

READMISSION RATES AND EMERGENCY DEPARTMENT VISITS AFTER CORONARY ARTERY BYPASS GRAFT SURGERY AND RELATED FACTORS

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ABSTRACT • INTRODUCTION : Coronary artery bypass graft (CABG) surgery is associated with complications like wound infection, arrhythmias, heart failure, and pulmonary complications, leading to hospital readmissions. This study aim was to determine rates of readmissions and emergency department (ED) visits in CABG surgery patients within 30 days post-discharge. Reasons for and frequency of readmissions, and associated factors were examined.

METHODS : Retrospective review of medical records of patients operated on in 2010 at a tertiary medical center was done. Adult (18+ years) CABG surgery patients were included while those who underwent CABG with valve surgery or had mental disorders were excluded.

RESULTS : Of the 110 patients studied, 9.1% were readmitted and 13.6% visited the ED within one month of discharge. The most frequent reasons for readmission were pleural effusion and dyspnea, and for ED visits, dyspnea and wound infection. Readmitted patients had fewer grafts performed than those who were not. Patients who visited the ED had higher incidence of bundle branch block and a trend towards higher body mass index than those who did not visit.

CONCLUSION : Patients must be closely followed up following CABG surgery for respiratory complications and educated about how to care for the surgical wound. Prospective studies with larger samples are recommended.

Keywords : coronary artery bypass, hospital readmission, risk factors, postoperative complications

INTRODUCTION

Coronary artery disease (CAD) is the leading cause of morbidity and mortality globally, including in Lebanon [1]. Coronary artery bypass graft (CABG) surgery is a common treatment for CAD. One in every 500 individuals

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RÉSUMÉ • INTRODUCTION : L'infection des plaies, l'arythmie cardiaque et autres complications pulmonaires sont liées au pontage aorto-coronarien, mieux connu sous le nom de PAC. Ces complications mènent à la réadmission du patient à l'hôpital. Cette étude a pour but principal d'analyser les raisons, le nombre des réadmissions et les visites aux urgences des patients ayant subi un PAC, ainsi que les facteurs associés.

MÉTHODE : Étude rétrospective des dossiers médicaux des patients d'un centre médical tertiaire ayant subi un PAC durant l'année 2010. Les patients souffrant de troubles mentaux ou ayant subi une chirurgie valvulaire en ont été exclus.

RÉSULTATS : Parmi les 110 patients étudiés, 9,1% ont été réadmis et 13,6% se sont rendus aux urgences pendant le mois suivant leur sortie de l'hôpital. Les raisons les plus fréquentes de ces réadmissions étaient l'épanchement pleural et la dyspnée. La raison la plus commune des visites aux urgences était l'infection des plaies. Les patients réadmis ont eu moins de greffes que ceux qui n'ont pas été réadmis. De plus, il est apparu que l'indice de masse corporelle ainsi que la fréquence des blocs de branche étaient supérieurs chez les patients s'étant rendus aux urgences.

CONCLUSION : Les patients ayant subi un pontage aorto-coronarien doivent être surveillés pour les complications respiratoires et entraînés à prendre soin de leur plaie. Des études prospectives avec de plus grands échantillons sont nécessaires.

Mots-clés : pontage aorto-coronarien, réadmission à l'hôpital, facteurs de risque, complications postopératoires

undergoes a CABG procedure globally per year [2]. CABG surgery has postoperative complications [3-4], many of which may lead to early hospital readmission following surgery. Early hospital readmissions (i.e. 30 days postoperatively) after CABG surgery are on the rise [3]. Readmission rates 2.9% to 12.9% were documented, occurring most frequently in the first four to eight weeks following CABG, for reasons directly related to the surgery [4-6]. Since the rates of readmission in CABG surgery were found to be associated with the quality of care in many studies, Ashton *et al.* [7] recommended using readmission rates as a key performance indicator of the quality of care. Despite the presence of some studies in Lebanon

that included patients who underwent CABG [8-9], none of them reported rates of readmission or visits to the Emergency Department (ED) and associated factors.

Surgical site infections are the most commonly reported readmission diagnoses [3-5, 10]. Saphenectomy wound infections accounted for 17% of 30-day readmission diagnoses [10], while sternal wound infections accounted for 7%-37% [4, 10].

Predictors of readmission were identified in many studies. A history of diabetes was found to be a significant risk factor for readmission [5, 10-11]. Atrial fibrillation, a common postoperative finding, and congestive heart failure were also associated with significantly higher readmissions rates following CABG surgery [10, 12].

The relationship between gender and readmission rates is not consistent. Some investigators found female gender to be a significant predictor [10, 13-14], whereas others did not after controlling for disease severity [15]. Older age was found to predict readmissions up to 6 months following surgery in a number of studies [5, 13-15].

Less common predictors of early readmission include history of chronic obstructive pulmonary disease [10], hypertension [3, 15] and pulmonary complications following surgery [3-4, 10]. Some investigators studied serum creatinine (Cr) levels, pre-operative left ventricular ejection fraction (LVEF), and post-surgical length of stay (LOS) as possible predictors of early readmission, but the results were inconsistent [4-5, 10]. Moreover, post-surgical LOS (≥ 8 days) was significantly related to infection within 30 days following CABG surgery, thus contributing to the risk of early readmission [5]. Finally, multiple visits to the emergency department (ED) were found to be

significantly associated with 7-day, 30-day, and 6-month readmissions [13], but these investigators did not report reasons for, or predictors of, ED visits.

To date, readmission rates following CABG surgery in Lebanon have yet to be examined, making this the first study to do so. More importantly, the causes and predictors of readmission may reflect the quality of care, thus the significance of the study. Reasons for, and predictors of, readmission and ED visits within 30 days of discharge were investigated in a sample of patients who underwent CABG surgery in 2010. Research questions were:

1. What is the frequency of readmissions & ED visits within 30 days post-discharge in CABG surgery patients?
2. What were the reasons for their readmission or ED visits?
3. What are the differences in demographic and clinical characteristics between those readmitted/who visited the ED and their counterparts?
4. What are the predictors of readmission and ED visits in the sample?

METHODS

This study used a quantitative descriptive, retrospective design. This design may be acceptable as a first step in estimating readmission rates following CABG and exploring related factors. Patients admitted in 2010 for CABG surgery at a major tertiary center in Beirut, Lebanon, were studied in terms of the number of readmissions and ED visits 30 days post-discharge, readmission diagnoses, and related demographic and clinical factors reported in the literature.

Inclusion criteria included • Age 18 years and above.
• Patients who have undergone CABG surgery.

Patients who underwent both CABG and valve surgery, and those with mental disorders (depression, schizophrenia or other psychoses) were excluded since there is a risk that they may not adhere to postoperative discharge education with regards to wound care, adherence to medications, etc., thus accounting for early readmission.

The Institutional Review Board and the hospital administration approved the study. Data were collected from the medical records. Since no documentation of education or income was available and the type of employment was not consistently included in the charts to reflect socioeconomic status (SES), hospital class was used as a proxy measure for SES.

Initially, a total of 114 patient case numbers were obtained from the medical records of the Cardiac Surgery Unit at the study hospital. The final patient count was 110 since 2 patients passed away during their hospitalization, and another 2 underwent valve surgeries in addition to their CABG surgeries. A power analysis conducted with a significance level set at 0.05 and power of 80% suggested this sample size to be reasonable for t-test analysis [16]. For logistic regression, the rule of thumb of at least 30 subjects per predictor was used [17].

TABLE I

SAMPLE DEMOGRAPHIC CHARACTERISTICS (N = 110).

Variable	Frequency	Percentage
Gender		
Males	94	85.5
Marital Status		
Married	108	98.2
Age		
66-89	55	50.0
51-65	41	37.3
36-50	14	12.7
Hospital Class		
Class 3	48	43.6
Class 1	42	38.2
Class 2	20	18.2
Living Status		
With spouse & children	85	77.3
With spouse	22	20.0
Other	3	2.7
Smoking Status		
Current smoker	47	42.7
Ex-smoker	32	29.1
Never smoked	31	28.2

TABLE II CLINICAL CHARACTERISTICS (N = 110).		
Variable	Frequency	Percentage
Diagnosis at Index Admission		
Coronary artery disease	66	60.0
Acute coronary syndrome	30	27.3
Chest pain for cardiac catheterization	8	7.3
Pulmonary edema	2	1.8
Supraventricular tachycardia	2	1.8
New onset atrial fibrillation	1	0.9
Bilateral lower limb ischemia	1	0.9
Most Frequent Co-Morbidities		
Hypertension	84	76.4
Hyperlipidemia	76	64.1
Diabetes mellitus	47	42.7
Cardiac arrhythmias	19	17.3
Renal diseases	16	14.5
Respiratory diseases	15	13.6
Other cardiovascular disease	14	12.7
Body Mass Index		
Overweight	51	46.4
Obese	40	36.4
Normal	17	15.5
Length of Stay		
5-7 days	51	46.4
8-10 days	42	38.2
≥ 11 days	17	15.4

Sample characteristics were summarized using means and standard deviations, frequencies and percentages. Readmission and ED visit groups were compared using t-test and chi-square. When the expected count was less than 5, Fisher's exact test was used. Logistic regression analyses were used to predict readmission and ED visits.

RESULTS

The sample included 110 patients. The majority of patients were males (85.5%), married (98.2%), older than 50 years (87.3%), and living with their spouse and children (77.3%). Almost half of the patients (43.6%) were of hospital class 3, suggesting low SES (Table I).

The most frequent diagnosis at index admission was CAD (60%), followed by ACS (27.3%). Seventy-six percent of patients had hypertension, 64.1% hyperlipidemia, 42.7% diabetes and 82.8% were overweight or obese (body mass index [BMI] > 25 kg/m²). Mean length of stay was 8.59 (± 3.4) days. Moreover, most of the sample (82.2%) had well preserved (i.e. normal to mildly impaired) LVEF (Table II).

Most patients underwent elective (93.64%), off-pump (95.5%) surgery, including three redo cases. The majority (78.2%) underwent both saphenous vein and internal mammary artery grafting, with three to four grafts in 65.5% of cases. The most frequently prescribed cardiac

TABLE III READMISSIONS WITHIN ONE MONTH AFTER DISCHARGE		
Reasons for Hospital Readmissions*	Frequency	Percentage
Pleural effusion	2	20
Chest pain	1	10
Dyspnea	1	10
Pleural and pericardial effusion	1	10
Atrial fibrillation & pericardial effusion	1	10
Heart failure exacerbation	1	10
Pneumonia	1	10
Hyponatremia and fever	1	10

* Percentages are out of the 10 patients readmitted within one month of discharge.

medications at discharge were aspirin (92.7%), anti-lipemics (87.3%), β-blockers (73.6%) and angiotensin converting enzyme inhibitor (ACEI) or angiotensin receptor blockers (ARB) (46.4%), as well as antiarrhythmics (21.8%) and Clopidogrel (10.9%).

Ten patients (9.1%) were readmitted within one month after the index discharge date, including one who was readmitted twice. Half of those readmitted came within the first week after discharge and one third came the second week. Table III displays the reasons for readmission. The most common reasons were pulmonary (40%), including pleural effusion and pneumonia. The patient readmitted twice presented the second time 3 weeks after discharge with pericardial effusion and cardiac tamponade.

On the other hand, 15 (13.6%) patients visited the ED within one month of the discharge date, including one patient who visited the ED twice (Table IV). The most frequent reasons for ED visits included dyspnea (33.3%), followed by wound infection and fever (each 20%). Almost half of those who visited the ED (46.67%) came within the first week after discharge. Three of those who visited the ED were also readmitted, including one who visited the ED after being discharged from readmission. The remaining two patients were a 78-year-old male who came to ED with dyspnea and was readmitted with

TABLE IV EMERGENCY DEPARTMENT (ED) VISITS WITHIN ONE MONTH AFTER DISCHARGE		
Reasons for ED visits*	Frequency	Percentage
Dyspnea	5	33.3
Wound infection	3	20.0
Fever	3	20.0
Evaluation of pleural effusion	1	6.7
Dressler's syndrome	1	6.7
Epistaxis	1	6.7
Displaced Foley catheter	1	6.7

* Percentages are out of the 15 patients who visited the ED within one month of discharge.

forearm cellulitis one week later, and a 73-year-old male who visited the ED with wound infection and was re-admitted for dyspnea the same week.

Table V shows the difference between the readmission groups. The main significant differences were in the medications prescribed at discharge. Those readmitted were less likely to be prescribed ACE inhibitors but more likely to be prescribed ARBs compared to those not readmitted. Readmitted patients had also fewer grafts than the others, the difference approaching statistical significance ($p = 0.054$). Readmitted patients were also less likely to have hypertension but more likely to have bundle branch block (BBB) than those not readmitted; these differences also approached significance ($p = 0.059$ and 0.062 respectively). No other significant differences were found.

Comparison of patients characteristics by ED visits are shown in table VI. The only significant correlate was BBB, with those who visited the ED more likely to have BBB than their counterparts. There was a trend towards higher BMI and longer LOS in patients who visited ED, but those differences did not reach statistical significance ($p = 0.06$ and 0.058 , respectively).

Logistic regression analysis to predict readmission included gender, hypertension, ACEI, number of grafts, and ARBs. The only significant predictor was the number of grafts, with more grafts predicting lower risk for readmission (OR = 0.36, CI: 0.14 to 0.89, $p = 0.027$).

The logistic regression model for predicting ED visits included ACEI, oral hypoglycemic agents, HTN, BBB, BMI, and gender. Patients were more likely to visit the ED if they had BBB (OR = 7.391, CI: 1.702 to 32.101, $p = 0.008$), and higher BMI (OR = 1.185, CI: 1.028 to 1.367, $p = 0.019$) at the index admission, or if their LOS was longer (OR = 1.183, CI: 1.005 to 1.393, $p = 0.044$).

DISCUSSION

This study provided baseline information about the status of CABG surgery patients operated on in 2010, which has the potential to reflect on some aspects of the quality of care at the study hospital. The readmission rate within one month of discharge following surgery was 9.1% and the rate of ED visits 13.6%. Most readmissions and ED visits occurred within one week of discharge. The most common reasons for readmission were pleural effusion, atrial fibrillation, and heart failure exacerbation; whereas the most frequent reasons for ED visits were dyspnea, wound infection, and fever. In the multivariate analysis, the

TABLE V
DIFFERENCES BETWEEN the READMISSION GROUPS

Variable	Not Readmitted (n = 10)	Readmitted (n = 100)	p value
Gender			
Male	86 (86.0%)	8 (80.0%)	0.608
Insurance class			0.969
Class 1	38 (38.0%)	4 (40.0%)	
Class 2	18 (18.0%)	2 (20.0%)	
Class 3	44 (44.0%)	4 (40.0%)	
Age (mean, SD)	64.32 (11.30)	69.9 (11.94)	0.142
Current smoking	45 (45.0%)	2 (20.0%)	0.128
BMI (mean, SD)	28.86 (4.34)	29.74 (5.53)	0.554
Hypertension	74 (74%)	10 (100%)	0.059*
Diabetes	43 (43.0%)	4 (40.0%)	0.855
Chronic obstructive pulmonary disease	10 (10.0%)	1 (10.0%)	1.000
History of atrial fibrillation	5 (5.0%)	1 (10.0%)	0.507
Bundle branch block	10 (10.0%)	3 (30.0%)	0.062
Creatinine (mean, SD)	1.07 (0.89)	0.94 (0.25)	0.652
Ejection fraction (< 40%)	15 (18.3%)	1 (12.5%)	0.683
Number of grafts (mean, SD)	3.04 (1.00)	2.4 (0.84)	0.054
Length of stay	8.53 (3.40)	9.20 (3.49)	0.555
Prescribed ACEI at discharge	39 (39%)	0 (0%)	0.013
Prescribed ARB at discharge	7 (7%)	3 (30%)	0.047**

SD: standard deviation BMI: body mass index *1-sided Fisher exact **Fisher exact test
ACEI: angiotensin converting enzyme inhibitor ARB: angiotensin receptor blocker

TABLE VI
DIFFERENCES BETWEEN the EMERGENCY DEPARTMENT VISIT GROUPS

Variable	No ED visit (n = 95)	ED visit (n = 15)	p value
Gender			
Male	80 (84.2%)	14 (93.3%)	0.352
Insurance class			0.329
Class 1	34 (35.8%)	8 (53.3%)	
Class 2	17 (17.9%)	3 (20.0%)	
Class 3	44 (46.3%)	4 (26.7%)	
Age (mean, SD)	64.74 (11.12)	65.33 (13.59)	0.854
Current smoking	39 (41.1%)	8 (53.3%)	0.372
BMI (mean, SD)	28.62 (4.46)	30.94 (3.86)	0.060
Hypertension	72 (75.8%)	12 (80.0%)	0.721
Diabetes	42 (44.2%)	5 (33.3%)	0.429
Chronic obstructive pulmonary disease	9 (9.5%)	2 (13.3%)	0.643
History of atrial fibrillation	4 (4.2%)	2 (13.3%)	0.148
Bundle branch block	8 (8.4%)	5 (33.3%)	0.016*
Creatinine (mean, SD)	1.7 (0.91)	1.00 (0.26)	0.784
Ejection fraction (< 40%)	13 (17.3%)	3 (20.0%)	0.805
Number of grafts (mean, SD)	3.01 (1.02)	2.80 (0.94)	0.450
Length of stay	8.35 (2.97)	10.13 (5.26)	0.058
Prescribed ACEI at discharge	34 (35.8%)	5 (33.3%)	0.853
Prescribed ARB at discharge	33 (34.7%)	2 (13.3%)	0.098

ED: emergency department SD: standard deviation BMI: body mass index *Fisher exact test
ACEI: angiotensin converting enzyme inhibitor ARB: angiotensin receptor blocker

only predictor of readmission was the number of grafts, whereas BMI, BBB and LOS predicted ED visits.

The readmission rate in this study was within the range of those reported by others [4-6]. There was no predominant pattern in the reasons for readmission. One third of readmitted patients presented with pleural effusion, while the most common reason in the literature was surgical wound infections [3-5, 10]. Only one patient in this study was readmitted with fever that was due to urinary tract infection. The differences in the results between the literature and the current study may be explained by the small sample size, relatively shorter procedures (lesser grafts), and perhaps different methods of wound care. Alternatively, we found that wound infection was a major cause for ED visits, and this may indicate that this complication was handled in the ED, thus preventing subsequent readmission. The main cause of readmission, pleural effusion, is likely related to intra-operative factors, such as topical cardiac cooling with ice, surgical interruption of lymphatic channels, pleurotomy or it could be a manifestation of post-cardiac injury syndrome [22]; these are benign incidences that resolve spontaneously [23]. These patients may not have been treated adequately, nor had adequate diuresis or drainage of pleural fluid prior to discharge.

Although 19 patients (17.3%) had arrhythmias in this study, namely atrial fibrillation and BBB, only one patient was readmitted because of atrial fibrillation. This suggests that arrhythmias were controlled in these patients. In terms of heart failure, although two patients were admitted with a diagnosis of pulmonary edema and eight had heart failure as co-morbidity, only one patient was readmitted because of heart failure, which is lower than the incidence reported by Stewart and colleagues [10]. This finding may be explained by the preserved systolic function in the sample, since most patients had LVEF values over 40%.

The most common reasons for ED visits were dyspnea (33.3%) followed by wound infections and fever that were equally prevalent (20%). Causes for dyspnea included bilateral pulmonary congestion, recurrent pleural effusions, and surgical site pain with secondary dyspnea. The causes of fever included post-pericardiotomy syndrome, gastroenteritis, and left lower extremity cellulitis. Although three of the patients who visited the ED got readmitted, a secondary analysis showed no significant relationship between readmissions and ED visits (Pearson $\chi^2 = 2.501$, $p = 0.137$) unlike what was reported by others [13]. This may be accounted for by the different reasons for readmissions and ED visits, and the fact that one of those patients visited the ED after discharge from his readmission.

Patients with history of hypertension, a significant CVD risk factor, and those not prescribed ACE inhibitors, were more likely to be readmitted; although the treatment of choice for heart failure and hypertension, with co-morbid conditions such as renal insufficiency or diabetes [20-21], is primarily with ACE inhibitors. Nevertheless, multivariate analysis showed only the number of grafts to nega-

tively predict readmission. It may be that patients who had more vessels grafted were better protected from post-surgery ischemia compared to those with fewer grafts and thus were protected from early readmission.

Other predictors of readmission documented in the literature were not replicated in this study, probably due to the small sample and different patient characteristics. For example, the fact that all patients had Cr less than 2.5 mg/dl and only one underwent dialysis prior to surgery may explain why Cr level did not predict re-admission in this study. Similarly, living alone was found to predict early hospital readmissions post-CABG surgery in other studies [18-19]. However, as opposed to western societies, no patient in this study lived alone reflecting the Lebanese culture where individuals often live with their families.

Patients who visited the ED were more likely to have BBB and the multivariate analysis indicated that having BBB, higher BMI, and longer LOS predicted ED visits. Patients with BBB visits to the ED may be explained by symptoms related to bradycardia or other conditions (intra-op myocardial protection, LV dysfunction, ischemia) to which BBB may be a surrogate finding. Patients with higher BMIs, and prolonged LOS, usually have higher risk for postoperative respiratory complications and infections. This may explain the findings whereby dyspnea and wound infection were the main reasons for ED visits. Most patients stayed 10 days or less; nevertheless, patients with longer length of stay were significantly older and more likely to have chronic obstructive pulmonary disease, thus were more vulnerable to postoperative problems.

Study limitations typical of retrospective medical record reviews warrant caution in drawing conclusions. Generalizability of the findings is limited by the small size of this sample recruited from one hospital. The quality of data in the charts was incomplete, especially the ED records, which may have influenced the results. It is also possible, although unlikely, that readmission and ED rates may be higher than what was found if some patients visited the ED at, or got readmitted to, other hospitals during the study period.

This low cost study allowed the identification of frequency, reasons and predictors of early readmission and ED visits at a tertiary center. These preliminary results can add to the sparse Lebanese database and encourage other medical centers to conduct larger scale studies. The findings suggest that there is room for improvement in the care of these patients, as suggested by the findings related to pleural effusion. The data related to the ED visits suggest that patients were adequately educated about the importance of reporting symptoms of fever and dyspnea, yet the cause of wound infection in these patients warrant further study.

Prospective studies with patient follow-up are recommended to get a more accurate picture of the rates and predictors of readmission and ED visits in CABG surgery patients. In terms of practice, improved intra-operative care and closer postoperative follow-up might be needed

in order to reduce the risk of pleural effusion, thereby reducing the risk of readmissions, considering the short hospital stay in the study hospital. Patient education about the symptoms to report needs to be supplemented by teaching about wound care and respiratory hygiene.

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REFERENCES

1. World Health Organization. Cardiovascular diseases (CVDs): Fact sheet. 2011. Available from <http://www.who.int/mediacentre/factsheets/fs317/en/>
2. Fredericks S, Ibrahim S, Puri R. Coronary artery bypass graft surgery patient education: A systematic review. *Prog Cardiovasc Nurs* 2009; 24 (4): 162-8.
3. Celkan M, Ustunsoy H, Daglar B et al. Readmission and mortality in patients undergoing off-pump coronary artery bypass surgery with fast-track recovery protocol. *Heart Vessels* 2005; 20: 251-5.
4. Nasri H, Maasoomi M, Motefakker M. Early hospital readmissions after coronary artery bypass graft surgery. *Iran Heart J* 2006; 7 (1): 25-30.
5. Hannan E, Racz M, Walford G et al. Predictors of readmission for complications of coronary artery bypass graft surgery. *JAMA* 2003; 290: 773-80.
6. Scrutinio D, Giannuzz P. Comorbidity in patients undergoing coronary artery bypass graft surgery: Impact on outcome and implications for cardiac rehabilitation. *Eur J Cardiovasc Prev Rehabil* 2008; 15(3): 379-85.
7. Kiefe C. Predicting rehospitalization after bypass surgery: Can we do it? Should we care? *Med Care* 1999; 37 (7): 621-4.
8. Abdallah M, Karrowni W, Shamseddeen W et al. Acute coronary syndromes: Clinical characteristics, management, and outcomes at the American University of Beirut Medical Center. *Clin Cardiol* 2010; 33 (1): E6-E13.
9. Dakik HA, Hannoush H, Obeid MY. Coronary artery bypass surgery in octogenarians: outcomes in a referral university hospital in a developing country. *Int J Cardiol* 2003; 92: 253-6.
10. Stewart R, Campos C, Jennings B et al. Predictors of 30-day hospital readmission after coronary artery bypass. *Ann Thorac Surg* 2000; 70: 169-74.
11. Herlitz J, Albertsson P, Brandrup-Wognsen G et al. Predictors of hospital readmission two years after coronary artery bypass grafting. *Heart* 1997; 77: 437-42.
12. Shirzad M, Karimi A, Tazik M et al. Determinants of postoperative atrial fibrillation and associated resource utilization in cardiac surgery. *Rev Esp Cardiol* 2010; 63 (9): 1054-60.
13. Slamowicz R, Erbas B, Sundararajan V et al. Predictors of readmission after elective coronary artery bypass graft surgery. *Aust Health Rev* 2008; 32 (4): 677-83.
14. Hassan A, Chaisson M, Buth K et al. Women have worse long-term outcomes after coronary artery bypass grafting than men. *Can J Cardiol* 2005; 21 (9): 757-62.
15. Steuer J, Blomqvist P, Granath F et al. Hospital readmission after coronary artery bypass grafting: Are women doing worse? *Ann Thorac Surg* 2002; 73: 1380-6.
16. Polit D, Beck C: *Nursing research: Generating and assessing evidence for nursing practice*, 8th edition, Pennsylvania: Lippincott Williams & Wilkins, 2008.
17. Pedhazur EJ: *Multiple regression in behavioral research*, 3rd edition, Orlando: HarcourtBrace, 1997.
18. Moore S. The effects of a discharge information intervention on recovery outcomes following coronary artery bypass surgery. *Int J Nurs Stud* 1996; 33 (2): 181-9.
19. Murphy B, Elliott P, Le Grande M et al. Living alone predicts 30-day hospital readmission after coronary artery bypass graft surgery. *Eur J Cardiovasc Prev Rehabil* 2008; 15: 210-15.
20. American Heart Association. Treatment of hypertension in the prevention and management of ischemic heart disease. 2010. Available from: http://my.americanheart.org/professional/StatementsGuidelines/ByTopic/TopicsD-H/Hypertension_UCM_321621_Article.jsp
21. Joint National Committee of the National Heart Lung and Blood Institute. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. 2003. Available from <http://www.nhlbi.nih.gov/guidelines/hypertension/jnc7full.htm>
22. Allen BS, Bucherg GD, Rosenkranz ER et al. Topical cardiac hypothermia in patients with coronary disease. An unnecessary adjunct to cardioplegic protection and cause of pulmonary morbidity. *J Thorac Cardiovasc Surg* 1992; 10 (3): 626-31.
23. Vargas FS, Cukier A, Hueb W et al. Relationship between pleural effusion and pericardial involvement after myocardial revascularization. *Chest* 1994; 105 (6): 1748-52.