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RESEARCH ARTICLE
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"FREQUENCY OF RE-EXPLORATION DUE TO EXCESSIVE BLEEDING AND ITS RELATION TO BODY MASS INDEX IN POST-OPERATIVE CORONARY ARTERY BYPASS GRAFTING AT A TERTIARY CARE HOSPITAL KARACHI"

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ABSTRACT

Objectives: To determine the frequency of re-exploration due to excessive bleeding in post-operative coronary artery bypass graft patients at a tertiary care hospital in Karachi.
To compare the frequency of re-exploration with body mass index in postoperative coronary artery bypass graft patients at a tertiary care hospital in Karachi
Study design and setting: A descriptive cross-sectional study was carried out at the Cardiac Surgery Unit, NICVD, Karachi, Pakistan, during the period Oct: 2022 to Dec 2023.
Materials and Methods: All participants who fulfilled the inclusion criteria and attended NICVD, Karachi, were included in the study. After outlining the protocol, risks, and advantages of the study, informed written consent was attained. All patient in our study was sent to a specialized intensive care unit (ICU). and kept under close observation during their post-surgery hospital stay, and re-exploration due to bleeding was recorded. Data was collected in Proform, and the SPSS-18 version was applied for analysis.
Results: Patients' ages varied from 30 to 70 years old, with a median age of 55. In the distribution of gender, 151 (75.1%) were male, while 50 (24.9%) were female. Re-exploration was found in 8 (4%) patients, whereas in comparison, re-exploration was noted in 5 (2.5%) vs. 3 (1.5%) patients between body mass index 19--30 vs. >30 kg/m2 patients, with a non-significant P-value (P = 0.432).
Conclusion: In conclusion, the low rate of re-exploration was noted due to excessive bleeding in post-operative coronary artery bypass surgery.
Patients with non-significant differences in body mass index. It is advised that further extensive research be done to validate the present findings.

Keywords: Bleeding, Body Mass Index, CABG, Re-exploration

Introduction

The most frequent cardiac surgical operation performed globally is coronary artery bypass grafting (CABG), which is still the "gold standard" therapy for coronary artery disease involving multiple vessels, especially left main coronary artery disease or three-vessel disease. The kind of procedure known as coronary artery bypass grafting (CABG) improves blood flow from the heart. People with severe coronary artery disease (CAD) are treated with it [1].

CAD is a disorder in which plaque accumulates inside the coronary arteries, reducing the oxygenated blood flow to the heart. Plaque is composed of fat, cholesterol, calcium, and other compounds present in the blood [2].

Nonetheless, CABG is an extremely complicated procedure that has been linked to several issues.

Major surgery complications are, for example, arrhythmia, stroke, acute kidney injury, graft failure, bleeding, cardiac tamponade, post-operative myocardial infarction, and pulmonary complications [3,4]. However, the most common complication after CABG is postoperative bleeding, which is considered an important problem and leads to re-exploration [5-7].

Re-exploration for extreme bleeding in post-operative CABG is about 9.3% while worldwide shows up to 11% being reopened [8]. The study by Karthik et al reported the frequency of re-exploration secondary to excessive bleeding in post-operative CABG patients was 3.1% [9]. Another study by Tambe et al reported the incidence of re-exploration secondary to excessive bleeding was 5.7% [10].

Most studies have evaluated the effect of body mass index (BMI) on early complications after CABG including post-operative bleeding which shows low BMI and normal BMI are more re-explored due to excessive bleeding than those who have high BMI [9,11,12].

The current study aims to find out the frequency of re-exploration due to excessive bleeding and its relation to BMI in post-operative CABG at a tertiary care hospital in Karachi Pakistan. A limited number of studies are conducted in Pakistan to determine the frequency of Re-exploration for bleeding in post-CABG. Furthermore, the findings of international studies are not generalizable to our local population due to differences in sociodemographics, living standards, health conditions, and healthcare delivery. So, there is a need to conduct such a study to determine the frequency of re-exploration due to excessive bleeding and its relation to BMI in post-operative CABG. This study will not only help in identifying the burden but also help in the identification of high-risk groups which ultimately help in the pre-operative counseling of patients. Knowing the frequency of this study will force researchers to further research to determine the risk factors and to improve strategies on how to prevent postoperative bleeding in post-operative bleeding.

Operational definition

Coronary artery bypass grafting (CABG)

The surgical process used to open an occluded coronary artery and restore normal blood flow was known as coronary artery bypass grafting [13]. A healthy blood vessel or artery was transplanted to the obstructed coronary artery during coronary artery bypass grafting (CABG). The obstructed section of the coronary artery was circumvented by the grafted artery or vein [2]. CABG can be elective, urgent, or emergent;

Elective surgery: is a planned surgery in which the patient is fully prepared before surgery to minimize surgery or post-surgery complications.

Urgent surgery: is a type of surgery in which the patient is operated on as soon as the patient is stabilized but should be operated on within 14 days but not within 24 hours after unstabilization.

Emergency surgery: its a type of surgery in which the patient should be operated on 24 hours after acute MI or post PCI complications.

Re-exploration for bleeding

Indication for re-exploration due to bleeding [9,14]. The presence of any one of the following was labeled as excessive bleeding:

Chesttubeoutput>400ml/hourfor 1 hour.

>300ml/hourfor 2to3hours.
200ml/hourfor4 hours.
Cardiac tamponade {should be considered in hypotensive patients (BP <90/50 mmHg), tachycardia (HR >100 b/min), increased CVP (>15 mmHg), increased inotropic support, plus
us paradoxus}.
Imagingevidenceoflarge clot(>4cm).
Largepericordialcollection>3cmparticularlyifcircumferential.
Body mass index:To determine if an adult was at a healthy weight, it was used as a screening tool. The adult's weight was expressed as kilograms divided by height squared (kg/m2). Weight was measured by using an electronic weighting machine while height was measured by using wall wall-mounted scale. BMI was measured pre-operatively and categorized as follows:

BMI values
·Less than 18.5 kg/m2 were labelled underweight.
·From 18.5 kg/m2 to 24.9 kg/m2 is healthy / normal weight.
·Overweight was defined as a body mass index of 25.0 to less than 30.0kg/m2.
·Obesity was defined as a BMI of 30.0 kg/m2 or greater.

Hypertension (HTN)
Hypertension is labeled when a history of hypertension and at least six months of antihypertensive drug use. Both controlled and uncontrolled.

Diabetic mellitus
DM is labeled when a history of diabetes and at least six months of anti-diabetic drug use. Both controlled and uncontrolled.

Family history
A patient who is either a male under 55 or a female under 65 has first-degree relatives with a history of coronary artery disease.

Smoking
The patient is presently smoking or has previously smoked 5 or more cigarettes per day for at least five years.

Material and methods
Study design
Descriptive cross-sectional study.

Study setting
The study was conducted Cardiac Surgery unit, NICVD, Karach, during the period Oct: 2022 to Dec: 2023

Sample size
Re-exploration secondary to excessive bleeding in post-operative CABG is 3.1 % 9, at a 2.4% margin of error and 95% confidence level. The study sample size was computed to be n=201

Sampling procedure
Consecutive Sampling (Non-Probability)

criteria
Patients planned for elective and urgent CABG.

Adult patients of age 30-70 years.
Gender male and female both patients.

Exclusion criteria
Emergency surgery.
Patients who had got ACS protocol within the last 5 days.
Patientswhohadtakenanti-platelettabletswithin5 days.
Liver disease.
Chronic kidney disease.
Patients had previous bleeding disorders.

Data collection procedure
In the study, data was collected after the approval of the Ethical Review Committee of NICVD Karachi. For this study, we included consecutive patients undergoing coronary artery bypass grafting (CABG) and meeting the inclusion criteria for selection at NICVD (Cardiac Surgery Unit). Before enrollment, all participants were informed of the goals and advantages of the study, and the primary investigator obtained written informed permission from each patient. Patient demographic information, including gender and age (in years), was collected. According to the operational criteria, the patients' medical histories were obtained concerning their smoking status, family history, diabetes mellitus, and hypertension. All coronary artery bypass grafting (CABG) surgeries were performed by cardiac surgeons with more than five years of experience. During their post-surgery hospital stay, all of the patients were moved into a specialist intensive care unit (ICU) and monitored closely. Any re-exploration resulting from bleeding was documented by the operational criteria. Every piece of information gathered was entered into a pre-made proforma (included in Appendix A). Strict adherence to inclusion and exclusion criteria as well as stratification allowed for the management of confounding factors and biases. Patient data was protected and only accessible by those with permission.
During their post-surgery hospital stay, all of the patients were moved into a specialized intensive care unit (ICU) and monitored closely. Any re-exploration resulting from bleeding was documented by the operational criteria. Every piece of information gathered was entered into a pre-made proforma (included in Appendix A). Strict adherence to inclusion and exclusion criteria as well as stratification allowed for the management of confounding factors and biases. Patient data was protected and only accessible by those with permission.

Result
In this study, a total of 201 patients were selected, to evaluate the frequency of re-exploration due to excessive and compare it with body mass index bleeding in post-operative coronary artery bypass graft patients at a tertiary care hospital and outcomes were analyzed as, the distribution of continuous variables was tested by applying the Shapiro-Wilk test for age (p=0.0001), height (p=0.0001), weight (p=0.001), body mass index (p=0.0001), duration of the procedure (P=0.0001) and duration of hospital stay (P=0.0001) respectively. The age of the patients ranged from 30 to70 years with a median of 55 and an interquartile range of 10 and C. I (530.7----55.76), whereas the range of height is from 1.55 to 1.82 meters with a median of 1.67 and with an interquartile range of 0.15 and C.I (1.66----1.69) as shown in **Table 1.**
The weight of the patients ranged from 55 to 110 kg with a median of 79 with an interquartile range of 15 and C. I (75.05----78.19), while the body mass index of the patients ranged from 19.03 to 39.26 kg/m2 with a median of 26.43 interquartile range of 6.98 and C.I (26.66----27.88) as shown in **Table 1**.
The duration of the procedure of the patients ranged from 50 to 155 minutes with a median of 135 and with an interquartile range of 17 and C. I (125.31----131.49), hence in the study the duration of

hospital stays of the patients ranged from 7.84 to 8.45 days with a median of 9 and with an interquartile range of 3 and C. I (7.84---- 8.45) as shown in **Table 1**.

In the distribution of gender 151 (75.1%) were male while 50 (24.9%) were female patients and diabetes mellitus was documented in 44(21.9%) patients as shown in **Table 2.**

Out of 201 patients, 115 (42.8%) patients were hypertensive, while 157 (78.1%) patients had a negative family history of coronary artery disease (CAD), compared to 44 (21.9%) patients who had a positive family history and in the distribution of smoking status 92 (45.8%) were smokers while 109(54.2%) were non-smoker patients. Re-exploration was noted in 8 (4%) patients as shown in **Table 2.**

Table 3 Re-exploration was found in 5 (2.5%) vs 3 (1.5%) patients between body mass index 19---30 vs >30 kg/having P-value observed a non-significant (P=0.432).

The statistical Stratification of gender, age group, hypertension, DM, smoking status, and family history of coronary artery disease (CAD) was done concerning re-exploration as seen in **Table 3**.

Discussion

It has been shown that 2% to 6% of individuals who have had coronary artery bypass graft surgery (CABG) need to have their bleeding examined again. [15–17]. In many cardiac units, re-sternotomy for bleeding following CABG is a primary cause of morbidity. As demonstrated before, re-examination for bleeding is linked to infections in both superficial and deep wounds. [18]. These patients often have hemodynamic instability, are more susceptible to the various dangers related to blood and blood products, and require an immediate or emergency re-sternotomy [15]. A higher risk of re-sternotomy for bleeding has been linked to older age, lower BMI, longer cardiopulmonary bypass periods, more distal anastomoses, and internal mammary use. [15, 17, 19, 20]. Over the past ten years, there have been several improvements to the practice of heart surgery, and many of these most likely have some impact on the rates of re-exploration after CABG.

Numerous changes, such as preoperative aspirin and clopidogrel use, a rise in unstable patients going through surgery— a large number of people are getting heparin injections —off-pump CABG, an advanced older and sickening patient undergoing surgery, and various protocols for the administration of antifibrinolytic medications are among the numerous factors that might influence the patient's hematological profile after cardiac surgery.

Between 2 and 11 percent of individuals who have had heart surgery experience severe bleeding [21]. Preoperative low hemoglobin levels, elevated inflammatory markers, complicated procedures, repeat procedures, antiplatelet drug-induced platelet dysfunction, advanced age, urgent or emergency procedures, poorly controlled diabetes, incomplete heparin reversal, and prolonged bypass time are some known predisposing factors [21]. Post-operative bleeding has been linked to coagulopathy and surgical bleeders [22, 23]. If postoperative bleeding meets the Kirklin and Barratt-Boyes criteria, it is considered excessive; nevertheless, alternative endpoints are also tried to characterize post-operative bleeding definitions.

Previous research has shown that cases with a surgically diagnosed source of bleeding had lower rates of death, emergency care stay, as well as wound infection [21, 24]. Excessive bleeding following surgery may result from surgical bleeders or [22,23].

Before surgery, some established risk factors include low hemoglobin levels, high inflammatory markers, complex or repeat procedures, antiplatelet medication-induced platelet dysfunction, advanced age, serious or emergence processes, unwell-controlled diabetes, incomplete heparin reversal, and extended bypass time [21].

Surgical bleeders and coagulopathy have been related to postoperative bleeding [22, 23]. Although postoperative bleeding is deemed excessive if it satisfies the Kirklin and Barratt-Boyes criteria, other endpoints are also attempted to define postoperative hemorrhage.

According to other studies, there was a decreased risk of mortality, duration of hospital stays in the ICU unit, and wound infection in patients whose bleeding source was surgically identified [21, 24]. Surgical bleeders or other factors may be the cause of excessive bleeding after surgery.[28].

Re-exploration of the chest to decrease the bleeding is contemplated if, despite these sufficient conservative measures, the parameters worsen. The use of point-of-care hemostatic testing in conjunction with an integrated transfusion strategy has been demonstrated in prior research to decrease significant bleeding after cardiac surgery as well as the need for red blood cell and platelet transfusions [29]. In addition to the immediate results, individuals who have coronary artery bypass grafting (CABG) and are reopened due to severe bleeding also have worse long-term graft patency. Great saphenous vein usage appears to be associated with an increased risk of early graft failure in patients who have undergone reexamination and have inadequate target vessels [30]. Additional potential causes include tranexamic acid, fresh frozen plasma (FFPs), platelet transfusions, and direct damage to the anastomotic site.

Consequently, patients who are reopened have a significantly greater frequency of re-angiography after one year [25, 27]. According to published research, mortality rates during chest reopening might reach 21%, 22%, and 37% [21, 26]. There isn't yet a set period that is advised for re-exploration [21, 24]. Acute respiratory distress syndrome (ARDS), hypothermia, acidosis, renal damage, and blood and fluid transfusions can all be prevented with an early re-examination of the chest [29]. Our study's results are consistent with those of other research. Here, a handful of these are covered. The patients in this research had ages ranging from 30 to 70, with a median of 55. 60% of the participants were men and 40% were women, according to Islam M, et al [8]. Tambe SP, et al found to have a mean age of 69 years [10]. In our study, 151 (75.1%) were male while 50 (24.9%) were female patients. Another study noted to have 67% males and 33% females [9] whereas the study of Tambe SP, et al found to have 74.8% male and 25.2% female cases [10].

In the present study, re-exploration was found in 8 (4%) patients. In another study, re-exploration for excessive bleeding in post-operative CABGwasabout9.3%while worldwide showedupto11%beingreopened [8].

A study by Karthik S, et al reported the frequency of re-exploration secondary to excessive bleeding in post-operative CABG patients to be 3.1% [9]. Another study by Tambe SP, et al reported the incidence of re-exploration secondary to excessive bleeding as 5.7% [10].

In a recent study, re-exploration was found in 5 (2.5%) vs 3 (1.5%) patients between body mass index 19---30 vs >30 kg/patients having a non-significant P-value (P=0.432). Most studies have evaluated the effect of body mass index (BMI) on early complications after CABG including post-operative bleeding which shows low BMI and due to severe bleeding, those with normal BMI are more frequently re-explored than those with high BMI.[9,11,12].

In a recent investigation stratified confounders and effect modifiers about exploration were found insignificant in gender (P=0.635) and hypertension (P=0.471), but age group (P=0.014), diabetes mellitus (P=0.0001), smoking status (P=0.018), and family history (P=0.014), a significant difference was found.

Following heart surgery, re-exploration for bleeding is still a common complication that can worsen outcomes including stroke, sepsis, sternal wound infection, hemodialysis, and extended hospital and intensive care stays [31, 32]. The number of patients having radiosurgery because of bleeding remains a significant issue despite significant advancements in intervention.

Heart surgeons are still concerned about postoperative bleeding and its potential to cause sternal infection following heart surgery [33–35]. In certain facilities, the re-exploration rate is still rising because of lower perioperative mortality, a rise in the elderly population in need of surgery, and an increase in the number of difficult procedures [33, 35, 36].

Cardiologists and anesthesiologists are very concerned about preventing and treating excessive bleeding during heart surgery since treating it entails hazards connected with exposure to allogeneic blood and substantial use of hospital resources. Preoperative exposure to strong anti-platelet medications that are already commonplace increases the risk of substantial bleeding [37, 38]. Given the safety concerns about antifibrinolytics, this risk is expected to rise even more.

Given its substantial mortality and morbidity, re-exploration following heart surgery is in this case the most feared bleeding-related complication [39, 40]. However, the increased baseline operational

risk of these patients may introduce bias into the findings regarding the adverse prognostic effect of reoperation for bleeding [41].

Conclusion:

In conclusion, the low rate of re-exploration was noted due to excessive bleeding in post-operative coronary artery bypass graft patients with a non-significant difference in body mass index. It is advised that further extensive research be done to validate the present findings.

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Table: 1 Descriptive Statistics of different variables n = 201

Variable	Mean±SD	Std.Error	95%ConfidenceIntervalfor Mean		Range	InterquartileRange	P-Value
			L. border	U. Border			
Age (years)	54.41±9.67	0.682	53.07	55.76	30-70	10	0.0001
Height(meter)	1.67±0.081	0.005	1.668	1.6906	1.55-1.82	0.15	0.0001
Weight (kg)	76.62±11.27	0.795	75.05	78.19	55-101	15	0.0001
Bodymassindex(kg/m^2)	27.27±4.36	0.307	26.66	27.8801	19.13-39.26	6.98	0.001
Durationofprocedure(min)	128.4±22.19	1.566	125.31	131.49	50-155	17	0.0001
Durationofhosp: stay(day)	8.14±2.21	0.156	7.84	8.45	3-12	3	0.0001

Table: 02 Frequencies of demographic and other variables

Variable		n(%)
Gender	**Male**	**151(75.1%)**
	Female	**50(24.9%)**
Diabetes Mellitis	**Yes**	**44(21.9%)**
	No	**157(78.1%)**
Hypertention	**Yes**	**115 (42.8%)**
	No	**86(57.2%)**
Familyhist:of coronaryartdis.	**Yes**	**44(21.9%)**
	No	**157(78.1%)**
Smoking	**Yes**	**92 (45.8%)**
	No	**109(54.2%)**
Re-exploration	**Yes**	**8(4%)**
	No	**193(96%)**

Table 03 Comparison ofre-explorationwith different variables (n=201)

Variables		Re-exploration		P-Value
		Yes	No	
BMI [kg/m^2]	**19–30**	5(2.5%)	137(68.2%)	**0.432**
	>30	3(1.5%)	56(27.9%)	
Gender	**Male**	6(3.0%)	145(72.1%)	**0.635**
	Female	2(1%)	48(23.9%)	
Age Groups	**30–55**	1(0.5%)	112(55.7%)	

	>55	7(3.5%)	81(40.3%)	**0.014**
Diabete	**Diabetes**	7(3.5%)	37(18.4%)	**0.0001**
	Non Diabetes	1(0.5%)	156(77.6%)	
Hypertension	**Hypertensive**	4(2.0%)	111(55.2%)	**0.471**
	Non-Hypertensive	4(2.0%)	82(40.8%)	
Smoking status	**Smoker**	7(3.5%)	85(42.3%)	**0.018**
	Non-Smoker	1(0.5%)	108(53.7%)	
Familyhistory withre-exploration	**Yes**	5(2.5%)	39(19.4%)	**0.014**
	No	3(1.5%)	154(76.6%)	