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Safe and effective anaesthesia during paediatric rigid bronchoscopy: An experience at a tertiary care centre of Eastern India

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ABSTRACT

Objective: Paediatric rigid bronchoscopy is always a challenging situation for anaesthetist and surgeon. Maintaining adequate ventilation and oxygenation is difficult as pulmonary gas exchange is reduced due to obstruction of airway by foreign body (FB). This study evaluates safe and effective anaesthesia during paediatric rigid bronchoscopy. **Study design:** A retrospective study. **Methods:** We report a study of nine children who had undergone rigid bronchoscopy by use of spontaneous ventilation with fentanyl, propofol, dexamethasone, midazolam and sevoflurane without the use of muscle relaxant. **Results:** Fentanyl, propofol, dexamethasone, midazolam and sevoflurane can be safely used in paediatric rigid bronchoscopy. No side effects are seen during and after the procedure. **Conclusion:** Spontaneous ventilation is usually the preferred method where propofol is combined with midazolam, fentanyl, dexamethasone and sevoflurane for safe and effective anaesthesia in children for rigid bronchoscopy.

Introduction

Foreign body (FB) inhalation is a leading cause of death in children in the age of 1–3 years [1]. Most of the death occurs Q2 at the time of aspiration, but those who reach the hospital alive are very less in number. Early diagnosis and removal of airway FB protect the child from serious morbidity and mortality. Tracheobronchial FB should be removed as early as possible once it is confirmed. Paediatric patients always pose a challenging situation to the anaesthesiologist. Sometimes the scenario gets worse, when paediatric patients had been planned for rigid bronchoscopy to remove airway FB. A plain chest X-ray has a relatively low sensitivity and

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specificity for tracheobronchial FB. The gold standard method for diagnosis and management for tracheobronchial FB is rigid bronchoscopy under general anaesthesia. Complete cooperation between endoscopist and the anaesthetist is paramount in getting an optimal outcome [2]. The anaesthetic goals at the time of rigid bronchoscopy include adequate depth of anaesthesia with minimal airway secretions, stable haemodynamics and rapid recovery of airway reflexes at the end of procedure. General anaesthesia can be either by spontaneous or controlled ventilation, which has its own merits and demerits.

Spontaneous ventilation is favoured by those who fear that positive pressure ventilation may dislodge the FB distally and thus making the retrieval of the object more difficult or making a ball valve obstruction with clinical deterioration [3]. Anaesthesia with spontaneous breathing through ventilating bronchoscope is usually preferred among patients with copious secretion and young paediatric patients. Spontaneous ventilation has more effective alveolar ventilation and allows better gas exchange in patients with inequalities in distribution of ventilation because of asymmetrical resistances among lung units [4]. Other major advantage of spontaneous ventilation is the absence of disruption of ventilation when attempting to retrieve the FB with the bronchoscope's ocular piece open.

Propofol is associated with smooth induction, rapid recovery from anaesthesia and has synergistic hypnotic effects when used in conjunction with sedative/hypnotic agents like opoids, benzodiazepines [5]. As propofol is a poor analgesic, it requires an adjunctive analgesic agent like fentanyl. Sevoflurane is a sweet smelling non-inflammable highly fluorinated methyl isopropyl ether used for induction and maintenance of general anaesthesia. Midazolam is a water-soluble benzodiazepine GABA (gamma-aminobutyric acid A) receptor complex that is present in the spinal cord [6]. Our study aims to seek a safe and effective practice of anaesthesia and ventilation management in case of paediatric bronchoscopy in our tertiary centre.

Materials and methods

Study design

This is a retrospective study of nine children who underwent FB removal by rigid bronchoscopy under spontaneous ventilation using midazolam, fentanyl, propofol and sevoflurane without use of muscle relaxant. This study was done at our tertiary care centre during the last two years (January 2013 to March 2015)

Clinical recording of foreign body inhalation

History of FB inhalation (peanut – 4, whistle – 2, groundnut – 3) was elicited in all nine patients. The patients presented to Otorhinolaryngology Outpatient Department at an average 3 days after inhalation of foreign body (varied from 2 to 7 days). On clinical examination two children had features of respiratory distress with tachycardia and tachypnoea; however, their oxygen saturation on room was normal. Oxygen saturation in all other cases was also normal. Radiological examination was showing partial collapse of right lower lobe with compensatory emphysema in 5 cases where two children had collapse on right lower lobe with hyperinflation on the left side. Partial collapse of left lower lobe was seen in two children.

Anaesthetic consideration

All the patients were kept nil orally for 4 h prior to the procedure. The aim of the anaesthesia during rigid bronchoscopy for FB removal is always to maintain spontaneous respiration throughout the procedure. Premedication used was Injection Glycopyrorolate 10 μg/kg IV; Injection Midazolam 0.04 mg/kg IV Injection Fentanyl 1 μg/kg IV and preoxygentaion for 3 min. Dexamethasone was given 0.1 mg/kg. The child was immobilized by hypnotic dose of propofol (2 mg/kg) with a maintenance infusion of 100–300 μg/kg to titrate depth of anaesthesia. The normal laryngoscopy was done and the trachea was sprayed *via* glottis with 1% lidocaine. All the patients were ventilated with a face mask and then handed over to the Otolaryngologist for rigid bronchoscopy. After induction of general anaesthesia, the rigid bronchoscope is inserted through the glottic inlet. The anaesthesia circuit was connected to the sideport of the bronchoscope for allowing ventilation. Sevoflurane was also used for maintenance through the side port of bronchoscope along with the 100% oxygen. In every case storz rigid bronchoscope with ventilating side arm was used for removal of foreign body. At the end of the procedure the child was administered 100% oxygen by anaesthetic mask and simultaneously nebulized with 1:10,000 adrenaline till completely awake.

Results

Removal of airway FB by rigid bronchoscopy was successful in all 9 cases. Throughout the procedure, SpO_2 ranged between 95% and 100% and no case converted into controlled ventilation. Pulse rate and mean arterial pressure remained within 10% of the baseline values during the procedure. Postoperative recovery was uneventful and X-ray chest done in all cases showed expansion of both lungs.

Discussion

Rigid bronchoscopy is performed in order to visualize the tracheobronchial airway and is carried out for either a therapeutic or diagnostic purpose. In 1897, Gustav Killian, a German Otolaryngologist performed the first bronchoscopy using a rigid esophagoscope and became successful in removing a pig bone from a farmer's right main bronchus [7]. Rigid bronchoscopy is a brief and intensely stimulating procedure and presents a challenge to the anaesthetist and surgeon. As surgeon and anaesthesiologist share the management of the obstructed airway with FB, there should be a clear communication and very good cooperation is essential. Before the procedure, a detailed anaesthetic and operative

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