

**POST OP PREDICTORS OF PROLONGED INVASIVE MECHANICAL VENTILATION
AND HOSPITAL STAY AFTER OFF PUMP CORONARY ARTERY BYPASS GRAFTING****¹Dr. Pateel GNP, ²Dr. Sucharita Das, ³*Dr. Shibu Sasidharan, ⁴Dr. Babitha M., ⁵Dr. Harpreet Singh Dhillon**¹DA, DNB, Consultant Anaesthesiologist, Rajshekar Multispeciality Hospital, 9th Cross, Sarakki, JP Nagar 1st Phase, Bangalore.²DA, DNB, Consultant Anesthesiologist, Department of Anesthesiology and Critical Care, Narayana Hrudayalaya, Bangalore.³MD, DNB, MNAMS; HOD (Anaesthesia); Dept of Anaesthesia and Critical Care, Level 3 UN Hospital, Goma.⁴DMRD, Consultant Radiodiagnosis, Department of Radiodiagnosis & Imaging, Ojas Hospital, Panchkula, Haryana.⁵MD, Psychiatry, Head, Dept of Psychiatry, Level III UN Hospital, Goma.***Corresponding Author: Dr. Shibu Sasidharan**

MD, DNB, MNAMS; HOD (Anaesthesia); Dept of Anaesthesia and Critical Care, Level 3 UN Hospital, Goma.

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ABSTRACT

Objective: The aim of this study was to analyze postoperative characteristics risk factors that associated with prolonged invasive mechanical ventilation and hence intensive care unit and hospital stay after off pump coronary artery bypass grafting. **Methods:** A Prospective, cross sectional, observational study was conducted on 140 patients aged more than 18 years at a tertiary level hospital in India. **Results:** Bleeding, redo surgery & prolonged duration of inotrope use were found to be strong predictors of prolonged medical stay and care with p values 0.03, 0.048, 0.0001 respectively. **Conclusions:** Strategies to delineate the patients at risk and to modify these risk factors by prophylactic measures should probably lead to a lower incidence of prolonged mechanical ventilation in patients undergoing isolated off pump CABG surgery.

KEY WORDS: Off Pump CABG, CABG, Risk Factors, Inotropes.**INTRODUCTION**

The last decade has seen significant advances in the treatment of coronary artery disease (CAD). Drug eluting stent and off pump CABG (OPCAB) are emerged as the alternative methods of coronary revascularization that avoids the use of cardiopulmonary bypass (CPB). The avoidance of CPB during OPCAB has made the operation equivalent to any other major non cardiac surgical procedure. This has led the cardiac anaesthesiologist to believe elective post operative ventilation may not always be necessary in these patients.

Prolonged mechanical ventilation (PMV), also known as delayed extubation, is an important complication following cardiovascular surgeries. Although occurs in only 3 to 9.9% of patients, it may be associated with considerable morbidity and mortality.^[1-3] A significant number of these patients will undergo tracheostomy.^[4] Patients who experience delayed extubation will have longer intensive care unit (ICU) and hospital stay, higher treatment cost and lower quality of life.^[5-8] Furthermore, it may lead to undue occupation of ICU beds leading to a lengthening of waiting list and cancellation of other elective cardiac operations.

PMV is most commonly defined as ventilation ≥ 24 hrs (Society of Thoracic Surgeons (STS) score), but has been variously defined as a cumulative duration of mechanical ventilation for ≥ 6 hrs, ≥ 8 hrs, ≥ 24 hrs, ≥ 72 hrs, or as long as ≥ 14 days.^[9-11] Majority of patients in the intensive care unit (ICU) are ventilated for few hours, **this study mainly concentrates on a group of patients who need ventilation for more than 24 hours.**

We defined PIMV as cumulative ventilation time of more than 24 hours believing that 24 hours is a sufficiently long time for hemodynamic stabilization and to off-set the deleterious effects of surgery. Moreover 24-hours cut-off limit for prolonged ventilation is also used in the STS database. Previous data have shown that mortality increases significantly in patients staying for ≥ 7 days in the ICU after cardiac surgery.^[12]

There are many complications associated with PMV, including vocal cord granulomas and ulcerations,^[13] oxygen toxicity, and local inflammation.^[14] Patients with prolonged mechanical ventilation experience worse physiological outcome due to atelectasis and intrapulmonary shunting.^[15] Respiratory failure and

pneumonia have been traditionally the leading causes of postoperative complications.^[16]

The clinical advantages of early extubation are mainly that it reduces the possibility of adverse effects of positive pressure ventilation and minimizes associated patient discomfort, potentially decreases the incidence of infection and facilitates early ambulation. The early extubation itself helps to reduce ICU stay and hospitalization cost.^[11]

Recent advances in anaesthesia, surgical techniques, myocardial protection, extracorporeal perfusion techniques, critical care protocols and improved perioperative management all had contributed to the success of early extubation and shorter hospitalization in the cardiac surgical population.^[17] In the last years cardiac anaesthesia has fundamentally changed from high-dose opiate based technique to a more balanced approach using moderate dose narcotics, inhalational agents, and shorter acting narcotics.^[18]

Thus, mainly due to financial constraints, the focus of cardiac anaesthesia started shifting in the early 1990's to lower dose opioids, earlier extubation and decreased ICU stay. This came to be labeled as 'Fast Track Cardiac Anaesthesia' (FTCA).^[19]

The aim of this study was to analyze postoperative characteristics risk factors that associated with prolonged mechanical ventilation and hence intensive care unit and hospital stay after off pump coronary artery bypass grafting. The risk factors included in our study were bleeding, transfusion, duration of inotrope support, redo surgery and tracheostomy.

MATERIALS AND METHODS

A) STUDY AREA: A tertiary level super-specialty hospital in India.

B) 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 coronary artery bypass grafting.

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

D) SAMPLE SIZE:

The percentage of patients undergoing off pump CABG in prolonged ventilation is 6% (3 to 9%), assuming the absolute precision is 4% and 95% confidence interval the minimum required sample size is 135

E) TIME FRAME OF THE STUDY: Study was done from April 1st 2016 to October 31st 2016.

METHODOLOGY

- As a standard policy of the unit all patients were explained the details of surgery and informed consent was taken.
- Anaesthesia and analgesia were standardized for all patients as per our institutional practice.

• INCLUSION CRITERIA

- 1) Patients willing to give informed written consent.
- 2) Patients age more than 18 years.
- 3) American society of anesthesiologists (ASA) grade 2 to 4
- 4) 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 difficulty airway.
- 4) Patients whose data is not accessible.
- 5) Patients with other co existing cardiac abnormalities like heart block, cardiac arrhythmias congenital heart disease, valve abnormalities, prosthetic valves, permanent pacemakers, ICD.

- 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 preoperative risk factors were noted, patients were induced with midazolam 0.1 mg/kg, fentanyl 5µg/kg, etimodate 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. 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 1mg/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 100 µg 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.
- Blood transfusion was done when patient was hemodynamically unstable due to blood loss and /or hematocrit was less than 25 in ABG. Preoperative blood transfusion was not included in the analysis.

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.
- 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 was maintained with fentanyl infusion 0.5 to 1 µg/kg/hour.\
- Once the patient is warm (temp > 35.50C), awake, conscious and cooperative, haemodynamically stable with minimal or no inotrope support and achieved good clinical neuromuscular recovery and chest tube draining is less than 50ml/hr., ventilator weaning was started with synchronized intermittent mandatory ventilation. Then patients were put on CPAP mode after slowly reducing the rate up to 8breath/minute in SIMV. Patients were extubated if arterial oxygen tension was > 70 mm Hg, arterial carbon dioxide tension was < 45 mm Hg and pH between 7.35 to 7.45 on CPAP with fractional inspired oxygen concentration less 0.5, for half an hour. And patients were extubated once they achieve extubation criteria. Those patients who could not be extubated in more than 96 hours and were expected to need PMV underwent surgical tracheostomy.

STATISTICAL METHODS

Patients were divided two groups GROUP A and GROUP B depending up on duration of mechanical ventilation.

Table 1 Mechanical Ventilation, Icu Stay, Hospital Stay.

	PARAMETER	GROUP A(n=113)	GROUP B(n=27)	P
1	Duration of MV(hours)	12±3.34	33±8.13	0.0001(S)
2	Duration of ICU stay(hours)	24±5.8	48±12.9	0.0001(S)
3	Duration of Hospital (days)	5±0.99	7±1.75	0.0001(S)

Table 2 Post Operative Predictors.

SL	PREDICTORS	GROUP A(n=113)	GROUP B(n=27)	P
1	Bleeding	9(7.96%)	6(22.22%)	0.03(S)
2	Redo surgery	5(4.42%)	4(14.81%)	0.048(S)
3	Duration-inotrope(hrs)	6.64±2.08	11.55±4.33	0.0001(S)

BLOOD TRANSFUSION:- In our study we observed blood transfusion intra-operatively and post operatively. Both intra operative and post operative blood transfusions were comparable in both groups and not associated with PMV.

- ✓ Similar results were observed with Totonchi *et al*²⁰ in his prospective observational study with 743 failed to find a predictive role of intraoperative transfusion for developing delayed extubation but it

GROUP A: Post-operative mechanical ventilation ≤ 24 hours.

GROUP B: Post-operative mechanical ventilation > 24 hours (PMV group)

Student's t-test or Mann Whitney test was used for to find the significance difference between the age, ASA grading, NYHA classification, LVEF, Serum albumin, Euro score, number of vessels grafted, duration of surgery, duration of inotropes support, duration of ICU stay, duration of hospital stay and with category of duration of ventilation and its expressed as mean and standard deviation.

Chi square or fisher exact test was used for to find the association between the gender, smoking, hypertension, diabetes mellitus, CKD, COPD, anemia, hypothyroidism, recent MI, bleeding, transfusion and redo surgery with Category of duration of ventilation and its expressed as frequency and percentage. p < 0.05 considered as statistically significance.

RESULT

There were 121(86.43%) male patients and 19(13.57%) female patients. Among all 27(19.28%) patients were associated with post-operative mechanical ventilation > 24 hours (GROUP B, PMV group). Remaining 113 patients were extubated ≤ 24 hours (GROUP A). Out of 27 patients in prolonged mechanical ventilation group, 3(11.11%) patients underwent tracheostomy. Following tables shows the results obtained in the present study:

showed post operative transfusion is associated with PMV

- Results were does not concur with our study in Suematsu *et al*,^[107] Cislighi *et al*^[21], who showed transfusion was one of the reasons for PMV.

BLEEDING:- In our study we found that post operative bleeding was associated with PMV and it was one of the most common reasons for redo surgery.

Similar results were found in the following studies

- ✓ Yende et al^[23] in his prospective observational study showed that post operative bleeding is associated with PMV and defined excessive post operative bleeding and same definition we used in our study.
- ✓ Wong et al^[24], Totonchi et al^[25], London et al^[26] which showed that postoperative excessive bleeding is an independent risk factor of prolonged mechanical ventilation.

INOTROPE SUPPORT:-In our study we found that GROUP B required longer duration of inotrope support compared to GROUP A and inotrope support was one of the reasons for PMV.

- ✓ Similar results were found with Wong et al,^[24] Totonchi et al^[25] who showed that inotrope dependency is one of reason for PMV

RE DO SURGERY (RE-EXPLORATION):- In our study we found that number of re do surgeries were more in GROUP B compared to GROUP A which is statistically significant. We also found that cause for most of the redo surgery was post operative excessive bleeding.

- ✓ Similar results were found with Natarajan et al^[27] Cislighi et al^[21] and Faritous et al showed that redo surgery was associated with PMV.

EURO SCORE:-In our study we found that mean EURO score is higher in GROUP B compared to GROUP A which is statistically significant and pre operative EURO SCORE helps to predict PMV along with mortality.

Similar observation were found with

- ✓ Sotirios N. Prapas et al^[28] found that Euro score was high in PMV group compared to early extubation group but not statistically significant.
- ✓ Saleh et al^[29] showed mean Euro score in PMV group was 4.9 compared to 2.4 in early extubation group and which was statistically significant.

Our study was not consistent with:

- Giakoumidakis et al^[30] did not observe any significant correlation between the duration of intubation and variables such as BMI, history of COPD, preoperative serum creatinine levels, type of surgery and EuroSCORE.
- EuroSCORE is known to correlate with an extended ICU stay but extended ICU stay may be sometimes not associated with prolonged ventilation.

LIMITATION OF THE STUDY

- 1) The observational nature of the study, the relatively small patients' sample which may affect the power of the study by increasing the chance of type II error (false negatives) and that it is a single centre study.
- 2) Most of the previous studies which we have used for reference were on "ON PUMP CABG" and only few studies were on off pump CABG. Our study tried to find risk factors for PMV in "OFF PUMP CABG" in the same way of previous studies.

- 3) We included only elective isolated off pump CABG cases but as per previous studies urgent surgery, was one of the reason for PMV. We failed to evaluate the same.
- 4) We did not include previous history of CVA or stroke, BMI and obesity in preoperative variables which were one of the risk factors for PMV according to some of the previous studies.
- 5) We did not provide quantitative data regarding the number of units of packed cell transfusion and/or the volume of postoperative mediastinal bleeding.

CONCLUSION

This study shows that post-operative bleeding, longer duration of inotrope support and redo surgery continue to be risk factors for PMV and hence prolonged ICU and hospital stay in patients undergoing off pump coronary bypass grafting. Strategies to delineate the patients at risk and to modify these risk factors by prophylactic measures should probably lead to a lower incidence of prolonged mechanical ventilation in patients undergoing isolated off pump CABG surgery.

CONFLICTS OF INTEREST

The authors have none to declare.

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