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Clinical profile of acute myocardial infarction in elderly patients

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ABSTRACT

Context: The aim of study was to determine the difference in presentation, risk factors, complications, management and outcome of elderly and young patients with acute myocardial infarction (AMI).
Settings and design: Tertiary care center; prospective observational study.
Materials and method: The study included 200 consecutive patients with AMI admitted in the ICCU, in a tertiary care center in West India. The group I consisted of 107 patients aged equal to or above 65 years and the group II consisted of 93 patients aged below 65 years.
Statistical analysis: Two tailed student's *t* test and Chi-square statistics (Fisher's test) for *P* value.
Results: The male female ratio was 1.27:1 and 3.43:1 in group I and group II respectively. Atypical presentations were more likely in the elderly, with shortness of breath as the most common presentation (40.18% versus 15.05%; $P < 0.05$. 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 ($P < 0.05$). The elderly were significantly less frequently revascularized ($P < 0.05$). Time from symptom onset to hospital admission was significantly longer in the case of elderly patients ($P < 0.05$). The elderly were more likely to have complications of cardiac failure ($P < 0.05$) and arrhythmias especially atrio-ventricular (AV) blocks. The elderly were also less likely to receive beta-blockers ($P < 0.05$). In-hospital mortality was higher in the elderly ($P < 0.001$).
Conclusion: We conclude that the manifestations of AMI are more subtle in the elderly, with different risk factors.

1. Introduction

The elderly with acute myocardial infarction (AMI) have been reported to present with more atypical symptoms.[1,2] AMI is associated with significantly higher mortality in the elderly compared with the young,[2–7] yet the elderly are treated less aggressively than the young.[2] Thrombolytic therapy has the greatest effect in the elderly even though there is an increased risk of haemorrhagic stroke.[8,9] The benefits of aspirin, angiotensin converting enzyme (ACE) inhibitors and beta-blockers in AMI have been substantiated in numerous trials,[10] but their usage in elderly AMI patients may be lower than in younger patients.[11] Because of the increasing burden on health care systems associated with MIs in the elderly, differences in clinical picture, and difficulties in dealing with elderly patients with myocardial infraction (MI), we analyzed the course of AMI in patients hospitalized in the intensive cardiac care unit (ICCU) of the tertiary care hospital. The aim of study was to determine the difference in presentation, risk factors, complications, management and outcome of elderly patients with acute myocardial infarction and young patients with acute myocardial infarction.

2. Material and methods

The study included 200 consecutive patients with AMI treated in the intensive cardiac care unit (ICCU) of the tertiary care hospital in Surat, India from October 2006 to September 2008. AMI was defined according to the European Society of Cardiology (ESC) definition 2000,[12] by the significant elevation of myocardial necrosis markers (Troponin-T or CK-MB two times the upper limit of normal level) in addition to a history compatible with MI, electrocardiographic abnormalities, or both. The history compatible with MI was defined as the presence of anginal chest pain lasting more than 30 min. The electrocardiographic abnormalities were defined as: 1 mm or more ST segment elevation in contiguous leads; 1 mm or more ST segment depression; definite T-wave inversion;

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evolution of pathologic Q-waves ($\geq$ 0.04 s); or new onset left bundle branch block (LBBB). The patients were separated into 2 groups according to age. The study group (group I) consisted of 107 patients aged 65 or over (aged 65–95 years; mean 73 $\pm$ 6.8) and the control group (group II) consisted of 93 patients aged below 65 years (aged 31–64 years; mean 47.2 $\pm$ 7.3). In this article, we have defined elderly patients as being 65 years or older.[13] Subjects of stable and unstable angina were excluded. Subjects fulfilling the inclusion criteria were analyzed. Baseline clinical history, complications, risk factors of AMI and past illness were documented in a prescribed performa. A detailed clinical examination was carried out. Investigations included fasting and 2 h post meal blood sugar estimation, cardiac biomarkers (CPK-MB or Troponin-T), blood urea, lipid profile, AST levels, Chest radiograph, Two-dimensional Echocardiography and Doppler study done for LVEF and complications of myocardial infarction. Congestive cardiac failure at the time of presentation was graded as per Killip's classification.[10] All patients received standard therapy according to the ESC standards and according to clinical setting. The complications like cardiogenic shock, heart blocks, arrhythmias at the time of admission were recorded. Ventricular premature beats (VPB) were graded as per Lown's grading system.[14] Hypertension was defined according to JNC VII (the seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure) criteria (2 measurement values of blood pressure $\geq$ 140/90 mmHg, or patient was on hypotension therapy before MI). Dyslipidemia was defined according to ESC prevention guidelines,[15] (total cholesterol $\geq$ 190 mg/dl and/or triglycerides $\geq$ 150 mg/dl, or patient was on hypolipidemic therapy-statins/fibrates before MI). Obesity was defined based on the body mass index $\geq$ 30 kg/m^2. Diabetes mellitus (DM) was diagnosed if patient suffered from DM before MI. The patient was assumed to be an addictive smoker if he/she smoked actively before MI. All episodes of ischemic heart disease and the episodes of invasive procedures in history were documented. Family history of coronary artery disease (CAD) is defined as any clinical atherosclerosis in the family diagnosed in females before 65 and in males before 55 years old. All the cases were followed up till satisfactory discharge from hospital or death for various events and complications.

2.1. Statistical analysis

Statistical analysis was carried out using SPSS software, and the mean values and frequencies of various risk factors (variables) were studied in the groups as a whole and individually in the two sub groups, namely AMI in elderly patients (group I) and AMI in young (group II). Continuous clinical characteristics in both groups were compared by unpaired *t*-test and categorical variables in both groups were compared by using Chi-square statistics (Fisher's test), data were presented in percentage and mean μ SD. A P value < 0.05 was assumed to be statistically significant.

3. Results

The present study comprised of total 200 cases of acute myocardial infarction (AMI) of which 107 belonged to group I (age $>$ 65 years) and 93 belonged to group II (age $<$ 65 years). [Table 1] summarizes the study results.

First, clinical symptoms of MI differed in the elderly as compared to younger patients. Typical angina chest pain was the most common presenting symptom in both age groups, but more likely in the young than elderly patients (81.76% versus 50.47%; $P < 0.05$). Atypical chest pain (28% versus 10.75%) or no chest pain (21.49% versus 7.53%) was more commonly observed in elderly group as compared to younger age group ($P < 0.05$). Dyspnea, palpitation, giddiness and syncope were reported more frequently by the elderly [Table 1]. Few elderly patients presented with abdominal pain, dental pain but the difference was not statistically significant. Also, electrocardiographic presentation differed in the elderly. ST elevation was less frequently detected in the elderly (56 {52.34%} versus 62 {66.66%}; $P < 0.05$). The differences were statistically significant. LBBB and changes of NSTEMI tended to be more frequent in the elderly, but the differences did not reach statistical significance ($P > 0.05$) in our observations [Table 1].

The number of elderly subjects arriving within 6 h of chest pain was significantly less as compared to young subjects (51/107 i.e. 47.66% Versus 62/93 i.e. 72%, $P < 0.05$).

Assessment of risk factors revealed there were more women in elderly group (47/107) as compared to group I (21/93) ($P < 0.05$). The young AMI patients were more likely to be smokers (43.01% versus 16.82%; $P < 0.05$) and obese (17.2% versus 5.61%; $P < 0.05$) compared to the elderly patients. However, there was no difference between the two age groups with regard to the presence of hypertension, diabetes mellitus and dyslipidemia. A family history of coronary artery disease was common ($P < 0.05$) among young patients and in 37 (34.58%) elderly patients no risk factor was found ($P < 0.05$) [Table 1].

Assessment of complications of AMI at the time of hospitalization revealed that 70 (65.42%) cases from group I presented with congestive cardiac failure (CCF) at the time of admission in ICCU as compared to only 34 (36.56%) cases in group II, which is statistically significant ($P < 0.05$) [Table 1]. In elderly group 32 (29.9%) patients presented Killip's class III of congestive heart failure as compared to only 5 (5.38%) in group I ($P < 0.05$) [Table 1]. Fifty three (49.43%) cases from group I had arrhythmias during in hospital stay compared to only 28 (30.11%) from group II ($P < 0.05$). AV block was seen in 22 (20.56%) cases from elderly group as compared to 6 (6.45%) cases from group I ($P < 0.05$) [Table 3]. Complete heart block was more commonly observed in elderly group (13.08% versus 1.07%, $P < 0.05$) as compared to group II. There was no difference between the two age groups with regard to occurrence of other complications like cardiogenic shock, recurrent MI, cerebrovascular accidents, bleeding complications and other arrhythmias (ventricular tachycardia or fibrillation, supraventricular tachycardia and atrial fibrillation). Forty eight (51.61%) patients in younger age group had no complications as compared to elderly group where only 25 (23.36%) had uncomplicated MI ($P < 0.05$) [Table 2].

Mortality was found to be significantly higher in elderly population group (I) than young population with AMI {30 (28.04%) versus 08 (8.6%) ($P < 0.05$)} [Table 3].

Thrombolytic therapy was considered in patients with STEMI or patients with new onset LBBB (68 patients in elderly and 69 patients in younger age group) and it was found that this therapy was under used in elderly group (I) only in 27 (39.7%) cases as compared to 44 (63.77%) in group (II) which was statistically significant ($P < 0.05$). Rest of patients had contraindications to thrombolytic therapy more so in elderly group but the difference was not found to be statistically significant in our study [Table 5]. Percutaneous transluminal coronary angioplasty (PTCA) was performed on 5 (4.67%) and 16 (17.2%) of groups I and II, respectively ($P < 0.05$). In elderly patients, PTCA and thrombolysis were done less frequently when compared to younger patients [$P < 0.05$; Table 4]. Among the other drugs used in the treatment of AMI and its complications (aspirin, NTG, low molecular weight heparin LMWH, β-blockers, ACE inhibitors, and lipid lowering agents), only 18 (16.82%) cases from elderly group (I) received β-blockers as compared to 56 (60.22%) cases from group (II) which was statistically significant ($P < 0.05$).

Table 1
Summary of study results.

	Group 1 Elderly with AMI ($N = 107$)	Group 11 Young with AMI ($N = 93$)	P value
Mean age in years	73.0 (SD 6.8)	47.2 (SD 7.3)	$< 0.05^*$
Male:Female	1.27:1 (60:47)	3.43:1 (72:21)	0.0017^*
Presentation within 6 h of onset of symptoms	51 (47.66%)	67 (72%)	$< 0.05^*$
ECG changes			
STEMI[a]	56 (52.34%)	62 (66.66%)	0.04^*
NSTEMI[b]	39 (36.45%)	24 (25.81%)	0.127
Acute new onset LBBB[c]	12 (11.21%)	7 (7.53%)	0.471
Presenting symptoms			
Typical anginal chest pain	54 (50.47%)	76 (81.72%)	0.0001^*
Atypical chest pain	30 (28%)	10 (10.75%)	0.0025^*
No chest pain	23 (21.49%)	7 (7.53%)	0.009^*
Diaphoresis	51 (47.66%)	45 (48.38%)	1
Breathlessness	43 (40.18%)	14 (15.05%)	0.0001^*
Nausea and or vomiting	45 (42.05%)	33 (35.48%)	0.38
Palpitation	16 (14.95%)	5 (5.37%)	0.0364^*
Giddiness	24 (22.43%)	7 (7.5%)	0.005^*
Syncope	11 (10.28%)	2 (2.15%)	0.022^*
Altered sensorium	11 (10.28%)	6 (6.45%)	0.44
Dental pain	2 (1.87%)	0 (0%)	0.49
Abdominal pain	4 (3.74%)	0 (0%)	0.12
Focal neurological deficit	4 (3.74%)	0 (0%)	0.12
CCF[d] at time of presentation (Killip's classification)	70 (65.42%)	34 (36.56%)	0.0001^*
Killip's Class I	12 (11.21%)	11 (11.83%)	1.0
Killip's Class II	19 (17.76%)	15 (16.13%)	0.85
Killip's Class III	32 (29.9%)	5 (5.38%)	0.0001^*
Killip's Class IV	7 (6.54%)	3 (3.23%)	0.34
Risk factors			
Hypertension	46 (42.99%)	29 (31.18%)	0.1
Diabetes mellitus	18 (16.82%)	16 (17.2%)	1.0
Smoking	18 (16.82%)	40 (43.01%)	0.0001^*
Dyslipidemia	24 (22.43%)	19 (20.43%)	0.86
Obesity	6 (5.61%)	16 (17.2%)	0.01^*
Family history of CAD[e]	3 (2.8%)	21 (22.58%)	0.0001^*
No above risk factor	37 (34.58%)	12 (12.9%)	0.001^*

$^*P$-value < 0.05 significant.
[a] STEMI = ST segment elevation myocardial infarction.
[b] NSTEMI = Non ST elevation myocardial infarction.
[c] LBBB = Left bundle branch block.
[d] CCF = congestive cardiac failure.
[e] CAD = coronary artery disease.

4. Discussion

The clinical picture of MI in elderly patients differs in many aspects as compared to younger patients. The factors affecting the course of MI in the elderly have not been studied in detail. The present study shows that with increasing age the preponderance of male among patients with AMI admitted to the hospital decreases and sex ratio becomes smaller. This possibly reflects a higher percentage of females in an elderly population and also a very likely a more equal distribution of risk factors for AMI between both

Table 2
Complications of MI during in-hospital stay.

Complication	Group I Elderly with AMI ($N = 107$)	Group II Young with AMI ($N = 93$)	P value
CCF[a]	70 (65.42%)	34 (36.56%)	$0.001^{\#}$
Cardiogenic shock	9 (8.41%)	2 (2.15%)	0.0652
Arrhythmia	53 (49.53%)	28 (30.11%)	$0.0061^{\#}$
Recurrent MI	10 (9.34%)	3 (3.23%)	0.09
CVA[b]	4 (3.74%)	1 (1.07%)	0.3749
Bleeding complication	5 (4.67%)	1 (1.07%)	0.2186
Death	30 (28.04%)	8 (8.6%)	$0.0005^{\#}$
No complication	25 (23.36%)	48 (51.61%)	$0.0001^{\#}$

$^{\#}P$-value < 0.05 significant.
[a] CCF = congestive cardiac failure.
[b] CVA = cerebrovascular accident.

Table 3
Various arrhythmias observed during in-hospital stay in both groups.

	Group I Elderly with AMI ($N = 107$)	Group II Young with AMI ($N = 93$)	P value
Arrhythmias	53 (49.53%)	28 (30.11%)	$0.0061^{\$}$
Type of arrhythmias			
VPB[a] (Lowns grading)			
Grade I	1 (0.93%)	1 (1.07%)	1.0
Grade II	7 (6.54%)	3 (3.22%)	0.3437
Grade III	4 (3.74%)	1 (1.07%)	0.3749
Grade IV	1 (0.93%)	0 (0%)	1.0
Grade V	0 (0%)	0 (0%)	1.0
SVT[b]	1 (0.93%)	3 (3.22%)	0.3396
AF[c]	3 (2.8%)	4 (4.3%)	0.7068
AV block	22 (20.56%)	6 (6.45%)	$0.0042^{\$}$
1st degree block	4 (3.74%)	1 (1.07%)	0.3749
2nd degree block	4 (3.74%)	4 (4.3%)	1.0
Complete block	14 (13.08%)	1 (1.07%)	$0.0009^{\$}$
LBBB[d]	12 (11.21%)	7 (7.53%)	0.4710
VT/VF[e]	2 (1.87%)	3 (3.22%)	0.6651

$^{\$}P$-value < 0.05 significant.
[a] VPB = ventricular premature beat.
[b] SVT = supraventricular tachycardia.
[c] AF = atrial fibrillation.
[d] LBBB = left bundle branch block.
[e] VT/VF = ventricular tachycardia/ventricular fibrillation.

Table 4
Treatment of MI.

Treatment	Group I Elderly with AMI ($N = 107$)	Group II Young with AMI ($N = 93$)	*P* value
Aspirin	102 (95.33%)	91 (97.85%)	0.45
ACE-I[a]	72 (67.3%)	69 (74.2%)	0.35
Beta-blockers	18 (16.82%)	56 (60.22%)	0.0001*
LMWH[b]	69 (64.5%)	70 (75.3%)	0.12
Thrombolysis	27 (23.23%)	44 (47.31%)	0.0018*
PTCA[c]	5 (4.67%)	16 (17.2%)	0.005*
CABG[d]	2 (1.87%)	3 (3.22%)	0.66

*P-value < 0.05 significant.
[a] ACE-I = angiotensin converting enzyme inhibitors.
[b] LMWH = low molecular weight heparin.
[c] PTCA = percutaneous transluminal coronary angioplasty.
[d] CABG = coronary artery bypass grafting.

genders at high age.[16] This trend was similarly noted in other study populations.[5,17,18] One of the possible reasons for this could to be loss of estrogen and its cardio-protective effects in the elderly females.[19] However, the role of hormone replacement therapy to reduce the risk of coronary artery disease in postmenopausal women is still controversial.[19]

In the elderly, numerous disorders often coexist. Ischemic heart disease, hypertension, diabetes mellitus, chronic obstructive pulmonary disease, chronic renal failure, digestive system disorders, as well as, joint and bone disorders occur more often in this group of patients. The coexistence of several diseases may cause the clinical picture of acute coronary syndrome to be uncharacteristic. In the present study more cases among the elderly population had atypical chest pain (28%), no chest pain (21.49%), on admission to hospital as compared to young population (10.75% and 7.53%). Dyspnea and other nonspecific symptoms like giddiness, syncope and palpitation are frequently observed in elderly patients as compared to young MI in the present study. Confusion or altered mental status may be the presenting manifestation of acute MI in up to 20% of patients over 85 years of age.[20] It was observed previously that 75% of patients over 85 with MIs did not complain about chest pain in the acute phase of MI.[21,22] Even when classic ischemic precordial discomfort is present, it tends to be less severe and less well defined. The elderly appear to have reduced pain perception.[23] This phenomenon may result from the increase of pain threshold of permanently ischemic sensory nerves, ischemic dysfunction of the cerebral cortex, and dysfunction of the autonomic nervous system.[24] The last one is very likely exemplified in that the elderly who did not describe chest pain also did not describe sweating, nausea, and vomiting.[1] The older the population, the more frequently the symptoms of heart failure exacerbation were described in the acute phase of MI.[6] Typical symptoms of chronic heart failure exacerbation were often accompanied by mental disorders, dizziness, presyncope, and syncope.[6]

Older patients are also more likely to have "silent" or unrecognized MIs compared to younger patients. These facts often result in delays in MI diagnosis in the elderly. The number of elderly subjects arriving within 6 h of chest pain was significantly less as compared to young subjects (47.66% versus 72%, $P < 0.05$). Such trends have been observed previously.[9]

As reported in other studies,[6] this study also showed that the young patients were more likely to have STEMI (66.66% versus 52.34%) as compared to the elderly patients.

Among the risk factors evaluation, hypertension, diabetes mellitus and dyslipidemia were just as prevalent in both the young and elderly AMI patients while smoking, obesity and family history of coronary heart disease were more prevalent in the young AMI patients. This low incidence of smoking in elderly is well explained as most of the elderly quit smoking as age advances and also number of females (postmenopausal) increases in elderly group with AMI who are usually non-smokers. The present study observed no risk factor in 34.58% cases in elderly with MI. Similar observation,[25] has also been reported by others suggesting age itself is a major risk factor for myocardial infarction. Knowing the prevalence of various modifiable risk factors among the two age groups may help in planning appropriate secondary preventive programs to target the different age groups. Emphasis for the elderly population should be more targeted at better control of hypertension, dyslipidemia and diabetes mellitus, while for the young population, in addition to hypertension and diabetes mellitus, smoking habits and control of obesity should be emphasized.

A striking finding on admission during and after the ICCU stay was the high occurrence rate of heart failure in the group I as compared to group II. It is known that cardiac failure is an important predictor of poor outcome after AMI.[26] It is also recognized that even with "best practice" interventions, the prognosis for established cardiac failure in the elderly patients remains poor.[27] Also, the management of cardiac failure in elderly patients is often complicated by multiple comorbid conditions, polypharmacy and the difficulty in tolerating recommended target doses of drugs.[27,28] Therefore, future research should be aimed at developing more effective strategies for prevention of cardiac failure in elderly patients. In the present study, the next common complications observed in elderly with MI were AV blocks as compared to young with MI. This is not related to differences in location and extent of myocardial necrosis and ischemia. In aging persons, the atrio-ventricular conduction system is subject to spontaneous fibrosis and more vulnerable to ischemia and necrosis.[29]

Despite the fact that older patients constitute the group of high coronary risk and that numerous observations and studies proved that these patients benefit significantly from PCI in acute MI,[30,31] invasive procedures in this group of patients are performed relatively rarely. This was consistent with our observations. PTCA was performed in 5 (4.67%) elderly patients and 16 (17.2%) younger ones,

Table 5
Thrombolytic therapy for patients with acute onset LBBB and STEMI.

	Group I elderly with AMI with STEMI[a]/LBBB[b] ($N = 68$)	Group II young with AMI with STEMI/LBBB ($N = 69$)	*P* value
Given thrombolytic therapy	27 (39.7%)	44 (63.77%)	0.0062#
Reasons for not giving thrombolytic therapy			
Presentation more than 6-10 h	27 (39.7%)	18 (26.08%)	0.1036
Collapsed requiring prolonged resuscitation	5 (7.35%)	2 (2.29%)	0.2744
Refused/non affording	3 (4.41%)	1 (1.45%)	0.3658
Stroke	4 (5.88%)	1 (1.45%)	0.2084
High systolic blood pressure	1 (1.47%)	2 (2.29%)	1.0
Gastrointestinal Bleed	1 (1.47%)	1 (1.45%)	1.0

#P-value < 0.05 significant.
[a] STEMI = ST segment elevation myocardial infarction.
[b] LBBB = left bundle branch block.

which made the difference statistically significant. Even thrombolysis is applied less frequently in the elderly (23.23% versus 47.31%; $P < 0.05$) because of contraindications and the diagnosis delay that causes exceeding of the therapeutic "window" of 12 h. Although several studies,[32,33] proved that elderly patients benefit from reperfusion therapy, they received both thrombolytic and invasive procedures less frequently when compared with younger patients.[30,31] This paradox phenomenon was observed in many clinical studies and registries,[33] and was confirmed in our study well.

The elderly AMI patients were as likely to receive anti-platelet agents and ACE inhibitors. This is a healthy trend. The elderly were, however, less likely to receive β-blockers compared to the young (16.82% versus 60.22%; $P < 0.05$). This trend was also noted in another study.[34] Advanced age, presence of obstructive airway disease, diabetes and congestive cardiac failure have limited the use of β-blockers in the present study. However more research is needed to evaluate the use and tolerability of β-blockers in elderly patients with the aim of increasing the usage of β-blockers in elderly patients to improve outcome after AMI.

In the present study, the overall mortality in elderly with MI was found to be higher than young. Structural changes of the heart related to the process of aging contribute to a great extent to the high early and late mortality of AMI in the aged. In the aged, 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 impedance to ventricular ejection due to anatomical changes in the arterial bed and insufficient vasodilatory capacity of the peripheral vessels. These ages related changes hamper normal ventricular functions and its adaptive mechanisms to the hemodynamic burden elicited by myocardial necrosis. This explain why ventricular dysfunction occurred more frequently in the very elderly patients before and during an AMI.[35] However age related changes in other organs and deterioration of their adaptive mechanisms to ventricular failure also play a role.

5. Conclusion

In conclusion, our observations confirmed the differences in the clinical picture of MI between older and younger individuals in many aspects. The elderly present less typical symptoms of MI, which is followed by the significant delay in diagnosis and initiation of the treatment. This group also has different cardiac risk factor profile characteristics. Despite the fact that the elderly constitute a group at high cardiovascular risk, the most effective methods of MI treatment, such as reperfusion procedures including PTCA, are performed significantly less often when compared to younger MI patients. The majority of differences noticed in our study have been observed previously.

Conflicts of interest

All authors have none to declare.

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