weeks after leaving hospital and monthly thereafter. Patients who did not attend follow up were contacted over the telephone. Socio-demographic information and selected risk factors of heart disease including lifestyle and baseline clinical features were recorded. Lifestyle was categorised as active or sedentary based on the occupation. Those who were skilled, semi-skilled and manual workers were categorised as having an active lifestyle and professional, technical and clerical grades were categorised as having a sedentary lifestyle [15].

Persistent ST elevation was defined as less than 50% resolution of ST elevation when the admission ECG (taken at point of first medical contact) was compared to post-procedure ECG. Depending on the regional ECG changes MI was classified as anterior STEMI, antero-lateral STEMI, inferior STEMI and posterior STEMI. The presence of cardiogenic shock was defined as patients who required inotropic support to maintain a minimum systolic blood pressure of 90 mmHg during or before the PCI. The time taken from development of symptoms to hospital admission (according to patient records) was defined as symptom-to-door time (SDT), and time from admission to re-establishment blood flow in the affected artery (as determined by fluoroscopy) was defined as the door-to-balloon time (DBT). PCI procedures for working hours were defined as those carried out on week days from 800 hours to 1600 hours.

The vessel affected and the degree of obstruction were recorded using fluoroscopic angiography by the consultant cardiologist. Concomitant involvement of other vessels (non-culprit vessels with over 70% plaque disease in the angiogram) was documented.

Ejection fraction was measured on admission, before leaving hospital, at six weeks and at six months by the Cardiologist or the Senior Registrar. Following the PCI, the patients were assessed for clinical improvement of chest pain. A 12 lead ECG was taken following the PCI procedure to assess resolution of ST changes. A coronary angiogram was performed before, during and after the PCI procedure and the flow results were recorded. The final flow was graded using Thrombolysis in Myocardial Infarction (TIMI) grading [16]. TIMI grade 3 coronary flow of the treated vessel and a residual stenosis less than 30% were taken as a successful PCI.

All patients received 100 U/kg of unfractionated heparin intravenously, oral aspirin (300 mg), oral clopidogrel (300 mg/ 600 mg loading dose) and atorvastatin 40 mg. Some received GpIIb-IIIa inhibitors during PCI. Post-interventional therapy for all patients included aspirin (150 mg), clopidogrel (75 mg) and atorvastatin 40 mg. Stenting procedures were performed according to standard techniques. The number and length of stents, and type of bare metal stents (BMS)/ drug eluting stents (DES) implanted, were the operator's discretion.

Main outcomes measured were death, re-infarction, target-vessel revascularisation, in-stent thrombosis and other major adverse cardiac events (MACE) at 6 months follow up. MACE included patients undergoing coronary artery bypass graft after PCI and recurrent hospital admissions. All deaths were considered cardiac unless a clear non-cardiac cause could be identified.

Continuous variables with normal distribution were described using mean and standard deviation while median and inter quartile range were used for those with a skewed distribution. Discrete variables were described using count and percentage. T test was used for comparison of continuous variables while chi-square test was used to compare discrete variables. Logistic regression models were used for multivariate analysis. Survival analysis was described using univariate Kaplan-Meier statistics with death at six months follow up as the end point. SPSS 17 and STATA 13 were used for statistical analysis. Approval for the study was obtained from the Ethics Review Committee of NHSL.

Results

The study sample included data from 139 consecutive patients who underwent either primary or rescue PCI for acute STEMI, between March 2013 and June 2014. Majority (85.2%) were males. All patients included in the study underwent early coronary interventions as the treatment choice for STEMI. Eighty eight underwent primary PCI and 51 underwent rescue PCI. Hundred and six (76.3%) patients were followed up for the full duration of six months. Mean age (SD) of the study participants was 52.3 (± 11.2 years). Mean age of those who underwent primary PCI was 53.2 years and rescue PCI was 50.9 years. Table illustrates the demography, characteristics of in-hospital patient management, mortality rate and angiographic features of the study population.

For primary PCI mean SDT was 568.2 minutes (95% CI 10 - 4320 min) and DTB time was 1093.7 minutes (95% CI 60 - 5760 min). Mean DTB time was 147 minutes for the primary PCI patients who were directly admitted to emergency treatment unit and transferred to PCI unit which reflects the time taken when patients are directly admitted to a hospital where primary PCI facilities are available.

Mean ejection fraction showed a rapid rise soon after the procedure which ranged from 46% to 50%. After that it remained constant for the first six weeks of follow up. The mean ejection fraction increased slightly up to 51% during the next five months. Among PCI patients, there was a similar rise soon after the procedure and reached 55% at six months. However, in the primary PCI patients, although there was a rise in ejection fraction after the procedure, the mean ejection fraction dropped to 48% after six weeks and remained so at six months.

Table. Characteristics of patients

Characteristic	*Primary PCI (n=88) Number (%)*	*Rescue PCI (n=51) Number (%)*	*Total PCI (n=139) Number (%)*
Male	75 (85.2)	41 (80.4)	116 (83.5)
Past medical history:			
Hypertension	26 (29.6)	8 (15.7)	34 (24.5)
Diabetes mellitus	23 (26.1)	17 (33.3)	40 (28.8)
Hyperlipidemia	15 (17.1)	7 (13.7)	22 (15.8)
Family history of CAD	16 (18.2)	13 (25.5)	29 (20.9)
Admission characteristics:			
Cardiogenic shock	8 (9.1)	8 (15.7)	16 (11.5)
Left ventricular failure	2 (2.3)	01 (2)	3 (2.2)
Ejection fraction (mean)	46.5%	46.2%	46.34%
Anterior myocardial infarction	54 (61.4)	36 (70.6)	90 (64.7)
Inferior myocardial infarction	29 (32.9)	14 (27.5)	43 (30.9)
Details of patient management			
Culprit vessel:			
Left anterior descending	53 (60.2)	38 (74.5)	91 (65.4)
Left circumflex	3 (3.4)	2 (3.9)	5 (3.6)
Right coronary	33 (37.5)	11 (21.6)	44 (31.2)
Multivessel CAD	38 (43.2)	22 (43.1)	60 (43.2)
Procedural success	86 (97.2)	51 (100)	137 (98.6)
BMS Stent	29 (32.9)	13 (25.5)	42 (30.4)
DES Stent	52 (59.1)	36 (70.6)	88 (63.8)
MACE	7 (7.9)	0 (0.0)	7 (5.0)
Glycoprotein IIb / IIIa inhibitors use:			
Given	50 (56.8)	29 (56.9)	79 (56.8)
Not given	38 (43.2)	22 (43.1)	60 (43.2)
Mortality			
Within 24hrs	3 (3.4)	0 (0.0)	3 (2.2)
Within 1 month	5 (5.7)	0 (0.0)	5 (3.6)
Within 6 months	6 (6.8)	0 (0.0)	6 (4.3)

CAD: Coronary Artery Disease, PCI: Percutaneous Coronary Intervention, MACE: Magor adverse cardiac event

Five patients who had MACE during the follow-up were aged more than 60 years. Of the seven patients who had MACE, only two (28.6%) had SDT less than three hours and only one patient had a DBT of less than two hours. Multi-vessel disease was responsible for five of those who had MACE. Figure shows the survival data of the study sample.

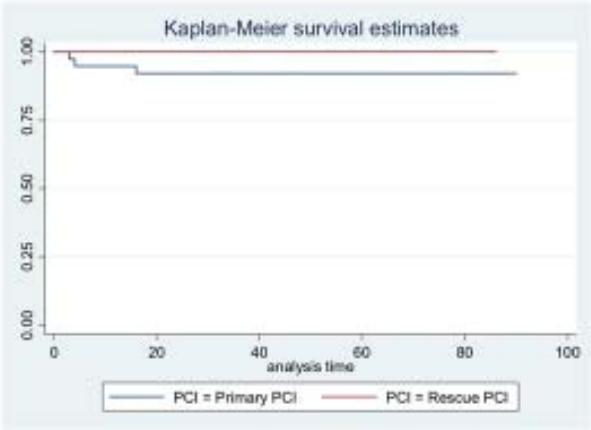

Figure. **Kaplan-Meier survival curves for primary and rescue PCI patients.**

Discussion

This is the first sizeable report on outcomes of primary PCI in acute STEMI from a government funded tertiary care hospital in Sri Lanka. This study describes the results of an unselected ''real-world'' patient cohort which showed a high success rate (98.6%) of the index procedure and an excellent overall in-hospital survival rate (97.8%), particularly in the absence of cardiogenic shock (almost 98.4%). Two of 123 patients without cardiogenic shock died (1.6%) which is similar to international data which shows in-hospital mortality of 5.2% in the second national registry of myocardial infarction (NRMI2) and 3% in ASSENT 4 trial [17]. In our study 16 patients had cardiogenic shock and four of them died (25%) which is similar to available data-32% in NRMI 2, 46.4% in SHOCK registry and 59.1% in American College of Cardiology-National Cardiovascular Data Registry (ACC-NCDR) [18,19].

Several other outcomes of this study compare favourably with those reported from private sector hospitals in Sri Lanka as well as those from HICs [12]. Thus, we suggest that post-PCI outcomes in a tertiary care hospital in a LMIC, at least in the short term, is similar to those from HICs not only for the low-risk (non-cardiogenic shock) patients, but even for those presenting with cardiogenic shock. These favourable results were maintained long term, though data is limited by the significant loss to follow up. The rates of initial success as well as TIMI 3 flow were also similar to HICs [13,17, 24].

There are several of findings in our study that merit further discussion. The mean age in our study group was less than 55 years which is lower than those from HIC [25]. Age is a strong prognostic indicator and it is possible that younger patients could have been selected out as a lower-risk cohort for the procedure. However, this lower age at presentation is consistent with other studies on acute MI in the general population of Sri Lanka who have not necessarily undergone primary PCI [26].

Unlike other studies, we did not find a significant association between door-to-balloon time and the outcome of PCI. Only 32.7% of primary PCI patients had a door-to-balloon time of ≤ 120 minutes. The DBT of our study was significantly higher than those in HICs though our outcomes were similar. Although surprising, this trend has also been observed in the second National Registry of Myocardial Infarction (NRMI-2). This may reflect the inherent difficulties in accurately timing the onset of coronary occlusion (when infarction begins as opposed to the pre-infarct anginal phase) or a survivor cohort effect [18].

There are several implications of our study. Widespread availability of primary PCI, although vigorously promoted, has yet to become a reality, even in the HICs [27]. We have shown that early PCI after STEMI is a viable therapeutic option in the government sector hospitals in Sri Lanka and can be performed with good outcomes despite relatively longer chest pain-to-presentation and door-to-balloon times. The key question is whether such programmes can be funded by the state on a widespread scale. This justifies further investigations including disability adjusted life years (DALY), quality of life and cost-effectiveness evaluations. Preservation of the workforce must be a state priority. In the provision of this service on a wider scale, temporary cost-saving measures including the use of cheap bare-metal stents, re-sterilized equipment including guiding catheters, wires and balloons and the involvement of tertiary care hospitals in each province of Sri Lanka to perform primary PCI may be helpful [29].

Our study has several limitations. The sample size was relatively small and only 76.3% had follow-up data. Although the sample consisted of consecutive patients undergoing primary PCI, they did not represent all patients who presented with acute STEMI. As described in the methods section, many such patients opt for fibrinolysis. Therefore, there may have been a bias towards either affluent (who would buy stents) or patients who were more ill undergoing primary PCI. Furthermore, our data represents a single centre experience where the operators were experienced and the institute was specialized in cardiac services. Whether these results can be generalised to other hospitals in LMICs is uncertain.

In conclusion, the results of this preliminary study raise the possibility that outcomes of PCI after STEMI in LMICs are similar to that in the developed world.

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Conflicts of interests

There are no conflicts of interest.

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