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Effect Of Preoperative Patients' Characteristics on Cardiopulmonary Bypass Time, Icu Stay and Mortality After Cabg

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Abstract

Background: Cardiopulmonary bypass (CPB) is a significant technology which temporarily replaces the heart and lungs during significant cardiac and vascular surgery. It replaces the functions of circulation and oxygenation enabling surgeons to work in a still and bloodless field. The patients who need CABG are often elderly and are living with multiple other chronic health issues, furthermore, they are undergoing a technically challenging procedure these factors directly influence on the length of time a patient has to spend on the bypass machine. This is not merely a surgical fact it is a determining factor that has a direct relationship with the recovery and this aspect directly affects the period of time within the intensive care unit as well as the survival rates.

Methodology: The retrospective study involved 200 patients that were subjected to CABG. Patient demographics such as age, blood pressure, gender, diabetes mellitus, smoking, and hyperlipidemia and ejection fraction were taken preoperatively. To determine relationships between patient features and surgical outcomes, statistical techniques were used.

Results: Low ejection fraction showed significant relationship with prolong ICU stay and mortality. Chi-square analysis showed that diabetes mellitus has major association with mortality but it is not an independent predictor whereas ordinal regression showed smoking and low ejection fraction as independent predictors of post-operative mortality.

Conclusion: This study shows that smoking status and left ventricular ejection fraction are important indicators of postoperative mortality in CABG patients. While other preoperative factors, such as age, gender, hypertension, diabetes, and hyperlipidemia, had no discernible independent impact on cardiopulmonary bypass

time or ICU stay, reduced ejection fraction was likewise linked to longer ICU stays. The results indicate that operating circumstances, not patient characteristics, are the main determinants of CPB duration. Prioritizing preoperative cardiac function evaluation and quitting smoking may enhance postoperative results and survival.

Introduction

Background

A heart-lung machine is used in cardiopulmonary bypass (CPB), also known as "on-pump" cardiac surgeries, to artificially maintain blood circulation and oxygenation. With the help of this technology, the surgeon can work on a bloodless, motionless heart while the machine temporarily substitutes the functioning of heart and lungs [1].

Coronary artery bypass grafting (CABG), the most common cardiac treatment in the world, is aimed to improve a patient's quality of life by reducing angina and heart failure symptoms while eventually increasing life expectancy. However, there are hazards associated with the procedure; past figures show that isolated CABG mortality rates usually range from 2.6% to 12.2% [2].

CABG has been a mainstay of heart surgery for more than 50 years. Clinical outcomes have made substantial strides over the years, despite a shift toward treating an increasingly aged and high-risk patient group [3].

When plaque builds up in the heart's arteries, it causes coronary artery disease (CAD). This process is known as atherosclerosis, and as it advances, you may not experience any symptoms, making it a "silent" ailment. Coronary Heart Disease (CHD) or ischemic heart disease (IHD) are terms used to define conditions where blood flow to the heart muscle is lessened. This broad group includes Acute Coronary Syndrome (ACS), silent myocardial ischemia, and stable angina. Essentially, the majority of deaths associated with coronary heart disease are caused by CAD. ACS is usually symptomatic and includes possibly life-threatening episodes like unstable angina and myocardial infarction, also referred to as a heart attack, while some forms of the disease may not show any symptoms [4].

Arterial hypertension remains to be one of the most significant risk factors that can be modified for individuals receiving CABG. Annually, hypertension and its related complications cause over 9.4 million deaths worldwide. Studies indicates that high blood pressure negatively impacts clinical outcomes after myocardial revascularization; in particular, individuals with a history of hypertension are more likely to die within two years of their bypass surgery [5].

Even though CABG is now a common treatment, it is still a serious surgery that affects the body's organs systemically. Predicting possible pulmonary morbidity and death in these patients includes identifying and evaluating preoperative risk variables. Clinicians is capable of significantly enhancing surgical outcomes and improve care techniques by accurately determining these potential risks [6]. While smoking is still the biggest cause of coronary heart disease, during the past 20 years, associated mortality in the US has steadily decreased. This gain is divided equally between successful risk-factor modification and improvements in evidence-based medical treatments; the drop in smoking rates alone accounts for 12% of the overall decrease in mortality. Tobaccos adverse effects on acute cardiac events, including heart attacks and unstable angina, and percutaneous coronary procedures are well-established, its exact influence on the results of cardiac surgery is less clear. Smoking has been shown to elevate mortality and complication rates in specialties such as thoracic, transplant, and vascular surgery. interestingly, reliable data about the short-term dangers for smokers having heart surgery is still lacking. Despite ten years of surgical discussion about whether active smokers should be eligible for these treatments or if they should be compelled to undergo an obligatory quitting period prior to surgery, this evidence gap persists[7].

Despite evidence shows that stopping smoking may decrease the incidence of coronary heart disease by approximately 12%, smoking is still the main cause of the ailment. CABG is still a vital surgical procedure and an important aspect of successful treatment for patients with advanced illness [8].About 20% to 30% of individuals undergoing CABG surgery have accompanied diabetes, making diabetes mellitus (DM) a known risk factor for CAD. However, there is presently not enough data to conclude with assurance how DM affects short-term mortality and morbidity rates after CABG procedures [9].Age is essential independent predictor for mortality in cardiac surgery. The higher frequency of comorbidities in older populations, which frequently results in more complex and drawn-out surgical treatments, is a major contributing factor to this higher risk. Additionally, older individuals are far more prone to postoperative problems and undesirable outcomes since they usually have lower physiological reserves [10].

The main cause of endothelial dysfunction which leads to the formation of atherosclerotic plaques and CAD, is hyperlipidemia. The risk of recurring ischemic cardiovascular events is greatly increased by these structural abnormalities [11].Advanced age is an important precursor in cardiac surgery elderly patients often face higher rates of morbidity and mortality due to an increased incidence of comorbidities and diminished physiological capacity for resilience [12].CABG is becoming more popular among older patients as the population evolves. In addition to having the highest prevalence of coronary artery disease, octogenarians are currently the population with the fastest pace of growth. For example in Germany the percentage of patients 70 years of age and older undergoing heart surgery increased from 11.2% in 1989 to 36.7% in 2000. In spite of this change, many surgeons remain cautious about operating on the elderly. It is always a worry that tissue weakness and extreme age can lead to a poorer postoperative outcome and a more problematic recovery process [13].

Having great advantages in the symptom relief, as well as in life expectancy, CABG is a component in the treatment of coronary artery disease. Though very effective, the operation has been reported to have inherent risks; the fatality rate directly correlates with cardiac functionality, with an outcome ranging between 1 and 7 percent of patients with normal Left Ventricular Ejection Fraction (LVEF) and remarkably large levels of impairments, respectively. To mitigate these risks, the medical community has been able to significantly reduce surgical mortality through better screening of the patients, better surgical procedures, and extensive pre-operative stabilization [14].

Poor preoperative ejection fraction, which is one of the critical indications of the amount of blood that is pumped by the left ventricle with each beat has been found to be a significant predictor of adverse outcomes in patients undergoing CABG surgery. Especially patients with a lower EF have a much higher likelihood to die and have problems following surgery. Such people will most likely demand additional clinical resources and will take more time to heal since the effectiveness of the heart pump is weakened before the treatment. As a result, EF is a reliable indicator of overall hospital resource usage, including the duration of hospitalization and the length of stay in the intensive care unit. [15].

For patients with poor EF, CABG appears to be more beneficial than medical therapy alone, indicating remarkable clinical improvement and long-term survival. In contrast to individuals with normal left ventricular function, CABG is linked to increased postoperative morbidity and mortality in this cohort [16].The prognosis for advanced coronary artery disease-related left ventricular (LV) dysfunction with medication is bleak. According to reports, 31% of patients with coronary artery disease-related congestive heart failure survive for two years. Patients with severe left ventricular dysfunction have been excluded from large multicenter CABG trials. Earlier studies on patients with left ventricular failure has frequently used a lenient EF criterion or found few people with low EFs [17].

One of the primary risk factors for vascular endothelial injury which leads in the formation of atherosclerotic plaque and CAD that causes recurrent ischemic cardiovascular episodes is hyperlipidemia. A spike in certain types of plasma fats has been proven to worsen atherosclerotic plaque buildup in the coronary arteries, and hyperlipidemia is a known risk factor for coronary artery disease and the progression of atherosclerosis. Among the various forms of plasma fats, high-density lipoproteins (HDL) are one of the most significant preventive factors, whereas low-density lipoprotein (LDL) lipids have been directly and profoundly correlated with coronary artery disease.

According to the latest research, a little rise in glyceride levels increases the risk of coronary heart disease, speeds up coronary artery disease, and causes new lesions and increased coronary artery involvement. Although research on the function of lipoproteins as markers of the degree of coronary artery involvement is still scarce, the correlation between blood lipid levels and coronary artery disease is widely recognized [18].

Aims

This study aims to evaluate the impact of various preoperative patient characteristics including gender, age, smoking, diabetes, hyperlipidemia, hypertension and ejection fraction on cardiopulmonary bypass duration, length of ICU stay and post-operative mortality following coronary artery bypass grafting.

Objectives

To evaluate the individual and collective effect of preoperative patient characteristics (gender, age, smoking, diabetes, hypertension, hyperlipidemia, and EF) on cardiopulmonary bypass time during CABG.

To evaluate the individual and collective effect of preoperative patient characteristics on postoperative ICU stay duration.

To evaluate the individual and collective effect of preoperative patient characteristics on postoperative mortality.

Rationale

The purpose of this study is to assess how preoperative patient factors affect the length of CPB, postoperative intensive care unit stay, and mortality in patients receiving coronary artery bypass grafting. The study is expected to enhance risk assessment during preoperative phases, as well as guide perioperative services by establishing patient related attributes that will strongly indicate poor surgical outcomes. These findings may be used to guide physicians in their surgeons, and perfusionist to optimize surgical planning, utilize ICU resources more, and eventually enhance patient outcome and care quality following CABG.

LITERATURE REVIEW

This research came up with five major risk factors that are linked with the length of stay (more than three nights) in intensive care units (ICU) after surgery, namely left atrial (LA) diameter of more than 4 cm, no use of preoperative beta-blockers, extended duration of mechanical ventilation (greater than 12 hours) and emergence of postoperative complications (pneumonia or atrial fibrillation (POAF). Addressing these particular variables and minimizing postoperative complications, healthcare professionals will be able to successfully decrease the recovery duration, lower hospital expenses, and maximize access to critical care beds [2].

Studies have shown that although smoking does not mean much in terms of the risk of in hospital mortality after a coronary artery bypass graft (CABG) surgery, there is a strong correlation with the severe postoperative pulmonary complications. The statistics indicate a strong curve in the outcome of patients: the present smokers are at

the biggest risk of facing respiratory problems, and the former smokers present a more favorable outcome. This makes a patient be advised by the clinicians to stop smoking before surgery to enhance short term recovery with the best outcome being the benefits of the surgery will last as long as possible and thus recommended to make the patient stop smoking at least one month before surgery [7].

The research was done on the effect of the preoperative use of statins on patients undergoing CABG with hyperlipidemia, particularly, whether preoperative therapy affects the long-term recovery. Although the study did not show a short-term decrease in Major Adverse Cardiovascular Events (MACE) and also, the benefit of the use of statins in the normolipidemic patient population was controversial, it indicated the efficacy of continuing the use of statins in the reduction of (LDL) C levels. The results indicate that long-term therapy could decrease the cardiovascular risks in the future even in patients with low preoperative cholesterol although the study did not directly follow those extended clinical outcomes [18].

Past researchers have established the main determinants of mortality in CABG patients such as age, gender, readmission of ICU post-surgery, comorbidity, and CPB operations. These are the variables that have a substantial influence on the outcomes, as they should be considered in the mortality reduction strategies. It is important to consider these factors in order to enhance the survival of patients undergoing CABG. This can guide specific efforts to decrease hospital death [19].

The research question of this work was the connection between cardiopulmonary bypass (CPB) duration and patient outcomes after cardiac surgery. The results show that the duration of stay of a patient in a heart-lung machine is a strong and independent predictive of complications and death. At the end, the researchers came to the conclusion that a long-term CPB directly depends on postoperative morbidity and mortality, and it is one of the most serious risk factors of surgical recovery [20].

Long-term inpatient stay in the Intensive Care Unit (ICU) longer than three days has a strong impact on healthcare expenditure and is a heavy burden on hospitals, which requires a proactive method of detecting pre- and perioperative risk factors. Although it is important to reduce the recovery time by mitigating complications, including strokes and infections, and bleeding, the most powerful approach to reduce the recovery time is to prevent ventricular dysfunction due to myocardial ischemia or improper preservation methods. Healthcare providers are able to significantly reduce the use of ICU by focusing on cardiac protection and optimization of surgical care, resulting in more efficient and cost-effective care of patients [21].

The highest number of deaths in the hearts surgery are most likely to happen in the first week of the postoperative years, and the most common is the number of deaths decreasing as the time of the hospital stay increases. Although the case of these deaths cannot entirely be attributed to postoperative complications, the length of stay in both the general hospital ward as well as the Intensive Care Unit (ICU) is clearly related with the likelihood of in hospital death. This implies that early intervention is important, but prolonged recuperation is usually a predictor of greater clinical susceptibility [22].

An examination of the preoperative and immediate postoperative data of 652 adult patients undergoing elective coronary artery bypass graft (CABG) surgery revealed that the data analysis at both preoperative and immediate postoperative phases was significantly useful in predicting the length of stay of a patient in the intensive care unit (ICU). Although recovery time is caused by numerous factors, the study has classified the volume of inotropic medications that the patient receives in the first six hours after the procedure as the most important factor. Assessing these perioperative variables, medical caregivers are able to more effectively predict the needs of ICU resources and to control patient recovery expectations [23].

One study comparing preoperative risk factors as predictors of long term mechanical ventilation following coronary artery bypass graft (CABG) surgery observed that

most of the traditional measures are not reliable. Having discussed different subgroups of patients, researchers concluded that popular predictors like pulmonary diagnosis lung mechanics and blood gases could not predict the needs of postoperative respiration correctly. The left ventricular ejection fraction was the only critical exception. The study, therefore, recommends that these normal parameters of the lungs should not be taken as exclusion criteria to surgery and as definite clinical guidelines to predict respiratory outcome [24].

This paper underscores that arterial hypertension is a high-lying, modifiable risk factor in the issue of patients undergoing off pump coronary artery bypass grafting (CABG). Through the study that was conducted by examining the effect of high blood pressure on clinical outcomes, the study concludes that history of high blood pressure is directly related to higher risk of post-operative complications and high rate of mortality. Conclusively, the results underscore the importance of controlling blood pressure as an effective way of enhancing survival and morbidity in patients undergoing surgery on the heart [25].

A recent single center study discovered that although diabetes mellitus (DM) alone is not a predictor of immediate in-hospital mortality or general complications after CABG, it is a strong risk factor in particular of long term and acute complications. The DM patients despite using pre-operative insulin had increased incidence rates of new renal failure, surgical site infections, and stroke. Finally, the study indicates that although the risks associated with surgeries in the short term can be managed, better results in diabetic patients involve the case selection and case management approach which is more personal [26].

MATERIALS AND METHODS

The study employed a retrospective design to evaluate the impact of preoperative patient factors on cardiopulmonary bypass (CPB) time, postoperative intensive care unit (ICU) stay, and mortality following coronary artery bypass grafting (CABG). Data were retrospectively collected from patients who underwent CABG at the Pakistan Institute of Medical Sciences (PIMS) and Peshawar Institute of Cardiology (PIC) between October and February. Relevant information was extracted from surgical logs, perfusion reports, and hospital medical records using a pre-structured questionnaire to document preoperative characteristics, CPB time, and postoperative outcomes, including ICU stay and hospital mortality. A total of 200 patient records were included in the analysis. Inclusion criteria comprised patients undergoing on-pump CABG procedures with documented preoperative factors such as smoking, diabetes mellitus, hypertension, hyperlipidemia, or ejection fraction. Patients undergoing off-pump cardiac procedures, other cardiac surgeries (congenital or valvular), or lacking preoperative factor documentation were excluded. Data analysis was performed using SPSS version 26, with continuous variables expressed as means and categorical variables as frequencies and percentages. Associations between preoperative characteristics and categorical outcomes were assessed using the Chi-square test, while ordinal regression was applied to identify independent predictors of prolonged CPB time, ICU stay, and mortality, with a significance threshold of $p < 0.05$. Ethical approval was obtained from the Bashir Institute of Health Science Institutional Review Board, as well as PIMS and PIC. Informed consent was obtained from all patients, and confidentiality was strictly maintained, ensuring that personal patient information was neither disclosed nor published. Data collection was conducted by study team members in compliance with ethical and social norms.

RESULTS AND DISCUSSION

Descriptive Characteristics of the Study Population

The analysis of 200 CABG patients, 69.5% were male and 86.5% were over 41 years old, with the majority aged 51-60. Preoperative cardiac function was normal in 51.5%

of patients, while 48.5% exhibited some degree of systolic dysfunction. Comorbidities were highly prevalent, with hypertension (66.5%) and diabetes (50.5%) being the most common. Preoperatively, 93.5% of patients had a CPB time between 60 and 200 minutes (mean categorical score: 2.50), and 93.5% had an ICU stay under 7 days (mean categorical score: 1.62). The overall mortality rate was 23.0%. (Table 4.1)

Table 4. 1: Baseline Characteristics of Patients Undergoing CABG (N=200)

Characteristic	***Category***	***N***	***%***	***Overall Mean***
Gender	Male	139	69.5%	
	Female	61	30.5%	
Age Categories	19–30 years	3	1.5%	
	31–40 years	9	4.5%	
	41–50 years	57	28.5%	3.94
	51–60 years	73	36.5%	
	61–70 years	43	21.5%	
	>70 years	15	7.5%	
Ejection Fraction (EF)	>55% (Normal)	103	51.5%	
	45–54% (Mildly reduced)	62	31.0%	1.70
	30–44% (Moderately reduced)	28	14.0%	
	<30% (Severely reduced)	7	3.5%	
Comorbidities	Hypertension	133	66.5%	
	Diabetes Mellitus	101	50.5%	
	Current Smoking	65	32.5%	
	Hyperlipidemia	35	17.5%	
CPB Time	<60 minutes	4	2.0%	
	60–120 minutes	102	51.0%	2.50
	130–200 minutes	85	42.5%	
	>200 minutes	9	4.5%	
ICU Stay	<3 days	90	45.0%	
	3–7 days	97	48.5%	1.62
	>7 days	13	6.5%	
Mortality	Yes	46	23.0%	
	No	153	76.5%	

Univariable Analysis of Associations

Chi-square tests were performed to assess the association of patient factors with key outcomes: CPB time, ICU stay, and mortality (Table 4.2). At the univariable level, Ejection Fraction (EF) showed a highly significant association with both ICU stay (p=0.001) and mortality (p=0.002). Diabetes Mellitus (DM) was also significantly associated with mortality (p=0.042). No other factors were significantly associated with the outcomes in these initial tests.

Table 4. 2: Chi-square Tests for Association with CABG Outcomes

Factor	**CPB Time (p-value)**	**ICU Stay (p-value)**	**Mortality (p-value)**

Factor	CPB Time (p-value)	ICU Stay (p-value)	Mortality (p-value)
Smoking	0.137	0.840	0.159
Diabetes Mellitus	0.910	0.695	**0.042**
Hypertension	0.754	0.665	0.359
Hyperlipidemia	0.184	0.978	0.392
Gender	0.127	0.543	0.291
Age (Categorized)	0.993	0.387	0.946
Ejection Fraction	0.387	**0.001**	**0.002**

Note: *$p < 0.05$ indicates statistical significance.*

Detailed Outcome Analysis by Risk Factors

Mortality Analysis

The association between comorbidities and mortality was examined in detail (Table 4.3). Diabetic patients had a mortality rate of 29.7% (30/101), compared to 16.2% (16/99) in non-diabetics, confirming the significant association (p=0.042). Although not statistically significant, higher numerical mortality rates were observed in smokers (30.8%), females (29.5%), and patients with hyperlipidemia (31.4%). A strong graded relationship was found between pre-operative ejection fraction and mortality (Table 4.4, Figure 4.3). Mortality rose sharply from 15.5% in patients with normal EF to 53.6% in those with moderately reduced EF (30-44%).

Table 4. 3: Mortality Rates by Comorbidity Status

Comorbidity	Mortality Rate	Total Patients	p-value
Diabetes Mellitus	Yes: 29.7% (30/101)	200	**0.042**
	No: 16.2% (16/99)		
Hypertension	Yes: 25.6% (34/133)	200	0.359
	No: 17.9% (12/67)		
Smoking	Yes: 30.8% (20/65)	200	0.159
	No: 19.3% (26/135)		

Comorbidity	Mortality Rate	Total Patients	p-value
Hyperlipidemia	Yes: 31.4% (11/35)	200	0.392
	No: 21.2% (35/165)		

Table 4. 4: Mortality by Ejection Fraction Category

EF Category	Mortality Rate	Total Patients
>55% (Normal)	15.5%	103
45–54% (Mildly Reduced)	19.4%	62
30–44% (Moderately Reduced)	**53.6%**	28
<30% (Severely Reduced)	42.9%	7
Total	**23.0%**	**200**

Figure 4. 1: Mortality rate by EF catogery

ICU Stay Analysis by Ejection Fraction

The distribution of ICU stay duration varied significantly across EF categories (p=0.001) (Table 4.5, Figure 4.4). Patients with moderately reduced EF (30-44%) had the highest proportion of prolonged ICU stays (>7 days) at 25.0%. In contrast, the majority of patients with normal or mildly reduced EF stayed in the ICU for less than 7 days.

Table 4. 5: ICU Stay Patterns by Ejection Fraction Category

EF Category	ICU <3 days	ICU 3–7 days	ICU >7 days
>55% (Normal)	44.7%	51.5%	3.9%
45–54% (Mild)	53.2%	43.5%	3.2%
30–44% (Moderate)	35.7%	39.3%	**25.0%**
<30% (Severe)	14.3%	85.7%	0.0%

Figure 4. 2: ICU Stay Distribution by EF Category CABG Patients (N=200)

Multivariable Analysis: Ordinal Regression

to identify independent predictors while controlling for other variables, ordinal regression analyses were performed for CPB time, ICU stay, and mortality. The complete results of all three models are presented in Table 4.6.

Table 4. 6: Ordinal Regression Analyses for Postoperative Outcomes (N=200)

Predictor	**CPB Time**		**ICU Stay**		**Mortality**	
	(p-value)	**Odds Ratio**	**(p-value)**	**Odds Ratio**	**(p-value)**	**Odds Ratio**
Smoking	0.572	1.191	0.968	1.012	**0.023**	**2.42**
Diabetes Mellitus	0.541	0.841	0.894	0.963	0.111	1.81
Hypertension	0.638	1.153	0.737	0.903	0.373	1.43
Hyperlipidemia	0.371	1.404	0.757	1.122	0.186	1.81
Gender (Female)	0.128	0.616	0.617	1.170	0.182	0.59
Age	0.486	1.098	0.134	1.222	0.206	1.24
Ejection Fraction	0.365	1.166	0.150	1.279	**0.001**	**0.51**
Model R^2	0.032		0.033		0.181	
Model p-value	0.601		0.597		**< 0.001**	

Predictors of CPB Time and ICU Stay

As shown in Table 4.6, the multivariable models found no statistically significant predictors for either CPB time (Model $R^2 = 0.032$, $p = 0.601$) or ICU stay (Model $R^2 = 0.033$, $p = 0.597$). All examined factors, including EF, age, and comorbidities, had p-values > 0.05 in both models.

Independent Predictors of Mortality

The ordinal regression model for mortality was significant (Model $R^2 = 0.181$, $p < 0.001$) and identified two independent predictors (Table 4.6).

Smoking: Current smoking status was a significant independent predictor of mortality (p=0.023), with smokers having 2.42 times higher odds of mortality compared to non-smokers (Odds Ratio, OR = 2.42).

Ejection Fraction: EF remained a highly significant independent predictor after adjustment for other factors (p=0.001). A higher EF category was associated with 49% lower odds of mortality (OR = 0.51).
Diabetes Mellitus, which was significant in the univariable analysis, was not an independent predictor in the multivariable model (p=0.111). Similarly, none of the other examined variables including hypertension, hyperlipidemia, gender, and age showed a statistically significant independent association with mortality in the adjusted analysis.

Summary of Significant Findings
The key statistically significant results of this study are consolidated in Table 4.7. In summary, univariable analyses revealed significant associations between reduced ejection fraction and both prolonged ICU stay and increased mortality, as well as between diabetes mellitus and mortality. However, multivariable ordinal regression identified only two independent predictors of post-CABG mortality: current smoking status (OR=2.42) and lower pre-operative ejection fraction (OR=0.51).

Table 4. 7: Summary of Statistically Significant Results

Finding	Statistical Test	p-value	Interpretation
EF associated with ICU stay	Chi-square	0.001	Lower EF is associated with longer ICU stay.
EF associated with mortality	Chi-square	0.002	Lower EF is associated with higher mortality.
DM associated with mortality	Chi-square	0.042	Diabetic patients have higher unadjusted mortality.
Smoking predicts mortality	Ordinal Regression	0.023	Smoking is an independent predictor, with 2.4x higher odds of mortality.
EF predicts mortality	Ordinal Regression	0.001	Higher EF is an independent protective factor, associated with 49% lower odds of mortality.

DISCUSSION
This study examined how preoperative patient characteristics affect outcomes after coronary artery bypass grafting (CABG), focusing on cardiopulmonary bypass (CPB) time, ICU stay, and postoperative mortality. Smoking was not linked to ICU stay or CPB time but remained an independent predictor of mortality, likely due to systemic and cardiopulmonary effects rather than prolonged ICU stay. Diabetes mellitus showed no association with CPB time or ICU stay but increased mortality risk, particularly when combined with other comorbidities. Hypertension and hyperlipidemia did not significantly affect mortality, ICU stay, or CPB time,

potentially due to effective perioperative management and statin use. Gender and age were also not independently associated with outcomes after adjusting for comorbidities and patient selection.
Ejection fraction (EF) emerged as a strong independent predictor of both ICU stay and mortality, with lower EF correlating with worse outcomes. No preoperative factor significantly predicted CPB time, suggesting that surgical technique and institutional practices may have a larger influence. Ordinal regression confirmed smoking and low EF as independent mortality predictors, underscoring the role of physiological reserve and ventricular function in postoperative risk. These findings align with prior studies highlighting the predictive value of EF and the limited independent impact of other demographic or comorbidity factors. Optimizing preoperative risk and managing key factors like smoking and EF are critical for improving CABG outcomes.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION:

This research indicates that left ventricular ejection fraction and smoking are useful predictors of postoperative mortality in patients of CABG. Other preoperative variables, including age, gender, hypertension, diabetes and hyperlipidemia did not have any discernible independent effect on cardiopulmonary bypass time or ICU stay reduced ejection fraction was also associated with increased ICU stay. The findings suggest that the circumstances of operations, rather than patient attributes are the primary factors that dictate CPB time. The cardiac function assessment that should be done before the operation and smoking cessation could improve the outcomes of the postoperative period and life expectancy.

LIMITATIONS:

The limitations to this study are a few things that need to be taken into consideration when interpreting the results. The design limits causal inferences because the retrospective design relies on completeness and quality of medical data. Its might be that the relatively limited size of its sample complicated locating significant correlations of certain attributes. Only short-term in hospital outcomes, long term morbidity and survival were not measured. Important clinical variables that may have influenced the outcomes were omitted such as length and management of diabetes, intense smoking levels, intraoperative issues, and postoperative issues. Also, the relevance of the study was restricted due to the fact that it was confined in a few hospitals within one country. Lastly there might be a reduction in the sensitivity of analysis in the case where continuous variables such as EF, CPB times and ICU stay are categorized.

RECOMMONDATIONS:

Future research designs should adopt a prospective, multicenter study design and with a larger and more diverse group of patients to enhance the generalizability of findings and reduce selection bias. Researchers are advised to measure other perioperative and intraoperative variables that were not assessed in the study like duration of diabetes, glycemic control (HbA1c), intensity and duration of smoking, intraoperative problems, myocardial protection methods and the postoperative problems. Continuous variables (ejection fraction, CPB time and ICU stay) should not be measured using the categorical method but with the help of continuous data to increase statistical sensitivity. Long term outcomes like quality of life, readmissions and late death should be measured to find out more about the long-term effects of the preoperative risk variables. More sophisticated risk prediction models and risk classification approaches could be embraced to enhance the process of perioperative risk assessment among CABG patients.

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