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Early Postoperative Complications of Open-Heart Surgery

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Abstract

Cardiovascular illnesses continue to be the primary cause of worldwide death. Heart transplantation is regarded as the only treatment intervention recognized as the gold standard for managing end-stage heart failure. Nonetheless, the persistent postoperative problems adversely affect both the survival rate and quality of life in heart transplant patients. This study aimed to detect the earliest complications after open-heart surgery at the Mosul center, using a prospective cohort design during the period from 1st May to 1st June 2025. The study includes 47 patients who had undergone CABG and valve replacement for the first time in intensive care units and wards, in Mosul Open Heart Center. Descriptive statistics were used to summarize baseline characteristics and complication rates. Comparative analyses: Chi-square tests for categorical variables and t-tests for continuous variables will be used to assess differences in complications across demographic factors, comorbidities, and surgical variables. The study shows that approximately 59.5% of the patients are experiencing moderate pain. Low urine output occurred in (40%) according to gender. Acute renal dysfunctions occurred in (27.6%), gastrointestinal dysfunctions occurred in (57.4%), according to age. Respiratory dysfunctions, acute renal dysfunctions, and low urine output had a significant relationship in the patients according to the chronic diseases. The study concluded that several complications occurred in open-heart surgery patients at the Mosul Surgery Center, including pain, respiratory distress, renal, and gastrointestinal problems. The results indicated that there is a statistically significant relationship between patients' age and kidney dysfunction and lack of gastrointestinal function, as well as a relationship between chronic diseases, kidney dysfunction, and gastrointestinal dysfunction. It also showed a relationship between most of the variables and the occurrence of complications in terms of the type of operation (CABG).

Keywords: *Coronary Artery Bypass Grafting, Mitral Valve Replacement, Open Heart Surgery, Postoperative Complications.*

Introduction

Open-heart surgery is typically reserved for severe or life-threatening heart conditions that cannot be managed through less invasive methods. While risks are associated with surgery, improvements in medical and surgical technology, and post-operative care have markedly enhanced outcomes, so it will be a critical intervention in the treatment of heart disease [1]. Saving life for many patients through open heart surgery which can relief symptoms, prevent additional cardiac damage, and extended life. Coronary artery bypass grafting is considered as the surgical intervention that is designed to enhance myocardial perfusion in individuals with advanced coronary artery disease (CAD). [2]. Using grafts, which may be harvested from the patient's own veins or arteries (such as saphenous veins or internal mammary arteries), the procedure reroutes blood past constricted or

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obstructed coronary arteries. Patients with severe CAD have a far better chance of survival and quality of life after CABG, but there is a risk of both short-term and long-term problems, especially in the early postoperative period. Coronary artery bypass grafting (CABG) patients are at increased risk for problems in the first 30 days after surgery, which might delay recovery or even be fatal. [3]. Possible causes of early postoperative complications include preexisting conditions, the complexity of the operation, and the body's response to stress and shock. Delayed rehabilitation and recovery due to these issues may have an impact on several bodily systems, including the cardiovascular system and the respiratory system. [4]. Patients frequently encounter arrhythmias, atrial fibrillation, myocardial infarctions, infections including those in deep sternal wounds, hemorrhage, renal complications such as acute kidney injury and respiratory disorders such as pneumonia in the initial days post-surgery. Usually, these complications need quick diagnosis, watched closely, and in rare cases, treated with medicine or surgery [5, 6]. To improve the results of coronary artery bypass grafting surgery, it is important to find risk factors and make a diagnosis as soon as possible and then use the right care methods. Multidisciplinary care teams are very important for improving surgical procedures and rehabilitation, as well as for increasing survival rates and lowering the risk of complications. [7-11]. This study aims to investigate potential problems that may arise after coronary artery bypass grafting (CABG) and identify the variables that contribute to their occurrence.

Materials and Methods

The study will adhere to the ethical principles outlined in the Declaration of Helsinki. Written informed consent will be obtained from all participants before inclusion in the study.

Study Design

This research will use a prospective cohort study design from 1st May 2025 to 30th June. The study will follow patients undergoing CABG over a specified period post-surgery to observe and document early postoperative complications.

Study Population

The study includes 47 patients who had undergone CABG and valve replacement for the first time in intensive care units and wards in the Mosul Open Heart Center. Both male and female patients with varying levels of comorbidities (e.g., hypertension, diabetes, chronic kidney disease) will be included.

Exclusion criteria will include:

1. The study will not include patients who are concurrently undergoing other major surgeries.
2. At the time of surgery, patients with active infections will be excluded.
3. Patients who refuse participation or are unable to provide informed consent.

Data Collection and Instrument

The instrument of the study was a questionnaire composed of two parts. Part one covered demographic characteristics of the nurses, including age, gender, years of service, educational levels, place of work, and shifting time of work [12]. Part Two: It consisted of eight problems (complications) that may happen after open heart surgery.

Data will be collected at multiple time points [13-17]:

1. Preoperative Data: Demographic information, preoperative risk factors (e.g., left ventricular ejection fraction, presence of diabetes, smoking history), and baseline lab results (e.g., renal function, complete blood count).
2. Intraoperative Data: Surgical technique (e.g., use of cardiopulmonary bypass, graft

type), duration of surgery, and anesthesia information.

3. Postoperative Data: Early postoperative complications will be documented daily for the first 30 days.

Statistical Analysis

Descriptive statistics (mean, standard deviation, percentages) will be used to summarize baseline characteristics and complication rates. Comparative analyses (e.g., chi-square tests for categorical variables and t-tests for continuous variables) will be performed to assess differences in complications based on demographic factors, comorbidities, and surgical variables. Kaplan-Meier survival analysis will be used to determine time to complication occurrence.

Results

The study included 47 patients undergoing cardiac surgery, with more than half under 60 years old, nearly 36% between 60-69 years, and nearly 10% 70 years or older. The gender distribution showed a moderate male predominance, with 59.5% male patients. Regarding compiling diseases association, diabetes was not frequent (17%), 93.6% having hypertension, and 38.2% were smokers. Surgical history represented in the form of CABG (70.2%), MVR (23.4%), while (6.3%) underwent combined CABG/MVR. Most surgical operations were planned as elective procedures (57.4%) (Table 1).

Table 1. Basic Demographic Features and Preoperative Factors of the Study Sample N= 47

Basic Demographic Features and Preoperative Factors		**F**	**%**
Age group (in years)	< 60 years	25	53.1%
	60-69 years	17	36.1%
	< 70 years	5	10.6%
Gender	Male	28	59.5%
	Female	19	40.4%
D.M	Yes	8	17%
	No	39	82.9%
H.T	Yes	44	93.6%
	No	3	6.3%
Smoking	Smoker	18	38.2%
	Non-Smoker	29	61.7
Types of Operation	CABG	33	70.2%
	Mital Valve replacement	11	23.4%
	CABG+ Mital Valve replacement	3	6.3%
Status of Operation	Elective	27	57.4%
	Urgent	13	27.6%
	Emergent	7	14.8%

The distribution of postoperative complications by gender among the 47 patients undergoing cardiac surgery showed interesting variations (Table 2). Pain association with gender demonstrated a significant (p=0.025) difference; moderate to severe pain was primarily associated with females, and no pain or mild-to-moderate pain was reported by males. Gastrointestinal dysfunction association with gender demonstrated a non-significant (p=0.0781) difference (14 males and 13 females affected, while 14 males and 6 females were

free from gastrointestinal dysfunction). Wound infection association with gender demonstrated a significant (p=0.044) difference (3 males and two females affected, while the remaining from both groups were free from wound infection.

Renal complications associated with gender demonstrated a significant (p=0.008) difference (9 males compared to 4 females affected, while 19 males and 15 females had normal renal function). Correspondingly, low urine output association with gender demonstrated a significant (p=0.037) difference (11 males and eight females affected, with 17 males and 11 females maintained normal urine output). Respiratory dysfunction, cardiac arrest, and atrial fibrillation have shown non-significant differences.

Table 2. The Incidence of Postoperative Complications According to Gender

Postoperative Complications		**Male**	**Female**	**P-value**
Pain	No pain	2	0	0.025
	Mild to moderate	20	8	
	Moderate to severe	6	11	
Gastrointestinal dysfunctions	Yes	14	13	0.0781
	No	14	6	
Wound infection	Yes	3	2	0.044
	No	25	17	
Acute renal dysfunctions	Yes	9	4	0.008
	No	19	15	
Respiratory dysfunctions	Yes	9	6	0.413
	No	19	13	
Low urine output	Yes	11	8	0.037
	No	17	11	
Cardiac arrest	Yes	1	1	0.831
	No	27	18	
Atrial fibrillation	Yes	4	2	0.786
	No	24	17	

The distribution of postoperative complications by age association among the 47 patients undergoing cardiac surgery showed interesting variations (Table 3). Pain association with age demonstrated significant (p=0.0141) variation: moderate to severe pain mainly was associated with younger patients (<60 years), with 6 patients in the 60-69 age group and 2 in the (<70 years) group. Similarly, gastrointestinal dysfunction was significantly associated with ageing (p=0.0213) (<70 years: 4 out of 5 patients affected, 60-69 years: 13 out of 17 patients affected, < 60 years: 10 out of 25 affected).

Renal complications were significantly p=0.017 associated with ageing (<70), with 4 out of 5 patients affected under 60 69 years, 5 out of 17 patients affected in those < 60 years, and 7 out of 25 patients affected in those under 60 years. Low urin output significantly (p=0.004) associated with ageing (<70 years: 1 out of 5 patients affected, 60-69 years: 11 out of 17 patients affected, < 60 years: 4 out of 25 affected). Surprisingly, wound infection has shown non-significant (p=0.661) association with ageing (<70 years: none affected, 60-69 years: 2 out of 17 patients affected, < 60 years: none affected). Respiratory complications non-significantly (p=0.402) associated with ageing (<70 years: 2 out of 5 patients affected, 60-69 years: 4 out of 17 patients affected, < 60 years: 9 out of 25 affected). Despite these

complications, the most serious cardiac complications (cardiac arrest and atrial fibrillation) demonstrated no significant age-related differences.

Table 3. The Incidence of Postoperative Complications According to the Patient's Age

Postoperative complications		**< 60 years**	**60-69 years**	**< 70 years**	**P-value**
Pain	No pain	0	2	0	0.0141
	Mild to moderate	16	9	3	
	Moderate to severe	9	6	2	
Gastrointestinal dysfunctions	Yes	10	13	4	0.0213
	No	15	4	1	
Wound infection	Yes	0	2	0	0.661
	No	25	15	5	
Acute renal dysfunctions	Yes	7	5	1	0.017
	No	18	12	4	
Respiratory dysfunctions	Yes	9	4	2	0.402
	No	16	13	3	
Low urine output	Yes	4	11	4	0.004
	No	21	6	1	
Cardiac arrest	Yes	0	1	1	0.328
	No	25	16	4	
Atrial fibrillation	Yes	1	4	1	0.653
	No	24	13	4	

The results of postoperative complications distribution based on association with diabetes mellitus (8 patients) and hypertension (44 patients) among the 47 patients undergoing cardiac surgery. Pain has a non-significant (p=0.478) association with diabetes (2 patients: no pain, 5: mild to moderate pain, and 1: moderate to severe pain), versus 0, 23, and 16 non-diabetic patients, respectively. Correspondingly, Pain has a non-significant (p=0.224) association with hypertension (2 patients: no pain, 26: mild to moderate pain, and 16: moderate to severe pain), versus 0, 2, and 1 normotensive subjects, respectively.

Diabetic subjects undergoing surgery have a significant (p=0.015) association with gastrointestinal dysfunction (2 out of 8 diabetic patients affected versus 25 out of 39 non-diabetic patients). Hypertension demonstrated a significant (p=0.053) association with gastrointestinal dysfunction (24 out of 44 hypertensive versus three normotensive patients).

Diabetic subjects undergoing surgery have a significant (p=0.0001) association with wound infection (5 cases of wound infection in diabetic patients versus 0 out of 39 non-diabetic patients). Hypertension demonstrated a significant (p=0.030) association with wound infection (4 out of 44 hypertensive versus 1 out of 3 normotensive patients).

Diabetic subjects undergoing surgery have a significant (p=0.002) association with renal complications (6 out of 8 diabetic cases versus 7 out of 39 non-diabetic patients). Hypertension demonstrated a significant (p=0.0001) association with renal complications (12 out of 44 hypertensive versus 1 out of 3 normotensive patients). Diabetic subjects undergoing surgery have an important (p=0.005) association with low urine output (7 out of 8 diabetic cases versus 12 out of 39 non-diabetic patients).

Hypertension demonstrated a significant (p=0.0001) association with renal complications (18 out of 44 hypertensive versus 1 out of 3 normotensive patients).

Diabetic subjects undergoing surgery have a non-significant (p=0.365) association with respiratory dysfunction (5 out of 8 diabetic cases versus 10 out of 39 non-diabetic patients). Hypertension demonstrated a borderline non-significant (p=0.058) association with renal complications (12 out of 44 hypertensive versus three normotensive patients experiencing respiratory dysfunction).

Diabetic subjects undergoing surgery have a non-significant (p=0.691) association with cardiac arrest (1 out of 8 diabetic cases versus 1 out of 39 non-diabetic patients). Hypertension demonstrated a significant association with cardiac arrest (p=0.0001). Atrial fibrillation demonstrated a non-significant association with diabetes (p=0.225) and hypertension (p=0.433), impacting four diabetic versus two non-diabetic patients, six hypertensive versus zero normotensive patients (Table 4).

Table 4. The Incidence of Postoperative Complications According to Chronic Diseases

Postoperative complications		**DM**		**P value**	**HT**		**P value**
		Yes 8	**No 39**		**Yes 44**	**NO 3**	
Pain	No pain	2	0	0.478	2	0	0.224
	Mild to moderate	5	23		26	2	
	Moderate to severe	1	16		16	1	
Gastrointestinal dysfunctions	Yes	2	25	0.015	24	3	0.053
	No	6	14		20	0	
Wound infection	Yes	5	0	0.000	4	1	0.030
	No	3	39		40	2	
Acute renal dysfunctions	Yes	6	7	0.002	12	1	0.0001
	No	2	32		32	2	
Respiratory dysfunctions	Yes	5	10	0.365	12	3	0.058
	No	3	29		32	0	
Low urine output	Yes	7	12	0.005	18	1	0.001
	No	1	27		26	2	
Cardiac arrest	Yes	1	1	0.691	2	0	0.0001
	No	7	38		42	3	
Atrial fibrillation	Yes	4	2	0.225	6	0	0.433
	No	4	37		38	3	

DM=Diabetes mellitus, HT=Hypertension

Postoperative complications following surgical operations demonstrated marked differences, including pain, wound infection, renal, gastrointestinal, cardiovascular, and respiratory complications (Table 5). Pain control showed a marked difference across procedure types (p=0.007), with distinct patterns emerging for each surgical approach. CABG patients showed the most promising pain profile (2 patients: no pain, 21 patients: mild-to-moderate pain, 10 patients: moderate-to-severe pain). MVR patients demonstrated no cases of complete pain relief (7 patients: mild to moderate pain; 4 patients: moderate to severe pain). In the combined CABG/MVR group, no patients had mild to moderate pain, and all 3 patients presented with moderate to severe pain.

Gastrointestinal dysfunction is common across all operations with no significant difference (p=0.556). CABG operation associated with neutral gastrointestinal dysfunction (17 affected and 16 unaffected) patients. MVR patients demonstrated a higher incidence rate (9 out of 11 patients affected versus two unaffected). The combined CABG/MVR group demonstrated 1 affected patient and two unaffected patients. Wound infection significantly (p=0.045) associated with procedure type, despite the relatively low incidence in all groups (CABG patients: 3 cases out of 33 wound infections, MRV: 1 case out of 11 operations, and the combined CABG/MVR group: 1 case out of 3 operations.

Renal complications demonstrated significant (p=0.002) variations among operative subjects (CABG patients: 10 cases out of 33 operations, no MVR patients developed acute renal dysfunction. However, the three patients demonstrating combined CABG/MVR showed acute renal dysfunction. Low urine output demonstrated a similar pattern (p=0.077), with 9 CABG patients affected, 7 MVR patients, and all three combined CABG/MVR patients associated with low urine output.

Respiratory dysfunction demonstrated a significant (p=0.006) link with type of operation, with MVR patients affecting 8 out of 11 versus only 5 out of 33 CABG patients. In combined CABG/MVR group, 2 out of 3 patients affected. The most striking complications, cardiac arrest, were highly correlated (p=0.004) with operation type, with no cases in CABG patients, while 1 MVR patient, and 1 CABG/MVR patient experienced this life-threatening complication. Atrial fibrillation demonstrated significant (p=0.004) differences (CABG patients having 1 out of 33 cases, MVR patients 3 out of 11 cases, and CABG/MVR patients having 2 out of 3 cases).

Table 5. The Incidence of Postoperative Complications According to the Types of Operation

Postoperative complications		**Types of Operation**			**P value**
		CABG	**MVR**	**CABG+MVR**	
Pain	No pain	2	0	0	0.007
	Mild to moderate	21	7	0	
	Moderate to severe	10	4	3	
Gastrointestinal dysfunctions	Yes	17	9	1	0.556
	No	16	2	2	
Wound infection	Yes	3	1	1	0.045
	No	30	10	2	
Acute renal dysfunctions	Yes	10	0	3	0.002
	No	23	11	0	
Respiratory dysfunctions	Yes	5	8	2	0.006
	No	29	3	1	
Low urine output	Yes	9	7	3	0.077
	No	24	4	0	
Cardiac arrest	Yes	0	1	1	0.004
	No	33	10	2	
Atrial fibrillation	Yes	1	3	2	0.004
	No	32	8	1	

CABG=Coronary artery bypass graft, MVR=mitral valve replacement

Discussion

The average age of the samples was 64.3, with more men than women. The majority of patients demonstrated hypertension, while most were not diabetic. Smoking did not affect the patients, as the majority were non-smokers; additionally, most procedures performed were elective, while emergency cases were the least common. Nearly half of the patients experiencing moderate discomfort were men, according to the sex distribution of complications. There were statistically significant variations between the sexes in cases of bursitis associated with renal failure, with men being more likely to suffer from this condition. Patients younger than 60 years old had moderate pain intensity 34% more often, suggesting a statistically significant association with other age groups. Patients between the ages of 60 and 69 had the highest prevalence of gastrointestinal problems, which was strongly linked to different age brackets. Notwithstanding their modest incidence rates, kidney function problems marked by decreased urine flow show a statistically significant connection with age groups. Diabetes was shown to be statistically significantly associated with the gastrointestinal systemic illness. Wound infections occurred in five diabetic individuals and four hypertensive patients. About a quarter of those with hypertension also had renal impairment, making it a more prevalent complication of the condition than diabetes. Patients with hypertension were more likely to have cardiac arrest compared to those with diabetes. There was a statistically significant relationship between the average pain severity and the operation type; patients undergoing open heart surgery reported the greatest pain intensity, while those undergoing mitral valve replacement reported the least. The study revealed a statistically significant association between various types of open-heart surgery and the incidence of respiratory and urinary disorders, with 21% of patients experiencing renal complications post-surgery. Conversely, patients undergoing mitral valve replacement surgery did not encounter any such disorders. Consistent with prior studies on postoperative complications following open heart surgery, the findings of the Negargar and Sadeghi study [1] indicate early graft dysfunction, arrhythmia, atrial fibrillation, low cardiac output syndrome, deep sternal wound infection, and an increased early mortality rate post-transplantation. Peretto et al. [18] reported that atrial fibrillation occurs in 15% to 40% of patients undergoing coronary artery bypass graft (CABG) surgery, in 37% to 50% following valve surgery, and up to 60% during combined procedures (bypass and valve intervention). It typically occurs within three days of post-operation. Huen and Parikh [19] indicated in their study that renal failure is frequently characterized by a three-fold elevation in baseline creatinine or the initiation of dialysis. Literature suggests that the incidence of acute renal injury following cardiac surgery ranges from 3% to 30% (10). Bachvarov [20] indicated in his research that open-heart surgery continues to present a significant risk for postoperative complications. Cardiovascular complications, especially rhythm and conduction disorders, are the most prevalent. Complications such as graft failure, considerable hemorrhage, cerebrovascular accident, and extended mechanical ventilation are correlated with the highest mortality risk [20].

Conclusion

The study concluded that several complications occurred in open-heart surgery patients at the Mosul Surgery Center, including pain, respiratory distress, renal, and gastrointestinal problems. The results indicated that there is a statistically significant relationship between patients' age and kidney dysfunction and lack of gastrointestinal function, as well as a relationship between chronic diseases, wound infection, kidney dysfunction, and gastrointestinal dysfunction. It

also showed a relationship between most of the variables and the occurrence of complications in terms of the type of operation (CABG).

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