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PREVALENCE OF HYPERGLYCEMIA IN NON-DIABETIC PATIENTS AFTER CABG SURGERY IN THE CARDIAC ICU AT TERTIARY CARE HOSPITALS IN PESHAWAR

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Abstract

BACKGROUND: CABG, or coronary artery bypass graft surgery is recognized intervention for patient with severe coronary artery diseases. While restoring cardiac blood flow is the primary objective of CABG while improve clinical outcomes, emerging evidence suggests that postoperative hyperglycemia can significantly impact recovery and long-term health outcomes. Traditionally, hyperglycemia has been closely associated with diabetes mellitus, but recent studies indicate that even non-diabetic patients may experience elevated blood glucose levels following CABG surgery, raising concerns about its prevalence and implications. The aim of this research is to find out the prevalence of hyperglycemia in non-diabetic patient following CABG surgery. METHODS: A cross sectional, descriptive study was conducted, 139 sample were collected through questionnaire. Further question were asked by the patient or according to his ICU charge sheet and then was noted in the questionnaire for research purpose. RESULTS: Following CABG surgery, 67 patients with hyperglycemia and 72 patients without it were involved in this study. Multiple variate

logistic study showed that patients with hyperglycemia were probably men, had a higher BMI, and were more probably ischemic and hypertensive heart diseases, myocardial infraction blood glucose level above 180mg/dl, pain after surgery which elevates BG and low body temperature, associated with post-operative hyperglycemia in non-diabetic patient. CONCLUSION: Preoperative non diabetic patient's characteristics are associated with hyperglycemia after cardiac surgery.

Keywords: Hyperglycemia, Coronary Artery Bypass, Non-diabetic.

INTRODUCTION

Coronary artery bypass grafting (CABG) is a commonly performed surgical procedure used to improve myocardial blood flow in patients with coronary artery disease (CAD). By grafting a blood vessel from another part of the body to bypass a blocked coronary artery, CABG restores myocardial perfusion and significantly improves survival and quality of life (1). Despite its benefits, CABG induces a marked endocrine and inflammatory stress response, which frequently leads to postoperative hyperglycemia in both diabetic and non-diabetic patients (2).

Postoperative hyperglycemia is associated with multiple adverse outcomes, including increased risk of infection, renal dysfunction, cardiovascular and neurological complications, prolonged hospital stay, and increased mortality (2,4,5). Although diabetes is a known risk factor, stress-induced hyperglycemia in non-diabetic patients has also been recognized as an independent predictor of morbidity and mortality in acute coronary syndromes, myocardial infarction, and major surgical interventions (6).

Hyperglycemia is defined by the American Association of Clinical Endocrinologists (AACE) as blood glucose levels greater than 140 mg/dL (>7.8 mmol/L) (7,8), while the Society of Thoracic Surgeons recommends maintaining postoperative glucose levels at or below 180 mg/dL during the first 24 hours after cardiac surgery (9). Stress hyperglycemia refers to a transient elevation in blood glucose occurring during acute illness or surgical stress in individuals without a prior history of diabetes (11). It develops due to activation of the neurohormonal stress response, where surgical trauma, anesthesia, and pain stimulate the release of counter-regulatory hormones such as catecholamines, cortisol, and glucagon. These hormones promote glycogenolysis, gluconeogenesis, insulin resistance, and reduced peripheral glucose utilization, ultimately resulting in elevated blood glucose levels (12–14).

Postoperative hyperglycemia has been reported in approximately 60% of cardiac surgery patients and 40% of non-cardiac surgery patients (8,15). Blood glucose levels ⩾200 mg/dL after surgery are associated with worse clinical outcomes compared to mild hyperglycemia or normoglycemia (16). Evidence also suggests that non-diabetic

patients who develop stress-induced hyperglycemia may experience higher complication and mortality rates than patients with pre-existing diabetes mellitus (17,18). The pathophysiology of stress hyperglycemia involves complex interactions between counter-regulatory hormones, inflammatory cytokines, and peripheral insulin resistance (11). In cardiac surgery, additional factors such as catecholamine-based inotropic support and occasional glucocorticoid use further exacerbate hyperglycemia (22). Therefore, effective glucose monitoring and timely management are essential to reduce postoperative complications and improve outcomes.

Despite its clinical importance, limited data exist regarding the prevalence and associated risk factors of postoperative hyperglycemia in non-diabetic patients undergoing CABG in the local population. This study aims to determine the prevalence of postoperative hyperglycemia and identify associated risk factors among non-diabetic patients undergoing CABG surgery at Rehman Medical Institute and Fauji Foundation Hospital, Peshawar.

The aim of this study is to investigate the prevalence of postoperative hyperglycemia in non-diabetic patients undergoing CABG surgery, with the objective of assessing its incidence in the cardiac ICU, evaluating the severity of hyperglycemia during the immediate postoperative period, and identifying associated risk factors including age, gender, body mass index, hypertension, myocardial infarction, and surgical variables.

METHODOLOGY:

A descriptive cross-sectional study was conducted in the Intensive Care Unit (ICU) of Cardiology at Rehman Medical Institute and Fauji Foundation Hospital, Peshawar. The study was completed over a period of three months. The study population included non-diabetic patients aged above 40 years who had undergone coronary artery bypass grafting (CABG) and were admitted to the ICU, CCU, or ward for postoperative care.

Patients with a known history of diabetes mellitus, those receiving preoperative glucose-lowering therapy, patients undergoing procedures other than CABG, and those aged below 40 years were excluded from the study.

The sample size was calculated using the formula $N = Z^2 \times P(1–P) / E^2$, where P was the estimated prevalence (10%), E was the margin of error (5%), and Z was 1.96 for a 95% confidence interval. Based on these values, the calculated sample size was approximately 139 participants. A total of 139 non-diabetic patients undergoing CABG surgery in tertiary care hospitals in Peshawar were included to assess the prevalence of postoperative hyperglycemia. This sample size ensured adequate statistical power with a 95% confidence level and a 5% margin of error.

A convenient sampling technique was used for participant selection.

Data were collected through a structured questionnaire in the cardiac ICU of both hospitals after reviewing patients' medical records. The questionnaire included demographic details, body mass index (BMI), comorbid conditions, family history of diabetes, postoperative glucose levels, body temperature, and pain status that could potentially influence blood glucose levels after surgery.

Ethical approval was obtained from the research ethical committee of Rehman Medical Institute following departmental approval. Data collection was carried out after formal permission, ensuring confidentiality and adherence to ethical standards.

Collected data were analyzed using appropriate statistical methods to determine the prevalence of postoperative hyperglycemia and its association with selected risk factors among non-diabetic CABG patients.

RESULTS

This study consists 67 patients with hyperglycemia and 72 patients without hyperglycemia. Patient who was Hyperglycemic patients were mostly noted as older, majority of them were men, had high BMI, many of them were hypertensive and ischemic heart diseases and also had myocardial infraction. The multivariate logistic focused age, gender, body mass index, blood glucose level above 180mg/dl, pain after surgery which elevates blood glucose and low body temperature, associated with post-operative hyperglycemia in non-diabetic patient.

Age of Patient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	40-49	25	18.0	18.0	18.0
	50-59	48	34.5	34.5	52.5
	60-69	54	38.8	38.8	91.4
	70 and above	12	8.6	8.6	100.0
	Total	139	100.0	100.0	

In our research 139 patients which were followed by CABG surgery were selected in which 25 patients age range was between 40-49 which makes around 18%, 48 patients age range was between 50-59 which makes 34.5%, 54 patients age range was between 60-69 which makes 38.8% and 12 patients range was above 70 which makes 8.6% of the total number of patient respectively.

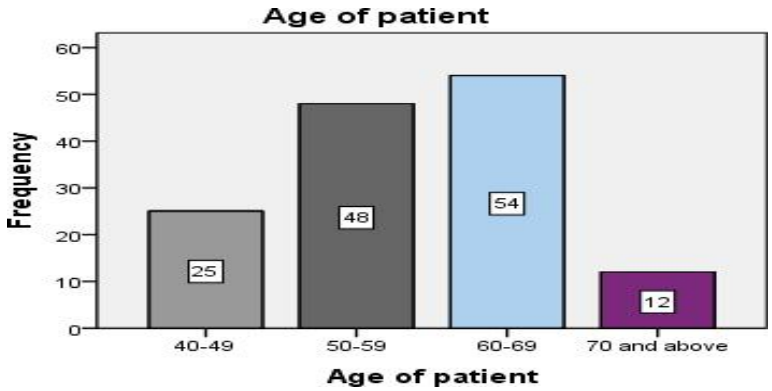

Figure ii: Age of Patients

In our research of 139 patients, 89 of the patient were male which make around 64.3% and 50 patients were female which makes 35.97% of the 139 patients.

Gender of Patient

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	89	64.0	64.0	64.0
	Female	50	36.0	36.0	100.0
	Total	139	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<18.5	3	2.2	2.2	2.2
	24.5	49	35.3	35.3	37.4
	29.9	77	55.4	55.4	92.8
	>30+	10	7.2	7.2	100.0
	Total	139	100.0	100.0	

Out of 139 patient 3 patients were underweight having a 2.2%, 49 patients had normal weight having a 35.3%, 77 patients and overweight having a 55.4% and only 10 patients were obsess having a 7.2% of the total number of patient in our research, according to the Standard categorization of BMI Index.

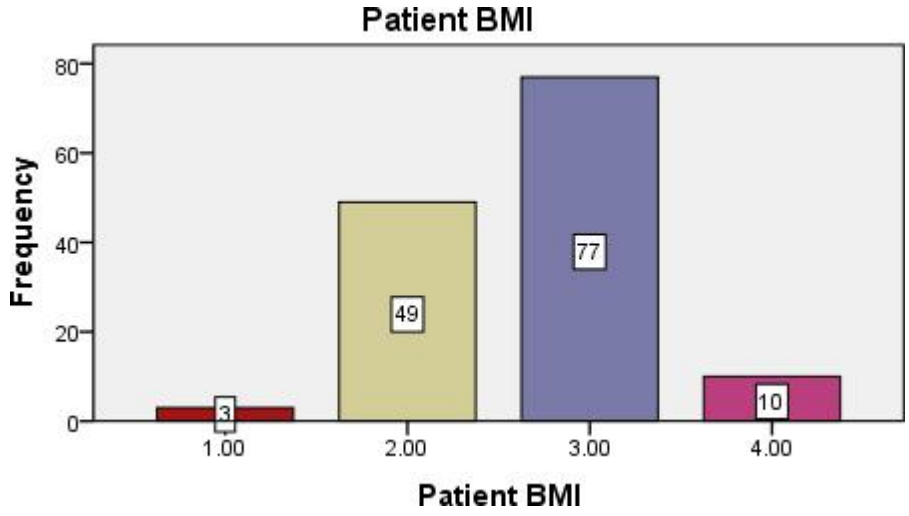

Figure iv: BMI Index

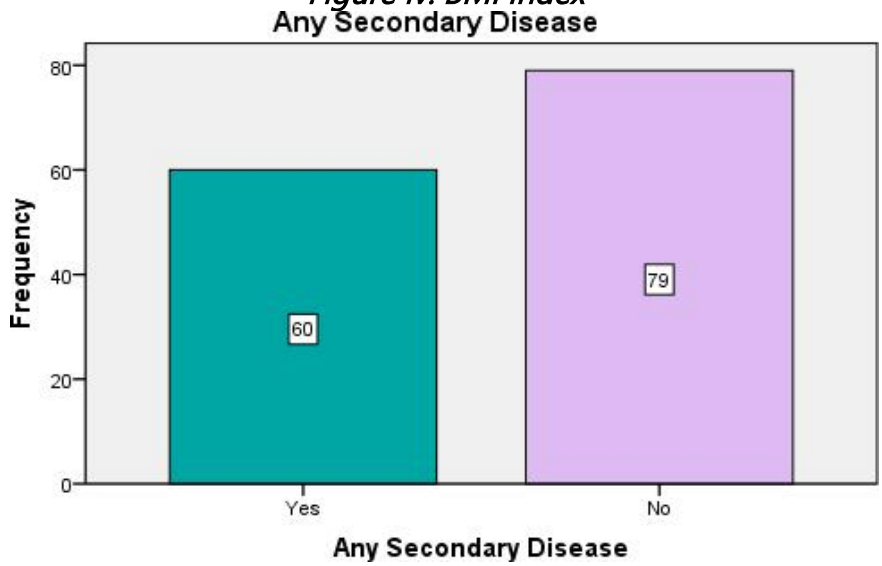

Figure v: Secondary Diseases

In our result 60 patient (43.2%) had secondary diseases which included Hypertension, Ischemic heart diseases, and myocardial infarctions and 79 patients (56.8%) were diagnosed without any secondary diseases.

Any Secondary Disease

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	60	43.2	43.2	43.2
	No	79	56.8	56.8	100.0
	Total	139	100.0	100.0	

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Family History

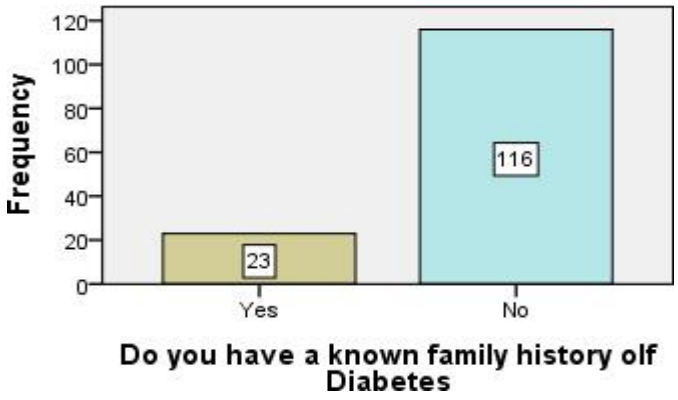

Figure vi: Family history

In our result 139 patient followed CABG surgery in which 23 patient (16.5%) had a family history of diabetes while 116 patient (83.5%) had no such family history of diabetes.

Do you have a known family history of Diabetes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	23	16.5	16.5	16.5
	No	116	83.5	83.5	100.0
	Total	139	100.0	100.0	

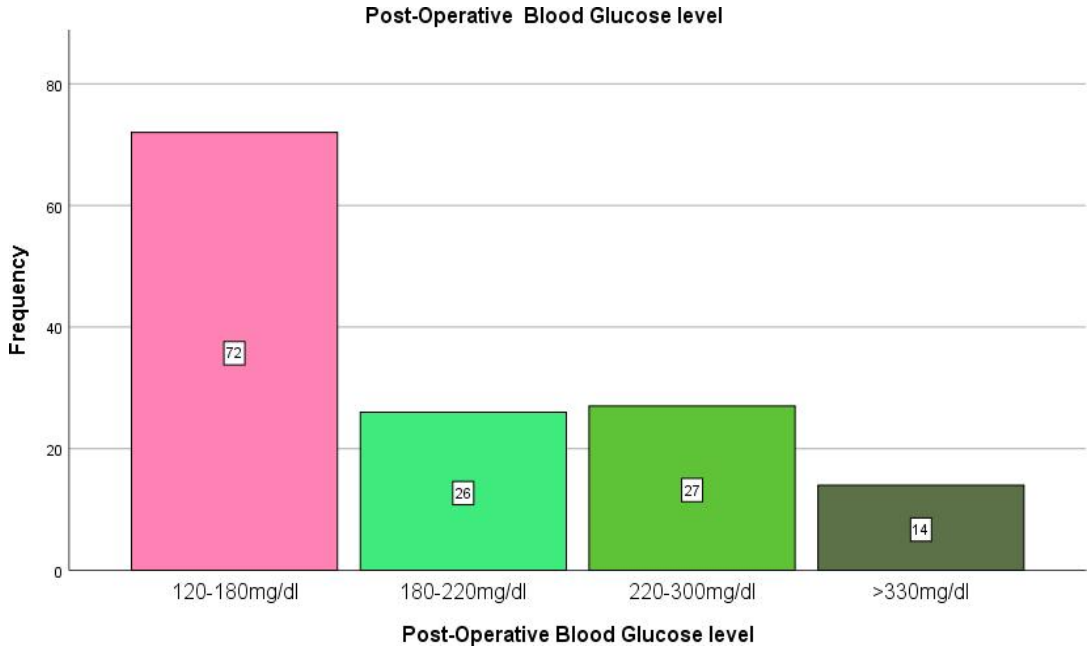

Figure vii: Post-Op Blood Glucose Level

In our result which was conducted on 139 patient after CABG surgery, 72 patients (51.8%) having a glcouse range of 120-180mg/dl, 26 patient (18.7%) glucose range was 180-220mg/dl, 27 patients (19.4%) glucose level 220-300mg/dl and only 14 patient (10.1%) had a glucose level above 300 respectively.

Post-Operative Blood Glucose level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	120-180mg/dl	72	51.8	51.8	51.8
	180-220mg/dl	26	18.7	18.7	70.5
	220-300mg/dl	27	19.4	19.4	89.9
	>330mg/dl	14	10.1	10.1	100.0
	Total	139	100.0	100.0	

Body Temperature

	Frequency	Percent	Valid Percent	Cumulative Percent
Low <37 C	29	20.9	20.9	20.9
Normal 37 C	101	72.7	72.7	79.1
Valid				
High >37 C	9	6.5	6.5	100.0
Total	139	100.0	100.0	

In our result which included 139 patient (20.9%) which followed CABG surgery, 29 patients (20.9%) showed hypothermia after the procedure, 101 patient (72.7%) had normal temperature and 9 patients (6.5%) having hyperthermia.

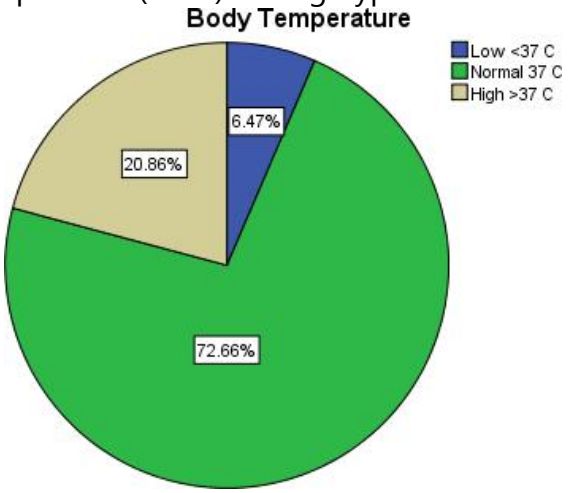

Figure viii: Body Temperature

Pain Affect Blood Glucose Level

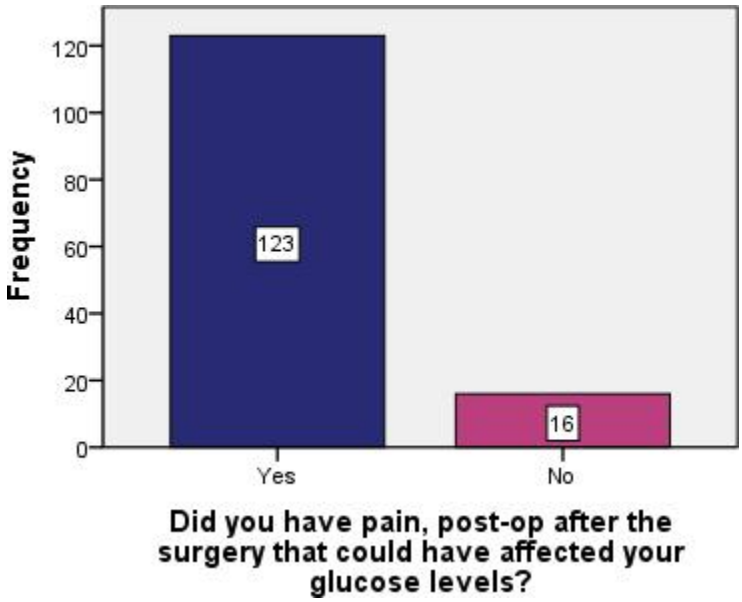

Figure ix: Pain Affecting Blood Glucose

In our result which was conducted on 139 patient after CABG surgery, 123 patients (88.5%) had post-op pain while 16 patients (11.5%) had no pain.

Did you have pain, post-op after the surgery that could have affected your glucose levels?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	123	88.5	88.5	88.5
	No	16	11.5	11.5	100.0
	Total	139	100.0	100.0	

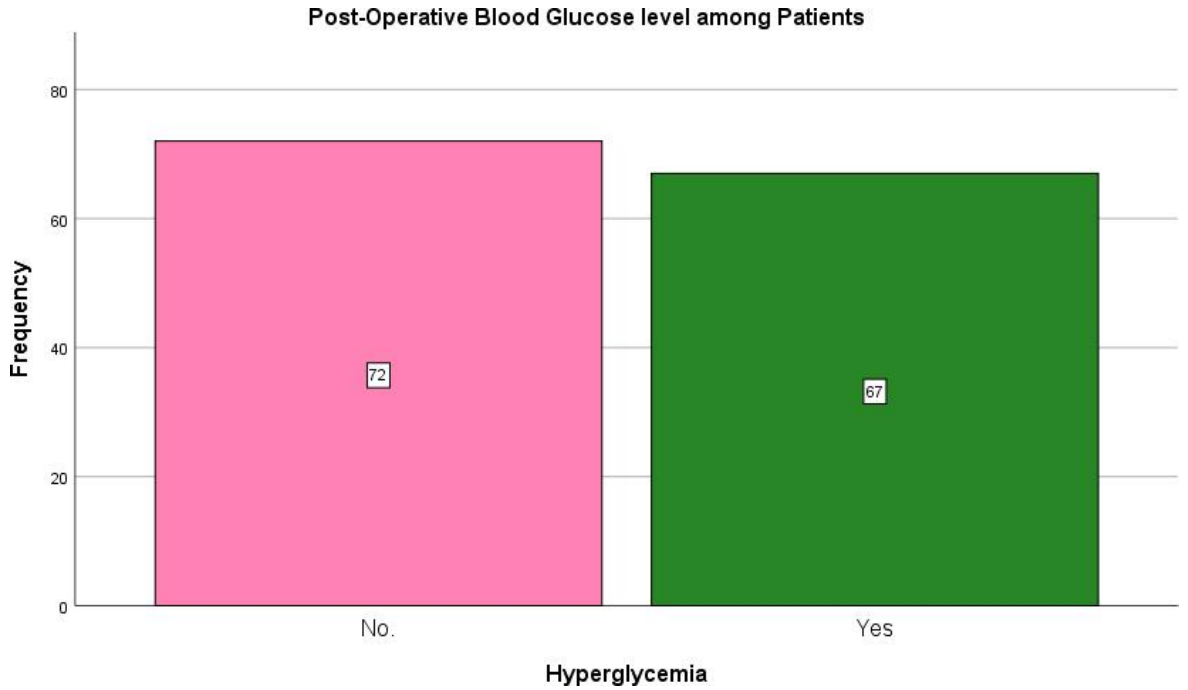

Figure x: Post-Op blood glucose level among patient

Post-Operative Blood Glucose level among Patients

Hyperglycemia

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	No.	72	51.8	51.8	51.8
	Yes	67	48.2	48.2	100.0
	Total	139	100.0	100.0	

By the end of our result we concluded that due to these various factor as mention above, can have post-operative hyperglycemia. In which 67 patients were considered diabetic (48.2%) and 72 patients were non-diabetic (51.8%).

DISCUSSION

In this study conducted in tertiary care hospitals in Peshawar, 139 non-diabetic patients undergoing CABG surgery were analyzed. The prevalence of postoperative hyperglycemia was found to be 76.25%, with 67 patients (48.2%) developing hyperglycemia and 72 (51.8%) remaining normoglycemic. This finding is higher than the study by Eshetu Tesfaye Dejen et al., which reported postoperative hyperglycemia in 34.1% of patients (8).

In terms of gender distribution, 89 patients (63.3%) were male and 50 (39.7%) were female. A similar male predominance was reported by Amina Godinjak et al., where 55% of participants were male and 45% were female (27).

Regarding comorbid conditions, 60 patients (43.2%) had secondary diseases such as myocardial infarction, hypertension, ischemic heart disease, or renal disease, while 79 patients (56.8%) had no associated comorbidities. Previous literature, including Michael J. Mack et al., has also shown that comorbid conditions significantly influence postoperative outcomes in CABG patients (31).

Body mass index showed that 2.2% of patients were underweight, 35.3% had normal weight, 55.4% were overweight, and 7.2% were obese. Although BMI has a limited but relevant association with postoperative glycemic control, studies such as Thomas Schricker et al. have demonstrated a significant relationship between higher BMI and insulin resistance as well as postoperative glycemic variations (32).

Temperature variations were also observed postoperatively, where 20.9% had hypothermia, 72.7% had normal temperature, and 6.5% had hyperthermia. Similar findings have been reported in large cardiac surgery cohorts, where hypothermia is commonly observed and may influence surgical outcomes (30).

Overall, the findings suggest that postoperative hyperglycemia is highly prevalent among non-diabetic CABG patients and is influenced by multiple factors including gender, comorbidities, BMI, and perioperative physiological changes. These findings are consistent with existing literature indicating that stress-induced metabolic responses significantly affect postoperative glucose regulation.

In conclusion, the majority of CABG patients in this study developed postoperative hyperglycemia, particularly males aged 50–69 years. Contributing factors included body mass index, comorbid conditions such as myocardial infarction, ischemic heart disease, hypertension, renal disease, and perioperative temperature changes. These findings highlight the importance of early monitoring and strict glycemic control in the postoperative period to reduce complications.

Limitations of the study include limited control over postoperative pain management and temperature regulation, which may have influenced glucose levels. Routine blood glucose monitoring in high-risk patients is recommended, particularly in those with higher BMI or extensive surgical procedures. Further research is required to explore preventive strategies and the long-term impact of postoperative hyperglycemia on clinical outcomes.

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