Vol. 11, No. 2, December 2024 ISSN: 2049-4963
https://www.ijbmsp.org/index.php/IJBMSP

Postoperative Complications and Associated Risk Factors Following Cardiac Surgeries

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Abstract – coronary artery disease is one of the leading causes of death worldwide requiring different procedures to relieve symptoms, slow the progression, and increase life expectancy. CABG is a surgical procedure needed to restore the normal blood flow to an obstructed coronary artery. In Valvular surgery, a surgeon replaces or repairs the damaged or diseased heart valve or valves. Both procedures are followed by complications and are associated with risk factors. This study employed non-probability consecutive sampling in a six-month descriptive cross-sectional analysis involving 125 patients aged 35-75. Data collection was facilitated using proforma designed for this study. The statistical analysis utilized a person chi-square test to evaluate the association between risk factors and complications. Our Study observed 6 complications associated with CABG and Valvular surgeries. The most frequent complication affecting 37 people was arrhythmia. Other complications included gastrointestinal (GIT) issues in 17 participants, postoperative bleeding in 9, sternal infection in 8, post-operative pneumonia in 4, and stroke in 1 patient. Myocardial Infarction (MI), diabetes mellitus, and hepatic failure were the risk factors related to these complications. This Study found that arrhythmia was the most common complication in patients after CABG or Valvular surgeries, followed by GIT Issues, post-operative bleeding, sternal infection, post-operative pneumonia, and stroke. These complications were linked to pre-operative risk factors, including a History of MI, diabetes mellitus, and Hepatic Failure. Addressing these risk factors is essential for improving patient care and outcomes while lowering healthcare costs.

Keywords – Cardiac surgeries, Coronary artery disease, Valvular surgery, Postoperative complications, Risk factors

1. Introduction

Coronary artery disease (CAD) is a cardiovascular disease that occurs from atherosclerosis or atherosclerotic occlusions of the coronary arteries [1, 2]. CAD, which results in angina pectoris can also manifest as stable angina or unstable angina, ischemic heart disease (IHD), Myocardial Infarction (MI), and sudden cardiac death [3-5]. CAD is identified as the leading cause of death in both developed and underdeveloped nations [6, 7]. Approximately 17.8 million deaths annually occur due to CAD, making it the third most common cause of death worldwide.

Coronary artery bypass grafting (CABG) is a type of cardiac surgery where a section of a blood vessel is grafted from the aorta to the coronary artery, bypassing the blocked vessel to improve blood flow to the cardiac tissues [8-10]. CABG is considered high-risk, with a 30-day morbidity rate of up to 14% and a mortality of 2% [11, 12]. Several factors such as patients' characteristics, provider characteristics, and post-operative factors contribute to the risk associated with CABG [13-15]. Patient-related risks include older age, female sex, African-American race, larger body surface area, and recent MI. The risk of morbidity and mortality is further increased by comorbidities such as chronic obstructive pulmonary disease (COPD), Congestive heart failure (CHF), cerebrovascular accident (CVA), following CABG varies between 1.4% and 3.8%. advanced age, history of stroke, diabetes mellitus, hypertension, and female gender are risk factors for these complications [16-18]. Additionally, post-CABG patients with a history of stroke have a ten times higher mortality rate and extended hospital stays [19-21]. Moreover, the combination of multiple risk factors can raise the likelihood of both the development of CAD and the severity of postoperative complications, highlighting the importance of comprehensive risk management [22-24].

Valvular Heart Disease (VHD) occurs when the heart valves fail to function properly, frequently due to conditions such as rheumatic heart disease, degenerative heart disease, congenital heart disease, or endocarditis [23, 25, 26]. The aortic valve and mitral valve are the most commonly affected, with the pulmonary valve primarily impacted by congenital conditions [27]. These conditions can prevent the valves from completely opening and closing leading to

impaired blood flow and increased strain on the heart. Heart valves are critical to maintaining proper blood circulation, and their dysfunction can have significant consequences.

Aortic valve disease, in particular, has been recognized as a cause of mortality for centuries 11. The development of aortic stenosis (AS) is characterized by the progressive development of the valve leaflets, leading to restricted movement and impaired blood flow [28]. The risk factors for AS include diabetes, hypertension, smoking, and elevated levels of Low-density lipoprotein. Atrial fibrillation (AF) and pulmonary complications are the most common complications following cardiac surgeries, particularly after valvular surgeries [29, 30]. The incidence of postoperative AF is significantly higher in patients undergoing valvular surgeries compared to those having CABG surgery. Pulmonary complications are associated with increased morbidity and mortality, and prolonged hospital stays.

This study aims to broaden the understanding by examining the complications and associated risk factors following CABG and Valvular surgeries. While other studies have provided valuable insights, most have been limited in scope, often focusing on single surgery.

2. Material and Methods

This study was carried out at tertiary care hospitals in Peshawar using a descriptive cross-sectional study design. This study was conducted for 6-month allowing for a thorough evaluation of the patient's characteristics in cardiac surgery. The sample size was 125, and the test was performed using a formula that considered a 95% confidence level.

Several strategies were used to reduce biases in the thorough analysis. Minimizing variability and ensuring consistency were made possible by standardizing data collecting techniques, inclusion and exclusion criteria, and procedures. Additionally, ethical considerations were prioritized, including obtaining informed verbal consent and protecting patient privacy and safety throughout the procedures. The patients' informed verbal was received, and clinical data was collected following the ethical guidelines for human samples outlined in the World Medical Association (WMA) 2013, Declaration of Helsinki by filling out a research proforma.

The convenience sampling technique was utilized to include all eligible patients undergoing CABG and valvular surgeries, thereby ensuring the representation of diversity within the target population. Patients aged 35-75 who had recently been admitted to the cardiac department of a tertiary care hospital, Peshawar for CABG or Valvular surgery were included in this study. Patients with a prior history of stroke, sepsis, infection, arrhythmia, or coagulopathies were excluded from this study.

In our analysis of the risk factors associated with postoperative complications, we collected data utilizing a well-organized proforma as a detailed tool for data collection. The data underwent statistical analysis employing the statistical software SPSS v22.0 and a person chi-square test was conducted.

3. Results

This study included 125 patients aged 35-75 years admitted to the cardiology department of a tertiary care hospital in Peshawar. Out of the total participants, 80 were male and 45 were female. The mean age of the participants was 53.38 with a standard deviation of ± 10.878. Participants in this study were grouped based on their surgical procedures. The majority of participants underwent CABG, followed by valvular surgeries, which were further subdivided into aortic valve replacement (AVR), mitral valve replacement (MVR), and double valve replacement (DVR). Out of the 125 participants, 50 were active smokers, 74 were diabetic, and 94 patients were hypertensive, the complete list of preoperative complications is included in Fig 1. We observed the patients for six months and noted the following complications after CABG and Valvular surgery. The complications included postoperative pneumonia, Stroke, Postoperative bleeding, Arrhythmia, GIT issues, and various combinations of these complications. The most common postoperative complication observed was arrhythmia, Followed by sternal infections. This outline is held across all types of surgeries: CABG, AVR, MVR, and DVR, with DVR patients experiencing a noteworthy frequency of arrhythmias plus bleeding. Complications are detailed in Table 2. Fig 2. Represents data of participants in which multiple complications occurred post-operative. The most common complications recorded were infections combined with arrhythmias. From the observations, we discovered 59 participants were extubated after 6 hours while 66 were extubated before 6 hours. Reintubation was required in 10 participants. Regarding the steroid, steroid was used in 59 participants, while anemia was present in only 9 participants.

The most commonly observed postoperative complication after CABG was arrhythmia, followed by sternal infection. Similarly, after valvular surgery, including MVR, AVR, and DVR arrhythmia was the most common complication, with sternal infection being the second most common. To assess the relationship between complications and risk factors following CABG and Valvular surgery, we utilized the chi-square test. Table 3 presents the statistical analysis and p-values for all the variables. The chi-square test between the risk factors and the post-operative complications including Diabetes mellitus, History of MI, and Hepatic failure identified a significant association.

Table 1. Frequency Distribution of Participants

Surgery	Subdivision	Number of participants	Percentage
CABG		81	64.8
Valvular Surgery		44	35.2
	Mitral Valve Replacement	22	50
	Aortic Valve Replacement	10	22.7
	Double Valve Replacement	12	27.27

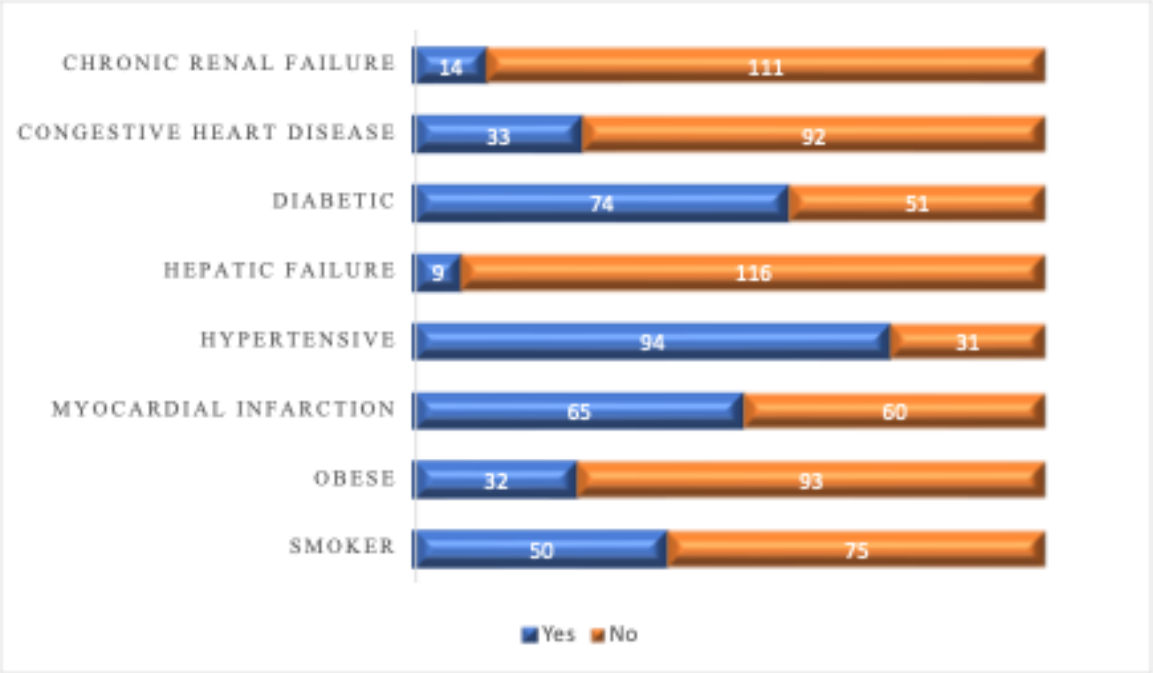

Figure 1. Frequency of Risk Factors Preoperatively

Table 2. Frequency of Complications occurred postoperatively

Complications	Number of participants	Percentage
Postoperative Pneumonia	4	3.2
Stroke	1	0.8
Sternal Infection	8	6.4
Postoperative Bleeding	9	7.2
Arrhythmias	37	29.5
GIT Insult	17	13.6

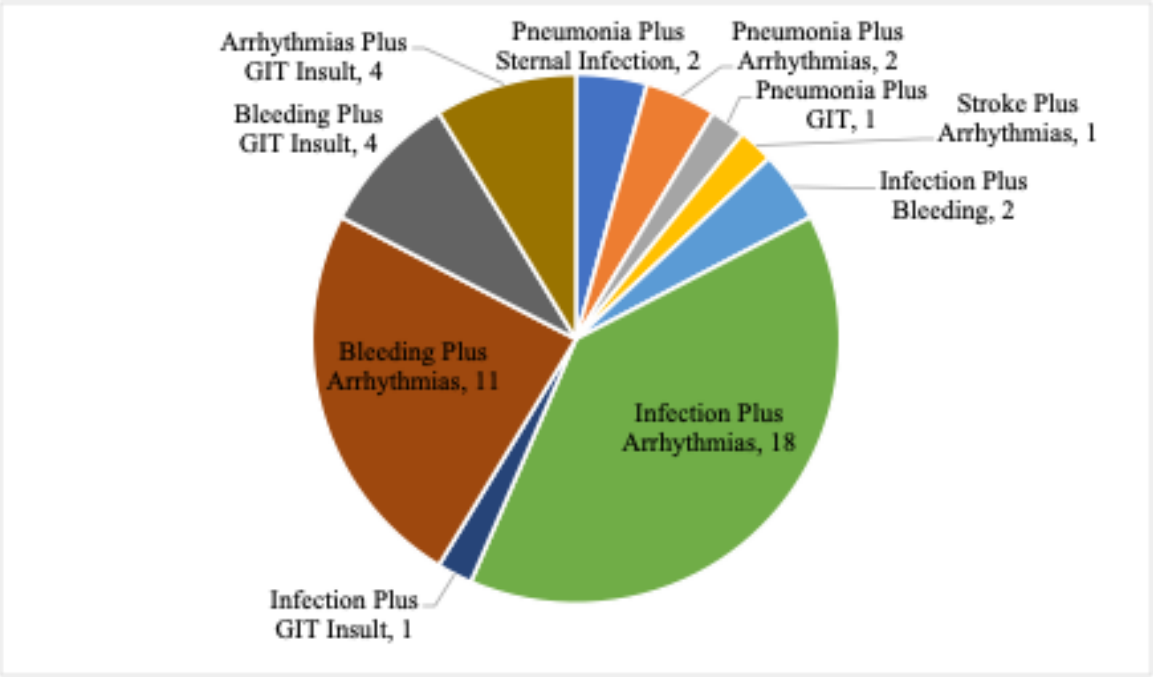

Figure 2. Frequency of multiple complications in participants postoperatively

Table 3. Statistical Analysis and p-values

S. No	Risk Factors	Responses	Frequency	Percentage	p-Value
1	**Smoking**	Yes	50	40	0.42
		No	75	60	
2	**Diabetes Mellitus**	Yes	74	59.2	0.005
		No	51	40.8	
3	**Hypertension**	Yes	94	75.2	0.20
		No	31	24.8	
4	**Obesity**	Yes	32	25.6	0.905
		No	93	74.5	
5	**History of MI**	Yes	65	52	0.05
		No	60	48	
6	**CHF**	Yes	33	26.4	1.00
		No	92	73.6	
7	**Hepatic Failure**	Yes	9	7.2	0.02
		No	116	92.8	
8	**Chronic Renal Failure**	Yes	14	11.2	0.09
		No	111	88.8	

4. Discussion

Our study found a significant association between preoperative risk factors and postoperative complications following CABG and Valvular surgeries. This highlighted the key role of certain risk factors in being associated with postoperative complications. These factors included a history of MI, Diabetes mellitus, and Hepatic failure.

The statistical analysis, employing the person chi-square test, highlighted a significant association between risk factors such as history of MI (p=0.05), Diabetes mellitus (p=0.005), and Hepatic failure (0.02) and postoperative complications. These findings are consistent with those of Tim Montrief et al. who also noted a significant association between these risk factors and postoperative complications [8].

Our Study contributed valuable insights into the ongoing discourse on addressing these risk factors essential for improving patient care and outcomes while lowering healthcare expenses, aiming to enhance the overall well-being of patients undergoing CABG and Valvular surgeries.

5. Conclusion

Following heart surgery, postoperative complications are frequent. Long-term survival is negatively impacted by the number and type of post-operative problems. Among the most prevalent complications are arrhythmias, sternal infection, postoperative bleeding, pneumonia, GIT complications, and stroke following both surgeries. These complications are associated with severe morbidity. Risks associated with these complications following both surgeries include; Smoking, hypertension, diabetes, History of MI, obesity, and patients with CHF. Smokers are found to have more GIT complications than non-smokers. Diabetic, Obese patients, Hypertensive and patients with a history of MI and CHF suffer from post-operative arrhythmias. Sternal infections were common in participants not using steroids post-operatively. Understanding these complications and risk factors is essential to optimizing patient care. Prevention of postoperative complications influences not only the expenses and results of the procedure but also probably has an immense impact on the results in the long term.conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Future Recommendations

Future research should prioritize, multicenter studies for broader applicability. Our study found that knowledge of risk factors, living a healthy life, using preventive techniques, and receiving an early diagnosis is important for managing complications following surgery. High-risk patients should be identified and treated accordingly. Proper use of antibiotics and steroids can reduce the occurrence of post-operative sternal infections.

Acknowledgment

We extend our gratitude to all the patients who participated in this study; their contribution was essential to making this research possible.

Letter of Undertaking

All authors agree on submitting this manuscript and declare that to the best of our knowledge, this manuscript is correct, not published nor is in consideration for publication elsewhere.

Conflict of Interest

The authors declare no conflict of interest.

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