Relationship between Selected Factors and Length of Hospital Stay in Coronary Artery Bypass Graft Patients

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ABSTRACT

Objective: One of the health outcomes indicating the quality of care is the length of hospital stay. This descriptive research aimed to examine the associations between psychological factors (mood state), operative factors (cardiopulmonary bypass (CPB) time, type of surgery) and post-operative length of hospital stay (LOS) in coronary artery bypass graft (CABG) patients.

Methods: A convenient sample of 109 coronary artery disease (CAD) patients admitted to a university hospital in central Thailand to have elective CABG surgery for the first time were approached. Data were collected by using a socio-demographic and clinical profile with the Profile of Mood State Brief-Thai (POMS-B Thai). Data were analyzed using Pearsons Product Moment Correlation and Spearmans Rank Correlation Coefficient to answer the research questions.

Results: The majority of the participants were males with an average age of 63.1 ± 9.5 years. The postoperative LOS ranged from 4 to 15 days with the average being 7.3 days. The total mood disturbance score averaged 10.5 points. The most common negative mood states were confusion and anxiety. The majority of the patients had only CABG surgery with an average CPB time of 89.9 minutes (SD 40.1). The significant factors associated with post-operative length of hospital stay were type of surgery and CPB time, while mood state was not found to be significantly related to LOS.

Conclusion: In order to promote patients recovery by shortening LOS, a rehabilitation program established by a health care team should be tailored specifically for the type of surgery and CPB time following CABG surgery.

Keywords: Length of hospital stay, psychological factors, coronary artery bypass graft

Siriraj Med J 2011;63:52-57

E-journal: http://www.sirirajmedj.com

An estimated 17.1 million people died from cardiovascular disease in 2004, representing 29% of all global deaths. Of these deaths, an estimated 7.2 million were due to coronary heart disease (CAD).[1] In Thailand, the Bureau of Policy and Strategy reported 18,453 cardiovascular disease-related deaths per 100,000 people in the Thai population in 2007. CAD has been shown to be the third leading cause of death per 100,000 people following accidents and cancer, respectively. Trends were also observed to escalate to 24.6% in 2002 to 28.4% in 2006. Coronary artery bypass graft (CABG) is one of the major treatments for CAD in order to increase blood flow to the myocardium in areas with blockages or narrowing of the coronary vessels. The main objectives of CABG are to prevent sudden cardiac death and relieve angina pain. In 2007, the Medical Association of Thailand reported 3,483 CABG procedures in Thailand (2,851 in government hospitals and 632 in private hospitals), which shows an increase of 1,270 from 2002. Even though CABG provides tremendous benefits for people, it can have adverse effects on patients in terms of physical or psychological aspects.[2,3] In 2009, CABG-related mortality was 1.7% in patients aged < 70 yrs. and 2.56%. in patients aged > 80 yrs.[4]

Length of hospital stay (LOS) is related to patients post-operative recovery process[5-7] and a significant index of healthcare outcomes.[8] LOS also indicates the quality of care delivered in a hospital and resource utilization.[9-12] In this study, LOS is the period of time a patient remains in hospital following CABG surgery. A prolonged LOS may indicate adverse outcomes for patients health status and healthcare services; increased medical expenses in

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terms of patients, families and hospitals; and decreased bed circulation in the hospital. According to the literature review, factors associated with the recovery process and post-operative LOS consisted of patients characteristics (such as age, sex, mood state and co-morbidity); medical practice (such as CPB time); and hospital characteristics (such as practice guidelines and policies).[6,10] However, this study focused on psychological factors (mood states) and operative factors (cardiopulmonary bypass time: CPB time and type of surgery).

Psychological factors

Mood states

Mood states are a person's frame of mind, e.g. anger, anxiety, confusion, depression, fatigue and vigor. Previous studies have found that depression and negative preoperative states of mind are associated with LOS and can be used to predict LOS.[13,14] For example, depression[14] affects both patho-physiological and behavioral mechanisms. In a patho-physiological mechanism, depression stimulates the sympathetic nervous system and inhibits the parasympathetic nervous system, which may increase the risk for ventricular tachycardia[15]. In a behavioral mechanism, depression reduces patients' adherence to medical treatments, such as performing effective coughing and ambulating, following surgery. Thus, the recovery process is prolonged and the LOS is extended. Furthermore, previous studies on the mood states of Thai CABG patients during the first 2 weeks following discharge have found the most common psychological distresses to be confusion, anxiety, depression and anger, respectively.[3] The present study, however, focused on the postoperative, not preoperative, psychological functioning of CABG patients.

Operative factors

Cardiopulmonary bypass (CPB) time

CPB time is the time between cerebral blood flow measurements (T1 = after the initiation of cardiopulmonary bypass at stable mild hypothermia and T2 = at the end of bypass). CPB time helps CABG surgery to be performed easily and effectively in the long run. However, CPB also leads to adverse physical function following the surgery. For example, an inflammatory response may occur and cause water within the blood vessels to diffuse to tissues and organs, such as the heart, lungs and brain. Due to the stimulation of CPB to fibrinolysis, bleeding may occur.[17] Therefore, if CPB time increases, tissues and organs will develop more edema which eventually causes complications. The LOS may be prolonged in order to treat these complications.

Type of surgery

Type of surgery included CABG only and a combination of CABG with other surgeries, such as valve repair. The literature review revealed that CABG combined with valve replacement was significantly associated with extended LOS.[18] Patients who had CABG combined with other surgeries incurred greater risks and spent more time undergoing surgery. Moreover, the injured myocardium and the severity of coronary artery disease and other diseases caused the patients to have a prolonged recovery process and extended LOS.

In conclusion, LOS in CABG patients is affected by psychological factors (mood states) and operative factors (CPB time and type of surgery). However, no study has been conducted to investigate the relationships between psychological factors, operative factors and post-operative LOS in Thai CABG patients. For psychological factors, a previous study assessed the mood states of Thai CABG patients during the first two weeks following discharge, but no studies have examined the pre-operative mood states specific to Thai CABG patients. This study aimed to 1) evaluate psychological factors, operative factors and post-operative LOS in CABG patients and 2) examine the relationship between psychological factors, operative factors and post-operative LOS in CABG patients.

The research questions were as follows:

1. What are the psychological factors (mood state), operative factors (CPB time and type of surgery), and post-operative length of hospital stay in CABG patients?
2. What are the relationships between psychological factors (mood states) and post-operative length of hospital stay in CABG patients?
3. What are the relationships between operative factors (CPB time and type of surgery) and post-operative length of hospital stay in CABG patients?

MATERIALS AND METHODS

The conceptual framework for the research was based on synthesis from the literature review, which found the following three factors to be associated with the recovery process and the postoperative LOS in CABG patients: 1) patient characteristics (such as physical and psychological factors and co-morbidity); 2) medical practice (such as operative factors); and 3) hospital characteristics (such as practice guidelines and policies).[6,10] However, the current study focused on psychological factors (mood states) and operative factors (CPB time and type of surgery). The current research was conducted in a large tertiary care hospital in metropolitan Bangkok (Fig 1).

Population and sample

The target population for the study comprised female and male post CABG surgery patients aged 18 years old or older. The entire sample of subjects was drawn from the surgical ward of a large university hospital. All subjects who met the inclusion criteria were consecutively approached for recruitment.

Criteria for inclusion:

- Patients who had undergone CABG surgery for the first time.
- Patients who were literate in the Thai language.

Exclusion Criteria:

- Patients who had undergone off-pump CABG surgery.

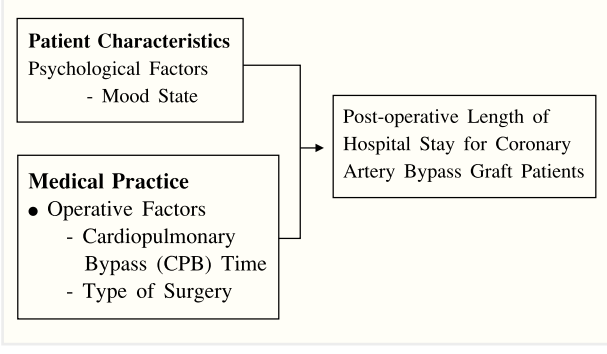

Fig 1. Conceptual Framework of Factors Associated with Post-operative LOS in CABG Patients

- Patients who had undergone emergency or urgent CABG surgery.

In this study, the sample size was determined by using power analysis with a statistically significant level of 0.05 (α). The power of the test equaled 0.80 and the effect size equaled 0.30. The sample size consisted of at least 88 patients.[17] To guarantee the final total sample size from loss during the course of the study, 20% of the sample was added to the total sample size. Therefore, the sample size was increased to 109.

Research instrumentation

The following two instruments were used for data collection:

1. A socio-demographic and clinical profile was used to measure socio-demographic characteristics (age, gender, education level, etc.) and clinical characteristics (diagnosis, type of surgery, CPB time and postoperative LOS). This profile was developed by the investigator.

2. Mood state was measured using the Profile of Mood State Brief-Thai (POMS-B Thai).[20] The Profile of Mood State Brief-Thai is a standardized 30-item adjective rating scale that measures six mood states, including anxiety, depression, confusion, anger, vigor, and fatigue. The profile was developed by McNair, Lorr, and Droppleman in 1981. Participants indicated the degree to which each adjective described their feeling on a 5-point scale ranging from 0 (Not at all) to 4 (Extremely) during the past week. Subscale scores were obtained by summarizing the responses to the items on the scale. The total mood disturbance (TMD) score for the POMS-B is the summary measure of distress for which higher scores indicate increased mood disturbance. In this study, the POMS-B Thai was permitted for use from Multi-Health Systems Inc.,[20] after paying US$ 1.5 / copy.

To determine the internal consistency reliability of the POMS-B Thai, the researcher tested the instrument with 30 patients who had the same characteristics as the subjects in this study. Next, the reliability was calculated by using Cronbachs coefficient alpha. As a result, the reliability of the whole instrument equaled .91, and the reliabilities for anxiety, depression, confusion, anger, vigor, and fatigue equaled .83, .83, .68, .86, .82, and .84, respectively.

Data collection

The process of data collection was conducted as follows:

1. The human subjects approval was obtained (Si 438/2008) by the Ethics Committee for Human Research, Faculty of Medicine Siriraj Hospital.

2. The researcher contacted the director of the hospital, the head of the Nursing Department, the head nurse of the unit and the patients to describe the research project and gain their cooperation in the study.

3. The researcher conducted the first data collection by interviewing patients one day prior to the CABG surgery through the following instruments: a socio-demographic and clinical profile and then the Profile of Mood State-Brief Thai (POMS-B Thai). Next, the second data collections concerning type of surgery, CPB time and postoperative LOS were obtained on the day of the post CABG patients discharge by using the socio-demographic and clinical profile.

Data analysis

The Statistical Package for Social Sciences (SPSS) for Windows, Release 13.0 was used for data entry and analysis. Pearson's Product Moment Correlation Coefficient was used to test the relationship between psychological factors (mood states), operative factors (CPB time) and the post-operative LOS in CABG patients. Additionally, Spearman Rank Correlation Coefficient was used to test the relationship between operative factors (type of surgery) and the LOS in CABG patients.

Findings

In this study, the data were obtained between October 2008 and February 2009 from 109 patients hospitalized for CABG surgery. The participants were recruited according to the studys eligibility criteria and wiliness to participate in the study.

Table 1 presents the socio-demographic and clinical characteristics of study samples. The majorities of the participants were male (72.5%), Buddhist (98.2%) and married (89%). Half of the subjects (49.5%) had graduated from grade school. Approximately 33.9% of the participants had no jobs and 22% were retired. Nearly half of the subjects (46.8%) had a family income of more than 20,000 baht per month and 50.5% stated that they had adequate incomes and some frills. For medical coverage, more than half of the participants (56.9%) used government welfare and 25.7% used the universal healthcare scheme. Most of the participants (66.1%) lived in rural areas and

TABLE 1. Frequency and percentage of demographic and clinical variables (N=109)

Variable	Frequency (%)
Gender	
Male	79 (72.5)
Female	30 (27.5)
Marital status	
Single	2 (1.8)
Married	97 (89.0)
Divorced/widowed	10 (9.2)
Religion	
Buddhist	107 (98.2)
Catholic	2 (1.8)
Income	
Insufficient	6 (5.5)
Nearly insufficient	11 (10.1)
Sufficient with no savings	34 (31.2)
Sufficient with savings	55 (50.4)
More than sufficient	3 (2.8)
Education Level	
Did not complete grade school	7 (6.4)
Completed grade school	54 (49.5)
Completed junior high school	7 (6.4)
Completed high school	11 (10.1)
Completed some college	12 (11)
Completed bachelor's degree	14 (12.8)
Completed master's degree or higher	4 (3.7)
NYHA classification	
Class 1	14 (12.8)
Class 2	76 (69.7)
Class 3	19 (17.4)
Type of surgery	
CABG	94 (86.2)
CABG with	15 (13.8)
Valve	9 (60.0)
Aneurysm	5 (33.3)
Aortic root replacement	1 (6.7)

the majority (69.7%) had Class 2 disease severity. The number of grafts for CABG was between 1 and 6 vessels, with an average of 3.6 vessels (SD 1.1). Furthermore, the length of stay in ICU was 2.8 days (SD 2).

Table 2 presents the mean age of 63.1 (SD 9.5) years with an average total mood state score of 10.5 points. Moreover, in the dimension of positive mood states, vigor had the highest score. In the dimension of negative mood states, the range from the highest score to the lowest score was as follows: confusion, fatigue, anxiety, anger and depression, respectively. For operative factors, the CPB time did not exceed 90 minutes and postoperative length of hospital stay was approximately 7 days.

Table 3 shows that CPB time had a positive and weak relationship with post-operative length of hospital stay ($r = .241$; $p < .05$). In contrast, the total mood disturbance score before surgery had no relationship with LOS.

Table 4 revealed a positive and weak relationship between the post-operative LOS and type of surgery ($r = .258$; $p < .01$).

TABLE 2. Range, Mean and Standard Deviation of Demographic, Clinical and Studied Variables (n = 109)

Variable	Range	Mean	SD
Age	38-83	63.1	9.5
% Ejection Fraction	20-81.5	54.3	16.2
Co-morbidity	0-4	1.0	1.1
Number of Graft	1-6	3.6	1.1
Psychological Factors			
Mood State (Pre-operative)			
Vigor	2-20	9.6	3.8
Confusion	0-14	5.4	3.3
Fatigue	0-19	5.0	4.0
Anxiety	0-15	4.1	3.8
Anger	0-12	3.0	3.1
Depression	0-13	2.7	3.3
Total Mood Disturbance (TMD) score	-16-59	10.5	16.5
Operative factors			
Cardiopulmonary Bypass Time (CPB time) (minutes)	35-278	89.9	40.1
Pre-operative Length of Hospital Stay (days)	1-9	2.2	1.4
Length of Stay in Intensive Care Unit (days)	1-12	2.8	2.0
Post-operative Length of Hospital Stay (days)	4-15	7.3	2.1

TABLE 3. - Pearson's Product Moment Correlation Coefficient among the Studied Variables (n=109)

Variables	1	2	3
Post-operative Length of Hospital Stay	1		
Cardiopulmonary Bypass Time	.241*	1	
Total Mood Disturbance Score	.035	.116	1

* $p < .05$

TABLE 4. Spearman Rank Correlation Coefficient among the Studied Variables (n=109)

Variables	1	2	3	4
Post-operative Length of Hospital Stay	1			
Type of Surgery	.258**	1		

** $p < .01$

DISCUSSION

Length of hospital stay post CABG

The average LOS in this study was 7.3 days which was less than a previous study[3] that found the average LOS to be 10.2 days. However, the latter study was conducted 8 years ago and selected participants who had no major complications.

Recently, postoperative LOS has been shortened due to the Thai health care policy which pays a hospital according to diagnosis-related groups (DRG). LOS is used as an index of health outcomes[8] to determine the effectiveness of care and resource utilization.[9-12] Therefore, the shortened LOS indicates either the effectiveness of caring or resource utilization in addition to reducing costs.

Psychological factors

In this study, vigor had the highest average score because the subjects had experienced chest pain prior to surgery and were unable to perform daily activities. They also believed they would feel better once again and have normal lives following surgery.

In addition, the current study found that scores for negative mood states, such as confusion, fatigue, anxiety, anger and depression before CABG surgery, were at a low level and similar to the negative mood states of Thai CABG patients during the first 2 weeks following discharge.[3] However, Thai CABG patients reported more confusion than anxiety, anger and depression. This finding differs from those of studies conducted in western countries which have found CABG patients more likely to report a high level of depression and anxiety preceding surgery.[14,21] The differences in cultures and religious beliefs may affect these two groups of patients. In western countries, most patients are self-reliant; therefore, they may feel depressed more easily when they are ill. In Thailand, however, most patients live in extended families which makes it easy for them to find caregivers, so that they do not feel as bothered and depressed by their sick role. Furthermore, religious beliefs play an important role in coping with illness-related stress in Thai CABG patients. It is possible that Thais, who are mostly influenced by Buddhism, believe that whatever happens must be accepted in terms of karma and their own previous deeds; no one can help or change the course of others lives. Western people, however, believe they need to manage and take control of their own lives. In addition, most Thai patients trust their healthcare teams and believe that a doctor can help them eliminate symptoms like chest pain by CABG. Therefore, feelings of depression or anxiety before surgery due to their disease or isolation from family and friends may occur less frequently in Thai CABG patients.

In this study, Thai CABG patients reported more confusion, complaining about feelings of uncertainty regarding their future illness prognosis such as "I'm not sure. How long should I stay in the hospital?", or "When will I return to work?" One possible reason may be that most decisions regarding the processes of care and healing are made by the staff. However, some physicians and nursing personnel lack the time to provide adequate patient education and counseling. Because of the structure of the medical system in Thailand, especially regarding the nature of health education, qualified medical personnel (i.e., nurses, physicians, medical social workers, and psychologists) are in extremely short supply. Therefore, most Thai CABG

patients lack knowledge about their illness and how to take care of themselves before surgery.

Operative factors (Type of surgery and CPB time)

The present study revealed that the majority of the participants had CABG only (n = 94). The explanation of this finding is that CAD can now be diagnosed earlier and physicians are more professional than in the past, so abnormalities can be detected early and treatments provided immediately. If other abnormalities, such as valve stenosis, are found with CAD, surgeons will perform surgeries for both CABG and the other abnormalities at the same time to prevent a high risk for complications. Regarding CPB time, the average using heart lung machines in this study was found to be nearly 90 minutes, which was somewhat longer than a previous study that reported CPB time for CABG patients to be 40-75 minutes.[22] One explanation is that the CABG patients in this study had greater illness severity than in the previous study since most of them had at least one co-morbidity in addition to CAD before surgery (Table 2). Thus, CABG surgery cases become more complicated and more time is spent using the machines for surgery.

Relationship between operative factors and post-operative LOS

CPB time and post-operative LOS

In this study, CPB time was found to have a positive and weak relationship with the post-operative LOS ($r = .241$, $p < .05$) (Table 3). This finding is similar to previous studies[12] which found that CPB time was one of the factors sharing a significant relationship with the postoperative LOS ($r = .37$, $p < .001$). Patients who have longer CPB times are more likely to stay in hospital longer than those who have shorter CPB times. Welsby et al.,[7] stated that CPB time was significantly associated with adverse health outcomes, such as prolonged LOS of more than 10 days ($p < .0001$). This finding may be explained by the bodys inflammatory response which occurs during surgery due to the contact of blood with the surfaces of the circuit. Furthermore, the CPB stimulates fibrinolysis and decreases both platelet count and function, and as a result, bleeding and thromboembolism occur.[16,17] During the CPB, the body temperature needs to be cooled down (hypothermia) to decrease cardiac metabolism and preserve main body organs, such as the brain and heart. However, hypothermia affects pancreatic function resulting in a decrease in insulin, so that the tissues cannot use glucose as normal and blood-glucose levels increase. Moreover, longer CPB times with hypothermia have been found to cause more serious effects and adverse symptoms from CPB-induced post-operative complications. As a result, patients require longer hospital stays.

Type of surgery and post-operative LOS

In this study, the type of surgery was found to be related to post-operative LOS ($r = .258$, $p < .01$) (Table 4). This finding concurs with the findings of previous studies[18,23] reporting that CABG combined with valve replacement was associated with extended post-operative LOS. The explanation of this finding is that patients who have combined CABG with other types of surgery require more time in surgery and cardiac muscles are more damaged. Moreover, the severity of co-morbidities, such as mitral regurgitation, may cause left ventricle dilatation and put patients at risk for heart failure. All of these problems cause patients who have CABG combined with other types of surgery to spend longer periods of time in the recovery process with longer hospital stays than those who have CABG only.

Relationship between mood states and post-operative LOS

The current study asserts that the total mood state score prior to the surgery is not associated with the post-operative LOS (Table 3). This finding, however, does not concur with previous studies[13,14] which found that depression and negative pre-operative mood states were associated with post-operative LOS. One possible explanation may be the differences in cultures and religious beliefs as discussed above. Another reason may be that the score for negative mood states in Thai CABG patients was considerably lower than the same score for CABG patients in western countries; thus mood state in Thailand has no relationship with post-operative LOS.

CONCLUSION

The findings revealed that CPB time and type of surgery were related to post-operative LOS. Therefore, to promote the recovery process and prevent extended LOS for patients who have undergone CABG with other surgery, health care teams should provide close monitoring and care based on principles such as clinical practice guidelines (CPG) for the patients, not only to prevent pre- or post-operative complications, but also to enhance recovery. Additional, information from this study will be used to tailor additional interventions aimed at improving health outcomes. Future studies should address creating and testing preparatory information for pre- or post-operative settings specific to Thai CABG patients. Other studies should include emergency and urgent CABG patients in order to achieve an appropriate representation of the population. A longitudinal prospective study should be conducted to investigate more phenomena involving the LOS in CABG patients.

ACKNOWLEDGMENTS

We would like to thank the King Prajadhipok and Queen Rambhaibarni Memorial Foundation for funding this study.

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