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ORIGINAL ARTICLE

Outcome of Elderly Population Undergoing Primary PCI in a Tertiary Hospital in Bangladesh

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ABSTRACT

Objective: To evaluate in-hospital and 1-year outcomes of primary percutaneous coronary intervention (PPCI) in elderly patients with ST-elevation myocardial infarction (STEMI).

Methods: All patients aged ≥ 65 years presenting with STEMI and undergoing PPCI at Ibrahim Cardiac Hospital & Research Institute, Bangladesh from January 2015 to August 2017 were consecutively included in the study based on predefined eligibility criteria. Data pertaining to angiographic characteristics, procedural variables, in-hospital and 1-year outcome variables were recorded and analyzed with the help of descriptive statistics and Chi-square Test.

Results: The mean age of the patients was 69.2 ± 5.2 (range: 65-85) years with male to female ratio being 4:1. The patients were predominantly diabetic (78%) followed by hypertensive (74%) and dyslipidaemic (70%) smoker (54%). Half of the patients presented with anterior myocardial infarction (MI), 30% had inferior MI, 12% with right ventricular (RV) extension and 8% with inferolateral extension. About one-quarter (24%) had arrhythmia with complete heart block (CHB). The culprit arteries were LAD (50%), followed by RCA (42%) and LCx (8%). Nearly half (46%) had single vessel disease, 34% double and 20% triple vessel disease. Majority (80%) received a single stent and 20% required two stents with mean diameter and length of the stents were 2.9 ± 0.4 mm and 27.3 ± 7.9 mm respectively. Intracoronary eptifibatide was used in 20% cases. In terms of left ventricular ejection fraction (LVEF), 58% and 28% had mild and moderate LV systolic dysfunction respectively. The mean duration of hospital stay was 4.0 ± 1.9 days. About 18% required repeat hospitalization. Overall, 7(14%) patients died (4 during their stay in the hospital due to cardiac cause and 3 during follow up due to non-cardiac causes). At 1 year follow up, in-stent restenosis was seen in 1 case followed by target vessel revascularization (TVR). The Association between age and outcome revealed that advanced age (age ≥ 75 years) was an important predictor of in-hospital and one-year outcome with Relative Risk (RR) of having unfavorable outcome was > 5-fold (95% CI: 1.6-19.5) in patients of advanced age than that in patients of age < 75 years (p = 0.008).

Conclusion: Primary PCI is a feasible treatment option for elderly Bangladeshi patients presenting with STEMI with fewer in-hospital and 1-year follow up deaths. Adverse cardiovascular events are even less. Advanced age (age ≥75 years) is an important determinant of adverse cardiovascular events including mortality, probably because of more medical co-morbidities associated with advanced age.

Key words: Elderly population, primary PCI, outcome etc.

INTRODUCTION:

Cardiovascular disease is the most common cause of morbidity & morality in persons aged 65 years and older, and its incidence increases with age.[1] The terms "elderly" and "older adults" usually refer to persons older than 65 years.[2,3]

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Older adults are rapidly increasing in the United States and by the year 2030, 1 of every 5 individuals might be older than 65 years.[4] In Bangladesh due to improved quality of life the number of people over 60 years is increasing rapidly.[5] In 2025, one in every 10 people will be 60 or above, and in 2050, one in every five people will be "elderly".[6] In Bangladesh population aged 65 or above was reported to be 5.1% (as a percentage of total) in 2018 (according to the World Bank Development indicators). As average life expectancy of Bangladeshi people is increased (73.5 years),[5] a higher proportion of elderly patients are expected to present with STEMI. As these patients may present with atypical symptoms, the diagnosis of MI may be delayed or missed.[7] In addition, the elderly would have more comorbidities and are less likely to receive reperfusion therapy compared with younger patients.[8,9] Among many factors, age is one of the predominant reasons of deferred PCI in elderly patients, from the patients' themselves or from patients' family perspectives.

Elderly patients are at particular risks of bleeding and other complications from acute therapies. The renal function tends to decrease, & the prevalence of comorbidities becomes high with advanced age.[10] Particular attention, therefore, must be paid to the proper dosing of antithrombotic therapies considering renal function, frailty, or comorbidities, and radial access should be preferred whenever possible.[10] There is no upper age limit with respect to reperfusion, especially with primary PCI.[11] Elderly patients are at high risk when they present with STEMI, a condition that often accounts for morbidity and death. Reasons for the high risk include atypical presentation, delays in seeking medical care, management by non-cardiologists, and, frequently, admission to hospitals that have no catheterization facility, which is particularly relevant to Bangladesh owing to limited numbers of catheterization laboratory facilities.[12,13] Mortality and morbidity have been shown to significantly reduce in elderly population when primary PCI was done in appropriate time frame, in comparison with thrombolytic therapy or medical management alone.[14]

To the best of our knowledge, there is insufficient data about the safety, efficacy and outcome of primary PCI in an elderly cohort of patients aged ≥ 65 years in a Bangladeshi population. Therefore, this study was done in older (≥ 65 years) Bangladeshi patients undergoing PPCI for STEMI to evaluate their in-hospital and 1-year outcome.

METHODS:

STEMI patients aged ≥ 65 years who underwent primary PCI at Ibrahim Cardiac Hospital & Research Institute, Bangladesh from January 2015 to August 2017 were the study population. A total of 50 such patients were consecutively included in the study. The clinical, angiographic, procedural, in-hospital and 1-year follow-up outcomes were collected in a specifically designed study database. Patients were followed up to 1 year via personal or familial telephone contact. The following major adverse cardiac events were defined: a) mortality (in-hospital and at follow up), b) cardiovascular death, as death due to cardiovascular causes, including unexplained sudden death, c) myocardial infarction if the event fulfilled criteria meeting the fourth universal definition of myocardial infarction, d) repeat revascularization, including any revascularization procedure in previously treated culprit lesions, e) stent thrombosis, classified according to the Academic Research Consortium (ARC) criteria and f) bleeding, scored according to the classification of the Bleeding Academic Research Consortium (BARC) (Bleeding was considered major if it had a BARC score > 2), g) stroke. Any of the above adverse events including mortality that developed among the patients during hospital stay and 1-year follow up period was considered as unfavourable outcome. Statistical analysis was done with the help of SPSS (Statistical Package for

Social Sciences), version 25.0. The test statistics used to analyze the data descriptive statistics and Chi-square (χ^2) Test. Association between age of the patients and outcome was analyzed using Chi-square (χ^2) Test with level of significance being set at 5%.

RESULT:

Baseline and clinical characteristics of the patients are presented in Table I. There were 41(82%) males and 9(18%) females. The mean age of the patients was 69.2 ± 5.2 (range: 65-85) years. The predominant comorbidities were diabetes (78%) followed by hypertensive (74%) dyslipidaemic (70%) and smoker (54%). The mean duration of symptoms was 5.2 ± 2.9 (range: 0.5 -12) hours. Forty four percent of the patients presented with acute kidney injury (AKI) and 2% with cardiac arrest. Serum Glutamic-Pyruvic Transaminase (SGPT) level was 47.4 ± 7.3 (range: 12-380) U/L. N-terminal pro b-type natriuretic peptide (NT-pro-BNP) was raised in 38%, normal in 16% and was not done in 46% patients.

Nearly half (46%) of the patients had single vessel disease (SVD), 34% double vessel disease (DVD) and 20% triple vessel disease (TVD). The infarct-related arteries (IRAs) were LAD (50%), RCA (42%) and LCx (8%). Majority (98%) of the procedures was done through radial access. Slow flow was found in 10% cases. Intracoronary eptifibatide was used in 20% patients and thrombus extraction was done in 2% patients (Table II). Nearly 60% of the patients had mild and 28% moderate LV systolic dysfunction (Fig.1).

In terms of diagnosis, 30% had Inferior MI and 22% had anterior MI, 14% had extensive anterior and another 14% anteroseptal MI. Inferior MI with Right Ventricular (RV) infarction and inferolateral extension were 12% and 8% respectively (Fig.2).

Majority (80%) of the patients required single stent to be implanted and 20% required two stents. In all cases, a drug-eluting stent (DES) was implanted. Both DES and bare metal stent (BMS) were implanted in 8% cases where more than one stent was required. Mean stent diameter was 2.9 ± 0.4) mm (range was 2.25-4.0 mm). The mean stent length was 27.3±7.9 (range: 12-38) mm.

Table I. Distribution of patients by their baseline & clinical characteristics

Baseline & clinical characteristics	Frequency	Percentage	Mean ± SD (range)
Age (years)	---	---	69.2 ± 5.2 (65-85 years)
Sex			
Male	41	82.0	---
Female	9	18.0	---
Smoking	27	54.0	---
Diabetes	39	78.0	---
HTN (Hypertension)	37	74.0	---
DL (Dyslipidemia)	35	70.0	---
SOB (shortness of breath)	11	22.0	---
Chest pain	49	98.0	---
Syncope	1	2.0	---
Cardiac arrest	1	2.0	---
History of coronary artery disease	7	14.0	---
CKD	10	20.0	---
Stroke	6	12.0	---
Duration of symptoms (hours)	---	---	5.2 ± 2.9 (0.5 -12)
Hypothyroidism	1	2.0	---
Chronic obstructive pulmonary disease (COPD)/Bronchial asthma	7	14.0	---
Prior MI	1	2.0	---
Prior PCI	1	2.0	---
Oedema	1	2.0	---
AKI	22	44.0	---
SGPT (U/L)	---	---	47.4 ± 7.3 (12-380) Mean ± SEM
NT-pro BNP			
normal	8	16.0	---
raised	19	38.0	---
not done	23	46.0	---

Table IV demonstrates in-hospital outcomes of patients. Total in-hospital mortality was 4(8%). One of them expired during the procedure with anterior MI, 1 following PCI on 2nd day due to cardiogenic shock, 1 due to reinfarction and the last one due to sepsis followed by cardiogenic & septicemic shock. Eight percent developed cardiogenic shock, 8% required mechanical ventilator, 24% had arrhythmia (CHB 12%, VT 6%, AF 4% and AV block 2:1 2%). Mean duration of hospital stay was 4.0 ± 1.9 days (range: 2-11 days).

Table II. Angiographic and procedural variables

Angiographic & procedural variables	Frequency	Percentage
No of vessel involved		
Single vessel disease (SVD)	23	46.0
Double vessel disease (DVD)	17	34.0
Triple vessel disease (TVD)	10	20.0
IRA		
LAD	25	50.0
LCx	4	8.0
RCA	21	42.0
Access		
Radial	49	98
Femoral	1	2
Intracoronary eptifibatide	10	20.0
Slow Flow	5	10.0
Pre dilatation	43	86.0
Post dilatation	10	20.0
Temporary pacemaker (TPM)	6	12.0
Thrombus extraction	1	2.0

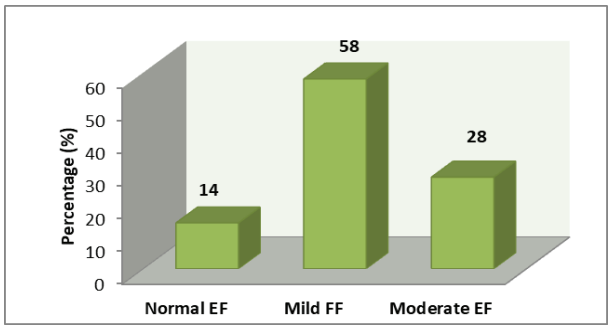

Fig I: Distribution of patients by their ejection fraction%

In nearly 70% of the cases, further revascularization was not needed due to diffuse nature of the disease or the lesion was of moderate type. Only 17.4% underwent further revascularization of non-culprit lesions either before discharge in the same admission or later with subsequent admission & 13% refused to receive stent of the non-culprit lesion (Fig. 3).

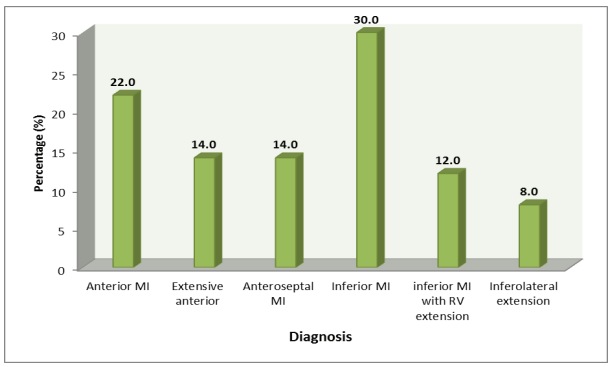

Fig 2: Distribution of patients by their diagnosis

Follow up after 1 year was done over telephone communication with patients themselves or their relations. Follow-up data was available for 45 patients. Follow up of one patient was not possible due to loss of contact. Of the 45 patients followed, there was a further 3(6.67%) patients died; all of them with non-cardiac causes. Further hospitalization was needed in 17.78% cases. In-stent restenosis (ISR) was observed in 1(2.22%) patient followed by TVR. Ischemic stroke developed in 2(4.44%) patients (Table V).

Table III. Distribution of patients by their Stent

Stent	Frequency	Percentage	Mean ± SD (range)
Stent number			
Single	40	80.0	---
Double	10	20.0	---
Stent type			
DES only	46	92.0	---
BMS only	0	0.0	---
DES & BMS both	4	8.0	---
Diameter of stent mm	---	---	2.9 ± 0.4 (2.25-4)
Length Stent mm	---	---	27.3 ± 7.9 (12-38)

The hypothesis that advanced age is likely to cause unfavorable outcome in patients undergoing primary PCI was tested with crosstab (Chi-square) analysis. The analysis revealed that advanced age (age ≥ 75 years) was an important predictor of

in-hospital and one-year outcome with Relative Risk (RR) of having unfavorable outcome was > 5-fold (95% CI: 1.6–19.5) greater in patients of advanced age than that in patients of age < 75 years (p = 0.008) (Table VII).

Table IV. In-hospital outcomes

In hospital outcome	Frequency	Percentage	Mean ± SD (range)
In hospital mortality	4	8.0	---
Time of death			
During procedure	1	2.0	---
After procedure	3	6.0	---
Arrhythmia			
CHB	6	12.0	---
AV block 2:1	1	2.0	---
VT	3	6.0	---
AF	2	4.0	---
Hypotension	4	8.0	---
Acute Left Ventricular			
Failure (ALVF)	17	34.0	---
Cardiogenic shock	4	8.0	---
Bleeding/ hematoma	0	0.0	---
Ventilator required	4	8.0	---
Length of hospital stay			
in days (n=46)	---	---	4.0 ± 1.9 (2-11)

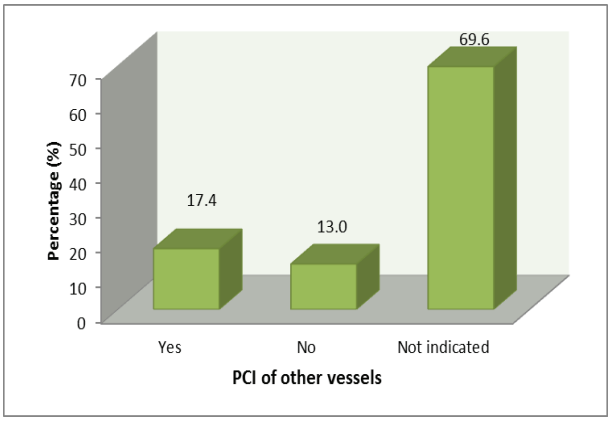

Fig 3: distribution of patients undergoing revascularization of non-culprit lesions

Table V. Distribution of patients by follow-up findings at 1 year (n=45)

Findings	Frequency	Percentage
Death at follow-up	3	6.67
Causes of death: Non cardiac	3	6.67
Subsequent hospitalization	8	17.78
Chest pain	2	4.44
SOB	4	8.89
Stroke	2	4.44
ISR	1	2.22
TVR	1	2.22
Creatinine		
normal	28	60.9
Raised creatinine	7	15.2
not done	10	23.9
LV systolic dysfunction		
No LV systolic dysfunction	9	19.6
Mild LV systolic dysfunction	16	34.8
Moderate LV systolic dysfunction	3	6.5
Echo not done	17	39.1

Table VI. Association between age and primary PCI outcome

Age (years)*	Group		Relative Risk (95% CI of RR)	p-value
	Unfavorable (n = 9)	Favorable (n = 41)		
≥ 75	6(66.7)	7(17.1)	5.7 (1.6– 19.5)	0.008
<75	3(33.3)	34(82.9)		

Figures in the parentheses indicate corresponding %;
***Chi-squared Test (χ^2)** was done to analyze the data.

DISCUSSION:

The most appropriate reperfusion strategy for older patients is primary angioplasty that is performed within an acceptable time frame.[14,7] However, the prognosis is still worse among elderly than among younger patients.[15-20] In the present study, we used DES in 100% cases. Both DES and BMS were used for a single lesion in 8.0% cases where more than one stent was required. This was due to financial constraints, as

patients could not afford a second DES. The 2017 ESC Guidelines for the management of STEMI, have stipulated implantation of DES over BMS with a Class I (level of evidence A) recommendation.

No access-site complications or haematomas were observed in the present study, because the radial access was the predominant (98%) access-site used. This approach is well-supported by guideline recommendations.[10] More than half cases was done through radial route in the study done by José et al[21] without experiencing much of the complication related to access site. Especially in case of PPCI, radial access is superior to femoral access,[22-25] despite the fact that this approach could be more difficult in elderly patients, particularly in women due to subclavian tortuosity. The latter cases may necessitate cross-over to alternate access. These factors exert important potential impacts on clinical outcomes.[26]

Thrombus aspiration was done in 1 patient in our series, due to huge thrombus load as well as to facilitate distal perfusion. Thrombo-aspiration was done in more than half of the cases in José et al's study.[21] It was not a predictor of adverse events in their study. Systematic application of this strategy failed to improve prognosis.[27,28] However, its selective use might offer some advantages, particularly for the high-risk populations, such as elderly patients. An important determinant after PPCI is inadequate reperfusion which is associated with poor prognosis.[29,30]

Subgroup analysis of Primary Angioplasty in Myocardial Infarction-I (PAMI-I) revealed no increased risk of stroke and intracranial hemorrhage in the elderly patients, in their PCI group.[31] This is also true for our population, where no such events were reported. In our 1 year follow up only 2 (4.3%) patients developed ischaemic stroke, which is not related to the procedure.

In our study, approximately 30% of cases presented with a symptom onset of > 6 hours. This feature was almost similar to that of Hernández et al.[21] In their study approximately 30% of the patients presented with chest pain of > 6 hours duration. This finding was important because a delayed presentation of > 6 hours was identified as a predictor of events in their study.

Eight percent (8%) of our population had cardiogenic shock. The incidence of cardiogenic shock was 11.5% in the study of Hernández et al.[21] Gharacholou and associates[31] showed that older patients undergoing PPCI have lower rates of procedural success, and are more likely to suffer from post-procedural complications. They had 4.8% mortality in 65-74 years and 13.1% mortality in the age group of ≥75 years at 90 days follow up. According to the authors, age is the strongest predictor of mortality at 90 days.[31] In our analysis advanced age (age ≥ 75 years) was found as a predictor of in-hospital and one-year outcome with RR of developing unfavorable outcome was > 5-times (95% CI: 1.6–19.5) higher in patients of advanced age than that in patients of age < 75 years (p = 0.008). Our in-hospital mortality rate was 8%. A subgroup analysis of PAMI-I trial also showed a fewer in-hospital deaths and a significant reduction in death or recurrent MI in patients aged ≥ 65 years who underwent immediate PCI.[31] Although our study did not include a comparison with fibrinolytic therapy, mortality following PPCI was very much consistent with that of PAMI-1.

The 1-month mortality seen in the registry done by Hernández et al.[21] was 12.2%. 2-year mortality rate of the registry done by Hernández et al.[21] was 24.2%, with a notable contribution of non-cardiovascular mortality. This mortality rate was higher than that observed in the general population but is within the range published by other registries of this population.[15,16,19,20,32-34] Mortality rate was increased by 6.67% in our population during the 1-year follow up period, all of which were due to non-cardiac causes. A review by Vimalraj et al reported non-cardiac causes as the predominant cause of death after all types of

PCI in the very elderly population.[35] The elderly may experience higher mortality from STEMI due to severe comorbidities, advanced coronary artery disease (CAD), as well as mechanical and electrical complications of acute myocardial infarction (AMI).[32,33]

The patients in our study were predominantly diabetic (78%) and hypertensive (74%) with 34% developing ALVF, and 8.0% cardiogenic shock, which might have contributed to adverse outcomes. Rigorous selection criteria gave certain advantages to the acute phase elderly infarction survivors over the general population for adverse cardiac events. It was revealed in a large Swedish study in the follow up of subsequent year.[15]

The role of complete revascularization was important. In our study 34% had DVD, 20% had TVD. However, only 17.4% underwent further revascularization of non-culprit lesions either before discharge in the same admission or later with subsequent admission. Hernández[21] showed that 55.4% of their patients had multivessel disease. In their study a sizable proportion of patients underwent revascularization of non-culprit lesions in the acute phase or as a subsequent procedure during admission. Over one-third (35.3%) had significant residual disease at discharge. According to COMPLETE trial- complete revascularization (before or after the index hospitalization) after primary PCI for STEMI is beneficial and superior to culprit-only revascularization in reducing death or MI.[30] There was no major bleeding during hospitalization or during 1 year follow up in our study. Hernández[21] reported the incidence of major bleeding to be 0.5% at one month and 2.4% at 2 year follow up. ISR was observed in 2.2% cases during follow up, followed by target vessel revascularization (TVR). The incidence of repeat revascularization was low in Hernández's study,[21] despite most of the patients receiving BMS. The incidence of stent thrombosis was 3.1%. although we didn't have any incidence of stent thrombosis possibly due to deployment of DES in most cases.

The present study showed that the in-hospital survival rate of PPCI was 92%. The overall mortality rate (in-hospital mortality plus 1-year mortality) in the present study was 14%. Abdullah showed that their survival rate of PPCI patients was 86% at month 1, followed by 83.9% at month 6, and 81.2% at month 12.[36] So from these evidences it could be postulated that patients treated with PPCI for STEMI have good prognosis if they survive the initial months. Before drawing conclusion, the following limitations deserve mention.

Limitations:

The sample size was too small to generalize the findings to reference population and the study was conducted a single center. Besides, we could not include the data of patients' adherence to drugs, as one year follow up was done over telephone.

CONCLUSION:

Primary PCI is a feasible treatment option for elderly Bangladeshi patients presenting with STEMI with fewer in-hospital and 1-year follow up deaths. Adverse cardiovascular events are even less. Advanced age is an important determinant of adverse cardiovascular events including mortality, probably because of more medical co-morbidities associated with advanced age.

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