Selective Early Extubation in Pediatric Cardiothoracic Surgery

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Abstract

Background: Early extubation after cardiac operation is an important aspect of fast-track cardiac anesthesia. In order to reduce or eliminate the adverse effect of prolonged ventilation the concept of early extubation in pediatric age group has been examined at our institution.

Material and Methods: To allow rapid emergence, low-dose opioids modified anesthesia and continuous infusion of propofol supplemented with low concentration of inhaled agent were used. Intercostal nerve block was used in lateral thoracotomies. Contraindication to early extubation were prolonged cardiopulmonary bypass (CPB) (>2.5 hours), hemodynamic instability, uncontrolled bleeding, severe pulmonary hypertension and congestive heart failure.

Results: Of 82 consecutive patients, age ranging from 6 mon-14 yr, mean of 3.3 yrs. Extracardiac procedures in 15 cases (18.3%) and those on CPB were 67 (81.7%). No patient required reintubation during the first 24 hrs after operation. One patient was reintubated 48 after extubation for sputum retention. There was no mortality and the incidence of perioperative morbidity was low.

Conclusion: Early extubation after pediatric cardiothoracic surgery can be safely achieved and is possible in the majority of patients.

Key Words: Selective – Extubation – Pediatric – Cardiothoracic – Surgery.

Introduction

The Escalating numbers of patient requiring cardiac surgery, efficient use of the limited facilities of fast-track cardiac anesthesia and efficient resource utilization has resulted in the adoption of early tracheal extubation techniques in cardiac surgery [1,2]. Early extubation has been documented in adults [3] and children [4,5] to avoid the potentially deleterious effects of mechanical ventilation, including laryngotracheal trauma, barotraumas or pneumothorax, mucus plugging, incorrect positioning or kinking of endotracheal tube, accidental extubation, infection and pulmonary hypertensive crises secondary to manipulation or suctioning of the endotracheal tube [6]. In addition, the postoperative use of sedation and analgesic drugs to facilitate tolerance of the endotracheal tube may also prolong the duration of intubation [6].

In order to reduce or eliminate the adverse effect of prolonged intubation, the concept of early extubation (in our study, either in the operating room or within one hour in the ICU) in pediatric age group has been examined at our institution.

Material and Methods

This is a prospective study on 82 consecutive pediatric age group of patients under cardiothoracic surgery between Oct., 2005 and Feb., 2007. Complex congenital heart disease, prolonged CPB >3.5 hours and neonates were excluded from the study.

The essential aspects of early extubation include: Choice of anesthetic agents, hemodynamic stability and postoperative analgesia.

The premedications were: Mediazolam 0.07-0.1mg/kg IM 30-50 min before induction of anesthesia.

Patients were induced with midazolam (0.1-0.1mg/kg), fentanyl (5-10mcg/kg) and pancuronium (0.1mg/kg). Maintenance anesthesia consisted of low dose of fentanyl 1-2mcg/kg and a low concentration of inhaled agents may be added as clinically indicated along with midazolam (0.1mg/kg), in addition propofol infusion (2-5mg/kg/hr).

Muscle relaxant was not used after the first dose unless there was patient movement.
Meticulous myocardial protection during aortic cross clamp is a necessary prerequisite for stable myocardial function after CPB.

In absence of severe pulmonary dysfunction, hemodynamic instability, excessive bleeding or anatomic concerns regarding the airways, the patient neuromuscular blocked is reversed at the conclusion of surgery and the patient is allowed to be awaken. Upon evidence of adequate ventilatory effort and satisfactory gas exchange, the patient is extubated either immediately in the operating room or within one hour in the ICU.

Post operative vital signs, EKG, CXR, blood gases and signs of low cardiac output were monitored in each patient in the ICU.

Postoperative pain was managed using either fentanyl 0.1mcg/kg/hr in incremental doses indicated, mepridine (pethidine) 0.5-1.0mg/kg IM or Acetaminophen/diclofenac suppositories per need. All lateral thoracotomies received intercostals nerve block.

In the ICU, inotropes and O2 requirements were provided accordingly.

**Results**

Of the 82 patients, 62 (75%) males and 21 (25%) females, age between 6 mon-14 yrs with a mean age of 3.3 yrs. Extracardiac procedures were 15 (18.2%) (including Blalock-Taussig shunt 10 cases, division of PDA 4 cases and division of vascular ring one case). Those on CPB 67 (81.7%) have a CPB time ranging from 27-60 min, mean of 45.7 min. Aortic cross clamp time ranging from 15-35 min, mean of 25.8 min.

All patients continued to have normal sinus rhythm in the ICU with evidence of right bundle branch block in the right ventriculotomy patients.

Concerning postoperative analgesia, 14 (17%) didn't require medications, 54 (66%) required paracetamol/diclofenac suppository only, 27 (33%) required mepridine injection, 5 (6%) required fentanyl beside paracetamol/diclofenac suppository.

None of the patients were reintubated during the first 24 hr post extubation in the ICU, one patient was reintubated after 48 hrs due to retention of secretions that was cleared out later.

There was no mortality and the incidence of perioperative morbidity was low.

**Discussion**

Postoperative ventilation of patients undergoing cardiac surgery has been standard practice for the past three decades [7]. Initially, it was justified because of relatively high incidence of respiratory insufficiency or low cardiac state after cardiac operation and the utmost of a high-dose anesthetic technique [7]. This practice has been a driving force for fast-tract cardiac anesthesia [3,8].

It is felt that patients who are extubated early have shorter ICU and hospital stay and therefore lower cost of care [10].

The potential benefits of early extubation include cost saving [7], lower nursing dependency, reduced airway and lung trauma [11], improved cardiac output and renal perfusion with spontaneous respiration [12] as well as the reduced stress and discomfort of endotracheal suctioning and weaning from the ventilator [13].

The opponents to early extubation argue that the immediate perioperative period is the most critical for myocardial ischaemia, haemodynamic instability and sympathetic nervous system activation [14]. The concern of immediate or early extubation is the possibility of reintubation and ventilation for respiratory failure in the immediate postoperative period. The low incidence of perioperative morbidity in this series suggest that our techniques may overcome these limitations.

Neonates and early months of infancy were excluded from the study because they are at a tremendous disadvantage when it comes to their base line respiratory function. Neonatal lungs behave physiologically like geriatric emphysematous lungs. They are overly compliant and prone to premature airway closure [15]. The respiratory muscle fibers of infants are less endurance oriented and fatigue resistance than adults and are prone to muscle fatigue, respiratory control is also immature and do not respond to hypoxia and hypercarbia as adults.

The immature myocardium of neonates is more susceptible to ischaemia as demonstrated in some studies and recovers slowly from the insult of surgery and cardiopulmonary bypass [16].

In this series, no patient required reintubation in the first 24 hrs post operation, the chances of requiring reintubation will be increased if the patients are hemodynamically unstable, cold, hypovolumic, or requiring considerable opiate medications [15]. The challenge is to deliver a stable,
warm, euvoletic, angesed and awake patient at the completion of surgery, clearly this is possible in the majority of patients undergoing cardiac operation.

Conclusion:

Early extubation after pediatric cardiothoracic surgery can be safely achieved and is possible in the majority of patients provided that all parameters are indicative of safe extubation.

The younger the age of the patient the difficulty decision of early extubation will be. But excluding neonates and early infancy would make it easier decision to take provided that the abovementioned policy followed.

References