Original Article

Perceived control and length of stay post coronary artery bypass graft surgery

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ABSTRACT

Background & Aim: Patients undergoing CABG might have increased complications postoperatively, especially prolonging post-operative Length of Stay (LOS). Perceived Control (PC) affects LOS post CABG and complications among different cardiac populations. However, this relation is not well-studied post CABG. This study aimed to determine whether PC was an independent predictor of LOS among patients post CABG.

Methods & Materials: A prospective observational design was used. A consecutive sample consisted of 220 patients from four hospitals in Amman, Jordan, who underwent elective CABG between July 2020 and January 2021. PC was assessed using the Arabic Version of the Control Attitude Scale-Revised. LOS and other necessary information were retrieved from the patients' medical records. Data were analyzed using stepwise multiple regression.

Results: 169 males and 51 females participated in this study. Age, female gender, as well as PC were found to be independent predictors for the hospital LOS. On the one hand, advanced age and female gender increased the hospital LOS, while higher levels of PC were protective. A one-year increase in age increased hospital LOS by 0.16 days, being female increased hospital LOS by 0.17 days, and a one-point increase in PC levels decreased LOS by 0.33 days. On the other hand, only female gender and PC were independent predictors for the ICU LOS. Similarly to hospital LOS, the female gender increased ICU LOS by 0.18 days while the one-point increase in PC decreased the ICU LOS by 0.21 days.

Conclusion: PC was an independent predictor that affects LOS after CABG. Increasing PC among this population, especially females and the elderly, might improve outcomes of their CABG surgery decrease hospital's LOS and the resultant morbidity.

Introduction

Cardiovascular Diseases (CVDs) affect the heart and/or blood vessels (1). In 2016, 17.9 million individuals died from CVDs, representing 31% of all global deaths and 85% of these deaths were due to heart attacks (2). Treatment of CADs can help manage the symptoms, reduce the risk of further problems, and improve the heart's functioning ability. Usually, CADs are treated medically either by medications or through a percutaneous coronary intervention, including balloon or stent implantation. However, these interventions will not be the optimal choice in some cases. Therefore, patients will be treated using surgical interventions. Coronary Artery Bypass Grafting surgery (CABG) is one of the most commonly performed major operations worldwide (3).

Usually, patients post CABG stay in the Intensive Care Unit (ICU) for a couple of days and in a hospital ward for nearly five days to one week if no complications occurred after the surgery (4). Length of Stay (LOS) measures the duration of a single episode of hospitalization (5). It reflects the efficiency of hospital management, resource utilization,

quality of care, and the severity of patients' conditions (6). Longer hospital stays cost hospitals more in terms of resources and money; therefore, hospital administrations aim to minimize LOS. Identifying factors and elements that affect LOS could help in the advancement of efficient clinical ways and improve resource consumption and organization.

Some pre-and post-operative risk factors can predict LOS for patients who undergo CABG surgery. Preoperative existing conditions (Obesity, Diabetes Mellitus (DM), Hypertension (HTN), and anemia) and severity among patients undergoing CABG significantly affect post-operative outcomes, including LOS (7). For example, being obese (Body Mass Index (BMI) over 30) was associated with longer LOS and more post-operative complications, including increased sterna, wound infection, and saphenous vein harvest site infection (8). Furthermore, the history of DM was a significant predictor for post-operative outcomes; prolonged ICU stay, infection, and renal dysfunction (9). Moreover, patients with HTN need longer ventilatory support and stay longer in the ICU (10). In addition to that, preoperative anemia was an important predictor for mortality, post-operative renal dysfunction, and a LOS of more than seven days (11).

Gender also might affect the LOS after CABG. In one study conducted recently to check the effect of Perceived Control (PC) on the relationship between anxiety and LOS after CABG surgery in Jordan, 250 patients were included. The results showed that females stayed longer in the hospital because they were more anxious and had lower PC levels (12). In another study, five hundred sixty-one patients (376 men, 185 women) were included to check the effect of gender on time to extubation following CABG surgery, ICU stays, and hospital LOS in Cleveland, Ohio. The results showed that females undergoing CABG surgery have longer (intubation times, ICU stay, and hospital LOS) compared to male patients (13).

PC is an aspect that researchers started to focus on and affect the LOS and other negative outcomes among cardiac populations. PC is defined as the extent to which an individual believes s/he has personal control over disease-related outcomes (e.g., recovery from a cardiac event) and the ability to make a difference in the consequences of experiences (12). PC is particularly relevant to patients with CVD (14). It also has a significant role in cardiac patients by improving mental health and health-related quality of life (12, 14).

Moreover, PC plays a crucial role in defining the adaptation to cardiac disease and psychosocial recovery. For example, PC moderates the negative impact of emotional distress on clinical outcomes such as post-myocardial infarction complications, including re-ischemia and malignant dysrhythmias (15). Furthermore, PC is one potential psychosocial predictor of distress to identify health outcomes among patients with CVDs (15). Moreover, in one study, PC moderated the effect of anxiety upon LOS post-CABG surgery (12). Also, it was concluded that longer LOS after CABG surgery had been linked to higher levels of anxiety. Moreover, it was found that PC moderated this relationship. However, limited studies have been designed specifically to check the relationship between PC and LOS post CABG, which indicated that PC might decrease LOS (12).

Thus, this study aimed to determine whether PC was an independent predictor of LOS among patients post CABG after controlling for socio-demographic and clinical characteristics. The research questions were: (1) what is the level of PC for patients post CABG? (2) What is the average of post-operative LOS among patients post CABG? (3) Are Control Attitude Scale-Revised (CAS-R) scores -measuring the PC- independent predictors of LOS among patients post CABG after controlling for socio-demographic and clinical characteristics?

Methods

Study design

A prospective observational design was used to evaluate the relationship between PC and LOS among patients undergoing CABG between July 2020 and January 2021.

Settings

Four hospitals in Amman, Jordan were included; one military, two private, and one educational. The diversity of these hospitals reflected the general practice in Jordan together; they receive many CABG surgeries and provide care for patients from all over the country.

Sampling and sample size

A consecutive sampling method was implemented. The inclusion criteria were: (1) elective CABG operation, (2) older than 18 years, (3) medically free from diseases affecting the LOS such as liver disease, renal failure, and cancer (as per medical records review), and (4) able to read and write in Arabic. The sample size was calculated using G power software based on the following criteria: medium effect size of 0.15, alpha of 0.05, and multiple regression with 13 predictors. Based on that, 200 patients were needed to obtain 0.95 power. Two hundred and fifty patients were screened. Of those who agreed to participate were 230, 10 patients had missing data in the files, including the time of discharge from the ICU\hospital; therefore, they were excluded from the study ending with 220 patients in the final analysis.

Data collection instruments: The Arabic Control Attitude Scale-Revised (CAS-R) was used to assess PC. The CAS-R is applicable and consistent for the cardiac population (15). Cronbach's α for the Arabic version is reported as 0.75 (15). Similar to the original (i.e., the English version) CAS-R, the Arabic CAS-R contains eight statements with five possible responses beginning from 1 "totally disagree" to 5 "totally agree". The total score ranges from 8-40, with higher scores representing higher PC levels (15). As there are no published means norms for the CAS-R instrument, researchers use the median as the cutoff point (15). This instrument's validity and reliability have been practically demonstrated. The Cronbach's alpha coefficients for heart failure (HF), CHD, and Acute Myocardial Infarction (AMI) patients were 0.76, 0.73, and 0.72, respectively (16). Construct validity was confirmed by hypothesis testing and factor analysis (16). As for LOS, it has been taken from the patients' medical records post-discharge and was reported in days.

Data collection

Research assistants accessed all participants who met the inclusion criteria at the cardiology clinics prior to surgery and provided the participants with detailed information about the study, including risks and benefits. Participants signed an informed consent if they agreed to participate then filled out two questionnaires: (1) a socio-demographic questionnaire about their gender, age, marital status, monthly salary, health insurance status, and working status, and (2) a CAS-R questionnaire to measure their PC level. This was done at cardiology clinics before surgery. All other additional necessary information was gathered from medical records after discharge, including LOS in hospital postoperatively, history of DM, HTN, HF, renal failure, previous MI, previous angina, and BMI.

Data analysis

SPSS version 22 was used to analyze data. Descriptive statistics were used to describe the study sample demographic clinical characteristics and to answer research questions one and two. To answer research question number three, two steps were done: First: correlations between (LOS in the ICU and in the hospital) with clinical and demographic variables. Then two stepwise

multiple regression models; one for the hospital LOS and one for the ICU LOS. These two models were done in three blocks for each model. In block, one age and gender were entered. In block 2, history of DM, HTN, HF, renal failure, previous MI, smoking, BMI, left ventricular ejection fraction were entered. In the final block, CAS-R scores were entered.

Ethical considerations

The institutional review board committee approved the study at the Applied Science Private University, Amman, Jordan, and from all institutions before data collection (ASUF2020-3-1). Research assistants ensured that (1) all participants' questions were answered; (2) patients knew that participation was voluntary, (3) they could withdraw at any time they wished to. Data were secured in a locked cabinet with access only by the principal investigator. All data were coded and entered into a password-protected computer to maintain the confidentiality of the participants' record information.

Results

A total of 220 patients participated in the study including 76.8% males (n=169) and 23.2% females (n= 51). Around 90.5% had angina (n=199), while the mean age was 69.5 ± 9.4 years. The mean ejection fraction was 48.1 ± 8.5. Eighty percent of the sample (n=167) had HTN, and 43.2% (n=95) had DM. Other characteristics (clinical and demographic) are shown in Table 1.

Table 1. Demographic and clinical characteristics of the patients N=220

Characteristics	N (%) or M±SD
History of DM	95 (43.2%)
History HTN	176 (80%)
History HF	49 (22.3%)
History RF	14 (6.4%)
Gender	
Male	169 (76.8%)
Female	51 (23.2%)
Age	69.54±9.39
Group 1 (less than 60)	43 (19.5%)
Group 2 (more than 60)	177 (80.5%)
BMI	26.8±4.6
Normal	83 (43%)
Overweight	67 (34.7%)
Obese	43 (22.3%)
Educational status	
Higher school	64 (29%)
Diploma	78 (35%)
Baccalaureate	71 (32%)
Graduate	7 (0.03%)
Marital status	
Single	20 (0.09%)
Married	135 (61%)
Widowed	45 (20%)
Divorced	20 (0.09%)
Hospital LOS (in days)	9.5±9.9
ICU LOS (in days)	6.7±7.9
LVEF	48.1±8.5
Total CAS-R	21.3±4.3

DM: Diabetes Mellitus, HTN: Hypertension, HF: Heart Failure, RF: Renal Failure, LOS: Length Of Stay, ICU: Intensive Care Unit, LVEF: Left Ventricular Ejection Fraction, CAS-R: Control Attitude Scale-Revised scores.

Participants' PC mean was 21.3± 4.2 and a range of 31. The mean of LOS in the hospital was 9.5 days, with a range of 67.9 days and a standard deviation of 9.9 days. As for ICU LOS, the mean was 6.7± 7.9 days with a range of 60.9 days. Age, gender, and PC were independent predictors for the hospital LOS. Specifically, advanced age and female gender increased the hospital LOS by 0.16 and 0.17 days, respectively, while higher levels of PC were protective since every point increase in PC decreased hospital LOS by 0.33 days. On the other hand, only female gender and PC were independent predictors for the ICU LOS. Similarly to hospital LOS, the female gender increased ICU LOS by 0.18 days while higher levels of PC decreased the ICU LOS since every point increase in PC decreased ICU LOS by 0.21 days (Tables 2 and 3).

Table 2. Correlation between ICU LOS, hospital LOS with the different variables, N=220

	HTN	DM	Previous AMI	HF	Gender	Age	BMI	CAS-R scores	LVEF	Smoking	RF
Hospital LOS	-0.11	-0.01	0.13	-0.05	0.32**	0.18**	0.20**	-0.40**	-0.11	-.08	-.06
ICU LOS	-.001	-.010	-.01	-.06	.163*	.090	.059	-.188*	-.01-	-.03	-.05

LOS: Length of Stay, ICU: Intensive Care Unit, HTN: History of hypertension, AMI: Acute Myocardial Infarction, BMI: Body Mass Index, LVEF, Left Ventricular Ejection Fraction, RF, History of Renal Failure, *: P<.05, **: P<.01.

Table 3. Predictors of hospital LOS and ICU LOS by stepwise regression, N=220.

Outcomes/Predictors	Standardized β	t	Model Statistics
Hospital LOS			
Age	0.16	1.88	
Female Gender	0.17	2.20	$R^2 = 0.24$; $F_{(3,216)}= 6.41$,
CAS-R Scores	-0.33	-4.95	$p< .001$
ICU LOS			
Female Gender	0.18	2.71	$R^2 = 0.07$; $F_{(2,216)}= 1.85$,
CAS-R Scores	-0.21	-2.44	$p< .05$

Discussion

This study aimed to examine the effect of PC on LOS of patients post CABG operation in Jordan. Results of this study revealed that higher levels of PC significantly reduced both ICU and overall hospital LOS. Moreover, age, female gender, and PC were independent predictors for the hospital LOS. Advanced age and female gender increased the hospital LOS, while higher levels of PC were protective (resulting in shorter LOS). Furthermore, the female gender increased ICU LOS while the increase of PC decreased ICU LOS.

The perceived control means among patients in the current study was 21.3, and the median was 26. The mean PC in previous studies ranged from 20-24 (12, 14, 15, 17). Therefore, this sample's PC level is similar to prior studies in other cardiac populations in both developed and developing countries. It is noteworthy that female patients in this study had lower PC levels than male patients, which might explain why the female patients stayed longer at the hospital. Thus, indicating that, indeed, higher levels of PC are associated with shorter LOS, as shown in the current study and previous studies. (12, 14, 15, 17).

It has been noted that PC has positive effects in decreasing LOS among different cardiac populations, including CABG patients. For example, PC has a significant role in cardiac patients, such as improving mental health and health-related quality of life (18). Moreover, PC plays a vital part in establishing the adjustment to cardiac disease and psychosocial recovery (19). PC also diminishes the negative impact of emotional stress on clinical outcomes, such as post-myocardial infarction complications including re-ischemia and malignant dysrhythmias (20).

Furthermore, PC is one potential psychosocial predictor of distress to identify health outcomes among patients with CVDs (21). Additionally, high levels of PC were associated with more involvement in active self-care, resulting in better symptom status than patients with lower PC levels (22). These effects enhance the patients' ability and might have a positive effect on decreasing the LOS.

In the current study, PC predicted shorter LOS. PC has been frequently reported as an important factor influencing positive outcomes among different patients' categories, including heart failure, acute myocardial infarction, and CABG (12). It has been recognized as an important predictor of in-hospital complications after CABG (12). This finding provides further emphasis on the vital role of PC in determining the adaptation to cardiac disease and psychosocial recovery (23). Thus, enhancing PC among CABG patients can improve outcomes, decrease LOS, and reduce consequent morbidities (12). On the contrary, the decrease in PC prediction increases the LOS, worsens mental health, and increases the tendency towards worsened physical health (24).

National and international literature reported that psychological factors, including anxiety and depression, were common among different cardiac populations, including HF, AMI, and cardiac surgery, and were associated with prolonged LOS (25). Negative psychological impacts like anxiety, depressive symptoms, and depression post CABG were reported (26). The psychological factor was linked to PC as it negatively correlates with anxiety and depression, explaining why those patients have shorter LOS (27). PC moderates the effect of anxiety and depression on their relation with different outcomes in varied cardiac populations, including LOS in HF, morbidity, and mortality after AMI, and LOS after CABG surgery (12). Previous studies showed that patients with higher PC levels walked longer distances than those with lower PC levels on a 6-minutes walk test (28). Furthermore, high levels of PC were associated with more involvement in active self-care, resulting in better symptom status than patients with lower PC levels (22). These effects enhance the patients' ability and might have a positive effect on decreasing the LOS.

With respect to gender, the female gender predicted longer LOS in both ICU & hospital after CABG compared to their male counterparts. This finding was in line with available conclusions from previous Jordanian studies on cardiac patients (12) and international literature (29). Higher negative psychological impacts like anxiety, depressive symptoms, and depression post CABG are possible explanations for this finding. Compared with men, women patients were found to be more anxious (30), having a higher incidence of cardiac comorbidities with lower physical function and more depressive symptoms in the month before CABG that may extend to six to eight weeks after surgery (31). This was associated with a higher chance for complications (32) and even higher depressive symptoms than that in the community samples/ general population (33). Attributable to complications, anxiety, and depression, longer LOS is a consequent result where anxiety was reported to be an independent predictor of more in-hospital complications (34). The female gender was at higher chances to develop post-operative complications related to higher anxiety levels, and consequently, longer hospitalization duration (34). Additional studies are suggested to scrutinize post CABG complications differences based on patients' gender.

Our findings indicated that age predicted longer LOS. Consistent findings were available (35). Advanced age is often associated with physical and operational changes of the heart and the vessels, even in normally aged hearts and prior to surgery (36). Among the structural changes, decreased cardiac reserve with age represented by impaired diastolic right

ventricular function and reduced its filling, myocardial and vascular stiffening leading to diastolic dysfunction and increased afterload. The aged heart also undergoes certain operational alterations and compensatory responses that reduce its capacity to meet the demands of the increased workload resulting from surgery and decrease its reserve capacity. Changes may include a decline in the high-energy phosphate metabolism and the greatest force of the heart, contractility, prolonged systolic contraction, prolonged diastolic relaxation, sympathetic signaling, etc. Additionally, cardiac protection against further injury and the repair processes is declining with age leading to increased dysfunction (37). Consequently, these changes are assumed to alter the threshold at which the individual can maintain physiologic adaptation after surgery, leave the aged patient vulnerable to higher incidence for complications, and longer stay in the ICU. A focused consideration to develop protection approaches intending to reduce the CABG complications among elderly patients is required.

Conclusion

In conclusion, this study added a new potion of knowledge about supporting the previous results that PC is a significant factor in decreasing the LOS after CABG operation. There was a significant increase in the LOS in those with a low level of PC. Low levels of PC were noticed to be significantly more prevalent among women compared to men. Therefore, the implication of strategies that improve PC among patients undergoing CABG will help in decreasing LOS resource utilization and enhancing the quality of life for those patients. Moreover, future research should focus on conducting interventional studies that enhance PC among patients undergoing CABG.

Limitation

One of the major limitations of this study was depending on chart review for collecting some of the information by which we depend on others for such information.

Conflict of interest

The authors declare that they have no conflict of interest.

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