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Original Research Article

Risk factors, clinical features and outcomes of acute myocardial infarction in elderly and young patients – A comparative study

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ABSTRACT

Introduction: Age is a strong and independent risk factor for the development of coronary atherosclerosis. AMI is a disease of older population and is uncommon in young, though it occurs at younger age in India compared to Western population. This emphasizes the growing importance of examining the risk factors and outcomes in the elderly and young in discrete populations. With age, multiple co-morbidities develop that intertwine and fundamentally alter the management of CVD. The primary objective of the present study is to compare the risk factors, clinical features, outcomes of AMI in elderly (age $\geq$ 60 years) and younger patients with AMI (age < 60 years)

Materials and Methods: This hospital based observational study was carried out on 200 study participants of either gender, with a diagnosis of AMI recruited on the basis of simple random sampling with replacement using a random number table. For the purpose of comparison 100 cases of AMI below the age of < 60 years (young) and 100 cases aged ≥60 years (elderly) were included in either groups (I and II) respectively. The study parameters with respect to the risk factors, clinical features and outcomes of acute myocardial infarction were studied on the 1^{st}, 7^{th} and 30^{th} day of follow up.

Results: Mean age of patients in the Group I (young, age <60 years) was 51.9 ± 3.8yrs where as that of Group II (elderly, age ≥60 years) was 69.5 ± 5.3 yrs. Males were affected more than females in either groups. Hypertension was most common risk factor seen in elderly (46%) whereas smoking was the predominant risks factor the young (54%). Elderly patients reported to the hospital late during the illness as compared to those in the younger. NSTEMI, LBBB, Killip's class III & IV heart failure were more frequently seen in elderly. LMCA was more involved in elderly patient. Thrombolysis was done in less in elderly compared to young, so also β-blockers, ACEI were used less in the elderly. The elderly had a higher mortality on 1^{st}, 7^{th} and 30^{th} day of follow-up.

Conclusion: Manifestations of AMI in elderly are more subtle with more atypical presentations and have higher rate of complications and mortality. A high index of suspicion is important in elderly patients to achieve a timely management.

1. Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally. An estimated 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke. 82% of premature deaths (under the age of 70) due to non-communicable diseases are in low- and middle-income countries, and 37% are caused by CVDs.[1] The GBD (Global Burden of Disease) 2015 study have reported that prevalence of IHD in eastern sub-Saharan Africa, the Middle East/North Africa region, and South Asia is just over 2,000 cases per 100,000.[2] The risk

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factors for CAD that can be controlled or modifiable are high BP, high blood cholesterol levels, smoking, diabetes, obesity, lack of physical activity, unhealthy diet and stress. Those risk factors that cannot be controlled, also termed as conventional are, age, gender (men are generally at greater risk of coronary artery disease), family history and race.[3] Age is a strong and independent risk factor for the development of coronary atherosclerosis. Older adults, even those with no prior coronary vascular disease (CVD) or CVD risk factors are likely to develop CVD due to the progression of the physiologic and pathologic changes in old age. About 80% of heart disease deaths occur in people aged 65 or older.[4] AMI is a disease of older population and is uncommon in young, though it occurs at younger age in India compared to Western population. In Global Registry of Acute Coronary Events (GRACE) study, the prevalence of young acute coronary syndrome (ACS) was 6.3%.[5]This emphasizes the growing importance of examining the risk factors and outcomes in the elderly and young. As fragmentary data are available in this regard, the comparison of the role of conventional cardiovascular risk factors in elderly persons and younger patients needs more understanding in discrete populations. Ageing predispose people to CVD as well as multiple co-morbidities that intertwine and fundamentally alter the management of CVD. With this background the present study was done to compare the risk factors, clinical features, outcomes of AMI in elderly (age < 60 years) and younger patients with AMI (age < 60 years)

2. Materials and Methods

This hospital based observational longitudinal study was carried out on 200 consecutive study participants of either gender, with a diagnosis of AMI and admitted to the Department of Cardiology, MKCG Medical College & Hospital during the period of October 2016 to September 2018. The study was approved by the Institutional Ethics Committee of MKCG Medical College, Berhampur (Approval No. 531). Study subjects were recruited on the basis of simple random sampling with replacement using a random number table. For the purpose of comparison 100 cases of AMI below the age of < 60 years (young) and 100 cases aged ≥60 years (elderly) were included in Group I and II respectively. The study parameters were studied on the 1^{st}, 7^{th} and 30^{th} day of follow up. For the purpose of the present study, AMI was defined as any patient with symptoms of ischemia (new or presumed new significant ST-segment–T wave (ST-T) changes or new LBBB, detection of a rise and/or fall in cardiac biomarker values (preferably cTn), with at least one value above the 99th percentile. Patients of stable, unstable angina, with history or electrocardiographic evidence of prior MI, coronary bypass surgery/PCI, with co-morbid conditions like valvular, congenital or cardiomyopathy, unwilling to participate in the study were excluded.

Informed written consent was obtained prior to the inclusion in the study. A standardized, pre-tested case record form was used to capture the data on clinical history, risk factors and outcome. Apart from clinical examination all relevant routine and specialized investigations were done. Complications like cardiogenic shock, heart failure, heart blocks, arrhythmia present if any during first 24 hour of admission were recorded. All the case were followed on 7^{th} day and 30^{th} day of admission for complications.

All patients underwent selective coronary angiography at a mean of 4 days (range 2-7days) after onset of infarction, using the per-cutaneous femoral or radial seldingers technique. Angiograms were analyzed. The patency of the infarct-related artery was assessed according to the Thrombolysis in Myocardial Infarction (TIMI) criteria. Patients with partial and complete anterograde perfusion were considered to have patent infarct-related coronary artery. Significant coronary artery lesions with >50% reduction in diameter were considered obstructive.

Treatment modality, mortality were compared in both groups using Chi-square statistics. Data's were presented in percentage and mean SD. Data analysis was performed using Microsoft excel and GraphPad Prism Free trial version 7.0 software. Statistical significance was considered as $P \leq 0.05$.

3. Results

During the period of the study, 1210 cases were diagnosed as AMI. Based on the inclusion and exclusion criteria 894 patients qualified for the study. Out of these, 485 patients were of age ≥60 years and 409 patients were of age <60 years. From each group 100 patients were selected by the method of simple random sampling with replacement using random number table. Group I represented young patients with an age<60 yrs and Group II included elderly patients with an age ≥ 60 yrs.

Mean age of patients in the Group I (young, age <60 years) was 51.9 ± 3.8 yrs where as that of Group II (elderly, age ≥60 years) was 69.5 ± 5.3 yrs. Males were affected more than females in either groups but the male:female ratio was low in the elderly population (1.38: 1) compared to young (2.84: 1). Hypertension was most common risk factor seen in elderly (46%). Smoking as an associated risk factor was significantly less in elderly (22%) as compared to the young (54%). No associated risk factor was seen in 32% of elderly compared to 13% in young which was significant. Patients in the elderly group reported to the hospital late during the illness as compared to those in the younger age group. 52% and 32% of elderly and younger patients respectively reported to the hospital later than 12 hrs. Whereas, it was observed that none of the elderly reported to the hospital within 1 hr. [Table 1] Atypical chest pain, dyspnea, nausea, vomiting, giddiness and syncope were

seen significantly more in elderly compared to the young. No chest pain was seen in 22% in elderly. [Table 2] STEMI was less frequently detected in the elderly, while NSTEMI was more frequently detected in this age group. LBBB more frequent in the elderly, but the differences did not reach statistical significance. Distribution of cases involving different wall (arterial territory) did not show significant variations in both age groups. Echo-cardiographic findings like RWMA, decreased EF and ventricular aneurysm did not show any significant difference seen in both groups. Killip's class III & IV heart failure was observed more commonly in the elderly age group. [Table 3] Normal vessel and non- obstructive coronary artery disease was present more in group I, whereas there was a higher incidence of single-vessel disease in the younger patient group. The incidence of double-vessel and multi-vessel diseases was more in the elderly patients. LMCA was more involved in elderly patient. LAD was most common culprit vessel in the either groups followed by RCA, LCX. No differences were detected for visible thrombus in coronary angiography between the two groups. Elderly patients had more severe extensive disease and more calcification. [Table 4]

Outcomes were observed on 1^{st}, 7^{th} and 30^{th} day of admission. Complications like heart failure, cardiogenic shock, arrhythmia, CVA and death were observed more frequently in elderly group. VPC and AV block was significantly more common in elderly. Statistically no significant difference was noted for AF, BBB, VT and VF between two groups. [Table 5] Thrombolysis was done in a significantly less number of cases in elderly compared to young. Elderly STEMI patients had a higher contraindication to reperfusion as also a risk of complication. β-blockers, ACEI were used in significantly less number of cases in the elderly age group. PCI & CABG were done in significantly less number of cases in elderly as compared to young age group. [Table 6] Death was observed significantly more on $1^{st}, 7^{th}$ and 30^{th} day follow-up in elderly as compared to young. [Table 7]

4. Discussion

The mean age of cases in Group I and Group II was 51.9 ± 3.8yrs and 69.5 ± 5.3 yrs respectively. In a systematic review and metanalysis the estimate of average age at the onset of acute myocardial infarction has shown that the mean age of occurrence of AMI varied between 55.9 to 62.9 years among the primary studies.[6] It was observed in the present study that the male:female ratio was 2.84:1 and 1.38:1 respectively in Group I and II, though males were affected more in both the groups. A higher percentage of females were affected by AMI in the elderly population. A similar trend was shown in the study by Zucker et al where they have observed that AMI was almost twice as common in men as in women (10% v

s 6%). Controlling for demographics, presenting signs and symptoms, electrocardiogram features, and hospital, male gender was a significant predictor of AMI (odds ratio [OR] 1.7; 95% confidence interval [CI] 1.4 , 2.0).[7] Moshki et al have reported the occurance of AMI in a study on 200 patients in Terhan that the prevalence of AMI was 33% and 67% in females and males respectively.[8] The higher incidence of AMI in elderly females may be due to the loss of protective action of estrogen in elderly females. The median symptom to door time (STDT) i.e. cases presenting for treatment before 12 hr was 48% in the elderly as compared to 68% in the younger subjects. Studies have reported the median symptom-to-door time to be 120 min.[9] Brown et al in their study on 1020 patients have observed that South Asians have a trend towards longer STDT than other ethnic groups.[10] But, in the present study the symptom to door time > 300 minutes, especially in the elderly. The delay in presentation in elderly may be due lack of symptom awareness, longer distance travelled from the hospital and problems of transportation in an undeveloped state, consultation with local practitioners or local primary health centre. In the CREATE study on treatment and outcomes of ACS in India the median symptom to door time was 300 minutes for patients with AMI.[11]

In the present study, hypertension was the commonest risk factor in elderly, while smoking was common in the younger group. Some studies have observed that risk factors like hypertension, dyslipidemia and diabetes were equally present in both groups but obesity, smoking and family history of coronary artery disease was more prevalent in younger age group.[12] A metanalysis done by Lei et al revealed that young AMI patients have different clinical characteristics and pathophysiology when compared to older patients and have reported that the rate of smoking in young AMI patients was much higher than that in older AMI patients (71.51% vs 40.43%).[13] Other studied have also reported that smoking, diabetes mellitus, family history of CAD, hypertension, hyperlipidemia and obesity contribute to the set of main risk factors for AMI in young patients.[14] The low incidence of smoking in elderly is well explained as most of the elderly quit smoking as age advances and also number of females (post menopausal) increases in elderly age group with AMI who are usually non-smokers. This study observed the absence of any risk factor in 32% patients in Group II suggesting that age itself is a major risk factor for myocardial infarction. But, most of the available literature suggest that the majority of patients suffering MI at a young age are reported to have at least one identifiable cardiovascular risk factor.[15] Studies have reported a higher prevalence of smoking, family history of premature CHD and male gender among young MI patients compared with their older counterparts.[16,17]

Atypical chest pain, non-specific symptom like giddiness, syncope and palpitation were more frequently in

Table 1: Clinico-demographic profile, associated risk factors and time elapsed before reporting to hospital

Parameter	Group – 1	Group – 2	p value
Age (in years)	51.9 ± 3.8	69.5 ± 5.3	< 0.001
Gender			
Male	74	58	0.016
Female	26	42	
Associated risk factors			
Hypertension	24	36	
Diabetes Mellitus (Type 2)	13	18	
Smoking	30	13	
Dyslipidemia	14	5	0.045
Family history of CAD	9	11	
Obesity	7	12	
No risk factor	3	5	
Hospital reporting time form being symptomatic			
≤ 1hour	3	1	
≤ 3hour	8	3	
≤ 6hour	30	12	0.01
≤ 12hour	27	32	
More than 12 hour	32	52	

Table 2: Presenting symptoms and signs

Parameter	Group – 1	Group – 2	p value
Presenting symptom and sign			
Typical chest pain	82	52	< 0.001
Atypical chest pain	14	28	0.015
No chest pain	3	22	0.001
Sweating	46	50	0.572
Dyspnea	16	40	0.002
Nausea and vomiting	30	36	0.368
Giddiness	10	29	0.007
Syncope	2	10	0.017
Palpitation	3	14	0.005
Altered sensorium	1	8	0.017
Focal Neurological deficit	2	4	0.408

Table 3: Type of AMI, wall involvement,associated heart failure and 2D Echocardiography findings in AMI

Type of AMI	Group – 1	Group – 2	p value
STEMI	64	38	0.002
NSTEMI	32	54	
Type of wall involvement			
Anterior wall	36	40	
Antero-septal wall	24	20	0.004
Lateral wall	6	4	
Inferior wall/Right Ventricle	34	36	
Heart failure (Killip's Classification)			
I	68	52	
II	14	13	0.023
III	11	23	
IV	7	12	
Abnormality in 2D Echocardiography			
RWMA	68	74	
→EF	60	68	0.43
Ventricular Aneurysm	0	2	

Table 4: Coronary angiography findings in AMI

Coronary angiography findings	Group – 1 (N = 84)	Group – 2 (N = 68)	p value
Normal	9 (10.7%)	4 (5.8%)	0.002
Non-Significant lesion	10 (11.9%)	6 (8.8%)	0.468
SVD	40 (47.6%)	19 (27.9%)	0.006
DVD	16 (19%)	23 (33.8%)	0.037
TVD	9 (10.7%)	16 (23.5%)	0.005
LM Disease	3 (3.5%)	6 (8.8%)	0.067
Calcification	4 (4.7%)	10 (14.7%)	0.208
Thrombus	5 (5.9%)	3 (4.4%)	0.045

Table 5: Complications of AMI on the 1^{st}, 7^{th} and 30^{th} day

Complications	Group – 1 (n = 100)			Group – 2 (n = 100)			p value
	1^{st} day	7^{th} day	30^{th} day	1^{st} day	7^{th} day	30^{th} day	
Heart failure	32	14	06	48	22	14	0.03
Cardiogenic shock	07	03	0	12	7	3	0.042
Re-infarction	0	04	0	0	8	04	≤ 0.001
Arrhythmias	24	18	8	36	24	16	0.761
Cardiac arrest	6	3	0	4	02	0	≤ 0.001
Cerebrovascular accidents	0	0	0	03	01	1	≤ 0.001
Bleeding complications	0	0	0	0	01	0	≤ 0.001
Post MI Angina	0	0	03	0	0	08	≤ 0.001
Ventricular Aneurysm	0	0	0	0	0	02	≤ 0.001
Death	8	9	10	12	14	16	≤ 0.001

Table 6: Interventions done in the patients of AMI

Type of interventions	Group – 1 (n = 100)	Group – 2 (n = 100)	p value
Thrombolysis			
Male	23	13	0.043
Female	10	5	
Pharmco -therapy			
b blockers	74	42	
Aspirin, Clopidogrel	100	100	
ACE Inhibitors	64	35	0.05
Statins	100	100	
LMW Heparin	62	53	
PCI	23	1	0.021
CABG	07	04	0.033

Table 7: Mortality in relation duration from admission

Duration from admission	Group – 1 (n = 100)	Group – 2 (n = 100)	p value
Death within 24hr of admission	8	12	
Death after 24hr and within 7^{th} day of admission	1	2	0.594
Death after 7^{th} day and within 30 days of admission	1	2	

Group II compared to Group I. Literature have suggested that most young MI patients do not report a history of previous angina, MI or congestive heart failure and they report this less frequently in their histories than their older counterparts.[18] The AMIYA Study in North India have found out that the most common symptom and presentation was chest pain and anterior wall myocardial infarction (AWMI) in 94.8% and 58.8%, respectively.[19] Such high incidence of non-specific symptoms in elderly could be because of pre occupied non-cardiac problems and not being able to describe their symptoms accurately or have higher pain threshold. STEMI was less common in the elderly as compared to NSTEMI. LBBB was also more common in the elderly, but the differences did not reach statistical significance in the present study. Both groups showed an involvement of extensive anterior wall, inferior wall, anterior wall and lateral wall in the descending order. But this was statistically insignificant when compared between the two groups. Studies have observed that ST elevation myocardial infarction (STEMI) is less common than Non-ST-elevation myocardial infarction (NSTEMI) in older adults, although the absolute numbers of STEMI increase with age.[20] A high incidence of heart failure and cardiogenic shock was observed in Group II compared to Group I. Similar observations have been made by Bhatia et al.[12] The high incidence is probably related to pre-existing heart disease as due to an increased association of hypertension, cardiomegaly or a declining myocardial reserve. Arrhythmias were significantly more common in elderly corroborated with the findings by Bhatia et al.[12] This may be due to the atrioventricular conducting system being fibrosed and more vulnerable to ischemia and necrosis. All the complications were observed more in elderly as compared to young age group on 7^{th} day follow-up. On 30^{th} day follow up, the complications like post MI angina and heart failure were more in elderly as compared to younger. Complications like cardiogenic shock, re-infarction, cerebrovascular accidents and ventricular aneurysm were observed only in elderly age group. Similar observations have been made by Meheta et al where they have observed that cardiovascular complications, including hypotension, shock, atrial fibrillation, heart failure and stroke and non-cardiovascular complications, including pneumonia and renal insufficiency on admission, were more common in older patients.[21] This may be due to the fact that in elderly the adaptations of cardiovascular system to stress is impaired as a consequence of anatomical, functional and metabolic changes in the heart itself and also increase in impendence to ventricular ejection due to anatomical changes in the arterial bed and insufficient vasodilatory capacity of the peripheral vessels. These age-related changes hamper normal ventricular functions and its adaptive mechanisms to the hemodynamic burden elicited by myocardial necrosis. Killip's class III & IV heart failure is more common in elderly compared to young. Similar observation was noted by MP Holey et al.[22] This may be due to structural change of heart in elderly due to ageing process and also poor adaptability. VPC and AV Block were significantly more in the elderly. No statistical significance was observed for AF, BBB and VT/VF between the two groups.[23]

The elderly may be more refractory to medical therapy possible because of advanced atherosclerotic diseases and ventricular dysfunction. Management decision during the first 24 hour have the greatest effect on survival in the elderly as is true with all age group Only 18% were given thrombolysis treatment in Group II compared to 33% in Group I. The reasons for giving thrombolysis in such less no. of cases in elderly were late presentation, history of stroke and a previous history of streptokinase use. Similar observation were presented in a study by the Fibrinolytic Therapy Trialists (FTT) collaborative Group.[24] About 42% elderly were treated with b-blockers as compared to the use of b-blockers in 74% young patients. It may be due to the existence of contraindications like Killip's Class III & IV heart failure, AV block; and COPD in Group II. Normal vessel and non- obstructive coronary artery disease was present more in Group I where as a higher incidence of single-vessel disease was seen in the younger patients, but the incidence of double-vessel and multi-vessel diseases was more frequent in the elderly patients. LMCA was more involved in elderly patient. LAD was most common culprit vessel in either groups followed by RCA, LCX. No differences were detected for visible thrombus in coronary angiography between the two groups. Elderly have more severe extensive disease and more calcification. Interventions like PCI and CABG were done less commonly in elderly compared to young. This observation was similar to the observations in study AMI in elderly.[22] Mortality rate was higher (14%) in elderly compared to the younger (10%). In a study by Kocher et al they have observed that the unadjusted in-hospital mortality rate was 7% and the unadjusted mortality rate was 24% at 1 year and continued to rise steadily beyond the first year.[25] Other studies have also observed a higher mortality in elderly patients.[26] Higher rate of mortality in elderly is probably due to structural changes of heart related to the aging process and age related changes in other organs and deterioration of their adaptive mechanisms to ventricular failure.

5. Conclusion

With an increasing age, the hospitalization rate of male patients with AMI is reduced and gender ratio became smaller. Manifestation of AMI in elderly are more subtle with more atypical presentations, there was also a delay in hospitalization in elderly resulting in delayed initiation of the treatment. Elderly subjects are under thrombolysed and have higher rate of complications and mortality. A high

index of suspicion is important in elderly patients to achieve a timely diagnosis. Since elderly patients with AMI differ in clinical presentation compared to young patients with AMI this issue needs perfect understanding as it will have important bearing on reducing the mortality and morbidity.

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7. Conflict of Interest

The authors declare they have no conflict of interest.

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