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Original Research Article

Operating room (OR) extubation after off pump coronary artery bypass grafting surgery: its feasibility and effect on post operative complication: a prospective study

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ABSTRACT

Background: The expansion of coronary surgery on the beating heart without cardiopulmonary bypass has led to increasing interest in ultra-fast track anesthesia, allowing extubation of the patient in the operating room. Ultrafast tracking of anesthesia (UFTA) is practiced routinely, whereas immediate on-table extubation after off-pump coronary artery bypass (OPCAB) grafting surgery has many concerns. The purpose of our study was to evaluate the safety and feasibility of Operating Room (OR) extubation.
Methods: Authors have conducted a study in 158 patients undergone OPCAB. Patients were observed carefully for their intraoperative behavior in terms of hemodynamics, urine output, requirement of inotropes, bleeding and body temperature and then selected for OR extubation. Post-operative complications such as bleeding, reoperation, re-intubation and ventilation, stroke, deep sternal infection and in-hospital mortality were checked. Serial ABG (Arterial Blood Gas) (pO_2, pCO_2 and O_2 saturation) was performed: preoperative, pre-extubation (OR), Intensive Thoracic Unit (ITU) on transfer and ITU 4 hours.
Results: Authors found OR extubation was safely feasible in 151 patients. 4 patients were reintubated and there were 2 in hospital mortality. None had deep sternal infection. The analysis of arterial Blood Gas revealed no significant changes between pre and post-operative values. All hospital survivors were discharged between 6th and 8th postoperative days.
Conclusions: Our results concluded that Operating Room (OR) extubation is feasible in the majority of patients undergoing OPCAB and the technique is safe, effective and does not increase post-operative complications.

Keywords: Artery bypass surgery, Arterial blood gas, Off pump coronary, Operating room extubation, Post-operative complication, Ultra fast track anesthesia

INTRODUCTION

The Concept of high quality and cost-effective management of cardiac surgical patients has lead to the development of Fast Track (FT) anesthesia and Operating Room (OR) extubation. To achieve this, protocols have been developed to provide safe, effective and rapid post-operative progression to the discharge of post cardiac surgery patients.[1] This approach has been practiced for more than two decades beginning back in the 1990's.[2]

For OR extubation anesthesia was modified from high dose of anesthetic drugs to short-acting anesthetic drugs and supplemented with Inhalation-based anesthesia, postoperative multimodal analgesia and maintenance of normothermia.[3] Patients and also their relatives have such psychological benefits. During the practice of OR extubation there should not be any compromise with the patient safety and quality of health care. Furthermore, we do not advocate the appropriateness of extubating every patient undergoing cardiac surgery; the factors that preclude OR extubation after Off Pump Coronary Artery Bypass Surgery (OPCAB) are bleeding, hypothermia, and cardiovascular instability which may lead to reintubation and increase in morbidity. Fast tracking and OR extubation in cardiac surgery is now an accepted technique due to improvement in resource utilization.[4] Present study of 151 patients confirms the feasibility and safety of OR in the patients undergoing OPCAB.

METHODS

The study was done from February 2013 to October 2015, total 186 patients had undergone OPCAB through median sternotomy under general anesthesia. Out of 186, 158 patients were included in this study. Exclusion criteria were patients with left main stenosis, Ejection Fraction (EF) <30%, with unstable hemodynamics, on intra-aortic balloon pump (IABP), with renal dysfunction, with associated valvular heart diseases, on inotropes, on temporary pacemaker, with intraoperative conversion to on-pump coronary artery bypass grafting (CABG), who are chronic smokers, and with chronic obstructive pulmonary disease. Out of 158 patients, 119 were males and 39 were females. Age ranges from 44 to 78years. Number of patients aged above 70years were 09.

All the patients underwent OPCAB surgery done by a single experienced surgeon. Left anterior descending artery was grafted with left internal mammary artery, and other coronaries were grafted with reversed saphenous vein conduits. Octopus was used as a retracting device during grafting. Patients were observed carefully for their intraoperative behavior in terms of hemodynamics, urine output, requirement of inotropes, bleeding and body temperature and then selected for OR extubation. Intraoperatively, patients were monitored by five-lead electrocardiogram with ST analysis, central venous pressure monitoring, invasive arterial pressure monitoring, pulse oximetry, end-tidal carbon dioxide monitoring, urine output, and nasopharyngeal temperature monitoring. Our general anesthesia (GA) protocol included induction dose of thiopentone sodium, rocuronium and fentanyl citrate, maintenance doses of pancuronium or vecuronium and fentanyl with reversal by pyrolate and neostigmine combination.

Peri-operative variables included diabetes, hypertension, COPD, Renal impairment, LV ejection fraction, serial blood gas analysis, Post-operative complication such as bleeding, reoperation, reintubation and ventilation, stroke, deep sternal infection and in hospital mortality. Serial ABG (pO_2, pCO_2 and O_2 saturation) were performed: preoperative, pre-extubation (OR), Intensive Thoracic Unit (ITU) on transfer and ITU 4 hours.

Utmost care was taken to maintain the patient's body temperature within normal limits. Therefore, the ambient temperature inside the OR was maintained between 20°C and 22°C. Furthermore, temperature monitoring was done vigilantly so as to facilitate conditions to allow OR extubation. In operating room active temperature control was done with heated water mattress beneath the patient, warm IV fluids, minimum room temperature around 22°C and OT temperature not allowed to drift down excessively. Furthermore, all the measures to avoid hypothermia were exercised postoperatively in the ICU also like patient covered properly, use of forced-air body warmer and fluid warmer.

Extubation criteria were as follows: a conscious alert patient with spontaneous eye opening and obeying commands, sustained head lift for 5 seconds or more, SpO2>98% with FiO_2<60%, $EtCO_2$<45mmHg, stable hemodynamics with minimal inotropes, no arrhythmias, no hypothermia, and normal arterial blood gas (ABG) analysis report. These criteria are summarized in Table 2.

RESULTS

Total of 158 patients were included in the study. The basic characteristics of the group of patients are shown in Table 1.

Table 1: Demographic data.

Variables	Value
Male/Female (n)	119/39
Age (y) mean (range)	61(44-78)
Hypertension	111 (70.25%)
Diabetic mellitus	62 (39.24%)
NYHA class	
Class I	8
Class II	126
Class III	20
Class IV	4
Left ventricle ejection fraction	
30-40%	21
41-50%	45
51-60%	68
61-and above %	24
Number of graft	
One	7
Two	21
Three	72
Four	47
Five	11
Average number of graft per patient	3.2

OR extubation was safely feasible in 151 (95.57%) patients out of 158 patients: in 7 patients OR extubation was not considered because of ineffective spontaneous breathing (no=3), need for emergency CPB conversion (no=2), need for IABP (no=2).

Out of 151 patients total 4 (2.65%) patient required reintubation. 2 for mediastinal bleeding. Both patients were reintubated within 1 hr of first operation and extubated again 4 hr after the end of revision surgery. One patient required reintubation 12 hours post operatively for hemodynamic instability and hypoxemia. One patient reintubated for confusion and loss of cooperation. There were 2 in-hospital deaths (1.32%; peri-operative stroke=1, delayed respiratory insufficiency=1).

Average number of grafts = 3.2 per pts (Table 2). None had deep sternal infection. Minor superficial skin infection developed in 6 (3.97%) patients. The analysis of arterial pO_2, pCo_2 and SpO_2 revealed no significant changes between pre and post-operative result. All hospital survivors were discharged between 6 and 8 postoperative days.

Table 2: Criteria for suitability for extubation in the operating room.

Criteria	Suitability for Extubation
Hemodynamics	Normotensive, heart rate <120, normal ECG
Lung function	PaO_2 >80mmHg, $PaCO_2$ <45 mm Hg at $FiO_2$0.5, Respiratory rate <30/min, Tidal Volume>5ml/kg, PEEP <5mmH_2O
Muscle strength	Spontaneous ventilation, head lift
Consciousness	Full contact with the patient responsive to simple commands
Surgical complication	Bleeding <100ml within last 30 minutes

PaO_2 = Partial Pressure of oxygen in Arterial Blood; $PaCO_2$ = Partial Pressure of Carbon dioxide in Arterial Blood; FiO_2 = Fractional concentration of oxygen; PEEP = Positive End Expiratory Pressure

DISCUSSION

With the recent advancement in anesthesia, surgery, cardiopulmonary bypass technique, myocardial protection, hemodynamic monitoring and postoperative analgesia several authors have promoted operation room (OR) extubation after on-pump cardiac surgery and observed reduced resource utilization, mortality rate and postoperative complication.[3,5-7]

Performing coronary surgery on the beating heart without cardiopulmonary bypass (OPCAB), increases roll of ultra-fast track anesthesia in cardiac surgery, allowing extubation of the patient in the operating theater. Early extubation (generally within 6-8 hours of surgery) was triad in the late 1990s. Extubation within 6 hours of surgery is considered standard of care for most patients, with the evaluation of ultra fast track anesthesia and On table or Operative Room (OR) extubation; 6 hours now seems a rather long intubation time for the average patient. Both terms implying extubation of cardiac surgical patients in the operating room (OR) table or within one hour of the end of surgery.

The core principles of ultra fast track anesthesia (UFTA) and OR extubation are choice and titration of short-acting anesthetic drugs and opioid-based anesthesia, postoperative normothermia, multimodal analgesia, early extubation, ambulation and early discharge.[8]

Royes et al, studied 109 consecutive patients under gone cardiac surgery, 100 patients were immediately extubated (92%) no patient required reintubation within the first 24 hours after operation.[3]

To allow rapid emergence, anaesthesia was modified from high dose technique to intravenous propofol anaesthesia supplemented with Inhalation-based anesthesia, sevoflurane. They also used intraoperative transe esophageal echocardiography to allow direct visualization of left ventricular filling, detection of abnormal ventricular function and detection of ischemia determined by new regional wall motion abnormality which helps identify patients who are unsuitable for OR or early extubation. At the end of the operation, if the patient is warm, not bleeding, hemodynamically stable and meets standard extubation criteria, patient can be extubated on the table.

Dorsa et al, reported on a large case series of 1196 patients undergoing Off Pump Coronary Artery Bypass (OPCAB) through a Standard Sternotomy incision.[9] About 20% of patients had moderate to severe left ventricular dysfunction. In all, 89% of patients met extubation criteria and were successfully extubated in the OR within about 15 minutes of skin closure. Independent predictors of OR extubation not being attempted were renal failure, Preoperative intra-aortic balloon pump, Redo operations and long surgical time.

Gangopadhyay et al, showed that patients extubated in the OR were awake immediately after surgery and had less chest infection compare to ventilated group.[4] Compared to conventional techniques, the potential benefits of early extubation in OR after cardiac surgery were reduced airway and lung trauma, improved cardiac output and renal perfusion with spontaneous respiration, reduced stress and discomfort of endotracheal tube suctioning and weaning from ventilation. There was no need for sedative drugs, ventilator disposables could be avoided, and patients were transferred to lower dependency ward early from post anaesthesia care unit.

Edgerton et al, observed that patients immediately extubated after off pump coronary artery bypass grafting had a reduced incidence of atrial fibrillation, shorter length of hospital stay and also reduced mortality.[10]

Borracci RA et al, successfully achieved extubation in the operating room in 87.1% of patients undergoing off pump coronary revascularization.[11] They concluded that preoperative and operative factors associated to failed extubation could be used as guidelines to improve safety in ultra fast track cardiac anesthesia; especially patients undergoing on-pump surgery with antecedent of heart failure or difficult cardiopulmonary bypass weaning should not be extubated in the operating room. In the same way, immediate extubation should be avoided in the obese patients with the hemodynamic compromise during off-pump coronary surgery.

Low dose OPD based general anaesthesia and time directed extubation protocols for fast track interventions have risk of mortality and major postoperative complications similar to dose of conventional non Fast track care and therefore appears to be safe for use in patients considered to be at low to moderate risk these fast track interventions reduces time to activation short pant length of stay in the Intensive Care Unit but did not reduce the length of stay in the hospital.[12]

The most common cause of reintubation is re-exploration for bleeding.[9] The success rate of OR extubation largely depends on maintaining normothermia.[13] Benefits of normothermia include normal postoperative respiratory efforts, acid–base balance, drug metabolism and mental status. Shivering is always a potential problem in the postoperative period that causes an increase in myocardial oxygen demand; the results have shown that by maintaining normothermia throughout the operation, shivering is an uncommon event.[3]

Singh KE et al, has emphasized on psychological benefits of OR extubation.[14] many patients fear being putting on ventilator postoperatively. As few as 4hours of postoperative ventilation causes more mental depression on postoperative day 3. If OR extubation is possible, at a minimum, patient is saved of psychological trauma.[7] Patients and also their relatives have such psychological benefits.

In present study authors included comparatively healthy and less morbid patient hence we could achieve OR extubation in majority of patients (97.57%). Authors do not advocate the appropriateness of extubating every patient undergoing cardiac surgery; some common exclusion criteria or patients' factors that have prevented the OR extubation include morbid obesity, severe respiratory disease airway, significant inotropic support or IABP pre-operatively, severe pulmonary hypertension and redo operations. Nearly all studies emphasize the importance of normothermia, Hemodynamic stability, pain control, absence of excessive bleeding or chest tube drainage and meeting standard extubation criteria prior to extubating in the OR.

Limitation of our study is that the patients included were less morbid, and hence, OR extubation was feasible in majority of OPCAB patients in our study. Authors have not used trans esophageal echocardiography. Bispectral index monitoring was not done to exclude intraoperative awareness.

CONCLUSION

OR extubation is feasible with an awake, warm, pain-free, and hemodynamically stable patient, and therefore, we emphasize the importance of normothermia, hemodynamic stability, analgesia, no bleeding, and meeting standard extubation criteria to be advocated stringently to perform OR extubation in OPCAB patients. Furthermore, strict adherence to the "select" group of patients is necessary for the success of OR extubation without increase in morbidity and mortality. With this, OR extubation can be safe and effective in OPCAB patients without any major complications; however, more clinical trials are necessary.

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REFERENCES

1. Swaminathan M, Phillips-Bute BG, Patel UD, Shaw AD, Stafford-Smith M, Douglas PS, et al. Increasing healthcare resource utilization after coronary artery bypass graft surgery in the United States. Circulation: Cardiovascular Quality Outcomes. 2009 Jun 16:108.
2. Hawkes C, Foxcroft DR, Yerrell P. Clinical guideline for nurse-led early extubation after coronary artery bypass: an evaluation. J Advanced Nursing. 2010 Sep;66(9):2038-49.
3. Royse CF, Royse AG, Soeding PF. Routine immediate extubation after cardiac operation: a review of our first 100 patients. Ann Thoracic Surg. 1999 Oct 1;68(4):1326-9.
4. Gangopadhyay S, Acharjee A, Nayak SK, Dawn S, Piplai G, Gupta K. Immediate extubation versus standard postoperative ventilation: Our experience in on pump open heart surgery. Indian J Anaesthesia. 2010 Nov;54(6):525-30.
5. Oxelbark S, Bengtsson L, Eggersen M, Kopp J, Pedersen J, Sanchez R. Fast track as a routine for open heart surgery. Eur J Cardio-thoracic Surg. 2001 Apr 1;19(4):460-3.
6. Hemmerling TM, Choinière JL, Fortier JD, Prieto I, Basile F. Immediate extubation after aortic valve surgery using high thoracic epidural anesthesia: a pilot study. Anesth Analg. 2003;97:601.

7. Hemmerling TM, Prieto I, Choinière JL, Basile F, Fortier JD. Ultra-fast-track anesthesia in off-pump coronary artery bypass grafting: a prospective audit comparing opioid-based anesthesia vs thoracic epiduralbased anesthesia. Canad J Anesthesia. 2004 Feb 1;51(2):163-8
8. Kandasamy A, Ramalingam SK, Simon HA, Arumugham S, Reddy BD, Krupananda H. Ultra fast-tracking versus a conventional strategy in valve replacement surgery. Indian J Anaesthesia. 2013 May;57(3):298-300.
9. Dorsa AG, Rossi AI, Thierer J, Lupiañez B, Vrancic JM, Vaccarino GN, et al. Immediate extubation after off-pump coronary artery bypass graft surgery in 1,196 consecutive patients: feasibility, safety and predictors of when not to attempt it. J Cardiothoracic Vascular Anesth. 2011 Jun 1;25(3):431-6.
10. Edgerton JR, Herbert MA, Prince SL, Horswell JL, Michelson L, Magee MJ, et al. Reduced atrial fibrillation in patients immediately extubated after off-pump coronary artery bypass grafting. Ann Thoracic Surg. 2006 Jun 1;81(6):2121-7.
11. Borracci RA, Dayán R, Rubio M, Axelrud G, Ochoa G, Rodríguez LD. Operating room extubation (ultra fast-track anesthesia) in patients undergoing on-pump and off-pump cardiac surgery. Arch Cardiol Mexico. 2006;76(4):383-9.
12. Wong WT, Lai VK, Chee YE, Lee A. Fast-track cardiac care for adult cardiac surgical patients. Cochrane Database Syst Rev. 2016 Sep 12;9:CD003587.
13. Hemmerling TM, Romano G, Terrasini N, Noiseux N. Anesthesia for off-pump coronary artery bypass surgery. Ann Cardiac Anaesth. 2013 Jan 1;16(1):28-39.
14. Singh KE, Baum VC. Pro: early extubation in the operating room following cardiac surgery in adults. Semin Cardiothorac Vasc Anesth. 2012 Dec;16(4):182-6.

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