

**POST OPERATIVE BLEEDING IN PATIENTS UNDERGOING OFF PUMP ELECTIVE
CORONARY ARTERY BYPASS GRAFTING: INCIDENCE, RISK FACTORS AND
OUTCOME*****¹Dr. Pateel GNP, ²Dr. Poornima S., ³Dr. Sucharitha Das, ⁴Dr. Gayatri Chidanand**¹DA, DNB Anesthesiology, Junior Consultant, Rajshekar Multispecialty Hospital, JP Nagar Bangalore 560078.²MD Anesthesiology, Assistant Professor, Dept of Anaesthesia, Oxford Medical College, Anekal Bangalore.³DA, DNB Anesthesiology, Associate Consultant, Dept of Anaesthesia, Narayana Hrudayalaya Bommasandra, Bangalore.⁴MD Anesthesiology, Senior Resident, Dept of Anaesthesia, Indira Gandhi Institute of Child Health, Bangalore.***Corresponding Author: Dr. Pateel GNP**

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ABSTRACT

Back ground: We aimed to identify incidence, risk factors and outcome of post operative bleeding after off pump coronary artery bypass grafting. Many previous studies involved cardiac surgeries with cardio pulmonary bypass. We concentrated on isolated off pump elective CABG and its post operative bleeding incidence, risk factors and other adverse events due to the bleeding, because beating heart coronary bypass is popular and commonly used now days.

Methods: A Prospective, cross sectional, observational study conducted on 140 patients aged more than 18years at tertiary level super-speciality hospital in Bangalore.

Results: Post operative bleeding associated with high incidence of blood transfusion, redo surgery, higher duration of ICU stay and mortality ($p=0.003$). Predictors old age, DM, CKD, anemia, hypoalbuminemia, higher ASA and NYHA class, high EuroSCORE, poor ejection fraction were found to be strongest predictors of post operative bleeding with statistical significance and hence poor outcome.

Conclusion: Severe post operative bleeding in off pump CABG leads to more blood transfusion and redo surgery causing significant morbidity and mortality. Currently, prediction and identification of risk factors which associated with it helps better planning of patient management and reduction in morbidity and mortality.

KEYWORDS: Off pump CABG, post operative bleeding, redo surgery, predictors of post op bleeding.

INTRODUCTION

Bleeding in cardiac surgery is the most common manifestation leading to an increased risk of transfusion, morbidity and mortality.^[1] The proportion of patients undergoing coronary artery bypass graft surgery (CABG) that requires reexploration surgery for bleeding has been reported to be between 2% and 6%.^[2-4] Such patients are often haemodynamically unstable and require urgent or emergent re-sternotomy and are also at greater risk from the various hazards of blood and blood products transfusion.^[2] Cardiac surgery has an estimated 20% of the total blood transfusions^[5] of which 11% of the transfusions were utilized in-patients undergoing coronary artery bypass grafting (CABG). Allogeneic blood transfusion is known to cause multiple adverse effects. In cardiac surgery, it is found to cause increase in postoperative ventilator hours, sepsis, acute respiratory distress syndrome (ARDS), postoperative sternal wound infection, renal failure, and death.^[6] Higher mortality and increased morbidity from adverse events such as renal failure, increased length of stay, sepsis, and mortality

have all been related to postoperative bleeding.^[7-9] The first step towards creating algorithms to decrease blood loss and transfusion is to identify patients at high risk of bleeding, transfusion requirements and reoperation for bleeding.

Post operative bleeding^[8] Excessive or massive bleeding is defined as blood loss of 100 – 200 ml per hour, on average, for the first four hours, or more than 2 liters in 24 hours following surgery. Bleeding which causes significant fall in hematocrit and necessitates transfusion and/or re-exploration (redo) surgery. Same criteria applied in our study.

MATERIALS AND METHODS

STUDY SITE: The study was conducted in tertiary level super-speciality hospital in Bangalore.

STUDY POPULATION: Present study was conducted on 140 patients aged more than 18 years, of either sex, who were scheduled for elective isolated off pump CABG.

STUDY DESIGN: A Prospective, cross sectional, observational study.

SAMPLE SIZE WITH JUSTIFICATION: The percentage of patients undergoing off pump CABG in prolonged ventilation is 6%(2 to 6%)^[2-4], assuming the absolute precision is 4% and 95% confidence interval the minimum required sample size is 135

TIME FRAME OF THE STUDY: Study was done from December 2016 to June 2017.

INCLUSION CRITERIA

- 1) Both male and female patients aged more than 18 years.
- 2) American society of anesthesiologists (ASA) grade 2 to 4.
- 3) Posted for elective off pump CABG.

EXCLUSION CRITERIA

- 1) Patients undergoing emergency CABG.
- 2) Conversion of off pump CABG to on pump CABG on emergency basis.
- 3) Patients with other co-existing bleeding related abnormalities like low platelet, abnormal coagulation profile, abnormal liver functions and bleeding disorder.
- 4) Patients on chronic antiplatelet therapy who failed stop it before 5 days of procedure and patients on anticoagulation therapy.

METHODOLOGY

Informed written consent and institutional ethical committee clearance obtained. Anaesthesia and analgesia were standardized for all patients as per our institutional practice. All patients included in the study were pre-medicated with tablet Alprazolam 0.25mg and pantoprazole 40mg orally at night before surgery and they were kept nil oral 8 hrs before surgery.

Next day on arrival of patients in the operating room 16 gauge intravenous cannula and 20 gauge arterial line either in radial or femoral was inserted under local anesthetic infiltration and an infusion of Ringer or normal saline was started.

The patients were connected to multi-parameter monitor which records the HR, IBP, ECG and SPO₂. The baseline vital signs were recorded and baseline ABG was taken. Patients were induced with midazolam 0.1 mg/kg, fentanyl 5µg/kg, etomidate 0.1mg/kg and pancuronium 0.1mg/kg and patients were intubated with appropriate size cuffed endotracheal tube under direct laryngoscopy and patients were ventilated with volume control ventilation. Central line inserted in internal jugular vein preferably on right side for CVP monitoring, intravenous infusion. Initially ventilator settings were kept FiO₂- 0.4, tidal volume 6-8ml/kg, f-12-14/min, PEEP- 5 and ventilator settings were managed according to EtCO₂ and ABG status which is done every hour and whenever necessary.

Anesthesia was maintained with inhalational anesthetic isoflurane (1-2%). Analgesia and muscle relaxation was maintained with fentanyl 1microgm/kg bolus and pancuronium 0.02mg/kg bolus respectively every hour and whenever required. ECG, ST segment, SpO₂, EtCO₂, invasive BP, CVP, FiO₂, anesthetic gases, nasopharyngeal temperature and urine output were monitored continuously.

Norepinephrine (40µg/ml dilution) and nitroglycerin (NTG) (1mg/ml dilution) infusion were used depending up on blood pressure. Epinephrine (40µg/ml dilution) and dobutamine (5mg/ml) also were used whenever necessary. Sudden drop in blood pressure was managed with 50 to 100µg bolus of phenylephrine.

Anticoagulation while grafting was done with unfractionated heparin 2mg/kg bolus and 1mg/kg top up doses every hour. ACT while grafting maintained above 250. At the end of grafting anticoagulation was reversed with protamine 1:1 ratio. Before closing the chest made sure that ACT is less than 140. Duration of surgery, number of graft, transfusion are noted. Anticoagulation protocol was standard for all patients.

Blood transfusion was done when patient was haemodynamically unstable due to blood loss and /or hematocrit was less than 25 in ABG.

Surgical technique:-All of our study patient's CABG had been performed by the same groups of surgeons. The standard approach was median sternotomy. Left internal mammary artery (LIMA) and Reversed Saphenous Vein Graft (RSVG) were harvested. Our usual grafting was LIMA to LAD and RSVG to OM, RCA, PDA and others.

The exposure of the left anterior descending (LAD) artery and the mid portion of the right coronary artery (RCA) were simple as these arteries lie on the anterior surface of the heart. To improve the exposure and minimize the heart displacement, for the lateral and inferior vessels, the patient was kept in Trendelenburg position with the bed rotated toward the surgeon. Deep pericardial traction sutures were used to manipulate the heart and expose the coronary arteries. The stabilization of the anastomotic site was achieved with the aid of octopus tissue stabilizer.

After completing surgery patients were shifted to ICU continued ventilation with VCV and monitoring was continued with ECG, ST segment, SpO₂, EtCO₂, invasive BP, CVP, nasopharyngeal temperature, urine output and chest tube drainage. Analgesia maintained with fentanyl infusion 0.5 to 1µg/kg/hour. Adequate nutritional support was applied; Stress ulcer prophylaxis was achieved in all patients by intravenous H₂ receptor antagonists or proton pump inhibitors during the ICU stay. Chest physiotherapy was prescribed routinely as soon as possible for all patients postoperatively, even for

those who were still mechanically ventilated. And patients were extubated once they achieve extubation criteria. Patients were monitored for post operative bleeding.

STATISTICAL METHODS

The information collected regarding all the selected cases were recorded in a Master Chart in Excel sheet. The statistical analysis was performed by STATA 11.2 (College Station TX USA). The patients were divided in to two groups **GROUP A** with no or minimal post operative bleeding and **GROUP B** with significant post operative bleeding (meeting post operative bleeding criteria). Shapiro wilk test was used to find the normality.

Student's t-test or Mann Whitney test was used to find the significant difference between the age, ASA grading, NYHA classification, LVEF, Serum albumin, Euro score, number of vessels grafted, duration of surgery and its expressed as mean and standard deviation.

Chi square or fisher exact test was used to find the association between the gender, smoking, hypertension, diabetes mellitus, CKD, COPD, anemia, hypothyroidism, Recent MI, post op bleeding, transfusion and redo surgery and expressed as frequency and percentage. $p < 0.05$ considered as statistically significant.

RESULTS

A total number of 140 patients who underwent isolated off-pump CABG were studied. Among all 15(10.7%) patients were associated with post operative bleeding (GROUP B). Remaining 125(89.3%) patients showed no or minimal bleeding (GROUP A). Out of 15 patients in post operative bleeding group (GROUP B), 13(86.6%) patients required blood transfusion and 6(40%) patients underwent redo surgery in less than 48 hours. In GROUP A 9(7.2%) patients required blood transfusion, 12(9.6%) patients underwent reoperation. Blood transfusion and reoperation is high in GROUP B compared to the GROUP A (P value 0.0001). Patients in GROUP B required higher duration of mechanical ventilator support (38 ± 19.3 vs 12 ± 3.3 hours) and ICU stay (52 ± 21.64 vs 28 ± 5.8 hours) compared to the GROUP A patients and which is statistically significant. Mortality is higher in GROUP B compared to the GROUP A. [TABLE 1]

There were 121(86.43%) male patients and 19(13.57%) female patients. Male and female patients were comparable in both groups. We found association between post operative bleeding and older age, higher ASA and NYHA class, diabetes mellitus, chronic kidney disease, preoperative anemia, poor ejection fraction and low serum albumin levels. Euro score was significantly high in post operative bleeding group [TABLE 2]

TABLE 1: POST OPERATIVE BLEEDING AND ITS RISK

STATUS	GROUP A (no bleeding)	GROUP B (bleeding)	P	STATS
BLEEDING	125(89.28%)	15(10.7%)	<0.0001	S
Blood transfusion	9(7.2%)	13(86.6%)	<0.0001	S
REOPERATION	12(9.6%)	6(40%)	<0.0001	S
Duration of MV(hours)	12 ± 3.34	38 ± 19.33	0.0001	S
Duration of ICU(hours)	28 ± 5.8	52 ± 21.64	0.0001	S
MORTALITY	3(2.4%)	2(13.3%)	<0.0032	S

TABLE 2: PREDICTORS AND STATISTICS

SL	PREDICTORS	GROUP A(n=125)	GROUP B(n=15)	P
1	Age	54.53 ± 8.54	64.4 ± 8.03	0.0001(S)
2	ASA grade	3.17 ± 0.38	3.37 ± 0.49	0.02(S)
3	NYHA class Mean	2.13 ± 0.81	2.74 ± 0.81	0.006(S)
4	Euro score	1.87 ± 1.39	4.07 ± 2.25	0.0001(S)
5	Gender(f)	15(12.00%)	4(26.66%)	0.11(NS)
6	Smoker	56(44.8%)	7(44.44%)	0.97(NS)
7	HTN	54(43.2%)	9(60.0%)	0.26(NS)
8	DM	30(24.0%)	8(53.33%)	0.016(S)
9	CKD	22(17.6%)	6(40.0%)	0.04(S)
10	COPD	13(10.4%)	2(13.33%)	0.72(NS)
11	Anemia	33(26.4%)	9(60.0%)	0.007(S)
12	Hypothyroidism	15(12.0%)	3(20%)	0.38(NS)
13	Recent mi	20(16.0%)	4(26.66%)	0.30(NS)
14	LVEF	53.4 ± 7.35	49.81 ± 9.88	0.03(S)
15	Serum albumin	3.51 ± 0.44	3.15 ± 0.6	0.005(S)
16	Duration surgery(hours)	4.59 ± 0.89	4.55 ± 0.86	0.83(NS)
17	Number of graft	2.58 ± 0.86	2.81 ± 1.66	0.32(NS)

DISCUSSION

This study identified the incidence, risk factors and outcome of post operative bleeding after off pump CABG in 140 patients. Most of the previous studies were conducted on patients undergoing on pump CABG (CPB) and combined with valve repair and other cardiac procedures and emergency cardiac procedures. Our study involved only isolated off pumps elective CABG.

The prevalence of post operative bleeding in our sample (10.7%) was higher than the range found in the literature (2 to 6%).^[2-4]

Morbidity and mortality after cardiac surgery can be caused by excessive bleeding^[9] which is common and preventable cause. Studies reported around 2%–8% of patients taken back to operating rooms due to bleeding.^[10] In our study also we found that post operative bleeding causes significantly higher need for blood transfusion, need for reoperation and also need for higher duration of mechanical ventilator support and ICU stay. Morbidity and Mortality is higher in patients with post operative bleeding group.

Study by Mehta et al^[11] proved that bleeding in men is 1.39 times more likely than in women. In our study both men and women were equally distributed. Gender did not show any significant association with post op bleeding. The reason must be small sample size comparatively in our study.

Dacey and colleagues^[12] found in 305 patients requiring reoperation due to bleeding that older age and number of distal anastomosis were associated with re-exploration. They involved both off pump and on pump CABG. Older age group patients had significantly more post op bleeding in our study. But among our isolated CABG patients, our data showed that the number of grafts was not significantly associated with same.

Moulton and coworkers^[13] found that, in 253 patients with postoperative bleeding requiring reexploration age, renal insufficiency were independent predictors of need for early re-exploration. In our study age and chronic kidney disease were significant variables.

Interestingly we found that patients with DM have a significantly greater risk for reoperation due to bleeding which is not seen in other studies **Dacey and colleagues^[12]**, **Moulton and coworkers^[13]**

Previous investigations found preoperative anemia to be an independent risk factor of in-hospital mortality and morbidity after coronary artery bypass grafting (CABG) or valve surgery.^[14,15] Our study also showed that pre operative anemia associated with higher post operative bleeding and mortality.

There is a well-documented association between preoperative hypoalbuminemia and increased

postoperative morbidity and mortality in surgical patients^[16] and one previous study showed low albumin pre operatively increases post op bleeding from surgical site.^[17] In our study also low albumin levels associated with bleeding and poor outcome.

Karthik et al^[18] studied that patients undergoing **emergency CABG** found to have more post operative bleeding. Our study only involved patients undergoing **Elective CABG**. He also found in his study increasing age (consistent with our study) and increased number of grafts (not consistent with our study) associated with post operative bleeding and reoperation.

Previous studies have shown that CPB was associated with increased post op bleeding and blood transfusions.^[19-21] Our study involved only patients undergoing off pump (without CPB) CABG. Post operative bleeding was not affected by **longer duration of surgery** in our study.

Marked differences in reoperation rates between various study sites suggest that surgeon technique and not patient characteristics may play a greater role.^[22] In our study we included patients who underwent surgery by same surgical team and bleeding due to the vessel injury and other surgical errors were excluded.

We identified significant other pre-operative variables that were predictive for re-exploration due to bleeding including high ASA grade, NYHA class, low EF; high EuroSCORE. With respect to high EuroSCORE our study is consistent with **Fröjd V, Jeppsson et al.^[23]**

Katrine Lawaetz Kristensen^[24] showed that seven significant pre- and intraoperative variables that were predictive for re-exploration due to bleeding: low BMI; low EF; high EuroSCORE; preoperatively increased creatinine; DM; procedures other than coronary artery bypass graft surgery (CABG) and prolonged time on ECC. This study is most consistent with our study but they involved all kinds of cardiac surgeries with on and off pump surgeries.

We did not find any significant association between a medical history with hypertension, acute myocardial infarction, COPD, hypothyroidism and risk for post op bleeding and reoperation. These parameters should be analyzed in further studies with higher sample size.

CONCLUSION

Severe post operative bleeding in off pump CABG leads to more blood transfusion and redo surgery, higher duration of mechanical ventilator support and icu stay causing significant morbidity and mortality. This study also shows that some of the pre operative predictors are associated with post operative bleeding and redo surgery hence morbidity and mortality. Currently, prediction and identification of risk factors associated with it helps

better planning of patient management and reduction in morbidity and mortality.

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