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Dexmedetomidine and Proprofol in Complex Microlaryngeal Surgery in Infants

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Abstract

We describe the case of an infant undergoing endoscopic repair of a laryngeal cleft where the combination of dexmedetomidine and propofol infusions was used as the anesthetic technique. With this regimen, endotracheal intubation was unnecessary during the perioperative period, the procedure lasted approximately three hours, and the child recovered uneventfully. Historically, the techniques used for microlaryngeal surgery involve the use of intermittent endotracheal intubation and insufflation of halogenated anesthetics to the oropharynx. Given the potential benefits of a technique that obviates the need for endotracheal intubation during microlaryngeal surgery and prevents insufflation of halogenated anesthetics in an open environment, the combination of propofol and dexmedetomidine should be considered as a viable and desirable anesthetic option for infants undergoing complex microlaryngeal surgery.

Keywords

laryngeal cleft; microlaryngeal; laser; dexmedetomidine; anesthesia

1 Introduction

In the anesthetic management of patients undergoing endoscopic repair of laryngeal clefts, airway management can be challenging. Several anesthetic techniques have been described for pediatric microlaryngeal surgery and those allowing for spontaneous ventilations facilitate the procedure as the surgeon does not have to maneuver around an endotracheal tube (1–3). Techniques that obviate the need of endotracheal intubation are desirable because they afford the otolaryngologist prolonged access to the airway for instrumentation and greatly facilitate

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the post-operative management. Herein we describe a technique using dexmedetomidine and propofol to anesthetize an infant undergoing repair of a Type 1 laryngeal cleft.

2 Case Report

A 4.5-kilogram, 11-week-old neonate of 38 weeks gestation, was brought to the operating room for repair of a Type I laryngeal cleft extending from the level of the arytenoids to the vocal folds. The newborn presented with episodes of cyanosis, coughing, and aspiration during feeds immediately after birth. At the age of 2-days a bedside flexible laryngoscopy suggested the presence of a laryngeal cleft. Consequently, oral feeds were discontinued and the child was fed via a nasogastric tube. On day of life 11, an operative laryngoscopy and bronchoscopy confirmed the presence of an isolate Type 1 laryngeal cleft, without any synchronous airway abnormalities. A repeat swallow study confirmed frank aspiration. With the nasogastric feeding tube in place, the patient was discharged home so that the child could gain weight prior to the planned repair.

On the day of surgery, anesthesia was induced with sevoflurane and nitrous oxide in oxygen. Once intravenous access was obtained, all inhalational anesthetics were discontinued and a 1mcg/kg dose of dexmedetomidine was administered over 10 minutes. Subsequently, continuous infusions of dexmedetomidine at 2 mcg/kg/h and of propofol (without a loading dose) at 300 mcg/kg/min were initiated. After induction of anesthesia, a second peripheral line was inserted and 0.5 mg/kg of dexamethasone and 0.01 mg/kg of glycopyrrolate were administered. Fifteen minutes after initiation of propofol and dexmedetomidine the surgical procedure commenced. The larynx was suspended using a 9-centimeter Parsons laryngoscope and endoscopic repair of the Type 1 laryngeal cleft was performed. Oxygen at flows ranging from 6 to 10 liters/minute was delivered to the oropharynx using a side port in the Parsons laryngoscope. Using laser precautions, a carbon dioxide laser was used to prepare the medial mucosal surfaces of the inter-arytenoid space, and two sutures were placed endoscopically to repair the laryngeal cleft. When laser was in use, the inspired oxygen concentration was reduced to 0.21. After the laryngeal cleft repair, a unilateral supraglottoplasty was performed to release a tight, fore-shortened aryepiglottic fold. During the procedure, the dose of propofol was decreased to 250 micrograms/kilogram/minute and the dose of dexmedetomidine increased to 2.5 micrograms/kilogram/hour. Throughout the anesthetic and surgical procedure muscle relaxants and opioids were not used and the patient was allowed to breathe spontaneously. During the procedure the heart rate ranged from 130 to 160 beats per minute, systolic blood pressure from 70–100 mmHg, and diastolic blood pressure from 40–60 mmHg. In total, 31.5 micrograms of dexmedetomidine and 190 milligrams of propofol were administered over the 185 minute duration of the anesthetic. Once the procedure was completed dexmedetomidine and propofol were discontinued, and the patient was transferred to the intensive care unit (ICU) breathing spontaneously. At no point during the perioperative period, was an endotracheal tube inserted nor was muscle relaxant used. Soon after arrival to the ICU fentanyl 0.5 micrograms/ kilogram was administered. The post-operative course was uncomplicated, as oral feeds were initiated and the patient was discharged in good condition on post-operative day five.

3 Discussion

Dexmedetomidine, an alpha-2 agonist, has been used as the intravenous anesthetic for shorter diagnostic otolaryngologic procedures (2,3) and as a sedative for laryngeal framework surgery in adults (4). In those reports the procedures were brief diagnostic interventions (less than 45 minutes) or did not require general anesthesia. Herein, the authors describe that the combination of dexmedetomidine and propofol alone was successfully used to anesthetize an infant undergoing repair of a laryngeal cleft. Our case, which lasted approximately three hours, illustrates that this combination of propofol and dexmedetomidine can be used for more complex and lengthier microlaryngeal procedures.

The anesthetic technique used in this case (a combination of propofol and dexmedetomidine) offers a number of advantages from the surgeons' perspective that are worthy of consideration. First, the technique allowed for spontaneous respirations such that this patient did not require endotracheal intubation at any point in the perioperative period. Consequently, as no endotracheal tube was inserted, the otolaryngologist had complete access to the supraglottis and unimpeded view of the surgical area which facilitated placement of the laryngeal sutures with greater dexterity and precision. Second, the risks of endotracheal tube-related damage to the suture line in the perioperative period, which can include dehiscence and the formation of granulation tissue, were eliminated. Third, during the 3 hour surgery, there was no significant supraglottic or glottic edema, a complication that can be seen when an endotracheal tube abuts the mucosal surfaces for the duration of the procedure. Therefore, the combination of dexmedetomidine and propofol can potentially provide excellent surgical conditions for the conduct of microlaryngeal surgery.

Apart from providing favorable operating conditions for the otolaryngologist, the use of dexmedetomidine and propofol obviated the need for delivery of volatile anesthetics to the supraglottis as is described and may be unavoidable with the use of techniques where volatile anesthetics are administered to the oropharynx. Therefore, the combination of dexmedetomidine and propofol can obviate the hazard for the surgical team and other members of the operating room team by avoiding the use of halogenated agents.

One limitation of the technique described here is the inability to adequately monitor end-tidal CO_2 levels during the procedure. While we did not measure $PaCO_2$ in our patient, the presence of spontaneous ventilations was repeatedly confirmed by direct inspection of the glottis and the use of precordial stethoscopes. However, at no point during the anesthetic was there clinical evidence of significant hypercapnia, cardiac arrhythmias, or hemodynamic lability. In addition, others who have described anesthetic techniques when patients breathe spontaneously, report only minimal increases in $PaCO_2$ (5). Another consideration of the technique described here are possible hemodynamic effects of dexmedetomidine including bradycardia and hypertension (6,7) that are predictable and easily treated. Nevertheless, as dexmedetomidine lacks respiratory depressant properties, it is a very desirable drug for microlaryngeal surgeries where spontaneous ventilations are warranted.

In conclusion, the combination of continuous infusions of dexmedetomidine and propofol can be considered as the anesthetic technique for complex microlaryngeal, as it can provide favorable surgical conditions and obviate the need for endotracheal intubation. Further studies are warranted to elucidate the limitations and reproducibility of this technique.

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