

## Exploring Complications After Coronary Artery Bypass graft in Cardiothoracic Intensive Care Unit at Assiut University

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### Abstract:

Coronary artery bypass graft surgery (CABG) is one of the common treatments for cardiac diseases, despite the numerous complications of CABG. The most serious adverse events are bleeding requiring further surgery, cardiac arrhythmias, deep sternal wound infection and death. **Aim of the study:** This study was carried to examine postoperative complications in patients undergoing CABGs. **Research design:** this prospective observational study was conducted at CICU in Heart Assiut University Hospital. **Methods:** Data collected through a period of seven months, from first of August 2019 to the end of January 2020. At this period there were 68 patients admitted to Cardiothoracic department for CABG surgery, while 8 died and 60 patients included to the study. Three tools were used, **Tool I:** Cardiac surgical patient assessment sheet, **Tool II:** Predictors of mortality, and **Tool III:** CABG Complications sheet. **Results:** Findings of the present study revealed that patients post CABG surgeries in CICU reported several complications included: Atrial fibrillation (26.6%), Ventricular ectopic (8.3%), Ventricular tachycardia (1.6%), Cardiac tamponed (6.6%), while there were (10%) reported pneumonia, and (6.6%) reported atelectasis, about nausea (43.3%) and also (43.3%) reported vomiting complications, there was (20.0%) By acute kidney injury stage I, there was (5%) of patients complain from wound infection. **Conclusion:** the most complications occurred post CABG operations was Postoperative Atrial fibrillation (POAF), gastrointestinal complications, and acute kidney injury (AKI). **Recommendations:** Results of the study help in preoperative risk assessment, and understanding complications after CABGs.

**Keywords:** Acute kidney injury, Coronary artery bypass graft & Postoperative atrial fibrillation.

### Introduction:

Coronary artery bypass graft (CABG) is performed for patients with coronary artery disease to improve the quality of life and decrease cardiac related mortality by creating new routes to narrowed and blocked arteries (Shahani, et al 2019). Coronary artery bypass grafting has become an acceptable treatment for coronary artery disease. Compared with medical treatment, CABG surgery has proved effective in relieving angina and improving exercise tolerance, and it prolongs life in patients with left main coronary artery disease and three-vessel disease with poor left ventricular function (Ahmed, et al 2015).

Despite major advances in surgery, patients undergoing CABG are still at risk of developing cardiac, respiratory, and renal complications, these complications can be reduced by an appropriate nursing plan (Tafelmeier, et al 2018). The incidence of cardiac complications after CABG is at least 10% Morbidity and mortality associated with cardiac surgery is significant to the patient and costly to the health care system (Ali, et al 2016). Some of possible

side effects and complications that may happen after heart surgery are reduced kidney function, Chest infection, Heart rhythm problems, Urinary retention, sickness and nausea, pain ,sleeping problems, constipation, blurred vision Poor appetite, Sore throat and hoarse voice, Tiredness, Tingling and numbness (Kendall & Bannister, 2018).

The complexity of patients admitted to cardiac surgery and its hemodynamic instability are major factors for a continuous observation of the nurses , for the immediate postoperative period where rapid and synchronized actions are performed from the installation of mechanical ventilation, cardiac monitoring, patient heating, connection of chest tubes to drainage bottles, control of hourly diuresis, blood pressure, administration of infused fluids, the ongoing assessment of level of consciousness and pain (Hardin & Kaplow, 2010).

Thus, nursing care is established in accordance with patients' needs, in order to maintain the haemodynamic balance and their vital functions and they vary according to postoperative period, if immediate, mediate, or late.

In addition to physical aspects, and psycho-emotional needs that can be highlighted and negatively influence patients' recovery and therefore require intervention (Riberio, et al 2015).

Nurses are essential health professionals providing patients with effective pain assessment and pain management. Managing postoperative pain appropriately is also important for recovery and involves providing patients with adequate amounts of analgesics, and utilizing non-pharmacological interventions (Jannette, et al 2021).

In this context, this study aimed to identify complications in mediate postoperative period of CABG surgeries. The results of this study may contribute to optimizing the preoperative risk assessment as well as postoperative management of patients.

### Significance of the study:

According to Assiut cardiothoracic surgery department records , There were 342 adult patients admitted to cardiothoracic intensive care unit at Heart university hospital post cardiac surgical procedures in 2020. Total number of CABG cases is 155. Cases were varying between one graft harvesting to four graft harvesting (Ahmed & Zien, 2020)

### Aim of the study:

This study was carried to examine postoperative complications in patients undergoing CABGs.

### Research design:

Prospective observational design was utilized in this study.

### Research question:

What are the complications after CABGs surgery in intensive care unit? .

### Setting:

The study was conducted at CICU in Heart Assiut University Hospital.

### Sample:

The sample of this study was consisted of 60 patients, admitted to CICU post CABG surgery. The study sample included patients whom their age  $\geq 30$  years old. The researcher excluded patients whom had Current neurological disorders or previous cerebral vascular accident with residual neurological deficit significant enough to limit exercise.

### Tools of data collection:

Three tools were utilized to collect necessary patients' data:

#### Tool I- Cardiac surgical patient assessment sheet:

This tool developed by the researcher after review of literatures to assess patient's condition and it include:

**Part 1: Patient socio-demographics sheet:** Included patients' age, sex.

**Part 2:** patient clinical data included: left ventricular ejection fraction (LVEF), smoking, diabetes mellitus (DM) , obesity, body mass index (BMI) ,smoking , and urgency of surgery.

**Tool II: Predictors of mortality include:** Euro Score (European system for cardiac operative risk evaluation) which used preoperative variables to estimate cardiac surgery mortality, SOFA score (The Sequential organ failure assessment), and APCHI score (Acute physiology and Chronic Health Evaluation). ((Mark, et al 2017), (Grooth, et al 2017), & (Jaganath, et al 2020))

#### Tool III: CABG complications sheet:

Complication monitoring sheet included Cardiac complications (POAF, ventricular ectopic, ventricular tachycardia) which detected by physician Echo graph. Respiratory complications ( pneumonia, atelectasis) which detected by chest X- ray. Gastrointestinal complications included nausea, vomiting, and constipation. Renal impairment which detected by Labs, wound infection, and others. A CPOT (Critical Care Pain Observation Tool) used to assess degree of pain, If a CPOT total score  $\geq 3$  points is evident, pain management is recommended (Camilia, et al 2017).

### Methods:

**The study field of work was carried out through the following phases:**

#### Preparatory phase:

#### Ethical considerations:

An official letter approval from dean of the Faculty of Nursing was sent to the director of Heart Assiut University Hospital. This letter included a brief explanation of the objectives of the study and permission to carry out the study. Verbal consents were obtained from patients about their participation. The aim of the study was explained to every patient before participation. Patients were assured that the study maneuver will cause no actual or potential harm on them and professional help will be provided whenever needed. Participants have the right to refuse to participate and withdraw from the study without any rational any time.

#### Field work:

Data collected through a period of seven months, from first of July 2019 to the end of January 2020. Data which was totally voluntary and oral consent was obtained.

#### A pilot study:

Pilot study was conducted and involved 10% of sample size, feedback and problems experienced during the pilot implementation were discussed.

**Validity and reliability of tools:**

Content validity of tools were reviewed by three jury experts, two of them in the field of critical care nursing, and one from Cardiothoracic surgical department for revision of its content validity and clarity. The reliability of assessment tools were tested using Cronbach'S Coefficient alpha test was equal ( $\alpha=0.84$ ).

**Literature review:**

The researcher reviewed extensive literature to get more knowledge about the study subject and identified all available evidence and studies about complications post CABGs. This is also helped in designing the study tools.

**Implementation phase:**

- Data collected and Initial assessment of every patient was done on admission day as baseline data and daily for 6 days using tool I.

- The socio-demographic and medical data were completed for all patients on admission as baseline data.
- After three scoring system used in predicting patient mortality rate. Euro score before the surgery, APCHI score and SOFA score used at first 24hrs in ICU.
- Complications monitoring sheet used in assessing incidence rate of postoperative complications, and length of ICU stay.

**Statistical analysis:** Data entry and data analysis were done using SPSS version 19 (Statistical Package for Social Science). Data were presented as number, percentage, mean $\pm$  standard deviation.

**Results:****Table (1): Distribution of patients related to patient's socio-demographic data :**

Socio-demographic data		No (60)	%
Age	Less than 40 year	3	5.00
	from 40-50 year	14	23.3
	More than 50 year	43	71.6
	Mean $\pm$ SD	55.72 $\pm$ 9.88(38-80)	
Gender	Male	49	81.6
	Female	11	18.3
Body Mass Index (BMI )	Normal weight	13	21.6
	Overweight	24	40.0
	Obesity class 1	14	23.3
	Obesity class II	5	8.3
	Obesity ClassIII	4	6.6
	Mean $\pm$ SD	28.799 $\pm$ 5.75	

**Table (2): Distribution of patients related to predictors of mortality rate (NO=60):**

Variables	No (60)	%
<b>Euro score</b>		
Low risk	20	33.3
Moderate risk	35	58.3
High risk	5	8.3
<b>Mean</b>	3.10 $\pm$ 1.57	
<b>SOFA score</b>	7.73 $\pm$ 3.53	
<b>APCHI score</b>	7.22 $\pm$ 2.35	

Table (3): Distribution of patients as related to postoperative complications (N =60):

Postoperative complications	No (60)	%
<b>Cardiac complications</b>		
Atrial fibrillation	16	26.6
Ventricular ectopic	5	8.3
Ventricular tachycardia	1	1.6
Cardiac tamponed	4	6.6
<b>Respiratory complications</b>		
Pneumonia	6	10.0
Atelectasis	4	6.6
<b>Gastrointestinal complications</b>		
Nausea	26	43.3
Vomiting	26	43.3
Constipation	21	35.0
<b>Renal impairment</b>		
Acute kidney injury stage I	12	20.0
Acute kidney injury stage II	5	8.3
Acute kidney injury stage III	4	6.6
<b>Wound infection</b>		
	3	5.0
<b>Degree of pain</b>		
Mean $\pm$ SD of pain scores	5.2 $\pm$ 2.34	
Length of ICU stay	4.25 $\pm$ 1.16	
Length of hospital stay	6.92 $\pm$ 1.37	

Table (4): Correlation Co-efficient between Socio-demographic data and Postoperative Complications:

Postoperative Complications		Age	Gender	BMI IN	ICU stay
Atrial fibrillation (AF)	R	0.216	0.091	0.346	0.427
	P	<b>0.007**</b>	0.490	0.098	<b>0.001**</b>
Ventricular ectopic	R	0.098	0.158	0.035	0.147
	P	0.456	0.228	0.789	0.267
Ventricular tachycardia	R	0.215	0.062	0.039	0.188
	P	0.100	0.640	0.765	0.153
Cardiac tamponade	R	0.129	0.046	0.149	0.132
	P	0.324	0.727	0.254	0.320
Pneumonia	R	0.021	0.158	0.029	0.188
	P	0.874	0.228	0.829	0.155
Atelectasis	R	0.168	0.391	0.230	0.305
	P	0.199	<b>0.002**</b>	0.077	0.019*
Nausea	R	0.002	0.067	0.181	0.177
	P	0.988	0.613	0.166	0.179
Vomiting	R	0.002	0.067	0.181	0.177
	P	0.988	0.613	0.166	0.179
Constipation	R	0.012	0.086	0.376	0.087
	P	0.927	0.512	<b>0.003**</b>	0.511
Acute kidney injury stage I(AKI I)	R	0.146	0.086	0.123	0.005
	P	0.266	0.513	0.347	0.971
Acute kidney injury stage II (AKI II)	r	0.108	0.143	0.082	0.032
	P	0.411	0.276	0.533	0.812
Acute kidney injury stage III(AKI III)	r	0.408	0.219	0.111	0.099
	P	<b>0.001**</b>	0.093	0.398	0.458
Wound infection	r	0.106	0.109	0.150	0.002
	P	0.420	0.408	0.252	0.987

\*Statistically Significant Correlation At P. value <0.05    \*\*Statistically Significant Correlation At P. value <0.01

Table (5): Correlation Co-efficient between Past Medical History With Complication

Postoperative complications		LVEF	Hypertension	Diabetes meletis	Smoking	Obesity	Type of admission
Atrial fibrillation (AF)	R	0.049	0.178	0.032	0.068	0.165	0.133
	P	0.711	0.173	0.811	0.607	0.207	0.311
Ventricular ectopic	R	0.004	0.169	0.128	0.138	0.034	0.052
	P	0.978	0.197	0.329	0.292	0.795	0.694
Ventricular tachycardia	R	0.143	0.110	0.096	0.099	0.103	0.047
	P	0.274	0.403	0.468	0.451	0.435	0.720
Cardiac Tamponade	R	0.143	0.045	0.084	0.065	0.202	0.111
	P	0.276	0.732	0.523	0.623	0.123	0.398
Pneumonia	R	0.065	0.056	0.105	0.138	0.080	0.121
	P	0.623	0.669	0.425	0.292	0.544	0.357
Atelectasis	R	0.143	0.045	0.196	0.351	0.211	0.097
	P	0.276	0.732	0.133	<b>0.006**</b>	0.106	0.460
Nausea	R	0.124	0.011	0.078	0.177	0.205	0.206
	P	0.344	0.931	0.556	0.177	0.116	0.114
Vomiting	R	0.124	0.011	0.078	0.177	0.205	0.206
	P	0.344	0.931	0.556	0.177	0.116	0.114
Constipation	R	0.211	0.129	0.239	0.139	0.325	0.061
	P	0.106	0.327	0.066	0.290	<b>0.011*</b>	0.643
Acute kidney injury stage I	R	0.024	0.085	0.070	0.035	0.137	0.182
	P	0.854	0.521	0.596	0.793	0.296	0.165
Acute kidney injury stage II	R	0.047	0.133	0.032	0.229	0.010	0.078
	P	0.722	0.313	0.811	0.078	0.938	0.552
Acute kidney injury stage III	R	0.052	0.226	0.084	0.074	0.064	0.097
	P	0.693	0.083	0.523	0.574	0.626	0.460
Wound infection	R	0.164	0.271	0.313	0.175	0.134	0.083
	P	0.212	<b>0.036*</b>	<b>0.015*</b>	0.182	0.308	0.527

\*Statistically Significant Correlation At P. value <0.05 \*\*Statistically Significant Correlation At P. value <0.01

**Table (1):** Shows that, The highest percentage of them were in the age above 50 years old with a mean of (55.72±9.88) ranged from 38 to 80 years old, and more than half (81.6%) of patients were males. The results also shows patients' Body mass index (BMI) which revealed that there were (40%) of patients were over-weight, and about (38.3%) of patients were obese..

**Table (2):** Represents predictors of mortality which shows the mean of EURO Score were (3.10±1.57). The highest percentage of participants have moderate risk (58.3%). Regarding to SOFA score Mean of scores (7.73±3.53). In context of APCHI score the mean of scores was (7.22±2.35), which represents approximate mortality 3% postoperative.

**Table (3):** Shows frequency of postoperative complications. The most common cardiac arthemia was Atrial fibrillation represents (26.6%) of patients. About ventricular ectopic, and ventricular tachycardia results was (8.3%), and (1.6%) respectively. In relation to **Respiratory complications**, the table shows that Atelectasis occurred at (6.6%) of patients. While the percentage

of patients who had Pneumonia, was (10%) of patients. The table also illustrates incidence of **Renal impairment**, the most recurrent was **acute kidney injury (AKI) stage I** which represents (20%) of patients. while AKI stage II and stage III represents (8.3%), (6.8%) respectively. Also the table showed **Gastrointestinal** complications the most recurrent complications were nausea, vomiting, and constipation with percentage (43.3%), (43.3%), and (35%) respectively. the table also revealed the mean of **pain scores** in relation to critical care observation tool which was (5.63±1.88). The mean of **length of ICU and hospital stay** which was (4.25±1.16 and 6.92±1.37) respectively

**Table (4):** The table shows a statically significant positive correlation between patient Socio-demographic data (Age and ICU stay) and Postoperative atrial fibrillation (POAF) with (respectively P= 0.007, P=0.001). The results also revealed a statically significant positive correlation between patients' gender and postoperative atelectasis with (P=0.002). There is also Statistically Significant positive Correlation between patients'

BMI and postoperative constipation. The table also shows a statically significant positive correlation between patients' age and postoperative AKI III, with (P=0.001).

**Table (5):** The table illustrates a statistically significant positive correlation between smoking patients and postoperative atelectasis (P=0.006), Obesity and postoperative constipation (P=0.011), and positive correlation hypertension and diabetes and wound infection ( respectively P=0.036, P=0.015)

### Discussion:

CABG is still a highly complex surgery and has been associated with a number of complications. The complications from this major surgery can be classified in various ways; some are catastrophic, such as death and stroke, while others can be self-limiting without any long term residual effects such as atelectasis, lower respiratory infection, or transient acute kidney injury (Hussain & Harky, 2019).

Socio-demographic data and clinical data collected as a baseline for patients. Results were regarding to age and sex. The average age was ranged from fifty five to sixty years old. More than two thirds of the study subjects were males. The study results also indicated that more than one third of the study subjects were obese and more than the second third of the study sample were overweight. The study The study results came in line with other published results of the same interest (Jawitz, et al 2021) , (Paez, et al 2019) ,(Khalifa, et al 2018)and (Costa, et al 20 .

In the current study, the researcher used Euro score for assessing preoperative variables influence on patients referred to CABGs. The study results revealed that the mean of Euro score was ranged from three to four points, which represents moderate risk (Nashef, et al 2012). These results could be explained by patients' socio-demographic data, and past medical history of the study sample. The study results agree with (Kolk, et al 2017), who reported that the median of Euro score was 3 points influenced by previous medical history of patients.

As predictors of mortality, the researcher used SOFA score, and APCHI score on patient admission to ICU. The study results show that the mean of SOFA score was ranged from seven two ten points, and the mean of APCHI score was ranged from seven to nine points. The study findings may be due to stability of haemodynamics of major of the study sample, and normal values of patients' Labs.

The study results were agreed with (Vincent, et al 2005, & Chang, et al 2017), which reported that

SOFA might be effective tool for guiding the use of preventive and early therapeutic strategies to prevent mortality and improve clinical outcomes for patients who undergo CABGs. Yalcin, et al 2019, founded that APCHI score acceptable for predicting mortality after patients underwent open heart surgery, the median APCHI score was 6 in his study population. Postoperative complications can jeopardize the success of the CABG procedure. The present study shows that the most common cardiac arrhythmia was Atrial fibrillation. Low incidence rate of cardiac arrhythmia may be due to using of vagal maneuvers in subventricular tachycardia when patients' hemodynamics are stable (logan, et al 2021). A positive correlation between postoperative atrial fibrillation (POAF) and patients' age, also there was a positive correlation with length of ICU stay. These results could be explained by low preoperative ejection fraction which associated with old age , previous MI, prolonged time on cardiopulmonary bypass, and longtime on mechanical ventilation which also increase length of stay. The study results came in accordance to ( Wasmer, et al 2017 & Mariscalco, et al 2008) whom recognized the association of atrial fibrillation with old age.

Postoperative atrial fibrillation is one of the most countered complications following CABG surgery, and promoting longer and expensive hospital stay, other morbidities and mortality. Studies have shown that POAF is associated with greater incidence of fatality in females than males (Pooria,et al 2020).

Concerning to Respiratory complications, the present study shows that the incidence of Pneumonia was more than Atelectasis. The results also showed a great association between atelectasis with patient gender and being smoking. These results could explained by the major of the study subjects were men with a history of smoking. The findings is supported by (Naveed, et al 2017 & Neshat, et al 2015) whom asserted on the incidence of atelectasis is more likely occurred in patients who had a preoperative pulmonary diseases, diabetes hyperlipidemia, smoking, alcohol consumption and steroid medications. Atelectasis are independently associated with advanced age, prolonged bypass time, pre-operative pulmonary hypertension, and intra-operative phrenic nerve injury.

In relation to Gastrointestinal complications (GICs) the current study revealed that gastrointestinal complications reported as nausea, vomiting, and constipation. There was a positive correlation between the incidence of constipation and obesity, this may because of the prevalence of obesity and overweight between the study subjects. The study findings came in line with Aithoussa, et al 2017, Gastro-intestinal complications (GIC) are one of the

serious extra-cardiac events following open heart surgery. These complications are frequently reported in high risk patients. Significantly, more patients with GICs had a history of previous gastric ulcer, peripheral vascular disease (PVD), worse preoperative renal function and anemia. Prolonged duration of cardiopulmonary bypass and Mechanical ventilation and ICU stay. **Silveria, et al 2021**, who asserted that a high incidence of constipation was founded in patients with obesity class II and III.

The current study revealed incidence of Renal impairment post CABGs through the first three stages of acute kidney injury (AKI). Most of Patients complain from AKI stage I. While, the results shows a statically significant positive correlation between patients' age and postoperative AKI III. The researchers explained the study results by presence of past medical history to renal disease, diabetes, low ejection fraction which associated with old age , emergency surgery and intra-aortic ballon pump also may lead to renal impairment.

The study results came in accordance to **Diodato, et al 2014**, reported that incidence of acute renal failure (ARF) after CABG is 2% to 3% with 1% of those patients requiring dialysis. There are multiple conditions that influence postoperative renal failure. These risk factors include preexisting renal dysfunction, decreased cardiac output, insulin dependent diabetes, and concomitant peripheral artery disease. Advanced age, black race, female gender, and the need for emergent surgical intervention or preoperative intra-aortic balloon support have all been implicated in increasing the risk of acute renal failure.

In current study, findings reported about five percentage of patients complain from wound infections and there was positive correlation with hypertension and diabetes. These results could explained by nursing care to wound and monitoring the process of acute wound healing to prevent wound complications and treat appropriately if complications arise. The results come in line with previous published studies of (**Matos, et al 2020, Lok, et al 2014 & Braxton, et al 2004**), whom reported that wound infection occurs in approximately 1%-2% of cases following median sternotomy. It is associated with diabetes, obesity, a chronic obstructive pulmonary disease, left ventricular dysfunction, peripheral vascular disease, reoperation and re-exploration for bleeding.

Pain management is an important aspect of high quality care and an integral component of patient satisfaction. Appropriate pain management for postoperative patients contributes to earlier mobilization, shortened hospital stay, and reduced costs (**Naqib, et al 2018**) .The current study used

Critical care Observation tool (COPT) to assess postoperative pain, the results revealed that the mean of pain score ( $5.63 \pm 1.88$ ). These results could be explained by nursing postoperative care using patient's pain assessment, teach patient strategies to deal with the pain, apply the analgesic treatment plan, monitor the results of treatment and document pain management. (**Salvadore , et al 2018**), reported that In the adult critically ill patient population the incidence of pain affects greater than 50% of patients and many patients have reported insufficient pain management during their ICU hospitalization. Inadequate pain control leads to short term negative outcomes including hyperglycemia, insulin resistance, greater infection rate, increased discomfort, and decreased patient satisfaction as well as the long-term poor outcome of chronic pain.

In context of length of ICU stay and length of hospital stay the findings revealed that the maximum length of stay ranged from four to eight days . These results could explained by incidence of one or more of previous reported postoperative complications. The findings came in accordance to **Almashrafi, et al 2016**, who reported that in general, complications are known to prolong LOS following cardiac surgery. For example, new onset of atrial fibrillation, renal dysfunction, and deep sternal wound infection were associated with increased ICU and postoperative LOS.

### Conclusion:

Based on the main results of the present study, it can be concluded that the most common postoperative cardiac complication was atrial fibrillation increased with advanced age causing increased in length of ICU stay. Respiratory complications included atelectasis increased with smoking patients. Gastrointestinal complications had a great incidence including nausea, vomiting and constipation which likely occurred in obese and overweight. The findings asserted on the association between age and acute renal injury. Other complications included pain, and prolonged length of stay.

### Recommendations:

Results of the study help in preoperative risk assessment, and understanding complications after CABGs help in the postoperative management to optimizing patient care. Rapidly nursing diagnosis to these complications prevent patients deterioration.

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