Predictors of Outcome Difference Following Acute Myocardial Infarction between Rural and Urban Patients

Mohammed Abdur Rahim[1*] A.B.K. Bashiruddin[2] Iqbal Mahmud[3] Debabrata Bhattacharya[2] Anisul Awal[4]
Prabir Kumar Das[6] Neena Islam[5] Md. Abdur Rouf[1] Muhammed Syedul Alam[1]

Abstract

Background: Different factors may influence management, complications and outcome of both rural and urban patients following Acute Myocardial Infarction (AMI). Aim of the study was to identify the factors influencing outcome following AMI between rural and urban population is lacking in our country.

Materials and methods: This was a cross sectional study carried out in the Department of Cardiology, CMCH from June 2018 to May 2019. One hundred and ninety-eight consecutively admitted AMI (STEMI) patients from both urban and rural area were included. Demographic, anthropometric, risk factors, presentation profile, inhospital complications and outcome were recorded and compared between the groups.

Results: Out of 198 patients 23.23% female and 76.23% were male. Mean age was significantly higher in Rural group (55.5±11.6 years) than the Urban (49.3±11.2 years) p value 0.037. Urban patients were more sedentary (68.8% vs. 43.8%, p=0.001) and having higher BMI (>25kg/m2 was 48.8% vs 30.6%, p=0.024). Rural patients presented late after symptom onset (5 hours vs. 13 hours) long distance to travel was mentioned as prime cause of delay by them. Inhospital mortality was higher among rural patients (12.4% and 3.9%; p=0.045). Adverse outcome was associated with increasing age, male sex and poor LV function in urban patients, while in rural patient it was related to lower education level, delayed presentation and poor LV function.

Conclusion: Outcome of AMI differs between rural and urban patients. This finding of different factors influencing outcome in two groups could be used to design specific preventative measures.

1. Assistant Professor of Medicine
Chittagong Medical College, Chattogram.
2. Medical Officer, OSD, DGHS.
3. Lecturer of Dental Unit
Chittagong Medical College, Chattogram.
4. Assistant Professor of Cardiology
Chittagong Medical College, Chattogram.
5. Associate Professor of Cardiology
National Center for Control of Rheumatic Fever and Heart Disease, Dhaka.
6. Professor of Cardiology (Retired)
Chittagong Medical College, Chattogram.

***Correspondence:** **Dr. Mohammed Abdur Rahim**
Cell : 01816 30 62 19
E-mail: rahimdr2004@yahoo.com

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Introduction

Globally, Cardiovascular Diseases (CVD) are the number one cause of mortality. According to the World Health Organization (WHO) it is estimated that 7.4 million deaths were due to Coronary Heart Disease (CHD) in 2015.[1] During recent decades, Bangladesh has experienced a rapid epidemiological transition from communicable to non-communicable diseases.[2] CHD is the fourth leading cause of death in Bangladesh, being responsible for 50,700 deaths in 2012.[3]

STEMI is a life-threatening heart disease, particularly with high early mortality if not treated properly. Despite global agreement on most issues related to the management of STEMI, clinical practice and outcome after STEMI varies with a great deal between countries and regions.[4,5] Healthcare disparities between urban and rural areas have been affecting billions of people worldwide. Rural residents have limited access to medical services.[6] Moreover, for high-impact conditions, such as AMI, patients living in rural areas may be less likely to receive evidence-based therapies and may experience worse outcomes.[7,8,9] The disparities could vary across countries with different economic status.[10]

CAD in rural Bangladeshi people is significant and is comparable to other developed countries.[11] Moreover, in rural areas of Bangladesh, most patients with STEMI have little access to thrombolysis or primary coronary intervention, because very few rural hospitals are ready to treat AMI patients. Due to lower level of education rural peoples are less cognizant of the dangers of delaying medical intervention. Relatively poor rural patients are also distressed about the high cost of latest invasive treatment options for AMI. The purpose of this study was to identify the factors influencing outcome of rural and urban AMI patients and to compare between two groups.

Materials and methods

This was a hospital based cross sectional study conducted on 198 patients admitted with STEMI in Cardiology Department of Chittagong Medical College Hospital from June 2018 to May 2019. Study populations were selected consecutively from those who were admitted with STEMI, a total 198 patients were enrolled. Patients residing in City Corporation, district sadar and Pourashova were considered as urban and those living outside were considered rural. Patients having co morbidities, other cardiac diseases and previous history of MI were excluded.

Total 77 urban and 121 rural patients were enrolled in the study. An informed written consent was taken from all patients. After obtaining demographic profile patients were interviewed and examined to collect data regarding symptoms, risk factors of MI, time taken to arrive at hospital, any pre hospital delay and cause of delay. Inhospital outcomes were assessed in terms of death and complications, e.g arrhythmia, cardiogenic shock, heart block and heart failure. Collected data of two groups were analyzed and compared to find out the differences between two groups regarding in-hospital outcome and predictors of outcome.

The statistical analysis was carried out by using Statistical Package for Social Sciences (SPSS-23). Quantitative or continuous variables were described as mean ± standard deviation. Means were compared using Student's t-test among groups. Qualitative or categorical variables were described as frequencies and proportions. Proportions were compared by using chi-square (χ^2) test. Logistic regression analysis was performed to determine the independent predictor of poor outcome. Statistical significance and confidence interval were set at $p<0.05$ and 95% level respectively.

Results

In our study total sample size was 198 among them urban patient was 77 and 121 patients from rural area. Male to female ratio in urban group was 4.5:1 and in rural group 2.8:1. Majority of the patients were from the 40-59 years of age group.

Table I Demographic profile of patients by their residential area (n=198)

Variables (unit)	Urban (n=77)	Rural (n=121)	p value
Sex			
Male	63 (81.8%)	89 (73.6%)	0.179
Female	14 (18.2%)	32 (26.4%)	
Age (years)			
<40	15 (19.5%)	4 (3.3%)	
40-59	41 (53.2%)	69 (57.0%)	0.037
≥60	21 (27.3%)	48 (36.7%)	
Mean ±SD	49.3±11.2	55.5±11.6	0.035
Range	22-85	25-90	
Educational level			
Illiterate	14 (18.2%)	51 (42.1%)	
Primary	20 (26.0%)	40 (33.1%)	<0.001
SSC	18 (23.4%)	21 (17.4%)	
HSC & above	25 (32.5%)	9 (7.4%)	
Net income (1000 BDT/month)			
≤10	5 (6.5%)	29 (24.0%)	
>10-20	25 (32.5%)	22 (18.2%)	<0.001
>20	47 (61.0%)	70 (57.9%)	
Median (IQR)	25 (20-34)	15 (11-20)	<0.001

The mean age of the urban and rural patients was 49.3±11.2 and 55.5±11.6. Urban patients were significantly younger than rural (p=0.035). Educational status of rural patients was significantly (p<0.001) lower than that of the urban patients. Similarly, net monthly income was also significantly (p<0.001) higher in the urban group than the rural group (Table I).

Table II Comparison of risk factors of AMI patients (n=198)

Variables (Unit)	Urban (n=77)	Rural (n=121)	p value
Positive family history	10 (13.0%)	15 (12.4%)	0.903
Sedentary lifestyle	53 (68.8%)	53 (43.8%)	0.001
Current smoker	39 (50.6%)	49 (40.5%)	0.161
Ex-smoker	20 (26.0%)	26 (21.3%)	0.814
BMI 23.0- 24.9 kg/m2	25 (32.5%)	39 (32.2%)	0.961
BMI 25 kg/m2	36 (48.8%)	37 (30.6%)	0.024
Central obesity	53 (68.8%)	69 (57.0%)	0.096
Hypertension	31 (40.3%)	43 (35.5%)	0.503
Diabetes mellitus	24 (31.2%)	35 (28.9%)	0.737
Dyslipidemia	28 (36.4%)	34 (28.1%)	0.222

Sedentary lifestyle was more prevalent in urban (68.8%) than rural (43.8%). Significantly higher number of urban patients (48.8% vs. 30.6%, p=0.024) have BMI ≥25 kg/m^2. Distribution of other risk factors between rural and urban patients were similar (Table II).

Table III Time taken to arrive, reason for delay and pre-hospital medication received by patients (n=198)

Variables (Unit)	Urban (n=77)	Rural (n=121)	p value
Time taken to arrive (Hours, range)	5 (2-18)	13 (5-24)	<0.001
Arrive within 2 hours	21 (27.3%)	12 (9.9%)	0.001
Delay >12 hours	27 (35.1%)	61 (50.4%)	0.034
Received pre hospital medication	5 (6.5%)	15 (12.4%)	0.087
Aspirin & / clopedigrol	4 (5.2%)	2 (1.7%)	0.742
LMWH	1 (1.3%)	13 (10.7%)	0.451
Reasons for delay			
Long distance (>50 km)	5 (18.5%)	26 (42.6%)	<0.001
Concern about the cost	3 (11.1%)	10 (16.4%)	0.257
Symptoms regarded as due to PUD	9 (33.3%)	7 (11.8%)	0.006
Unawareness	7 (25.9%)	14 (22.9%)	1.0
Others	2 (7.4%)	6 (9.8%)	0.845

Median time of hospital arrival was 5 hours for urban and 13 hours for rural patients. 50.4% rural patients arrived after 12 hours of symptom onset, 27.3% urban patients arrived within 2 hours. Long distance from hospital was reported as a reason for delay by 42.6% rural patients in contrast, 33.33% urban patients mentioned symptoms seemed to be due to PUD (Table III).

Table IV Complications of AMI patients (n=198)

Variables (Unit)	Urban (n=77)	Rural (n=121)	p value
Cardiogenic shock	16 (20.8%)	22 (18.2%)	0.651
LVF	12 (15.6%)	30 (24.8%)	0.122
Heart block	12 (15.6%)	12 (9.9%)	0.234
Arrhythmia	7 (9.1%)	16 (13.2%)	0.376
Mortality	3 (3.9%)	15 (12.4%)	0.045

Mortality was significantly higher among rural patients compared to urban patients (12.4% vs. 3.9%, p=0.045). Most common complication was cardiogenic shock 20.8% in urban and 18.2% in rural, followed by left ventricular failure 15.6% and 24.8% respectively (Table IV).

Table V Predictors of poor outcome following AMI

Variable	Urban patients					Rural patient				
	β	p value	Odds Ratio (OR)	95% CI for OR Lower	Upper	β	p value	Odds Ratio (OR)	95% CI for OR Lower	Upper
Age (Years)	0.071	0.044	1.074	1.002	1.150	-0.002	0.915	0.998	0.956	1.041
Male sex	2.060	0.030	7.842	0.926	66.40	10.532	0.317	1.703	0.600	4.831
Monthly income	0.000	0.549	1.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000
Lower education	1.019	0.327	2.771	0.361	21.290	1.073	0.038	2.924	1.709	12.062
Sedentary life style	1.851	0.099	6.363	0.708	17.04	10.463	0.972	1.011	0.378	2.581
BMI ≥25 kg/m^2	0.536	0.909	1.061	0.372	3.031	0.470	0.823	0.900	0.358	2.261
DM	-0.685	0.384	0.504	0.108	2.359	-0.660	0.217	0.517	0.181	1.473
HTN	1.076	0.174	2.933	0.622	13.824	-0.660	0.217	0.517	0.181	1.473
LVEF (%)	-0.190	0.001	0.827	0.739	0.926	-0.279	0.591	0.757	0.274	2.094
Arrival time (hours)	-0.005	0.810	0.995	0.953	1.038	0.170	<0.001	0.844	0.784	0.909

Increased age (OR1.074, 95% CI, 1.002 - 1.150) male sex (OR 7.84, 95% CI, 20.926 - 66.401) and low ejection fraction (OR 0.827, 95% CI, 0.739-0.926) are independent predictive factors for poor outcome following AMI in urban patients. Lower education (OR 2.924, 95% CI, 1.709 - 12.062) low ejection fraction (OR 0.844, 95% CI, 0.784 - 0.909) and longer time to arrive in hospital (OR 0.977, 95% CI, 0.906-0.999) are independent predictive factors for poor outcome following AMI in rural patients (Table V).

Discussion

Among 198 patients, 76.7% were male and 23.3% female. Male patients were four times more than female in urban and three times in rural community. This was comparable with that of INTERHEART study and its South Asian Cohort (Overall Male 76% and 85% in South Asian Male).[12] Urban patients suffered from AMI were significantly younger than rural. Comparatively higher age of the rural patients is in agreement with that of Kim et al.[13] Among the risk factors of acute MI sedentary lifestyle and BMI >25 kg/m2 was more prevalent in urban patients, patient with comorbidities e.g hypertension, diabetes, smoking, dyslipidemia, family history of CAD was equally prevalent in rural and urban patients. Chadha et al reported that the prevalence of coronary heart disease and its urban-rural differences were not related to any particular risk factor and it is therefore necessary to look for other factors beyond the conventional explanations.[14] Urban patients arrived at hospital significantly earlier than rural patients. Rural patients mentioned long distance to travel as the main reason of delay, the urban patients who delayed misinterpreted symptoms as PUD. Das et al reported 62.7% acute MI patients presented after 12 hours in Chittagong Medical College Hospital.[15] The author also observed age more than 65 yrs, traveling long distance more than 50 miles from home residence and misinterpreting chest pain as PUD were associated with late presentation. Mortality was significantly higher among rural patients, similarly, Bhuiyan et al found higher in-hospital mortality among rural patients following AMI in Nebraska (11.5% vs. 9.3, p- <0.001).[8] In urban patients increase age, male sex and low ejection fraction were found

independent predictive factors for poor outcome. Lower education, longer time to arrive in hospital and lower ejection fraction were identified as independent predicting factors of poor outcome in rural patients. As above discussion long distance and longer time to arrive hospital influence outcome in rural group our national policy may be adopted to provide coronary care services nearer to them. Rapid diagnosis and early intervention may improve their outcome. Concern about the cost of treatment was found second cause of delay, necessary steps to increase affordability of rural population as well as reduction of treatment cost may result in better outcome. Increasing awareness of urban peoples about the symptoms of coronary diseases as well as changing lifestyle, increasing physical activity and proper weight management may reduce the prevalence of coronary artery disease and associated mortality.

Limitations

Urban patients enrolled in our study was less then rural, many of the urban patients with coronary artery diseases treated in private hospital. Usually those from middle and lower economic status who cannot provide high cost of treatment was admitted in our hospital.

Conclusion

Mortality was higher among rural patients. Urban patients were younger, more sedentary and obese than rural patients. Rural patients had lower education and less monthly family income. Rural patients presented late after onset of symptom and mentioned long distance to travel as the main reason for delay. Urban patient who presented late misinterpreted the symptom as PUD. Increasing age and male sex in urban and delayed presentation and lower education in rural patients were found individual predictor of poor outcome. Low LVEF was associated with adverse outcome in both groups.

Recommendation

Further study with larger sample size separately in rural and urban patients may be done for better understanding of outcome difference and influencing factors.

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Contribution of authors

MAR-Design, conception, acquisition of data, data analysis, drafting and final approval.
ABKB: Acquisition of data, data analysis, drafting & final approval.
IM-acquisition of data, data analysis and final approval
DB-Acquisition of data, data analysis, drafting and final approval.
AA-Data analysis, critical revision & final approval.
PKD-Design, critical revision & final approval.
NI-Data analysis, critical revision & final approval.
MAR-Acquisition of data, drafting & final approval.
MSA-Interpretation of data, critical revision & final approval.

Disclosure

All the authors declared no competing interest.

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