Induction of Anesthesia with Dexmedetomidine and Sevoflurane for a Pediatric Difficult Airway

Ling-Xin Wei, Xiao-Ming Deng, Jing-Hu Sui, Lei Wang
Department of Anesthesiology, Plastic Surgery Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100144, China

**Key words**: Children; Dexmedetomidine; Difficult Airway

Difficult airway is a challenge frequently faced by anesthesiologists. For children recovering from burns with severe scarring contracture in the neck and chest wall, the best strategy is to maintain spontaneous breathing during the induction of anesthesia and to insert a laryngeal mask airway to secure the airway as early as possible.

Sevoflurane is the common choice for the induction of anesthesia in children with a difficult airway. However, adverse respiratory events such as apnea and obstructive airway may occur at the time of inhaling a high concentration of sevoflurane. Dexmedetomidine, a potent α₂-receptor agonist, has scarcely any effect on respiration. Therefore, intravenous dexmedetomidine combined with the inhalation of low-concentration sevoflurane would be an excellent alternative for severe difficult airway in children.

A 7-year-old, 28-kg male child, with scar contractures of the chin, neck, and chest, was scheduled for insertion of a tissue expander into the right upper arm and back under general anesthesia, in September 2015.

Physical examination showed the following findings relating to his difficult airway. His mouth opening measured 4.5 cm in width, with head and jaw movement significantly inhibited, and his lower teeth could not extend forward beyond the upper teeth. The chin and chest wall were in close adhesion, with the neck presenting in a position of flexion. Extension of the neck was significantly inhibited. The whole neck was covered by rigid scar tissue, which made it difficult to identify the anatomic location of the cricothyroid membrane. The patient’s Mallampati classification was Grade IV, and his clinical presentation is shown in Figure 1.

From arrival in the operating room, the patient was continuously monitored using an anesthesia monitoring device. The patient was placed in a semi-reclined position. After a 24° intravenous cannula was inserted on the dorsum of the hand, 100% oxygen was inhaled by mask for 3 min. Dexmedetomidine 1 µg/kg was administered intravenously for 10 min, followed by continuous infusion at a rate of 0.5 µg/kg/h. After dexmedetomidine of 1 µg/kg was given, sevoflurane 1% and nitrous oxide 50% in oxygen 50% were inhaled at a fresh flow rate of 6 L/min. The inhaled concentration of sevoflurane was increased to 3% through increments of 1% every three breathes. The child fell asleep 30 s after inhalation. When P ET CO₂ was >45 mmHg (1 mmHg = 0.133 kPa), an attempt was made to insert a 2.5° Ambu AuraOnce laryngeal mask airway (LMA) (AMBU [XIAMEN] LTD., Xiamen, China). Although mild limb movement occurred, the LMA was placed successfully and the capnography curve could be monitored. Connecting the LMA to a semi-closed anesthesia circuit, sevoflurane 3% and N₂O 50% were inhaled to maintain anesthesia. Assisted ventilation was used, when required, to maintain P ET CO₂ at 35−45 mmHg. After 3 min, fiberoptic bronchoscopy was performed through the conduit of the LMA, and 3 ml of lidocaine 2% was sprayed around the vocal cords through the work channel of the bronchoscope. Next, the tube was smoothly inserted into the trachea, guided by the bronroscope. The intubation was confirmed by auscultation of the bilateral lungs. The LMA was left in place to maintain the patent airway, along with the tube.

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**Address for correspondence**: Dr. Xiao-Ming Deng, Department of Anesthesiology, Plastic Surgery Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100144, China

E-Mail: dengxiaoming2003@sina.com

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During the induction of anesthesia, $\text{SpO}_2$ was maintained at a level $>95\%$. Spontaneous breathing was maintained without apnea. The duration of intubation from the beginning of inhalation until the insertion of the LMA and from the beginning of inhalation to the fiberoptic intubation was 2.5 min and 9 min, respectively. The end-tidal concentration of sevoflurane, after the insertion of the LMA and after intubation, was 2.3% and 2.8%, respectively.

Our anesthesia plan for this child with neck contractures involved fiberoptic intubation through the LMA, to maintain spontaneous breathing under general anesthesia. However, maintaining spontaneous breathing and patent airway before the insertion of the LMA was a major challenge during the induction of anesthesia. Although the instruction guide for dexmedetomidine does not recommend its use in children, numerous clinical investigations have shown its efficacy and safety as an adjunct in pediatric anesthesia.\[1,2\] Dexmedetomidine would be the optimum selection for a difficult airway as it has no influence on breathing. In this case, after dexmedetomidine $1\,\mu g$ was infused, the child could still talk and refused to receive topical anesthesia on the base of tongue. Therefore, sevoflurane was inhaled to induce the child quickly into a state of general anesthesia. Insertion of LMA was attempted only 2 min after inhalation of sevoflurane 3%, which is usually too soon for LMA insertion. Owing to premedication with dexmedetomidine 1 $\mu g$/kg, the LMA was successfully placed without adverse respiratory events although mild limb movement occurred.

With an increasing depth of anesthesia, apnea and the obstructive airway events are likely to occur. It was crucial to maintain the balance between breathing and the depth of anesthesia. Compared with the depth of anesthesia required for tracheal intubation, the depth of anesthesia needed is less for insertion of the LMA. Consequently, the first step was to insert the LMA to secure the airway. In addition, the distance between the patient’s mouth and chest wall was reduced by his neck fixed in flexion, making insertion of the LMA more difficult.\[3\] The child was placed in a semi-reclined position during the induction of anesthesia, which not only decreased the severity of glossoptosis but also facilitated the insertion of the LMA. Once the LMA was inserted successfully, further management of the airway became easier.

Overall, the anesthesia strategy for pediatric difficult airway requires meticulous planning. Clinical situations are constantly changing, which means there cannot be a standard scheme of anesthesia applicable to all difficult airways. Even the induction of anesthesia with sevoflurane and dexmedetomidine being a safe alternative for a difficult airway, the anesthesiologist in charge still needs to be proficient in the pharmacological properties of these two drugs.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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