Original Article

Depression among older adults who developed acute coronary syndrome (ACS) during hospitalization for non-cardiac illness: A prospective observational study

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Abstract

Background: Atypical presentations of ACS delay its recognition and treatment in the older adults. During hospitalization, depression and functional decline, which is unique to older adults, leads to poor clinical outcome. Steps taken for its prevention is unlikely to become a priority for the Cardiologist. This study was conducted to identify depression among older adults who developed ACS during hospitalization for noncardiac illness and their outcome. **Methods:** 310 older adults with ACS were included from 26 June 2020 to 13 October 2020. Subjects were divided into those admitted primarily due to an ACS (Group I, n = 94) and those developing ACS after admission for noncardiac illness (Group II, n = 216). Co morbidities, medications, investigations, management, clinical outcome, Geriatric Depression Scale was compared between the two groups at the time of admission, after 30 days and after 6 months. **Results:** Majority of them were admitted due to acute kidney injury (27.1%) in group II and had a non ST elevation ACS (90.2%). Optimum management was given to a lesser extent because of the clinical condition of these patients. Depression during hospitalization, during follow up and poor clinical, functional and cognitive outcome was more in group II. **Conclusion:** Optimum medical management was not given to considerable number of patients because of atypical presentations, clinical condition, along with functional and cognitive decline which resulted from depression. Clinicians must be vigilant for the development of depression when an older adult is admitted to the hospital, as early detection and optimum management provides better clinical outcome.

Keywords: Acute coronary syndrome, atypical presentation, cognitive decline, depression, functional decline

Introduction

Acute Coronary Syndrome (ACS) is termed when a myocardial infarction is suspected or confirmed in a patient. It is diagnosed with an increase or decrease in the cardiac troponin levels with at least one value of more than 99th percent of upper reference limit (URL) of normal.[1] This should be along with supportive evidence of either the typical symptoms, changes in the electrocardiograph (ECG), newly detected regional wall motion abnormality in the echocardiography or when there is a new loss of viable myocardium detected through imaging.[2] Literature shows that, 9 to 14 percent of NSTEMI patients had normal coronary vessels or no coronary vessel with more than 50 to 60% stenosis on coronary angiography. These patients come under the type 2 ACS according to joint task force definition of ACS.[3] These patients also had a better clinical outcome compared with those with a coronary lesion.[4]

Around 60 percent of the total ACS occurs in the older adults. The ACS-related death is also higher among them (80 percentAlthough older adults are not included in many of the clinical trials of ACS, literature shows that they more commonly had atypical presentations, non ST elevation ACS, higher in-hospital mortality, and recurrent ACS.[5] During a

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hospital admission for non cardiac illness, the elevation of troponin is because of myocardial injury which occurs mainly because of supply-demand mismatch. Such an increased in blood concentrations of cardiac troponin is seen with sepsis, focal infections, renal failure, anemia, seizure, malignancy, exacerbations of bronchial asthma or COPD, stroke, electrolyte imbalance, peripheral vascular disease and post-surgery. The older adults have worse outcomes after an ACS due to their co morbidities, and a reduced likelihood of receiving adequate management because of concerns about drug toxicity. Optimum management is often used to a lesser extent in the older adults because of their clinical condition. The stress caused by non cardiac illnesses on the cardiovascular system such as tachycardia, hypotension, abstinence from regular medication such as aspirin, beta blockers, ACE inhibitors or ARB and associated conditions such as anemia, renal dysfunction, electrolyte imbalance contribute to the development of ACS.

Literature has showed that, older adults who received recommended treatment after an ACS had lower rates of mortality in the hospital than those who did not.[4] The side effects of medication can be overcome by adjusting the dose of medication according to age, gender, renal function and volume of distribution.[6] During hospital admission, the risk of developing depression should be considered among the older adults. Depression, which is not a natural part of aging, is often reversible with prompt and appropriate treatment. If left untreated, depression results in physical, cognitive and social impairment as well as delayed recovery from medical illness and surgery, increasing the health care utilization and risks. Many a time, guideline based optimal therapy was not given in this group because of the fear of complications and hence the outcome was also poor. There is a paucity of data in this domain and hence in this context this study was conducted to assess the risk factors, level of guideline-based treatment and depression among older adults hospitalized primarily for ACS and who developed an ACS post-hospitalization for a non cardiac illness.

Materials and Methods

Selection and description of participants

A prospective observational study was conducted in a Tertiary Care Centre in Kochi from 26 June 2020 to 13 October 2020. As there were no previous studies taking into account all the noncardiac illnesses leading to an ACS, a pilot study was conducted. Based on the pilot study results of prevalence of acute coronary syndrome after admission for the non cardiac illnesses in the older adults (76%), conducted in 100 samples and with 20% relative precision and 95% confidence, the minimum sample size came to 310 samples.

Technical information

The subjects included in the study were those above 60 years of age, who were admitted primarily with an ACS or those who developed an ACS following admission for a non cardiac illness. The study was initiated after obtaining clearance from the Ethics Committee of the Institute. After screening for inclusion, patient consent was obtained for participating in the study. Patient details including socio-demographic data, past medical history, medications on admission, and the reason for current admission was obtained. After the admission, details about ECG changes during ACS, cardiac troponin levels, changes in the echocardiogram were noted. The study group was divided into two based on the time of development of ACS, at initial presentation or after admission for a non cardiac illness. The management given to the subjects of the two groups was noted in detail. The clinical outcome of the patient in the hospital was noted including total number of days admitted. Geriatric Depression Scale (GDS) was used for the assessment of depression during hospitalization, after one month and after 6 months. Created by Yesavage *et al.*,[7] GDS was found to have 92% sensitivity and 89% specificity. It contained 30 brief questionnaires in which participants are asked to respond by answering yes or no and a score above 10 was indicative of depression.

Statistics

Statistical analysis was performed using IBM SPSS version 20.0 software. Categorical variables were expressed using frequency and percentage. Chi square with continuity correction was used to test the statistical significance of the association of all variables between groups. A P value of < 0.05 was considered to be statistically significant.

Results

Baseline characteristics

During 26 June 2020 to 13 October 2020, a total of 12,262 subjects were admitted to the hospital [Figure 1]. Out of this 4,329 (35.3%) were older adults of >60 years of age. The total number of subjects who were admitted with or developed an Acute Coronary Syndrome (ACS) after admission were 310 (7.16%). The data of 310 older adults were included in the study after screening according to the inclusion criteria. Of these 94 (30.3%) subjects were admitted primarily with Acute Coronary Syndrome (ACS) and they were taken as controls (GROUP-I). The rest of 216 subjects (69.6%) were admitted for other illnesses after which they developed ACS during the course of the illness (GROUP-II). In Group II, the reason for the current admission to the hospital is shown in Table 1. Majority of the subjects were admitted due to acute kidney injury (n = 84, 27.1%) after which they developed an ACS in hospital. The second most common cause was sepsis, which was seen in 51 subjects (16.5%). The rest of the causes are shown in Table 1.

Comparison between the groups

The major observations seen in the two groups are shown in Table 2. The mean age was similar between the groups, with subjects admitted to the hospital for non cardiac illness being older (72.65 vs. 71.03 years). The mean number of days

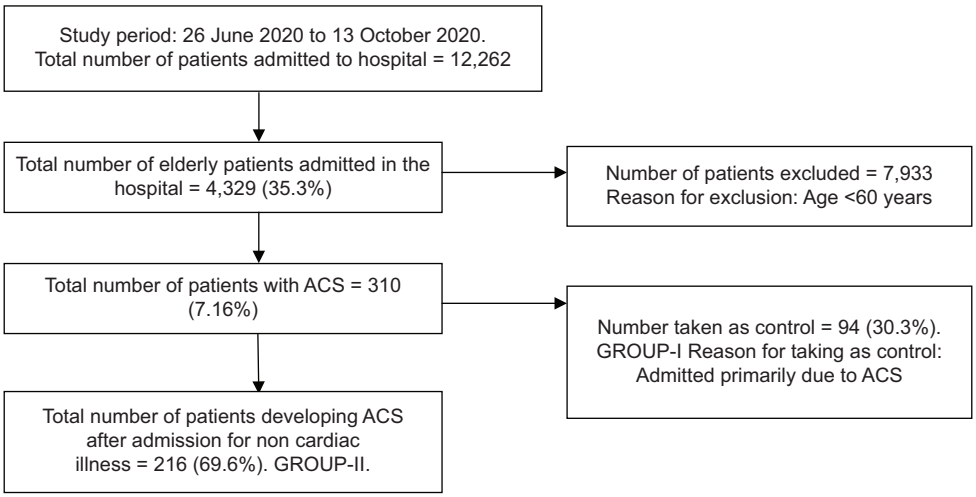

Figure 1: Study plan

Table 1: Reason for admission in Group-II

Variable	Number (*n*)	Percentage
Acute kidney injury	84	27.1
Sepsis	51	16.5
Anemia	44	14.2
Seizure/encephalopathy	42	13.5
Cancer/chemotherapy	39	12.6
Lower respiratory tract infection	35	11.3
Exacerbation of bronchial asthma/COPD	30	9.7
Urinary tract infection	29	9.4
Hyponatremia	28	9.0
Stroke	25	8.1
Hepatitis/chronic liver disease	24	7.7
Cellulitis/pressure sore/gangrene	23	7.4
Peripheral vascular occlusive disease/DVT	15	4.8
Upper GI bleeding	12	3.9
Combination of dyselectrolytemia	11	3.5
Orthopaedic surgery	9	2.9
Hypokalemia	7	2.3
Hyperkalemia	7	2.3
COVID-19	6	1.9
Abdominal surgery	6	1.9
Lower GI bleeding	5	1.6
Neurosurgery	3	1.0
Meningitis	2	0.6
Hypoglycemia	1	0.3

Group II: Patients admitted for non cardiac illness and later developing an ACS

hospitalized were also almost similar with an increase among the subjects admitted for non cardiac illness (10.34 vs. 9.6 days). Male subjects were more in both the groups. Female subjects were more in the group admitted with non cardiac illness (n = 58, 26.9% vs. n = 24, 25.5%).

In the past medical history, systemic hypertension (n = 158, 73.1% vs. n = 65, 69.1%), coronary artery disease (n = 100, 46.3% vs. n = 41, 43.6%), dyslipidemia (n = 79, 36.6% vs. n = 27, 28.7%), cerebrovascular accident (n = 27, 12.5% vs. n = 8, 8.5%) and history of coronary artery bypass graft (n = 24, 11.1% vs. n = 9, 9.6%) was seen more among the subjects admitted with non cardiac illness who later developed an ACS. The use of antiplatelets (n = 131, 60.6% vs. n = 52, 55.3%), beta blockers (n = 107, 49.5% vs. n = 45, 47.9%) and ACE inhibitors (n = 6, 2.8% vs. n = 2, 2.1%) on admission was more among the subjects who were admitted to the hospital due to non cardiac illnesses. Initial cardiac troponin elevation was seen more among the subjects admitted with ACS (n = 91, 96.8% vs. n = 200, 92.6%) but the subsequent values were elevated more among the subjects in the Group II. There was a higher percentage of non ST elevation ACS among the subjects who were admitted to the hospital due to non cardiac illnesses (n = 195, 90.3% vs. n = 75, 75.5%, *P* 0.001). On an echocardiogram, left ventricular dysfunction was seen more in subjects of Group II (n = 73, 33.8% vs. n = 27, 28.7%). Only a screening echocardiogram was performed in most subjects of Group II (n = 42, 19.4% vs. n = 11, 11.7%). Medical line of management (n = 167, 77.3% vs. n = 59, 69.2%) was given mostly in the Group II. There was a higher use of use of angiotensin converting enzyme inhibitors (n = 4, 1.9% vs. n = 0, 0%), antiplatelets (n = 149, 69% vs. n = 62, 65.9%), heparin (n = 144, 31.5% vs. n = 29, 30.9%) and statin (n = 144, 66.7% vs. n = 59, 62.8%) among Group II. coronary angiogram (n = 13, 13.8% vs. n = 13, 6%, *P* 0.014) and percutaneous transluminal coronary angioplasty (n = 13, 13.8% vs. n = 13, 6%, *P* 0.045) was more in Group I.

More subjects were stabilized with medication (n = 167, 76.4% vs. n = 59, 62.5%) and most of them succumbed to death (n = 29, 13.4% vs. n = 12, 12.8%) in Group II during hospitalization. During hospital admission, majority of the subjects in Group II had depression (n = 63, 52.5% vs. n = 28, 46.7%). Mild to moderate (n = 80, 39.6% vs. n = 21, 23.3%, *P* 0.014) and moderate to severe cognitive impairment (n = 37, 18.3% vs. n = 16, 17.8%, *P* 0.014) was also seen more in Group II. Majority of these subjects were also disabled (n = 105, 48.6% vs. n = 32, 34%, *P* 0.059) in Group II.

After 30 days in Group II, there was an increased number of repeat admissions (n = 25, 13.4% vs. n = 8, 9.8%) and death (n = 36,

Table 2: Comparison between the two groups during hospital admission

Variable	Group-I	Group-II	*P*
Age	71.03	72.65	
Number of days admitted	9.6	10.34	
Gender			
Male	70 (74.5%)	158 (73.1%)	0.809
Female	24 (25.5%)	58 (26.9%)	0.809
Past medical history			
Systemic hypertension	65 (69.1%)	158 (73.1)	0.471
Diabetes mellitus	68 (72.3%)	145 (67.1)	0.363
Coronary artery disease	41 (43.6%)	100 (46.3%)	0.663
Dyslipidemia	27 (28.7%)	79 (36.6%)	0.180
Chronic kidney disease	28 (29.8%)	57 (26.4%)	0.538
Malignancy	16 (17.0%)	29 (13.4%)	0.409
Cerebrovascular accident	8 (8.5%)	27 (12.5%)	0.308
CABG	9 (9.6%)	24 (11.1%)	0.687
PVOD	14 (14.9%)	19 (8.8%)	0.110
PTCA	10 (10.6%)	18 (8.3%)	0.515
Atrial fibrillation	5 (5.3%)	7 (3.2%)	0.383
Medication on admission			
Lipid lowering agents	59 (62.8%)	135 (62.5%)	0.965
Anti-platelets	52 (55.3%)	131 (60.6%)	0.380
Beta blockers	45 (47.9%)	107 (49.5%)	0.788
Angiotensin receptor blockers	22 (23.4%)	50 (23.1%)	0.961
ACE inhibitors	2 (2.1%)	6 (2.8%)	1.000
Cardiac troponin (Trop-T) elevation			
Initial trop-T elevation	91 (96.8%)	200 (92.6%)	0.244
Second trop-T elevation	89 (94.7%)	209 (96.8%)	0.383
Third trop-T elevation	91 (96.8%)	209 (96.8%)	1.000
Type of acute coronary syndrome			
STEMI	23 (24.5%)	21 (9.7%)	0.001
NSTEMI	71 (75.5%)	195 (90.3%)	0.001
Echocardiogram findings			
RWMA	44 (44.7%)	94 (43.5%)	0.850
LV dysfunction	27 (28.7%)	73 (33.8%)	0.380
Only screening done	11 (11.7%)	42 (19.4%)	0.096
Management given			
ACE inhibitors	0 (0.0%)	4 (1.9%)	0.435
Angiotension receptor blockers	15 (16.0%)	34 (15.7%)	0.962
Beta blockers	56 (59.6%)	124 (57.4%)	0.722
Single Antiplatelet	27 (28.7%)	70 (32.4%)	0.520
Dual antiplatelets	35 (37.2%)	79 (36.6%)	0.912
Heparin	29 (30.9%)	68 (31.5%)	0.912
Statins	59 (62.8%)	144 (66.7%)	0.507
Coronary angiogram	13 (13.8%)	13 (6.0%)	0.014
PTCA	13 (13.8%)	13 (6.0%)	0.045
In hospital outcome			
Stabilized with medication	59 (62.7%)	167 (76.4%)	0.083
Stabilized with intervention	13 (13.8%)	13 (6.9%)	0.087
Aborted cardiac arrest	8 (8.5%)	1 (0.5%)	<0.001
Repeat ACS	1 (1.1%)	0 (0.0%)	0.668
Stroke	1 (1.1%)	1 (0.5%)	1.000
Death	12 (12.8%)	29 (13.4%)	1.000
Depression			
No depression	32 (53.3%)	57 (47.5%)	0.461
Depression present (GDS >10)	28 (46.7%)	63 (52.5%)	0.461
Cognition			
No cognitive impairment (CI)	53 (58.9%)	85 (42.1%)	0.014
Mild to moderate CI	21 (23.3%)	80 (39.6%)	0.014
Moderate to severe CI	16 (17.8%)	37 (18.3%)	0.014
Performance status			
Requires no assistance	10 (10.6%)	17 (7.9%)	0.059
Requires assistance	52 (55.3%)	94 (43.5%)	0.059
Disabled	32 (34%)	105 (48.6%)	0.059

Contd...

Table 2: Contd...

Group I: Patients admitted primarily for ACS. Group II: Patients admitted for non cardiac illness and later developing an ACS

19.3% vs. n = 15, 18.3%) as shown in Table 3. There was also an increase in depression (n = 54, 41.9% vs. n = 11, 17.2%, *P* 0.001). Mild to moderate (n = 29, 19.2% vs. n = 6, 9%, *P* 0.057) and moderate to severe (n = 11, 7.3% vs. n = 2, 3%, 0.057) cognitive impairment was also observed in Group II. There was a higher number of patients who required assistance (n = 90, 59.6% vs. n = 38, 56.7%, *P* 0.039) and who were disabled (n = 36, 23.8% vs. n = 9, 13.4%, *P* 0.039) in Group II.

After 6 months in Group II, there was a higher number of repeat admission (n = 21, 13.9% vs. n = 6, 9%), and death (n = 27, 17.9% vs. n = 7, 10.4%) as shown in Table 4. Depression (n = 31, 26.7% vs. n = 12, 20%) was seen more in Group II. More number of these subjects had mild to moderate (n = 17, 13.7% vs. n = 4, 6.7%) and moderate to severe (n = 5, 4% vs. n = 0, 0%) cognitive impairment. Higher number of these subjects required assistance (n = 58, 46.8% vs. n = 27, 45%, *P* 0.074) and were disabled (n = 22, 17.7% vs. n = 4, 6.7%, *P* 0.074).

Discussion

Summary of findings

In this prospective study, we observed that, following a development of ACS after a hospital admission, there was a prolongation of hospital stay. Majority of them were male subjects because of their lifestyle habits leading to ACS and most of them had a past history of systemic hypertension. Most of the patients were on lipid lowering agents before admission. Subjects with acute kidney injury developed ACS more frequently and majority of them were treated medically without any intervention. The most common type of ACS was the Non ST elevation type and serial troponin levels were raised in majority of the patients. Regional wall motion abnormality was seen in most patients in the screening echocardiogram. Most of them received a cardiology consultation, but only few patients underwent a coronary intervention. Most of them were stabilized with medication and the most prescribed medication was antiplatelets. Optimum medical management was not given to a reasonable number of subjects because of their current medical condition, adverse effects of the drug, lack of specialty consultation, functional and cognitive decline during an ACS.

Considerable number of older adults had depression during hospital admission, after 30 days and after 6 months which

Table 3: Comparison between the two groups after 30 days

Variable	Group-I	Group-II	*P*
Outcome after 30 days			
Stable	57 (69.5%)	117 (62.6%)	0.273
Repeat admission	8 (9.8%)	25 (13.4%)	0.406
Death	15 (18.3%)	36 (19.3%)	0.854
Depression			
No depression	53 (82.8%)	75 (58.1%)	0.001
Depression present (GDS >10)	11 (17.2%)	54 (41.9%)	0.001
Cognition			
No cognitive impairment (CI)	59 (88.1%)	111 (73.5%)	0.057
Mild to moderate CI	6 (9%)	29 (19.2%)	0.057
Moderate to severe CI	2 (3%)	11 (7.3%)	0.057
Performance status			
Requires no assistance	20 (29.9%)	25 (16.6%)	0.039
Requires assistance	38 (56.7%)	90 (59.6%)	0.039
Disabled	9 (13.4%)	36 (23.8%)	0.039

Group I: Patients admitted primarily for ACS. Group II: Patients admitted for non cardiac illness and later developing an ACS

Table 4: Comparison between the two groups after 6 months

Variable	Group-I	Group-II	*P*
Outcome after 6 months			
Stable	47 (70.1%)	91 (60.3%)	0.162
Repeat admission	6 (9.0%)	21 (13.9%)	0.306
Death	7 (10.4%)	27 (17.9%)	0.163
Depression			
No depression	48 (80%)	85 (73.3%)	0.325
Depression present (GDS >10)	12 (20%)	31 (26.7%)	0.325
Cognition			
No cognitive impairment (CI)	56 (93.3%)	102 (82.3%)	0.093
Mild to moderate CI	4 (6.7%)	17 (13.7%)	0.093
Moderate to severe CI	0 (0%)	5 (4%)	0.093
Performance status			
Requires no assistance	29 (48.3%)	44 (35.5%)	0.074
Requires assistance	27 (45%)	58 (46.8%)	0.074
Disabled	4 (6.7%)	22 (17.7%)	0.074

Group I: Patients admitted primarily for ACS. Group II: Patients admitted for non cardiac illness and later developing an ACS

maybe attributable to the hospitalization, decline in medical condition, multiple medications, decline in functional status, social isolation etc. This further led to cognitive impairment and reduced functional status during hospitalization, after one month and after 6 months. Repeat hospitalization was also required for a significant number of subjects. At the end of 6 months, only 124 subjects survived out of 216 (57.4%) showing that there is a high risk of mortality among these subjects.

Comparison with prior studies

Baseline characteristics

The mean age of the subjects admitted to the hospital for non cardiac causes in this study (72.1 ± 7.4 years) was similar to that reported in a study conducted in Barcelona, Spain[8] on ACS in older adults admitted with community acquired pneumonia (73.1 ± 14 years) showing an increase in days of admission with increase in age. Male subjects (73.1%) outnumbered females (26.9%) which is similar to a study (71.7% male) conducted in São Paulo, Brazil[9] on ACS in subjects after a non cardiac surgery. The mean length of hospital stay was 10.34 days similar to 12.3 days in the study conducted in San Carlos, Spain on hypokalemia leading to ACS in the older adults[10] showing that there is an increase in the hospital stay due to development of ACS after admission. The medication most commonly used before admission was lipid lowering agents (n = 135; 62.5%). The highest number of subjects taking lipid lowering agents was observed in the study (42.7%) conducted in Uppsala, Sweden[11] on ACS in older adults admitted with atrial fibrillation. Subjects developing ACS after a Lower respiratory tract infection was 11.3% which was similar to 12% in Louisville, USA[12] on subjects admitted with community acquired pneumonia. Subjects developing ACS after sepsis was 16.5% similar to 26% in Kentucky, USA[13] on ACS developing in hospital in patients admitted with community acquired pneumonia. 8.1% developed ACS after a stroke which was lower compared with a study (27%) performed in Trondheim, Norway.[14] Seizure as a risk factor for developing an ACS was seen in 13.5% subjects in this study compared with 6.7% in a study conducted in Beirut, Lebanon.[15] Anemia as a risk factor for developing ACS was seen in 14.2% of the subjects which was lower compared with a study (20.4%) done in Edinburgh, UK on anemic subjects developing ACS after a non cardiac surgery.[16] Risk for developing an ACS was highest among older adults having an acute kidney injury in this study (27.1), which was higher when compared with 16% observed in a study in Saudi Arabia[17] on acute kidney injury developing in chronic kidney disease patients. Subjects developing ACS with a risk of hyperkalemia was 2.3% compared with 4.5% and hypokalemia was 2.3% compared with 10.1% in a study conducted in San Carlos, Spain[18] on serum potassium levels and the risk of developing ACS. Both hypo and hyperkalemia had an increased mortality after 30 days and 1 year. Association of hyponatremia with development of ACS was seen in only 1.6% of patients in Kfar Saba, Israel[19] compared with 9% in this study. Repeat ACS and all-cause mortality was seen mostly in subjects with hyponatremia compared with controls in that study. The risk of developing ACS after a neurosurgery was 5.9% in a study conducted in Ontario, Canada[20] compared with 1% in this study. Abdominal surgeries had a risk of 20.8% in a study conducted in São Paulo, Brazil[9] compared with 1.9% in this study and post orthopaedic surgeries 8.3% subjects had an ACS compared with 2.9% in this study. An elevated troponin levels after a non cardiac surgery, irrespective of the presence of ischemia, independently worsened the mortality after 30 days in these studies.

Management

Medical management was given for 90.3% of the subjects in this study. Angiotensin receptor blockers were given only for 15.7% patients in this study compared with 78.3% given in a similar study conducted in São Paulo, Brazil[9] on ACS after a non cardiac surgery. ARB/ACE inhibitors were not given to majority of the

subjects due to development of hypotension, acute kidney injury and hyperkalemia during hospital stay among these subjects. Beta blockers were given for 57.4% of the subjects compared with 42.1 in a study performed in Japan on in-hospital ACS in hypokalemic subjects.[10] Beta blockers were withheld in the rest of them due to risk of developing hypotension. Antiplatelets were given to 69% compared with 63.2% in the study conducted in Dallas, TX, USA[21] on ACS in cirrhosis subjects. They were not given in the rest of the subjects due to high risk of bleeding and anemia during admission. Heparin was given only to 68% compared with 86.7% given in a similar study conducted in São Paulo, Brazil[9] on ACS after a non cardiac surgery due to anemia during admission and high risk of bleeding in these subjects. Statins were given to only 66.7% of the subjects compared with 98.3% given in a similar study conducted in São Paulo, Brazil.[9] This was mostly due to elevated the liver function tests and lack of speciality consultation during an ACS in these subjects. Coronary angiogram was performed in 6% of the subjects followed by PTCA compared with 33% CAG and 19% PTCA in a study conducted in Boston, USA[22] among subjects who developed ACS during admission for AKI. This was mostly because of lack of speciality consultation during an ACS in these subjects. Coronary intervention was performed for 6% of the subjects compared with 11.9% in the Kerala ACS registry. Palliative line of management was given to 3.7% of the subjects which was not showed in any of the literature. Optimum management was not given to a considerable number of subjects because of their current medical condition, adverse effects of the drug and lack of cardiology consultation during an ACS.

Clinical outcome

One subject (0.5%) developed stroke in hospital similar to the study conducted in Uppsala, Sweden[23] on ACS in subjects admitted with atrial fibrillation. Another subjects had an aborted cardiac arrest (0.5%) in hospital compared with the study (1.8%) conducted in Dallas, TX, USA[21] on ACS in cirrhosis subjects. In hospital mortality was 13.4%, compared with a study (12.7%) performed in Sydney, Australia[24] on ACS in stable dialysis subjects and to the study (15%) conducted in São Paulo, Brazil[9] on ACS after a non cardiac surgery. At the end of 30 days 4.3% of the subjects developed an ACS similar to the study (10%) conducted in São Paulo, Brazil[9] on ACS after a non cardiac surgery. Total deaths after 30 days were 19.3%, similar to the study (16.1%) performed in Sydney, Australia[24] on ACS in stable dialysis subjects.

In the literature search of 27 studies, the follow up was performed after either 30 days or 1 year. No study had a follow up period of 6 months and hence the data of this study was compared with the outcome after 1 year. At the end of 6 months 4.6% of the subjects developed a repeat myocardial infarction in this study compared with the study (3.8% after one year) conducted in Kfar Saba, Israel[24] on hyponatremia as a risk factor for developing ACS. In this study 0.7% of the subjects developed a stroke similar to 1.4% (after 1 year) in the study conducted in Uppsala, Sweden[23] on ACS after admission for Atrial fibrillation. Total deaths were 17.9% in our study compared with 3.6% (after 1 year) in the study conducted in Uppsala, Sweden.

Assessment of depression

None of the studies in the literature search conducted an assessment for depression, among the older adults who were admitted to the hospital for non cardiac illness and later developed an ACS. In this study, depression was assessed using Geriatric Depression Scale (GDS), cognitivedecline was assessed using montreal cognitive assessment tool and decline in performance status was assessed using karnofsky performance status score.

During admission, 28.3% of the subjects had depression compared with 65.7% in an observation by Hayajneh *et al.*[25] on older adults with ACS who were seeking emergency care. There was a need to reassess the score in 96 (44.4%) of the subjects due to delirium and cognitive impairment during admission. 57 (26.4%) of the subjects had mild to moderate depression and moderate to severe depression was seen in 6 (2.8%) of the subjects. Depression assessed after 30 days in this study showed that majority of them had no depression (n = 75; 49.7%). 51 (33.8%) of the subjects had mild and 3 (2%) of the subject had moderate depression. There was a need to reassess the score in 22 (14.6%) of the subjects due to delirium and cognitive impairment. Depression assessed after 6 months in this study showed that majority of them had no depression (n = 85; 68.5%). 31 (25%) of the subjects had mild depression. There was a need to reassess the score in 6.5 (8%) of the subjects due to delirium and cognitive impairment.

Assessment of cognition

Gu *et al.*[26] observed that at the time of admission, older adults with NSTEMI had a 48% prevalence of cognitive impairment. 70.8% of them had mild impairment compared with 20.8% in this study, 23.8% had moderate compared with 16.2% and 5.4% had severe cognitive impairment, compared with 17.1%. There was also a 35.1% decline in cognition after one year in patients admitted with NSTEMI in the study.[26] There was a need to reassess cognition in 14 (6.5%) of the subjects due to delirium. Cognitive assessment after 30 days showed that majority of the subjects had no cognitive impairment. Mild cognitive impairment was seen in 20 (13.2%) of the subjects and 9 (6%) of them had moderate and severe cognitive impairment. There was a need to reassess the cognition in 2 (1.3%) of the subject due to delirium. Cognitive assessment after 6 months also showed that majority of the subjects had no cognitive impairment. Mild cognitive impairment was seen in 16 (12.9%) of the subjects. One of them (0.8%) had moderate cognitive impairment and 3 (2.4%) had severe cognitive impairment. There was a need to reassess the cognition in 2 (1.6%) of the subjects due to delirium.

Assessment of functional status

None of the studies in the literature search conducted an assessment of performance status among older adults who were

admitted to the hospital for non cardiac illness and developed an ACS. During admission, majority of them required considerable assistance (n = 61; 28.2%). Only 1 (0.5%) subject had mild symptoms. 5 (2.3%) of them had some symptoms. 11 (5.1%) were unable to do normal activity and 33 (15.3%) required occasional assistance. 50 (23.1%) of them were disabled and 19 (8.8%) of them were severely disabled. 7 (3.2%) of them were very sick and 29 (13.4%) of them were moribund. After 30 days, majority of them required considerable assistance (n = 52; 34.4%). 3 (2%) of the subjects had mild symptoms. 6 (4%) of them had some symptoms. 16 (10.6%) were unable to carry normal activity and 38 (25.2%) required occasional assistance. 29 (19.2%) of them were disabled and 7 (4.6%) of them were severely disabled. After 6 months, majority of them required considerable assistance (n = 39; 31.5%). 3 (2.4%) of the subjects was normal and had no symptoms. 6 (4.8%) of them had mild symptoms. 16 (12.9%) had some symptoms and 19 (15.3%) of them were unable to do normal activity. 19 (15.3%) of them required occasional assistance. 15 (12.1%) of them were disabled and 7 (5.6%) of them were severely disabled.

At the end of six months, only 57.4% were alive among the subjects admitted for non cardiac illness compared with 63.8% admitted primarily due to ACS, showing a higher mortality among this group.

Strengths and limitations of this study

This main strength of this study is that none of the previous literature focused on the geriatric aspect of depression among the older adults getting admitted for ACS or later developing an ACS after hospitalization. The study also considers the risk factors, the level of guideline-based treatment, clinical, functional and cognitive outcome among these patients. The major limitation of this study was that it was conducted in a single tertiary care centre over a small cohort and the samples were obtained only for a period of four months. Due to the same, the exact burden of ACS developing in non cardiac illnesses in the community could not be identified. The elderly require a long term follow up period, but in this study, it was limited to six months.

Conclusion

The observations from this study suggest that there is a high proportion of older adults who develop an acute coronary event in the hospital and deteriorate because of it. Optimum management is withheld from most of these subjects due to their current medical condition and adverse effects of the drugs. This study highlights that clinicians must be vigilant for the development of cardiac complications when an older adult is admitted to the hospital, as early detection and optimum medical management would be very beneficial to these subjects. Age should not be the reason for withholding procedures and interventions which are lifesaving. The plan of management should be individualized based on risk versus benefit. Clinicians must consider assessment of depression during hospitalization and must take measures to prevent it as it influences the clinical, cognitive and functional outcome. Clinical trials should include elderly patients proportionate to their prevalence among the treated population. In the coming years, the burden of ACS and depression among older adults is only expected to increase, and this can lead to an adverse impact on the social care and health economics. But, with the above efforts, older adults can achieve a better outcome after an ACS.

Ethics approval and consent to participate

The Ethical approval was obtained by the Ethics Committee of Amrita School of Medicine on 16/02/2021. All methods were performed in accordance with the relevant guidelines and regulations of the Ethics Committee of Amrita School of Medicine.

Consent

Written informed consent was obtained from all the participants.

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Conflicts of interest

There are no conflicts of interest.

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