Original Article

Depression in Acute Coronary Syndrome Patients: A Cross-sectional Study in Malaysia

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Abstract

Background and purpose: Linked with high mortality rate, depression is common among acute coronary syndrome (ACS) patients. The current study sought to identify the factors associated with depression among ACS patients in Malaysia.

***Materials and Methods*:** A cross-sectional study was conducted on 400 ACS patients in two Malaysian hospitals: Hospital Universiti Sains Malaysia (USM), Kelantan and Hospital Sultanah Nur Zahirah (HSNZ), Terengganu. ACS patients were included if they were above 18 years of age, able to read and/or write in Bahasa Melayu language and had informed consent. Patients were excluded if they were intubated, had an altered mental status, mental retardation and had psychological problems prior to ACS. Depression in this study was defined as having dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest or involvement, anhedonia, and inertia among ACS patients. A questionnaire was distributed to all 400 ACS patients. Simple and multiple logistic regressions were used for data analysis.

***Results*:** The mean (standard deviation) age of ACS patients was 60.4 (11.3) years at Hospital USM and 61.2 (10.4) years at HSNZ. Nearly all of the depressive-ACS patients were Malay (79.4%), 85.9% were male, and 79.7% were married. Approximately 87.7% of depressive-ACS patients had ischemic heart disease, 87.1% had stroke, 83.4% had hyperlipidaemia, 81.8% had diabetes mellitus, and 80.7% had hypertension. The factors associated with depression were female gender (adjusted odd ratio (OR): 2.48, 95% confidence interval (CI): 1.50, 4.10, $p<0.001$) and ischemic heart disease (adjusted OR: 2.44, 95% CI: 1.41, 4.25, $p=0.002$).

***Conclusion*:** The results showed that female gender and ischemic heart disease were the most significant associated factors of depression among ACS patients.

***Keywords*:** Acute Coronary Syndrome; Depression; Gender Identity

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1. Introduction

Cardiovascular disease is the leading cause of death worldwide. Out of 31% of all global deaths, it is estimated that 17.9 million individuals died from cardiovascular disease in the year 2016 (1). Patients with coronary artery disease (CAD) may present with acute coronary syndrome (ACS) or stable angina. ACS includes ST-elevation myocardial infarction, non-ST-elevation myocardial infarction, and unstable angina. In the year 2012, ACS accounted for 24.7% of deaths in Malaysia (2). In the United States, over 17 million adults have survived from ACS, with 1.2 million new survivors being added each year (3). Despite these survival rates, two out of every five ACS patients report a depressive symptom (4), in which the symptom that remain long after discharge (5). The prevalence of major depression after ACS is more than 10%, twice that of the general population. Among patients with cardiovascular disease, depression is prevalent and has a significant negative impact on various outcomes (6). The association between ACS and depression has been extensively reported and studied. This relationship is bidirectional where cardiovascular disease has been shown to increase the risk of depression, while depression is found to be associated with higher rates of cardiovascular mortality and morbidity (7). The presence of depression in patients with coronary disease has been linked to lower rates of compliance with treatment and lifestyle modification; it is thus important to detect depression among patients in this group (6). Following an ACS event, patients often experience psychological stress. This may account for the prevalence of depression in this patient group. Untreated depression can have a significant impact on patient's quality of life and increase the burden on family members (8). ACS patients with depression reported more chest pain, used more primary care services, and had more hospital re-admissions (9-12). In addition, depressed patients were also less likely to return to work, adhere to medical recommendations, and experience life satisfaction (13-15). The troubling connection between ACS and depression warrants further investigation in Malaysia due to the difference in social and cultural background compared to other Western countries, where the bulk of research had been carried out. There was a need to conduct studies in examining the self-reported level of depression in order to inform a long-term secondary risk prevention strategy for ACS patients. Thus, the current study aimed to identify the factors associated with depression among ACS patients. Based on the findings, the researcher hoped to seek solutions to this mental health challenge among ACS patients in Malaysia.

2. *Materials and Methods*

Lasting for ten months, this cross-sectional study was carried out at two Malaysian hospitals: Hospital Universiti Sains Malaysia (USM), Kelantan and Hospital Sultanah Nur Zahirah (HSNZ), Terengganu. The present study was approved by the Emergency Department Review Board and the Human Research Ethical Committee, USM. At HSNZ, the study was approved by the Medical Research and Ethics Committee and registered with the Ministry of Health through the National Medical Research Registry (NMRR). The registered NMRR ID was NMRR-13-1469-18867. Consent was obtained from both hospital directors at Hospital USM and HSNZ. ACS is defined

as a range of acute myocardial ischemia state including unstable angina (UA), NSTEMI, and STEMI. UA refers to new onset of severe angina or accelerated angina; no rest pain, angina at rest within past month but not preceding 48 hours (angina at rest, subacute), or angina at rest within 48 hours (angina at rest, acute). A patient presenting with UA may progress to NSTEMI or even STEMI. The diagnosis of NSTEMI is established if a raised cardiac biomarker is detected. In STEMI, ST elevation may be present in the ECG, whereas in UA, they are usually absent, and whenever present, they are usually transient. STEMI is a clinical syndrome defined by characteristic symptoms of myocardial ischemia in association with persistent electrocardiographic ST elevation and subsequent release of biomarkers of myocardial necrosis. New or presumably new left bundle branch block (LBBB) has been considered a STEMI equivalent.

The ACS patients were included if they were (i) above 18 years old; (ii) able to read and/or write in the Bahasa Melayu (BM) language, and (iii) had informed consent. The patients were excluded if they were intubated, had an altered mental status, had mental retardation and psychological problems prior to ACS. Co-morbid illnesses included diabetes mellitus, hypertension, hyperlipidaemia, stroke, ischemic heart disease, and etc.

A convenience sampling method was applied where the sample of ACS patients was taken from the wards where it was easy to reach. The only criteria using this convenience sampling method was whether the ACS patients agree to participate in this study or not. Therefore, all ACS patients who fulfilled the inclusion and exclusion criteria during the study period were included. After applying the inclusion and exclusion criteria, a total of 400 patients were eligible for this study.

A standardised questionnaire was distributed among 400 ACS patients at each hospital, Hospital USM and HSNZ. The questionnaire included two sections. The first section gathered information on socio-demographic details, such as age, gender, race, marital status, occupation, total income, educational level, and co-morbidity.

The second section was composed of the Depression Anxiety Stress Scale 21 (DASS-21). The current research employed the DASS-21, because it differentiates between the varying aspects of depression, physical arousal, psychological tension, and agitation. DASS-21 was validated using BM version with the Cronbach's alpha of 0.84 for depression (16).

The DASS-21 consisted of three main scales: depression (DASS-D), anxiety (DASS-A), and stress (DASS-S). Each scale had seven items which used a four-point response scale. The 0 point stood for 'Did not apply to me at all'. 1 point indicated 'Applied to me to some degree, or some of the time'. 2 points indicated 'Applied to me to a considerable degree, or a good part of time', and 3 points indicated 'Applied to me very much, or most of the time'.

The DASS-21 is a short form of the DASS (the long version has 42 items), and the final score for depression must be multiplied by two to align with the original 42 items. The subscale ranges between 0 and 42. Once multiplied by two, the score is transferred to the DASS profile sheet, enabling comparisons in the depression category. ACS patients were categorized as having a normal level of depression if they scored between 0 and 9, while patients with

scores of 10 to 42 were classified as having abnormal depression.

The questionnaire was distributed to ACS patients admitted to all medical wards, including the Coronary Rehabilitation Ward and the Cardiac Care Unit. The questionnaire was given by hand during the admission into the wards. The subjects received thorough explanations regarding the study before signing the informed consent forms. The researcher explained to the subjects that they should answer the questions according to their feelings after the ACS event, not prior to it.

The informed consent forms included the title of the research, the researcher's name, an introduction to the study, the purpose of the research, qualifications for participation (inclusion and exclusion criteria), study procedures, and risks. The informed consent forms also provided possible benefits, ensured confidentiality and required a signature. Eligible subjects filled in and signed the informed consent forms. The respondents had 10 to 15 minutes to answer all the questions. Then, the questionnaire was returned to the researcher.

Data entry and analysis were conducted with the Statistical Package for Social Sciences Software, version 24 (17). The continuous variables were described as mean and standard deviation, or median and interquartile range where appropriate. Categorical variables were presented by frequency (n) and percentage (%).

Logistic regression was used to analyze the data, as the current study involved binary outcome (in which there are only two possible outcomes: depressive and non-depressive). The independent variables were screened one by one using simple logistic regression. Only variables that were statistically important with p-value less than 0.25 or were clinically important were included to proceed with multiple logistic regression. Results are presented as the crude and adjusted odd ratios (OR), 95% confidence interval (CI), and p-value. The p-value < 0.05 was considered to indicate statistical significance.

3. *Results*

The results of the present study were divided into two groups; depressive and non-depressive group. Depressive group cases were defined as having 10 to 42 score while non-depressive group cases were defined as having 0 to 9 score. The mean (standard deviation) age of ACS patients was 60.4 (11.3) years at Hospital USM and 61.2 (10.4) years at HSNZ. Nearly all of the depressive-ACS patients were Malay (79.4%), 85.9% were male, and 79.7% were married. Approximately 87.7%, 87.1%, 83.4%, 81.8%, and 80.7% of depressive-ACS patients had ischemic heart disease, stroke, hyperlipidaemia, diabetes mellitus, and hypertension, respectively (Table 1).

Table 1. Socio-demographic Characteristics of ACS patients at Hospital USM and HSNZ (n=400)

Variables	Depressive Frequency (%)	Non-Depressive Frequency (%)
Gender		
Male	213 (85.9)	35 (14.1)
Female	108 (71.1)	44 (28.9)
Race		
Non-Malay	63 (84.0)	12 (16.0)
Malay	258 (79.4)	67 (20.6)
Marital Status		
Single	12 (92.3)	1 (7.7)
Married	220 (79.7)	56 (20.3)
Divorced/Widowed	89 (80.2)	22 (19.8)
Occupation		
Unemployed	105 (74.5)	36 (25.5)
Governmental	43 (89.6)	5 (10.4)
Private	47 (85.5)	8 (14.5)
Others	126 (80.8)	30 (19.2)
Diabetes Mellitus		
No	123 (77.8)	35 (22.2)
Yes	198 (81.8)	44 (18.2)
Hypertension		
No	79 (79.0)	21 (21.0)
Yes	242 (80.7)	58 (19.3)
Hyperlipidaemia		
No	165 (77.5)	48 (22.5)
Yes	156 (83.4)	31 (16.6)
Stroke		
No	260 (78.8)	70 (21.2)
Yes	61 (87.1)	9 (12.9)
Ischemic Heart Disease		
No	171 (74.7)	58 (25.3)
Yes	150 (87.7)	21 (12.3)
Other Comorbid		
No	244 (77.7)	70 (22.3)
Yes	77 (89.5)	9 (10.5)

The potential cofounders in this study were age, gender, and presence of comorbid. The cofounders were controlled by using multiple logistic regression analysis to give the adjusted odds ratio (OR), as all the significant variables in the simple logistic regression were adjusted in multiple logistic regression. The cofounders could also be avoided by using restriction analysis, as this method was done with other variables, such as race, household income level, and education status level. Depression in ACS patients was associated with female gender (adjusted OR: 2.48, 95% CI: 1.50, 4.10, p<0.001) and ischemic heart disease (adjusted OR: 2.44, 95% CI: 1.41, 4.25, p=0.002), as summarised in Table 2. Compared to men, women with ACS had 2.55 times the odds to have depression when adjusted for ischemic heart disease. The ACS subjects with a history of ischemic heart disease were 2.30 times more likely to experience depression when compared to subjects without a history of ischemic heart disease.

Table 1. Factors Associated with Depression among ACS Patients (n=400)

Variables	Simple Logistic Regression			Multiple Logistic Regression		
	b	**Crude Odd Ratio (95% CI)**	**p-value**	**b**	**Adjusted Odd Ratio (95% CI)**	**p-value**
Gender						
Male	-	1.00	-	-	1.00	-
Female	0.91	2.48 (1.50, 4.09)	0.000	1.83	2.50 (1.50, 4.15)	<0.001
Ischemic Heart Disease						
No	-	1.00	-	-	1.00	-
Yes	0.89	2.42 (1.41, 4.18)	0.001	0.83	2.44 (1.41, 4.25)	0.003

b regression coefficient; CI confidence interval; Forward LR and Backward LR variable selection applied; Multicollinearity and interaction terms checked and not found; Assumptions met: Hosmer Lemeshow test *p*-value 0.324. Overall, the correctly classified percentage = 80.3%, and the area under the ROC curve = 67.6%.

4. Discussion

It is important to emphasize that this study only involved ACS patients admitted to two hospitals during the study period and no attempts were made to analyse the general ACS population as a whole. Even though the research involved two different hospitals, there were no significant differences in terms of socio-demographics. The researcher had identified a bidirectional effect between ACS and psychological health prior to starting the current study. To overcome this problem, the researcher explained to the subjects that they should respond to the questionnaire based on their feelings and symptoms after the onset of ACS rather than considering their symptoms before ACS. In addition, the researcher excluded subjects who had a history of depression before starting the study. Based on these considerations, it is possible to say that the probability of subjects having psychological factors before ACS was very low. The current study indicated that females were more depressed following ACS. The findings of the present study were aligned with other studies in which the researchers concluded that females tend to be more persistently depressed after ACS than males (18-21). Hormonal changes in females following ACS events may explain this finding. ACS often occurs in older female patients, because they are transitioning from the pre-menopausal to the menopausal or post-menopausal period. These changes result in imbalances in oestrogen, progesterone and cortisol levels. Any decline in the level of oestrogen combined with ACS events could cause a variety of physical and emotional symptoms, leading to stress, frustration, and ultimately depression.

Many patients feared from dying during and after an ACS event. This condition increased the inflammatory response and the cortisol levels (22). Without progesterone and higher level of cortisol, female began to feel more overwhelmed and easily stressed, which contributed to depression. Depression in ACS patients was also related to those cases with ischemic heart disease. Various studies were conducted through surveys on the patients with established coronary disease, acute myocardial ischemia and unstable

angina. The outcome of the present study showed that the patients consistently reported a high rate of depression between 15% and 20% (23, 24). In patients with ischemic heart disease, depression was noted in 65% of the cases after ACS, with 16% to 22% reporting a level of major depression.

In conclusion, the findings indicated that the most significant factors associated with depression were female gender and cases with ischemic heart disease. Preventing illness is better than curing it. Considering the increase in depression among ACS patients in recent years, the researchers should pay more attention towards the psychological factors and preventive actions. Without doubt, education should be promoted to increase the people's awareness of ACS psychological factors while promoting their future health.

Limitation

The current study faced a few limitations. First, it was confined to two hospitals and involved a small study sample. Hence, the results of the study cannot be generalised to the entire national population because the data were collected from only two centres, Hospital USM and HSNZ. Also, using the convenience sampling method, the researchers were unable to generalize the findings to the whole population.

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Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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