

USE OF DEXMEDETOMIDINE AS THE MAIN ANESTHETIC AGENT in PATIENTS WITH LARYNGO-TRACHEOMALACIA

- A Case Report -

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Abstract

The successful use of Dexmedetomidine as the main anesthetic agent for three pediatric patients with tracheomalacia presenting for different kinds of urgent operations is described. Patients were kept spontaneously breathing without intubation during their whole procedures. Surgical conditions were adequate, and hemodynamic and respiratory profiles were within baseline limits.

Introduction

Providing general anesthesia to patients with tracheomalacia can be a big challenge to the anesthetist in terms of the type of anesthetic agents used and airway and ventilatory management¹. Easy collapsibility of the trachea during coughing and recovery from anesthesia may make extubation of the trachea extremely difficult, leading to prolonged intubation and ventilation in these patients^{1,2}. The avoidance of endotracheal intubation, where practical, may decrease postoperative coughing and the risk of airway collapse on emergence³.

Dexmedetomidine is a potent alpha-2-adrenergic agonist, which has analgesic and sedative effects with little effect on ventilation^{4,5}. In the present case report, we describe the use of dexmedetomidine as the primary anesthetic in three pediatric patients who underwent different emergency operations without airway intervention. The same surgeon with whom the anesthesia plan was pre-discussed carried out the three operations.

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Case 1

A 5-month-old male infant, (4 kg), known to have seizure disorder, developmental delay, failure to thrive and laryngomalacia was scheduled for repair of irreducible inguinal hernia and insertion of a gastrostomy feeding tube. On preoperative evaluation, the patient had inspiratory stridor, tachypnea, and tachycardia. His SpO₂ was 88% on 5 L/min. O₂. He had left subclavian central venous line inserted due to difficult peripheral venous access.

Upon arrival to the OR, standard monitors were applied. A loading dose of Dexmedetomidine (1 µg/kg) was then given over 10 minutes followed by a 2 µg/kg/hr infusion. A slow infusion of propofol (50 µg/kg/min) was also started. After the loading dose of Dexmedetomidine, the surgeon was asked to pinch the skin with forceps to assess the adequacy of sedation before infiltration of local anesthetic solution. A total of 3ml Bupivacaine 0.25% was infiltrated by the surgeon. The patient was kept spontaneously breathing with 3 L/minute O₂ flow applied through a simple facemask. During the procedure, the patient's SpO₂ remained around its baseline with an end-tidal CO₂ of 45-50mmHg measured through a catheter under the face mask. Heart rate and mean blood pressure were decreased by less than 20% from their baseline and there was no significant drop in the respiratory rate.

Surgical conditions were excellent throughout. By the end of the surgery, drug infusions were stopped and patient sent back to pediatric intensive care unit (PICU) where he remained sedated for around one and half hours without the need for additional analgesic medications.

Case 2

A 3-year-old female patient (10 kg) known to have bilateral hydronephrosis and laryngomalacia was scheduled for diagnostic cystoscopy. On pre-operative assessment she was tachycardic (115 b/m), BP 100/70 mmHg. She had expiratory stridor with SpO₂ of 90% on 3L/min. facemask oxygen. Her attending pediatrician indicated that this was her best condition and nothing else could be done to improve her condition.

In the operating theatre, standard ASA monitoring was applied and a new peripheral intravenous line was

secured, A loading dose of Dexmedetomidine 1 µg/kg was infused over 10 minutes then continued as infusion at 2 µg/kg/hr. Propofol 1% infusion was also started at 50 µg/kg/min. Lignocaine gel was applied in the patient's urethra by the surgeon for topical anesthesia prior to insertion of the cystoscope. The patient was kept spontaneously breathing through a simple face mask with oxygen flow of 4 liters/min. The procedure was done uneventfully in 15 minutes and the patient had no significant changes in her blood pressure, heart rate, respiratory rate and end tidal CO₂. She was transferred to the PACU, where she remained sedated for about 80 minutes and discharged to the ward afterwards.

Case 3

A 3-year-old female patient (12 kg) with a history of congenital tracheo-esophageal fistula repaired when she was one day old, presented with a history suggestive of foreign body aspiration. She was known to have recurrent chest infections but her current presentation was associated with more than usual difficulty in breathing and transient attacks of cyanosis. She was brought to theatre as an emergency case for rigid bronchoscopy. Preoperative evaluation revealed that the patient is having severe inspiratory stridor and expiratory wheezes. SpO₂ was 85% on 4 L/min oxygen via simple facemask.

On arrival to the OR, oxygen treatment was maintained at 4 Lit/min. via simple face mask, standard ASA monitors applied, and her in situ venous access checked. Dexmedetomidine 2 µg/kg was given as a loading dose over 10 minutes and continued as infusion 6 µg /kg/hr, Propofol intravenous infusion was also started at 100 µg/kg/min. Topical anesthesia lignocaine spray up to a total dose 4mg/kg was applied two minutes prior to insertion of the rigid bronchoscope.

The procedure, which revealed the presence of laryngo-tracheomalacia, was done smoothly in about 15 minutes, and ended with the recovery of a fragment of a melon seed shell from the patient's right main bronchus. During the procedure, the patient maintained spontaneous ventilation with SpO₂ 85-90%, End-tidal CO₂ 45-50 mmHg. There were no significant changes in her baseline heart rate and blood pressure. By the end of the procedure, the infusions were discontinued and the patient was sent to the PACU where she remained

sedated for about two hours and discharged to the ward afterwards.

Discussion

The choice of anesthetic option for patients with airway malacia who present for different types of surgeries can be difficult and tricky¹. This is especially true for those patients presenting for emergency operations where preparation of patients can be limited.

The option of general anesthesia technique for these patients usually requires the use of airway and ventilation support maneuvers such as CPAP or PEEP to prevent intraoperative airway collapse. As postoperative coughing with the risk of airway collapse on emergence will increase with the use of endotracheal intubation⁶⁻⁸, the avoidance of a tracheal tube, provides smoother anesthesia course. Also, reports of Laryngeal mask airway (LMA) use in these patients ranged between success^{3,9,10} and failure⁶.

Although the use of inhalational technique while maintaining spontaneous respiration is a logical way of general anesthesia in these patients, there had been some case reports of Isoflurane and Enflurane induced tracheomalacia^{11,12}. Precipitation of airway obstruction during sevoflurane general anesthesia in a child with congenital tracheomalacia had also been reported⁶.

The use of Intravenous anesthesia maintenance techniques is yet another option especially in older children¹. However, the use of Propofol which is the most commonly used intravenous anesthetic agent for total intravenous anesthesia, was found to be associated with dose-related depression of central respiratory output to upper airway dilator muscles and of upper airway reflexes¹³.

In view of those limitations, we opted to use a Dexmedetomidine-based sedation technique, supplemented with minimal dose Propofol and combined with local anesthetic infiltration/topicalization of the surgical site as necessary.

Dexmedetomidine is an α 2-adrenergic agonist which is currently FDA-approved for the short-term (less than 24 hours) sedation of adult ICU patients. It has analgesic and sedative effects with little effect on ventilation⁴. Literature about its clinical use in pediatric patients is based on case reports and includes

sedation during mechanical ventilation, prevention of emergence agitation following general anesthesia with sevoflurane or desflurane, provision of procedural-sedation, and to prevent withdrawal following the prolonged use of opioids and benzodiazepines¹⁴.

Our aim was to avoid airway maneuvering during anesthesia, meanwhile maintaining adequate spontaneous breathing. In all of the three cases herein presented, this was achieved successfully with adequate intra-and postoperative outcome.

Use of dexmedetomidine as the sole anesthetic will require higher doses, (5-10 μ g /kg/hr), which might affect the respiratory and hemodynamic profile. This is especially true for upper airway surgery as described by Ramsay and Luterman¹⁵. Shukry et al¹⁶ in their use of dexmedetomidine as the sole anesthetic in four infants requiring bronchoscopy in a dose of 2-5 μ g/kg/hr found out that a bolus dose of propofol was needed for one of the patients. They suggested that infusing a small dose of propofol would decrease the Dexmedetomidine needed to achieve adequate surgical conditions without respiratory and cardiac complications, a combination technique opted in our patients.

Although brief in duration, rigid bronchoscopy is an intensely stimulating procedure that requires better control of airway reflexes. Seybold et al¹⁹ successfully used Dexmedetomidine (2.5 μ g/kg/hr with boluses of 0.25-1 μ g /kg) combined with propofol 200-250 μ g/kg/min for rigid bronchoscopy in two pediatric patients. In our bronchoscopy case we did not use Dexmedetomidine increments but instead we used a higher loading dose and infusion rate (2 μ g /kg and 6 μ g/kg/hr respectively), and smaller Propofol dose (100 μ g/kg/min). Our plan was based on the fact that respiration is more likely to still be preserved when Dexmedetomidine is used as the primary anesthetic agent than Propofol.

In conclusion, we report on three cases of successful use of Dexmedetomidine-based anesthesia in patients with airway malacia who presented for different emergency surgeries. Airway interventions were successfully avoided and surgical conditions were adequate. Further controlled studies are needed to establish the safety and efficacy of Dexmedetomidine-based anesthesia in such patients.

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