REVIEW ARTICLE

Changing anesthesia trends in cardiothoracic surgeries: a fast changing perspective

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ABSTRACT

Off late, many complicated procedures are being performed throughout the globe in cardiothoracic surgery departments. Many of these advancements can be attributed to advancements in anesthesia techniques, availability of newer and safer anesthetic drugs. However, such role has never been stressed upon whereby advancements became possible in cardiothoracic surgeries. However the journey of advancements and refining of surgical and anesthetic techniques is never ending. The current narrative review throws light on the facts due to which cardiothoracic surgery has become highly safe.

Key words: Cardiothoracic surgeries; Off-pump coronary artery bypass; Fast-track management; Thoracic Epidural Anesthesia

Citation: Bajwa SJS, Kaur J, Khanna M. Changing anesthesia trends in cardiothoracic surgeries: a fast changing perspective. Anaesth Pain & Intensive Care. 2016;20 Suppl 1:S136-S139

Received: 19 July 2016; **Reviewed:** 29 August 2016; **Corrected:** 5 September 2016; **Accepted:** 10 September 2016

INTRODUCTION

Cardiac surgery as well as cardiac anesthesia has come a long way since the performance of the first human open heart surgery by John Gibbon in 1952.[1] The surgical techniques and the equipment required for cardiac procedures have also undergone great refinement. In the early days of cardiac surgery, a non-disposable Melrose rotating drum oxygenator was used for maintaining the extra-corporeal circulation (ECC). It had to be dismantled for cleansing and chemical sterilization, which led to long delays between consecutive surgical procedures. The primitive oxygenators and the surgical techniques necessitated the arrangement of around 18 points of donor blood for the priming of the ECC as well as for the transfusion in the post-operative period, which is unrealistic in the present scenario. The availability of better epicardial tissue stabilizers paved the way for the successful commencement of Off Pump Coronary Artery Bypass (OPCAB) in 1961,[2] eliminating the side- effects of cardiopulmonary bypass. Furthermore, the refined small intracoronary shunts prevent carbon-dioxide embolization into the coronary arteries, prevent intra-operative ischemia and decrease the blood loss during coronary anastomosis in OPCAB.

OPCAB - A BOON FOR CARDIOTHORACIC SURGERY

Due to avoidance of the cardiopulmonary bypass, OPCAB is associated with reduced Systemic inflammatory response syndrome as compared with CABG.[3] Hemodilution is avoided and the coagulation cascade is well preserved in OPCAB, resulting in reduced peri-operative blood and blood products requirements. But, recently a hypercoagulable state has been described after OPCAB. So, it is recommended to use clopidogrel

and aspirin after OPCAB surgery.[4] The incidence of neurologic, pulmonary and renal dysfunction is also reduced after OPCAB.[5-10] Clinical studies have shown that the degree of myocardial injury as assessed by biochemical markers is reduced after OPCAB as compared to CABG.[8,11-13] Thus, OPCAB offers reduction in duration of ventilator support, length of ICU stay and early hospital discharge.

The availability of better anesthetic drugs, improved monitoring gadgets and surgical techniques have led to the changing trends of anesthesia practice in cardiothoracic surgery, from the pre-operative assessment and optimization of the patient to induction of anesthesia, intra-operative monitoring, extubation and discharge of the patient. The advent of OPCAB demanded the cardiac anesthesiologist to be more vigilant for skillful management of the hemodynamics.

PERI-OPERATIVE MEDICATIONS

Continuing β-blockers till the time of surgery have been shown to decrease the peri-operative mortality.[14] The use of these drugs is being encouraged in the post-operative period as well along with the use of aspirin, statins and angiotensin-converting enzyme (ACE) inhibitors. The American College of Chest Physicians in a consensus conference on antithrombotic and thrombolytic therapies has recommended institution of aspirin within 6 hours after CABG over continuation of pre-operative therapy.[15] ACE inhibitors and statins are being recognized for their "pleotropic effects". Both the agents have been shown to have beneficial effects on the endothelial function, potent anti-inflammatory effects and a doubtful role in angiogenesis. ACE inhibitors help in ventricular remodeling after acute myocardial infarction and reduce damage after ischemic reperfusion. The circulating levels of adhesion molecules which are implicated in the endothelial dysfunction after CBP are reduced with the peri-operative use of statins.

Contribution of anesthetic drugs in cardiothoracic surgery advancements

Inhalational Agents

Prospective randomized clinical studies have shown favorable properties of inhalational agents in patients undergoing CABG surgery. The use of volatile anesthetic agents is recommended over total intravenous anesthesia practices particularly in patients at high risk for ischemic events.[17] With the routine practice of fast-track anesthesia, inhalational agents are being used as primary anesthetics for cardio protection. Opioids and benzodiazepines are related to "supplemental status". Sevoflurane is being preferred in cardiac anesthesia due to its favorable hemodynamic effects and cardio protective properties. It has been shown to be potent trigger for pre-conditioning cascade.[18] The use of inhalational agents during cardiac surgery (including CPB) has now been recognized to reduce the incidence of awareness.[19]

Neuromuscular blocking agents

Conventionally, pancuronium had been the neuromuscular relaxant of choice along with high-dose narcotic techniques, because of its long duration and the tendency to offset opioid – induced bradycardia. But, with the practice of fast-track anesthesia, the use of shorter acting blocking agents such as rocuronium is being encouraged to avoid residual paralysis and allow early extubation. Also, the use of neuromuscular transmission monitoring to assess residual paralysis and use of pharmacological reversal agents is recommended in fast-track anesthesia techniques.

INTRA-OPERATIVE MONITORING

Along with the use of routine invasive monitoring, cerebral monitoring with BIS (BiSpectral Index) / Entropy is increasingly being encouraged in cardiac anesthesia for the higher risk of awareness and recall, particularly with fast-track techniques and for better titration of anesthetic drugs. But, the efficacy remains controversial. Intra-operative TEE is helpful in guiding the anesthesiologist (fluid administration, verification of PAC in proximal pulmonary artery) as well as the surgeon (verification of retrograde cardioplegia cannula, placement of left ventricular vent, IABP tip relative to arch vessels and detection of new ischemic changes. The trend of using pulmonary artery catheters has evolved over the past two decades from steadily increasing use in the 1980s and 1990s to relatively lower use now. Various clinical trials have suggested that despite the substantial amount of physiologic information obtained, major clinical outcomes remain the same with the use of PAC. Based on the existing literature it is not possible to give precise criteria for use of a PA catheter in CABG.[20] The higher the patient risk (based primarily on established preoperative clinical predictors), the more favourable is the risk-benefit ratio. Risk factors include the following (Table 1):

Table 1: Risk factors associated with poor prognosis

No.	Risk factors
1.	Significant impairment of ventricular function (EF < 40%, evidence of acute or chronic congestive heart failure, known elevation of left ventricular end-diastolic pressure (LVEDP) on preoperative catheterization, need for preoperative intra-aortic balloon pump (IABP), acute or chronic severe mitral regurgitation due to ischemia, ventricular septal defect after myocardial infarction, or other mechanical complications).
2.	High risk for intraoperative ischemia or difficult revascularization (i.e., recent, large myocardial infarction or severe unstable angina, known poor revascularization targets or severe microcirculatory disease, reoperation, catheterization laboratory PCI "crash").
3.	Severe comorbidities (e.g., renal failure, on or approaching need for dialysis; severe chronic obstructive pulmonary disease).
4.	Combined procedures that significantly lengthen duration of surgery or add significant blood loss (e.g., CABG-carotid, other vascular procedures).

FAST-TRACK MANAGEMENT

Fast-track management with early extubation (4 to 8 hours post-operatively) has been adopted as the standard practice in nearly all cardiac centers. However, there is relatively little change in the anesthetic management of the sick cardiac patients as well patients undergoing complex surgical operations for multi-vessel disease combined with valve repair or replacement, VSD repair along with CABG after acute MI and for patients undergoing repeat surgeries, over the past decade. The long duration of surgeries as well as critical hemodynamics in such procedures usually mandates overnight or even prolonged post-operative mechanical ventilation.

Thoracic Epidural Anesthesia

There has been resurgence in interest in the use of thoracic epidural anesthesia (TEA) for cardiac surgery in the past 15 years. Thoracic sympathectomy with coronary vasodilating effects have been well appreciated since long. Good post-operative analgesia with TEA helps in fast-tracking and early ICU discharge. It is frequently used as a supplement to general anesthesia for cardiac surgery, particularly in Europe and Asia.

CONCLUSION

The advancements in cardiothoracic surgery have been largely possible due to advancements in anesthetic techniques and availability of newer drugs. However the journey of advancements and refining of surgical and anesthetic techniques is never ending. In future we may see more advancement in this field which can help in serving the mankind better.

Conflict of interest: No conflict of interest with anyone

Authors' contribution: SJSB & CS: Concept, Design, Literature search, Data acquisition, Manuscript preparation & review

MK: Literature search, Manuscript preparation & review

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