Readmission after Cardiac Surgery: Study of Predictors and Frequency

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Abstract

Background: Hospital readmissions after cardiac procedures are believed to be associated with higher in-hospital mortality and may predict poor outcomes. In addition high rate of readmission following discharge is associated with increased cost of care. Therefore, awareness of factors that predict increased risk for hospital readmission after cardiac surgery may improve the ability to reduce early readmission rates among this category of patients.

Aim of the Study: To assess predictors for hospital readmission after cardiac surgery.

Subjects and Methods: A descriptive exploratory design was utilized in the current study. A sample of convenience including 115 adult male & female patients who were admitted to the Cardiothoracic Surgery Departments at Kasr Al-Aini Hospital, Cairo University over a period of six months were recruited.

Tools of Data Collection: Four tools were utilized to collect data pertinent to the current study: Socio-demographic/medical data sheet; Perioperative open heart surgery assessment sheet; Hospital readmission assessment sheet; and the LACE index Scale (Lengths of hospital stay in days; Acuity of illness at the time of admission; Carlson co-morbidity score; and Emergency department visits numbers during previous six months.

Results: The current study revealed that the majority of the studied sample were males, married, having an elective admission with percentages of (67.8%), (86.1%) & (87%) respectively, and nearly half of them were between 40-59 years & came from rural area in percentages of (50%) & (52.2%) respectively. Out of the 115 patients who discharged from the hospital 18% required a second hospital and ICU readmission. Main reasons for readmissions were wound problems (42.9%), congestive heart failure (14.3%), atrial fibrillation (9.5%), pleural effusion (9.5%), renal failure (9.5%) and respiratory failure (4.8%). Binary logistic regression analysis revealed that preoperative renal failure, delayed extubation (mechanical ventilation >8h), re-exploration for bleeding, perioperative use of intraaortic balloon pump (IABP), postoperative dysrhythmias, postoperative heart failure and postsurgical (ICU) length of stay (>3 day) were independent predictors for readmission.

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Conclusion & Recommendations: Based on findings of the current study, it can be concluded that readmission following discharge is an important adverse outcome of cardiac surgery that needs continued attempts to explore and manage the risk factors of readmission. So the study recommends identification & close monitoring of those at risk for readmission; Establishment of hot line services for providing proper consultation after hospital discharge, especially for emergent cases; and provision of surveillance units for detection of high risk patients.

Key Words: Open heart surgery — Hospital readmission — Predictors — Frequency.

Introduction

Open heart surgery plays an important role in the management of wide range of cardiovascular diseases and encompasses the care of a patient with greater acuity and complexity. Cardiac surgery, including coronary artery bypass grafting (CABG) and vascular surgery represent the most common classes of surgical procedure performed globally. Nearly 800,000 cardiac surgical procedures are performed annually worldwide. However, in Egypt, according to statistics and medical record department (2009) at Kasr El Aini hospital, the number of patients admitted for cardiac surgeries during the last three years starting from January 2006 to December 2008 was recorded as: 987 patients during the year 2006, 1256 patients during the year 2007, and 1280 patients during the year 2008, which reveals gradual increment in patients' number.

Early hospital readmissions following discharge after cardiac operations are common, and account for 8% to 24% of discharged patients, and are likely related to patient co-morbidities and perioperative care. Among the most common causes of readmission are complications that may be encountered by patients following surgery. So, it is important to direct the attention to perioperative complications as important source of patient mor-
Aim of the study:

Readmission to the intensive care unit (ICU) after cardiac surgery is associated with higher costs and may be correlated with an increased mortality [6]. Hospital readmission is a complex, multifactorial outcome, and it remains unclear how hospital readmission rates can effectively and safely be lowered [7].

Therefore, a study that helps to identify risk factors and predictors of readmission among patients undergoing open heart surgeries could be beneficial. The nurse as one of the health care team should have a significant role in identification of risk factors for readmission. This could help in two ways: First; providing database about the main risk factors predisposing to hospital readmission. These data can be utilized by the health team members in the future plan of care for such group of patients. Second; proper post operative care for patients after cardiac surgeries can improve their condition, and reduce readmission rate that may be associated with higher costs and place a significant burden on health care resources and may be correlated with increased mortality. Thus predicting and managing patients at high risk for readmission to the hospital and intensive care unit (ICU) after cardiac surgery is paramount and allows resources to be targeted appropriately. Furthermore; it could decrease morbidity and mortality [8]. The nurse can identify patients at the greatest risk for rehospitalization through understanding of factors associated with readmissions following cardiac surgery. The nurse can implement effective interventions, and develop strategies to promote the quality of life and functional abilities of their patients as well as reduce rates of hospital readmissions [9]. Moreover, post hospital discharge care helps in earlier identification and treatment of complications that evolve after discharge, and lead to re hospitalization.

Aim of the study:

The current study was conducted to assess frequency & predictors of hospital readmissions among patients undergoing open heart surgery at Kasr Al-Aini Hospital, Cairo University.

Subjects and Methods

Research design: A descriptive exploratory research design was utilized in the current study.

Setting: The current study was carried out at the cardiothoracic critical care departments and cardiothoracic surgical wards affiliated to Kasr El Aini Hospital-Cairo University from 2011-2012.

Sample: A sample of convenience including 115 patients who undergone open heart surgery was recruited in the current study, with the following inclusion criteria: Adult, male and female, undergone different types of cardiac surgeries such as coronary-artery bypass grafting (CABG), cardiac valve replacement (CVR), combined CABG and CVR, repair of atrial or ventricular septal defects and aneurysm repair.

Tools of data collection: Four tools were used to collect data pertinent to the study. Three tools were developed by the researchers; Sociodemographic and medical data sheet, perioperative open heart surgery assessment sheet, and hospital readmission assessment sheet. The fourth tool: The LACE (Lengths of hospital stay; Acuity of illness at the time of admission; Carlson co-morbidity score; and Emergency department visits) index score. It was adopted from Walraven, (2010) to quantify and predict the risk of early unplanned readmission of medical or surgical patients after discharge. All tools were revised by a panel of five nursing experts, and then piloted by the investigator.

A- Socio-demographic and medical data sheet: It includes data related to age, sex, occupation, marital status, body mass index in addition to comorbidities.

B- Perioperative assessment data sheet: It consists of three parts: Preoperative assessment which covers data related to; vital signs, preoperative laboratory values, current medications therapy, cardiac assistive devices. Intraoperative assessment which covers data regarding: Type of operation, operation technique, types & numbers of grafts for CABG patients, inotropic administration, blood transfusion, in addition to intraoperative events such as cardiac arrhythmia. Postoperative assessment covers data related to postoperative period such as patients’ initial vital signs at the immediate postoperative period, postoperative lab investigations, postoperative complications, length of ICU stay, vital signs before hospital discharge & total length of hospital stay.

C- Hospital Readmission Assessment Sheet: It covers data related to readmission such as; Frequency, type, interval between discharge and readmission times, main complaint, readmission sitting, and different reasons for readmission including: Pulmonary; cardiac; gastrointestinal; genitourinary; hematological; metabolic; and neuropsychiatric problems, in addition to assessment of surgical wound problems. This sheet was fulfilled only for readmitted cases.
D. The LACE index uses four factors to gauge the risk of death or unplanned readmission after hospital discharge. These factors are: Length of hospital stay in days; Acuity of illness at the time of admission; Charlson co-morbidity score (a measure of the number and severity of a person's chronic condition); and Emergency department visit numbers during previous six months. Total LACE scores range from 0 to 19, high-risk patients for readmission are those who obtained LACE 10. Patients who get scores 10-19 have 2.0% expected risk of readmission, while those who get score >19 have 43.7% expected risk for readmission.

Subtotal LACE score include: Length of hospital stay accounts a score starting from one point for one day hospital stay to seven points for 14. Acute emergent illness on admission has a score of three. Charlson co-morbidity scale (a measure of the number and severity of a person's chronic condition) takes score that ranged between 0-5. Emergency department visit numbers during previous six months accounts a score starting from one (for one time emergency department admission) to four (for more than four times emergency admission).

Protection of human rights:

The current study was approved by human research committee at the Faculty of Nursing Cairo University. Official permissions to conduct the study were obtained from directors of Cardiothoracic Surgical Intensive Care Unit at El Manial University Hospital & El Manial Specialized University Hospital in addition to cardiothoracic surgical wards affiliated to each hospital. Written consents for patients' agreements to be included in the study were also obtained. Confidentiality and anonymity of each subject were assured through coding of all data.

Procedure:

The current study was conducted on two phases: The designation phase and implementation phase. As regards the designation phase, it was concerned with construction and preparation of different data collection tools. This in addition to obtaining managerial arrangements to carry out the study. A pilot study was carried out on 15 patients who had undergone cardiac surgery and who fulfilled the inclusion criteria over a period of one month to test feasibility, objectivity, and applicability of the study data collection tools. Carrying out the pilot study gave the investigator experience to deal with the included subjects, and the data collection tools. Based on the results of the pilot study needed refinements and modifications were done in the data collection instruments. Because modifications were minor and didn't affect the main data so that subjects who shared in the pilot study were included in the actual study sample.

Regarding the implementation phase; it was carried out after obtaining official permissions from the research committee, and from the heads of the selected hospital ICUs and wards to proceed in the current study. The researcher visited the selected settings on daily basis alternatively. Patients' medical files were reviewed to identify those who matched the inclusion criteria. Then patients were informed individually about the purpose and nature of the study and the researcher obtained written consents from those who could read and write and from responsible care givers in case of inability to read and write. The study was conducted over a period of 12 months divided into six months for data collection and other six months for follow-up.

Data collection instruments were fulfilled for each patient throughout four different times: The first time was preoperatively, where selected patients interviewed at cardiothoracic surgical wards, then the researcher fulfilled sociodemographic and medical data sheet, LACE index scale, and Preoperative assessment sheet. The second time was done postoperatively (during the first 48 hours) in cardiothoracic surgical intensive care units to fulfill intraoperative, and postoperative assessment sheets which included immediate postoperative assessment and identification of early postoperative complications.

The third time was done after returning back to the cardiothoracic surgical ward to assess for late postoperative complications, and obtain pre discharge data. The fourth and final assessment time was done over a period of six months after hospital discharge to assess occurrence and frequency of hospital readmission, which was done after six months of discharge, through using hospital readmission assessment sheet. The follow-up was done either by phone call in addition to meetings of patients during their follow-up, or through visiting cardiothoracic surgical wards, cardiothoracic surgical intensive care units and sometimes critical care units affiliated to Kasr Aini hospital. During follow up period, the researcher was concerned with identification of: Occurrence of readmission; obtaining data about readmission such as (main compliant or reasons of readmission, frequency, the sitting where they readmitted, and the treatment plan).
Statistical analysis data:
Upon completion of data collection, data were tabulated and analyzed using SPSS version 20. Descriptive and inferential statistics were done such as mean and standard deviation; frequency; percentage; chi square test; and logistic regression.

Results
Findings of the current study revealed that a total of 115 patients with open heart surgery were included. Most of the studied sample were males, married, between the age of 40-59 years, came from rural area and had elective admission to the hospital, in percentages of 67.8%, 86.1%, 50%, 52.2% & 87% respectively (Table 1).

Hypertension, dyslipidemia & diabetes mellitus were the commonest comorbidities among the studied sample in the percentages of 60%, 55.7%, 53.9% respectively, followed by cardiac comorbidities including recent MI, preoperative AF, and heart failure in the percentages of 36.4%, 22.6%, 8.7%, 7% respectively. Also results of the current study showed that more than half of the studied sample 66% undergone CABG surgery & 36% had triple vessel graft (Fig. 1).

According to LACE index score, about one third of the studied sample (31.3%) were at high risk for readmission, of them, approximately one third actually readmitted, representing more than half of the readmitted patients (52.4%). Regarding the exact number, the current study revealed that, out of 115 patients who discharged, (n=21, 18%) readmitted to the hospital within 6 months of discharge. The most common causes of readmission were wound problems (42.9%), and congestive heart failure which accounted for 14.3% of the readmitted patients (Figs. 2,3). Comparing the readmitted and not readmitted patients in relation to mean LACE index scores indicated a significant statistical difference (t=22.43 at p<0.000) (Table 2).

More than half of the readmitted patients were in the age group from 40-59 years & obese with BMI 30kg or above. While the majority of them were males, had prolonged postoperative ICU stay (>3 days) and prolonged hospital stay (>10 days), with means of 4.42 day ±SD=2.80, and 20.381 day ±SD=8.66 respectively.

As regards to factors predisposing to readmission, the current study revealed that preoperative renal failure, prolonged mechanical ventilation, use of IABP, postoperative dysrhythmia, postoperative heart failure, reoperation for bleeding, post-surgical (ICU) Length of Stay (LOS >3 day) were significantly associated with hospital readmission were at p 0.05, 0.001, 0.006, 0.008, 0.02, 0.001 respectively (Table 3).

![Fig. (1): Percentage distribution of the studied sample as regards preoperative comorbidities (N=115).](image1)

![Fig. (2): Percentage distribution of hospital readmissions among the studied group (N =115).](image2)

![Fig. (3): Percentage distribution of the readmitted group regarding reasons of readmission (N=21).](image3)
Body mass index for readmitted patients

Among normal Over weight Or 30 obese
(18.5-24.9) (25.0-29.9) (above)

Fig. (4): Percentage distribution of the readmitted group as regards to body mass index (N=21).

Table (1): Frequency distribution of the studied sample as regards socio-demographic characteristics (N=115).

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-19</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>41-58</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>61-80</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>X±SD</td>
<td>51.77±13.89</td>
<td></td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>78</td>
<td>67.8</td>
</tr>
<tr>
<td>Female</td>
<td>37</td>
<td>32.2</td>
</tr>
<tr>
<td>Residence:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>55</td>
<td>47.8</td>
</tr>
<tr>
<td>Rural</td>
<td>60</td>
<td>52.2</td>
</tr>
<tr>
<td>Marital status:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>9</td>
<td>7.8</td>
</tr>
<tr>
<td>Married</td>
<td>99</td>
<td>86.1</td>
</tr>
<tr>
<td>Divorced</td>
<td>6</td>
<td>5.2</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Table (2): Classification of the studied sample according to lace index scores (n=115).

<table>
<thead>
<tr>
<th>LACE score</th>
<th>No Readmission (n=94)</th>
<th>Readmission (n=21)</th>
<th>Total (N=115)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Low risk for readmission</td>
<td>69</td>
<td>73.4</td>
<td>10</td>
<td>47.6</td>
<td>79</td>
</tr>
<tr>
<td>High risk for readmission</td>
<td>25</td>
<td>26.6</td>
<td>11</td>
<td>52.4</td>
<td>36</td>
</tr>
<tr>
<td>X±SD</td>
<td>8.87±2.13</td>
<td>10.28±1.70</td>
<td>8.99±2.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table (3): Predictors of hospital readmission following open heart surgery based on logistic regression analysis (N=115).

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Adjusted Odds Ratio</th>
<th>(95% Confidence Interval)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative renal failure</td>
<td>1.57 (1.01-2.44)</td>
<td>*0.05</td>
<td></td>
</tr>
<tr>
<td>Prolonged mechanical ventilation</td>
<td>1.84 (1.28-2.65)</td>
<td>**0.001</td>
<td></td>
</tr>
<tr>
<td>Perioperative use of IABP</td>
<td>1.47 (0.99-2.19)</td>
<td>*0.006</td>
<td></td>
</tr>
<tr>
<td>Postoperative dysrhythmias</td>
<td>1.33 (0.97-1.82)</td>
<td>**0.008</td>
<td></td>
</tr>
<tr>
<td>Postoperative heart failure</td>
<td>1.95 (1.13-3.37)</td>
<td>*0.02</td>
<td></td>
</tr>
<tr>
<td>Reoperation for bleeding</td>
<td>1.15 (1.05-1.26)</td>
<td>*0.002</td>
<td></td>
</tr>
<tr>
<td>Postsurgical (ICU) LOS (&gt;3 day)</td>
<td>1.78 (1.38-2.31)</td>
<td>**0.001</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Despite the fact that cardiac surgery has made significant advances over the past fifty years, early & unplanned hospital readmission following discharge after cardiac operations is common. As revealed from the current study, the age of approximately one half of the sample ranged between 40-60 years, with a mean age of 51.77 years ±SD =13.89. These findings are in concordance with that of Sharaf Eldein [10], who studied predictors of early post operative atrial fibrillation and indicated that, the mean age was 55 years ±SD=7.3. The current study revealed that hospital readmission after cardiac surgery was found among 18.2% of the studied sample. This result was in agreement with Lee III who conducted a study of predictors for hospital readmission after CABG and stated that readmission rates within 30 days of CABG range from 6% to 21% in the medical literature.

Wound problems were the most common causes for readmission which accounted for 42% of readmitted patients. In this regards Magnus [12], studied causes of 30-day readmission after cardiac surgery and found that infection is one of the primary causes of readmission and accounted for more than one quarter of the readmission causes. However, Okonta et al. [13], studied surgical site wound infection after open heart surgery and had contradicting finding to that of the current study. They indicated that the incidence of sternal wound infection worldwide is low.
The current study revealed that more than one half of the readmitted patients were obese and one third was overweight, representing globally most of the studied sample. Consistent with this finding was that of McGinn [14], who studied prevalence of dysglycemia among CABG surgery patients and indicated the dominance of overweight. In this regards, Morries [15], stated that the higher the BMI, the lower the level of self-reported physical health and the greater chances of being readmitted to the hospital. Moreover, from the researchers’ point of view obesity represents a significant factor that negatively affects patients’ daily living activity, recovery from surgeries, and thus increase the possibility of readmission to hospital.

As regards predictors/risk factors associated with hospital readmission following cardiac surgery, the current study showed that prolonged mechanical ventilation was one of the most common postoperative respiratory complications especially among the majority of the readmitted group. In this regards, Lola, et al. [16] revealed that mechanical ventilation >24 hours was one of the independent predictors for readmission after cardiac surgery. As well, congestive heart failure was one of the independent predictors of readmission. These findings are similar to those found by Lee [17], who studied early readmission for congestive heart failure after cardiac surgery, and indicated that congestive heart failure is a risk factor for readmission at 30 days after hospital discharge.

In addition, IABP was one of the predictor of readmission after hospital discharge. This finding is in consistence with that of Durham & Gold [18], who revealed that the need for pre and post operative IABP represents an independent predictor for early readmission. On the other hand Miceli [19] reported that IABP has favorable short and long-term outcome in patients with left main coronary artery disease, unstable angina, left ventricular dysfunction and congestive heart failure requiring medical treatment. Prolonged ICU stay was also a predictor for readmission following cardiac surgery. This is in concordance with that of Joskowiak et al. [20], who studied readmission to the intensive care unit after cardiac surgery and documented that extended stay in the ICU was the most powerful variables to predict ICU readmission. Contradicted with this finding was that of Elliott and Cowper et al. [21], who indicated that although shorter stays offer clinical benefits, premature discharge could increase adverse events and thus risk factors for ICU readmission.

Reoperation for bleeding in the current study was a significant predictor for readmission following discharge. Similarly, Bocken et al. [22], studied ICU-readmission after cardiac surgery and found that re-exploration for bleeding were independent predictors of readmission. Moreover, assessment of independent risk factors in our study revealed that, preoperative renal dysfunction was proved to be an important factor that predisposes patients to readmission following discharge. This is in agreement with that of Polate [23], who proved that preoperative renal insufficiency was an independent predictor for readmission to intensive care unit after cardiac surgery. From the researchers’ point of view, understanding of predictors of readmission, and the importance of preoperative assessment and management of detected health problems could help in proper management and minimize the probability of readmission after surgery.

Conclusion:

Hospital readmission following open heart surgery remains a problem and was related to patients’ co-morbidities, intraoperative factors, as well as postoperative management. Identification of predictors of readmission such as preoperative renal failure, postoperative prolonged mechanical ventilation, perioperative use of IABP, postoperative dysrhythmia, postoperative heart failure, re-operation for bleeding, postsurgical prolonged ICU LOS >3 day could help to identify patients at risk of hospital readmission. Strategies aimed at the prediction and management of these risk factors may decrease the need for subsequent readmission and may improve patients’ outcomes.

Recommendations:

- Establishment of specialized hospital documentation system to be concerned with recording intraoperative data to be available and accessible for health care staff members and documentation of readmitted cases to provide an accurate statistics for readmission rate.
- Provision of surveillance units responsible for detection of high risk patients & providing intense monitoring for those patients.
- Patients at risk for readmission should be followed up through a strict system following discharge that includes telephone follow-up and home visits.
- Establishment of hotline services for providing proper directions after hospital discharge, especially for emergent cases.

References

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