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Impact of Socioeconomic Status on In-Hospital Outcome of Patients with Acute Coronary Syndrome in Egypt

Ahmed Hosny El-Adawy[1, *], Ghada Elkhawaga[2], Samir Abd Elraheem[1], Essam Mahfouz[1]

[1]Department of Cardiovascular Medicine, Faculty of Medicine, Mansoura University, Mansoura, Egypt
[2]Department of Community Medicine, Faculty of Medicine, Mansoura University, Mansoura, Egypt

Email address:

dr_ahmed_hosny@msn.com (A. H. El-Adawy), ghadaelkhawaga@yahoo.com (G. Elkhawaga), samir.abdelraheem@yahoo.com (S. A. Elraheem), mahfouzessams@gmail.com (E. Mahfouz)

[*]Corresponding author

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Abstract: Cardiovascular problems are still the leading cause of deaths globally. Socioeconomic inequality continues to pose a challenge to health care suppliers and can greatly affect the clinical outcome of medical problems, especially in the cardiovascular field. This study aimed to assess the in-hospital outcome of patients with acute coronary syndrome admitted in the coronary care unit and to determine the relation between socioeconomic status (SES) and in-hospital outcome of acute coronary syndrome. A prospective observational study was conducted on 301 patients presented with acute coronary syndrome during the period from August 2015 to May 2016. A questionnaire was used to assess their socioeconomic status. Admitted patients with acute coronary syndrome (ACS) were classified into 31 (10.3%) patients with non-ST segment elevation myocardial infarction (NSTEMI), 162 (53.8%) with ST segment elevation myocardial infarction STEMI and 108 (35.9%) with unstable angina (UA). According to patients SES, they were classified as 77 with high SES, 74 with middle SES, 84 with low SES, and 66 with very low SES. The study revealed that the lower socioeconomic status was statistically significant associated with increase of acute coronary syndrome mortality (P <0.001), the incidence of impaired left ventricular function, heart failure and stroke was associated. While, lower socioeconomic status was significantly associated decrease in the incidence of coronary angiography and percutaneous intervention. No significant change in the incidence of arrhythmia and major bleeding between socioeconomic status classes. Lower socioeconomic status in patients with acute coronary syndrome was considered as a risk factor for increased in-hospital mortality, stroke, impaired left ventricular function, and heart failure. To the best of author's knowledge, this study considered first report in Egypt discussing the in-hospital outcome of patients with ACS and to determine the relation between SES and in-hospital outcome of ACS patients.

Keywords: Acute Coronary Syndrome, Socioeconomic Status, In-Hospital Outcome

1. Background

Coronary heart disease (CHD) is a main cause of mortality and disability all over the world. Although its mortality rates have been declined over the past few decades, CHD accounts for about one-third or more of all deaths in individuals over 35 years [1]. In the United States, nearly one-half of middle-aged men and one-third of middle-aged women will develop manifestation of acute coronary syndrome (ACS) which can be presented with unstable angina, non-ST segment elevation myocardial infarction (NSTEMI) or ST segment elevation (STEMI) [2].

Short term outcome (in-hospital or 30 days outcome) of patients with acute MI has been decreased over the past 30 years, concomitantly with the increasing use of reperfusion strategies and proven preventive therapies as beta blockers, aspirin and statins [3]. In a previous report evaluated in the period from 1987 to 2002, the 28 day case fatality has been declined from 5.3 to 3.8% [4]. A similar trend was observed in analysis of data on 2.5 million patients from the American national registry of MI. in which in-hospital mortality after

acute MI has been declined from 10.4% in 1994 to 6.3% in 2006 [5].

Beside death, other patient-main outcomes include stroke, heart failure and major bleeding. In the Global Registry of Acute Coronary Events (GRACE) of patients with non ST segment elevation ACS, the rates of in-hospital outcome heart failure or shock, MI, major bleeding or stroke were 10, 2.4, 1.8 and 0.5%, respectively [6].

Socioeconomic status (SES) can be defined as one's access to financial, social, cultural, and human capital resources. There are multiple approaches to measure SES. The most commonly used measures are education, occupational level and income. Each of these indicators measure various, closely related aspects of SES, and may be relevant to different health outcomes at different stages in life course [7]. Low SES associates not only with higher total mortality [8], but also with increased risk of CHD death [9].

Measuring SES is difficult and multifactorial. All conventional measures of SES have a clear gradient, paralleling health, but parts of effects of each these indicators are explained through the other indicators of SES [10].

This study aimed to assess the in-hospital outcome of acute coronary syndrome and to monitor the correlation between socioeconomic status and in-hospital outcome of acute coronary syndrome among those patients.

2. Methods

2.1. Design and Subjects

A prospective observational study was conducted during the period from August, 2015 to May, 2016 at coronary care unit, Mansoura Specialized Medical Hospital, Mansoura, Egypt. Three hundred and one patients presented with acute chest pain confirmed by Electrocardiogram (ECG) changes and or cardiac biomarkers elevations were admitted in the study.

Patients with atypical chest pain, not fulfill the criteria of ACS (chest pain, specific associated symptoms, abnormalities on ECG, and levels of serum markers of cardiac injury [11] and those who refused to participate in the study were excluded from the study.

2.2. Sample Size Calculation

A sample size used in the current study was calculated using online program with confidence level of 95% and a study power 80%. Additional 10% was added to compensate for drop out cases.

2.3. Case Definitions

Among patients considered to have angina, there are three presentations of angina that suggest an ACS (rest angina which is usually more than 20 minutes in duration, new onset angina that markedly limits physical activity and increasing angina that is more frequent, longer in duration, or occurs with less exertion than previous angina).

Unstable angina (UA) and acute Non ST-segment elevation myocardial infarction (NSTEMI) differ primarily in whether the ischemia is severe enough to cause sufficient myocardial damage to release detectable quantities of a marker of myocardial injury (troponins).

Unstable angina (UA) is considered to be present in patients with ischemic symptoms suggestive of an ACS and no elevation in troponins, with or without electrocardiogram changes indicative of ischemia (ST segment depression or transient elevation or new T wave inversion).

Non ST-segment elevation myocardial infarction (NSTEMI) is considered to be present in patients having the same manifestations as those in UA, but in whom an elevation in troponins is detected.

Acute MI is defined as a clinical (or pathologic) event caused by myocardial ischemia in which there is evidence of myocardial injury or necrosis [12]. Criteria are met when there is a rise and /or fall of cardiac biomarkers, along with supportive evidence in the form of typical symptoms, suggestive ECG changes, or imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

2.4. Measurement of Outcome Variables

Mortality, stroke, heart failure, major bleeding, arrhythmia and impaired left ventricular dysfunction were measured in this study.

Mortality was measured in patients with ACS and died during first 30 days of his clinical presentation.

Stroke was defined in patients with ACS and has clinical manifestation of cerebral stroke **(**paralysis or loss of muscle movement**,** difficulty talking or swallowing**,** memory loss or thinking difficulties**,** emotional problems, pain, numbness or other strange sensations in parts of their bodies affected by stroke, changes in behavior and self-care ability) confirmed by cerebral C. T or MRI [13].

Patients with heart failure are those with ACS and has clinical manifestation of heart failure (dyspnea, paroxysmal nocturnal dyspnea, orthopnea, Cheyne-stoke respiration, cardiogenic shock) and his echo evaluation showed impaired ventricular systolic function [14].

Major bleeding defined as patient with ACS and has any clinically overt sign of hemorrhage that "is actionable" and requires diagnostic studies, hospitalization, or treatment by a health care professional, ≥ 5 gm/dl provided the hemoglobin drop is related to bleeding, cardiac tamponade, bleeding requiring surgical intervention for control (excluding dental/nasal/skin/hemorrhoid), bleeding requiring intravenous vasoactive drugs, intracranial hemorrhage and intraocular bleeding compromising vision [15].

Arrhythmia confined to the patient with ACS and his ECG showed either tachy-arrhythmia (SVT, A. F, atrial flutter, VT, VF) or brady-arrhythmia (sinus node dysfunction, HB) [16].

Patients with impaired left ventricular dysfunction are those with ACS with history of completely normal left ventricular function and on his new evaluation revealed impaired left ventricular function (ejection fraction below 40%) [17].

2.5. Clinical and Para-Clinical Measures

The study was conducted in two phases for all investigated patients.

2.5.1. Phase I

i. Questionnaire

All participating patients were subjected to a predesigned questionnaire form about SES and were Followed up and evaluated for the outcome during the first month.

An interviewer-administered structured questionnaire focused on personal and socio-demographic data. Social class was assessed using the social scoring system developed by El-Gilany and Elkhawaga (2012) [18]. These criteria include age, sex, education, occupation, marital status, residence, income and housing status. It also included past medical and family history, clinical pattern of the attack: time of onset and presenting symptoms. According to patients SES, they were classified as 77 with high SES, 74 with middle SES, 84 with low SES, and 66 with very low SES.

Medical history, main management (investigations, treatment and period of stay in the hospital) and in-hospital outcome e.g. death, stroke, heart failure, arrhythmia, major bleeding, and impaired left ventricular function were reported. Chest pain was assessed according to Montalescot et al. (2013) [19] where patient with typical chest pain should meets the following three criteria (substernal chest pain or discomfort of characteristic quality and duration, or increase with exercise or emotional stress and or relieved with rest and/or nitroglycerine), patient with atypical chest pain which meets two criteria of the previous, patient with non-cardiac chest pain which meets one criterion or none of the above.

ii. Past History of Risk Factors for CHD

The other independent variables considered for this study included hypertension, smoking, diabetes mellitus (DM) and additional criteria included age, sex, risk factors and past medical history.

iii. Clinical Examination

All admitted patients were investigated general and cardiac examination (inspection and palpation for pericardial bulge, dilated veins, pulsations and thrills, auscultation for heart sounds, added sounds, murmurs and pericardial rub).

iv. Laboratory Investigations

The laboratory testes including complete blood count, serum creatinine, cardiac biomarkers (creatine kinase MB and troponin) and fasting blood sugar were performed**.**

v. Electrocardiography

Standard resting 12 leads ECG was done. Based on the main clinical, electrocardiography, and cardiac enzymes results, the studied patients were classified into UA group (n=108), NSTEMI group (n=31) and STEMI group (n=162).

vi. Echocardiography

To assess left ventricular function (ejection fraction, fractional shortening, regional systolic wall motion abnormalities) Echocardiography was performed.

2.5.2. Phase II

All admitted patients were followed up for 30 days considering hospital treatment (thrombolysis, anti-platelets, beta blockers, lipid lowering drugs, ACEs inhibitors or ARBs, anticoagulants, percutaneous intervention, CABG), duration from admission to reperfusion therapy, length of hospital stay (5 days, 6-10 days, 11-20 days, 21-30 days, 30 days), In- hospital outcome (death, stroke, major bleeding, arrhythmia, heart failure, impaired left ventricular function).

2.6. Statistical Analysis

Data were coded then analyzed using the computer program SPSS (Statistical package for social science) version 16. Qualitative data were described as numbers and percentages. The χ^2 test or Monte Carlo test or Fisher's exact test was used for comparison between groups as appropriate. Quantitative data were described as means ± (SD) after testing for normality by Kolmogorov-Smirnov test. One way ANOVA test was used for comparison between groups. Odds ratios and their 95% confidence interval were achieved.

3. Results

This study revealed statistical significant differences between studied groups regarding mean age, sex, residence, time from symptoms, mode of transport, smoking and history of myocardial infarction (Table 1).

Table 1. *Socio-Demographic Characteristics and Medical History of Studied Patients.*

Criteria	NSTEMI n=31	STEMI (MI) n=162	UA n=108	Significance
Age				
Mean ± SD	61.03±8.72	57.45±10.27	65.02±10.43	F=2.95; P=0.054
Min-Max	48.0 - 84.0	21.0 - 84.0	29.0 - 82.0	
Sex				
Male	21(67.7)	133 (82.1)	62 (57.4)	x^2=19.7; p<0.001
Female	10(32.3)	29 (17.9)	46 (42.6)	
Residence				
urban slum/urban	18 (58.1)	87 (53.7)	54 (50)	x^2=0.73; p=0.701
rural	13 (41.9)	75 (46.3)	54 (50.0)	
SES Classes				
High	8 (25.8)	46 (28.4)	23 (21.3)	
Middle	4 (12.9)	39 (24.1)	31 (28.7)	MC*; P=0.504
Low	12 (38.7)	43 (26.5)	29 (26.9)	
Very low	7 (22.6)	34 (21.0)	25 (23.1)	

Criteria	NSTEMI n=31	STEMI (MI) n=162	UA n=108	Significance
Time from symptom				
<4h	25 (80.6)	132 (81.5)	95 (88.0)	
4-12h	4 (12.9)	18 (11.1)	12 (11.1)	MC; P=0.117
>12h	2 (6.5)	12 (7.4)	1 (0.9)	
Mode of transport				
Ambulance	5 (16.1)	30 (18.5)	5 (4.6)	
Taxi or private transport	23 (74.2)	129 (79.6)	99 (91.7)	MC; P=0.004
Public transport	3 (9.7)	3 (1.9)	4 (3.7)	
Smoking	15 (48.4)	108 (66.7)	44 (40.7)	x^2=18.34; p<0.001
Known diabetic	17 (54.8)	78 (48.1)	63 (58.3)	x^2=2.77; p=0.25
Known hypertensive	22 (71.0)	101 (62.3)	77 (71.3)	x^2=2.65; p=0.266
History of myocardial infarction	7 (22.6)	14 (8.6)	33 (30.6)	x^2=21.64; p<0.001
History of heart failure	0 (0.0)	2 (1.2)	5 (4.6)	MC; p=0.119
Chest pain[#]				
Typical	31 (100.0)	156 (96.3)	108 (100.0)	MC; p=0.07
Atypical	0 (0.0)	6 (3.7)[$]	0 (0.0)	

*MC, Mote Carlo test.
[#]All cases were presented with chest pain.
[$]6 cases only with STEMI (MI) had atypical chest pain.

Moreover, statistical significant differences were seen among different ACS categories regarding mean systolic or diastolic blood pressure, thrombolysis, beta blockers, ACEs inhibitors, percutaneous intervention, duration of hospital stay, impaired left ventricular function, heart failure, arrhythmia and death as reported in table 2.

Table 2. *Clinical Presentation, Management and in-Hospital Outcome of Studied Patients' [#].*

Measurements	NSTEMI n=31	STEMI (MI) n=162	UA n=108	Significance
BMI				
Mean ± SD	30.25±4.3	29.29±5.16	30.33±4.62	F=1.64, P=0.196
(Min-Max)	(21.0-39.0)	(18.0-62.14)	(23.0-40.0)	
Heart rate				
Mean ± SD	88.23±22.96	83.4±18.89	80.86±11.18	F=2.36, P=0.096
(Min-Max)	(6.0-160.0)	(30-140.0)	(55.0-130.0)	
Systolic blood pressure				
Mean ± SD	132.9±29.57	113.77±38.9	130.09±14.11	F=11.06, P<0.001
(Min-Max)	(0.0-170.0)	(0.0-180.0)	(90.0-170.0)	
Diastolic blood pressure				
Mean ± SD	82.58±18.61[c]	72.04±24.98[cd]	84.07±10.85[d]	F=12.44, P<0.001
(Min-Max)	(0.0-110.0)	(0.0-100.0)	(60.0-110.0)	
Cardiac enzymes	31 (100.0)	161 (99.4)	107 (99.1)	MC, P=0.85
Coronary angiography	9 (29.0)	57 (35.2)	24 (22.2)	x^2=5.21, P=0.074
Thrombolysis	0 (0.0)	112 (69.1)	1 (0.9)	x^2=149.4, P<0.001
Beta blockers	28 (90.3)	134 (82.7)	102 (94.4)	MC, P=0.014
ACEs inhibitors	30 (96.8)	146 (90.1)	108 (100.0)	MC, P=0.002
Anticoagulants	31 (100.0)	160 (98.8)	107 (99.1)	MC, P=0.814
Percutaneous intervention	3 (9.7)	49 (30.2)	2 (1.9)	x^2=37.1, P<0.001
CABG	1 (3.2)	6 (3.7)	1 (0.9)	MC, P=0.37
Duration of hospital stay				
5 days	22 (71.0)	80 (49.4)	89 (82.4)	
6-10 days	9 (29.0)	80 (49.4)	18 (16.7)	MC, P<0.001
11-20 days	0 (0.0)	2 (1.2)	1 (0.9)	
Death	2 (6.5)	31 (19.1)	0 (0.0)	MC, P<0.001
Stroke	0 (0.0)	8(4.9)	3 (2.8)	MC, P=0.327
Heart failure	6 (19.4)	52 (32.1)	12 (11.1)	x^2=16.3, P<0.001
Major bleeding	0 (0.0)	14 (8.6)	4 (3.7)	MC, P=0.08
Arrhythmia	13 (41.9)	45 (27.8)	22 (20.4)	x^2=5.99, P=0.05
Impaired left ventricular function	13 (41.9)	72 (44.4)	24 (22.2)	x^2=14.3, P=0.001

[#] All patients were examined by ECG, received anti platelets and lipid lowering drugs.
*MC=Mote Carlo test.

There is significant increase in ACS mortality, incidence of stroke, incidence of impaired left ventricular function and incidence of heart failure as we go lower in SES classes (P <0.001). The results of the current study revealed a significant increase in ACS mortality as we go lower in the SES. It showed statistically significant association between SES and in-hospital mortality (P <0.001) (Table 3).

Table 3. *Complications Reported Among Patients with Different Socioeconomic Classes.*

Complication		SES Classes			
		Highn. (%)	P (CI)	Middlen. (%)	P/(CI)
Death	Yes	4 (12.1)	1	4 (12.1)	P=1
	No	73 (27.2)		70 (26.1)	1.043 (0.25-4.33)
Stroke	Yes	1 (9.1)	1	2 (18.2)	P=0.615
	No	76 (26.2)		72 (24.8)	2.11(0.19-23.79)
Impaired left ventricular function	Yes	13 (11.9)	1	22 (20.2)	P=0.06
	No	64 (33.3)		52 (27.1)	2.08(0.96-4.53)
Heart failure	Yes	7 (10.0)	1	16 (22.9)	P=0.032*
	No	70 (30.3)		58 (25.1)	2.76(1.063-1.33)
Major bleeding	Yes	4 (22.2)		3 (16.7)	
	No	73 (25.8)		71 (25.1)	
Arrhythmia	Yes	14 (17.5)		22 (27.5)	
	No	63 (28.5)		52 (23.5)	

Table 3. *Continued.*

Complication		SES Classes				significance
		Low n. (%)	P / (CI)	Very low n. (%)	P/(CI)	
Death	Yes	9 (27.3)	P=0.253	16 (48.5)	P=0.001*	MC#
	No	75 (28.0)	2.19 (0.646-7.43)	50 (18.7)	5.84 (1.84-18.5)	P=0.001
Stroke	Yes	0 (0.0)	P=0.478	8 (72.7)	P=0.012*	MC#
	No	84 (29.0)	2.19(0.646-7.43)	58 (20.0)	10.5(1.3-86.18)	P<0.001
Impaired left ventricular function	Yes	39 (35.8)	P<0.001*	35 (32.1)	P<0.001*	χ^2=25.7,
	No	45 (23.4)	4.267(2.05-8. 9)	31 (16.1)	5.56(2.58-11.98)	P<0.001
Heart failure	Yes	22 (31.4)	P=0.005*	25 (35.7)	P=0.005*	χ^2=17.08
	No	62 (26.8)	3.55 (1.42-8.87)	41 (17.7)	3.55 (1.42-8.87)	P=0.001
Major bleeding	Yes	5 (27.8)		6 (33.3)		MC#
	No	79 (27.9)		60 (21.2)		P=0.657
Arrhythmia	Yes	25 (31.2)		19 (23.8)		χ 2=3.76
	No	59 (26.7)		47 (21.3)		P=0.289

#MC: Monte Carlo test.

There is no significant change in the incidence of major bleeding and arrhythmia between SES classes. Statistical significant differences in time from symptom onset until arrival to hospital, in performing coronary angiography and percutaneous intervention between SES classes, (P <0.001) as illustrated in table 4.

Table 4. *Management Among Different Socioeconomic Classes.*

Management		SES Classes				significance
		High n (%)	Middle n (%)	Low n (%)	Very low n (%)	
Time from symptom	<4 h	77 (30.6)	69 (27.4)	71 (28.2)	35 (13.9)	MC# P=0.001
	4-12 h	0 (0.0)	3 (8.8)	10 (29.4)	21 (61.8)	
	>12 h	0 (0.0)	2 (13.3)	3 (20.0)	10 (66.7)	
Coronary angiography	Yes	35 (61.4)	14 (24.6)	4 (7.0)	4 (7.0)	MC# P<0.001
	No	11 (10.5)	25 (23.8)	39 (37.1)	30 (28.6)	
Percutaneus intervention	Yes	34 (69.4)	9 (18.4)	6 (12.2)	0 (0.0)	MC# P<0.001
	No	12 (10.6)	30 (26.5)	37 (32.7)	34 (30.1)	

#MC: Monte Carlo test Discussion.

Cardiovascular diseases are still the leading cause of mortality all over the world not only in developed countries [20] and in many developing countries including Egypt. Although, There is a positive relation between SES and health in developed countries [21], only a few studies have examined this association in non-developed countries including South Africa countries [22]. Ischemic heart diseases mortalities have been decreased over the 8th decade of the previous century, this decrease in mortality rate differ between lower and higher SES classes [23].

Regarding cardiovascular risk factors and cardiac disorders, many studies have shown that a lower socioeconomic status (SES) is commonly associated with them [24]. But few studies mentioned important association between SES and IHD mortality [25] and others mentioned no or weak associations [26].

SES is a complex phenomenon depends on a wide variety of variables that is often a combination of financial, occupational, and educational impacts [27]. To assess patient's SES, the most commonly used indicators are income, education, and occupation. Each of these indicators measure various, often closely related aspects of SES, and may be relevant to different health outcomes at different stages in life course [7].

Acute coronary syndromes (ACS) can be presented with unstable angina (UA), acute NSTEMI, and acute STEMI. The main in-hospital outcome of acute coronary syndrome includes death, stroke, major bleeding, arrhythmia, and heart failure [6].

The current prospective observational study was carried on 301 patients presented with acute chest pain and confirmed diagnosis of ACS based on ECG changes and or cardiac enzymes elevation in order to assess the in-hospital outcome of acute coronary syndrome and to monitor the correlation between socioeconomic status and in-hospital outcome of acute coronary syndrome among those patients. All participating patients were subjected to a predesigned questionnaire form about SES, findings of medical examination and investigations were performed and patients were Followed up and evaluated for the outcome during the first month.

Admitted patients with acute coronary syndrome were classified into 31 (10.3%) patients with NSTEMI, 162 (53.8%) with STEMI and 108 (35.9%) with unstable angina (UA). According to patients SES, they were classified as 77 with high SES, 74 with middle SES, 84 with low SES, and 66 with very low SES.

The results of this study revealed a significant increase in ACS mortality as we go lower in the SES. The association between SES and in-hospital mortality was statistically significant ($P < 0.001$). This unique relation between specific mortality of a disease and SES is well documented in developed countries [21], but this relation is not well documented in less developed countries including Egypt [22].

Other studies was carried out by Welch et al. on 84423 patients in England revealed association between in-hospital mortality of ACS and SES as patient go lower in SES, increased risk of mortality. [28]. A previous study performed by Hutchings et al. on 51572 patients show the same relation and referred this to that: patients with lower SES received lower quality of treatment [29]. In contrast,, the study conducted by Ciccone et al. on 49949 patients in Italy showed no relation between ACS in-hospital mortality and SES when managed under optimum conditions [30]. Moreover, another study carried in Canada by Pilote et al. on 145882 patients revealed also a negative relation either in short term or long term mortality [31].

In this study there is a statistically significant change between SES classes and time from onset of symptoms until patients arrived to the hospital and seek medical care. This appear when many patients with low SES take a long time from beginning of chest pain until they seek medical advice (about 66% of patients who wait more than 12 hours from symptom onset until arrival to hospital were of very low SES). However, in this study, all patients with high SES seek medical advice in less than 4 hours. The 2013 American College of Cardiology Foundation/American Heart Association guidelines for management of acute STEMI recommend early recognition and administration of reperfusion therapy since the beneficial effects of therapy with reperfusion agents are greatest when performed soon after presentation [32]. This apparent that in the term which states that: “time is muscle".

This delayed presentation to treatment can explain the higher mortality in the very low SES class.

Other studies revealed that a higher risk of mortality has been associated with lower SES in the setting of ACS [33]. This is because of obstacles to in-time medical care and settled appropriate interventions [34]. Numerous studies have shown SES-related differences in the employment of appropriate therapies such as invasive cardiac procedures [35].

This study showed significant statistically change of SES in the prevalence of coronary angiography and PCI. Current results clearly revealed that significant decrease in the incidence of coronary angiography and PCI as we go lower in SES classes ($P < 0.001$). This decrease in the use of coronary angiography and PCI may also explain the higher mortality and morbidity in very low SES class.

Previous study showed that lower SES has been associated with lower rate of PCI [36], longer suspense for the procedure, and less recover in quality of life after PCI compared to higher SES [37].

The current study results also revealed a statistically significant change between SES in the prevalence of impaired left ventricular function assessed by echocardiography, heart failure, and stroke. Meanwhile, it showed no statistically significant change between SES in the prevalence of major bleeding or arrhythmia. This in agreement with previous studies which explain the relation between SES and heart failure also document as the patient go lower in the SES, he will be at increased risk of developing heart failure following attack of ACS. This increase in heart failure with the decrease in SES was confirmed in the meta-analysis of Hawkins et al., 2012 who found that socioeconomic depravation is a powerful independent predictor of heart failure development and adverse outcomes after ACS [38].

To explain the increased incidence of impaired left ventricular function assessed by echocardiography and heart failure among those with very low and low SES and decreased this prevalence among those with high SES, it is important to notice that the most common causes of systolic dysfunction are coronary (ischemic) heart diseases and that effective therapy of it lead to reduction in the rate of heart failure [39]. This effective therapy is mostly applied to patients with high SES in contrast to those with lower classes who presented late and receive less effective treatment.

For increased incidence of stroke in lower SES and decreased its incidence in high SES classes, there are probably some reasons. One of them is probably the general condition of the patient and associated co-morbidities. It is most probable that people with lower financial resources and who don't work tend to have less healthy food and those with lower education have less knowledge about what exactly constitutes a healthy lifestyle and diet. According to Keeley et al., 2003, if high-quality PCI is available, multiple

randomized trials have shown enhanced survival and a lower rate of intracranial hemorrhage and recurrent MI compared to fibrinolysis [40].

The possible causes that arrhythmia in the current study wasn't affected by SES is possibly that the mechanism of arrhythmia following ACS is the damaged myocardium, which produces a substrate capable of developing reentrant circuits or associated with enhanced automaticity [41], and modulating factors, such as electrolyte imbalance (hypokalemia), dysfunction of the autonomic nervous system (increased sympathetic activity), continued ischemia and elevated plasma levels of free fatty acids. These factors may act on both substrate and triggers to induce arrhythmias [42]. These two mechanisms are not modified by SES class of the patient.

Also, in this study results, the possible cause that major bleeding wasn't affected by SES is possibly that all patients with ACS were managed in the same manner with anti-platelets, thrombolysis, and anticoagulants. These agents increase the risk of major bleeding. Another possible cause is that other associated co-morbidities like liver cirrhosis and esophageal varices. These co-morbidities do not change with SES.

4. Conclusions

Socioeconomic status didn't affect the type of presentation of ACS. Short- term mortality of ACS is increased as we go lower in the SES which is associated with longer time from presentation to hospital management and management of chest pain. Lower SES was also associated with high prevalence of impaired left ventricular function, heart failure, stroke, and lower rate of coronary angiography and PCI. There was no relation between SES and prevalence of arrhythmia and major bleeding.

Study Strengths, limitations and recommendations.

To the best of author's knowledge, this is the first registry data to assess the association between SES indicators and the in-hospital mortality of ACS patients in Egypt. While most of the evidence for socioeconomic inequalities in health come from western countries and USA. All the data in this study were recorded by well-trained physicians and the validity of the data were further checked. Nevertheless, the study has some limitations. The principal limitations of this study are related to its relatively small sample size and also to the measurement of SES which is to some extent were subjective as it depended on the patient educational level, mentality and social behavior. Optimum medical management should be the same for all patients with ACS regardless their SES. There should be medical awareness about ACS and the importance of its early recognition and management to the public especially those with low SES.

Ethical Statement

Study protocol was approved by Medical Ethics research Committee of the faculty of medicine, Mansoura University, Egypt and from the mangers of the hospital in which the study was conducted. Informed written consent was obtained from each participant in the study. Confidentiality and personal privacy was respected in all levels of the study. Collected data will not be used for any other purpose.

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Conflict of Interest

The authors declare that they have no competing interests.

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