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Difficult Pediatric Endotracheal Intubation: A New Approach to the Retrograde Technique

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The availability of the Seldinger Introducer has dramatically improved the ability to cannulate arteries and veins in infants and children.[1] A modification of this technique was used in the management of a difficult endotracheal intubation in a 30-month-old child.[2–5]

REPORT OF CASE

A 30-month-old child was scheduled for a left mandibular condylectomy with replacement by a costochondial rib graft for hypoplasia of the left mandibular condyle and partial ankylosis of the left temporomandibular joint. Physical examination revealed an 11.6-kg child with profound micrognathia and immobilization of the temporomandibular joint on the left side with deviation of the jaw to the left. The maximum oral opening was 9–10 mm. A mild pectus excavatum was present. Examination of the neck revealed the trachea to be in midline position with a very superior larynx. Past medical history was uneventful. A general anesthetic had been administered via mask without difficulty at another institution for bilateral inguinal hernia repairs at 15 months of age.

Because of a history of intermittent airway obstruction with sleep, the child was premedicated only with 0.2 mg atropine, intramuscularly. An otolaryngologist was present in the operating room with an open tracheostomy set. A 12-gauge extracath for possible emergency transtracheal ventilation was available. Diazepam, 1.5 mg, was given intravenously. Several attempts at a blind nasotracheal intubation were unsuccessful. Subsequently, anesthesia was induced with halothane and oxygen via mask. Positive end-expiratory pressure of 4–6 cmH_2O was required to maintain a patent airway. A towel roll 2.5–3 inches in diameter was placed between the scapula. The cricothyroid membrane was palpated and 0.5 per cent lidocaine, 0.3 ml, was injected transtracheally through a 25-gauge needle. A 16-guage red rubber catheter with number 2 silk suture firmly tied was passed through the naris into the posterior pharynx and retrieved from the mouth. A thin-walled 20-guage needle, attached to a saline-filled tuberculin syringe, was introduced through the cricothyroid membrane. After confirmation of the intratracheal position (by aspiration of air into a fluid-filled syringe), a 0.021 extralong flexible tip guide wire§ was threaded via this needle superiorly into the trachea, through the larynx, into the posterior pharynx and retrieved via the mouth. The wire and number 2 silk suture were spliced and retrieved through the left naris. A well-lubricated 4.5-mm nasotracheal tube was threaded through the side hole, over this wire, maintaining tension on the wire from both ends. Palpation and visual inspection confirmed the tip of the tube in the trachea at the site of the cricothyroid membrane puncture. While applying gentle downward pressure on nasotracheal tube, the guide wire was withdrawn and the nasotracheal tube was advanced further into the trachea. Palpation and auscultation confirmed appropriate intratracheal placement. The tube was secured. Anesthesia was continued with nitrous oxide, halothane and fentanyl.

At the end of surgery, which lasted seven hours, the child was transported to the recovery room with the endotracheal tube in position. Administration of humidified oxygen was initiated. The trachea was extubated the next morning. This was accomplished by passing a 0.035 extra-long guide wire§ through the endotracheal tube. The nasal tracheal tube was withrawn over this wire into the posterior pharynx. Both wire and nasal tracheal tube were removed after demonstration of ability to maintain an adequate airway.

DISCUSSION

Provision of a secure airway may prove challenging at times in pediatric or adult anesthesia. With our patient, the combination of a fixed temporomandibular joint, inability to open the mouth, and mandibular hypoplasia provided a diffcult situation. Previously suggested alternatives include awake nasotracheal intubation, nasotracheal intubation over a fiberoptic laryngoscope, and tracheostomy.

Because of the age of the child and the anatomy of the upper airway, we were doubtful of the success of an awake blind nasotracheal intubation. After multiple unsuccessful attempts, this approach was terminated.

Success with a fiberoptic laryngoscope depends on the availability of the instrument, use of an endotracheal tube which will pass easily over the laryngoscope, and competence and familiarity by the anesthesiologist. A pediatric fiberoptic laryngoscope was not available at our institution. Current marketed scopes have outside diameters (OD) of 3.9 and 4.0, effectively allowing the use of endotracheal tubes of only 5.0 mm inside diameter (ID) and greater.

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§ Becton-Dickinson, 100 cm 0.021 and 0.035, Safe guide, Stainless Steel Guide Wire.

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Tracheostomy without a previously secured endotracheal tube with or without general anesthesia carries certain risks. Since the duration of artificial airway maintenance was expected to be brief, tracheostomy was considered a last resort.

The original idea of a retrograde guide for endotracheal intubation involved passing a catheter through a tracheostomy and into the pharynx as a guide for subsequent endotracheal intubation.[3] Other authors utilized a large bore needle to introduce a catheter through the cricothyroid membrane, passing the catheter between the vocal cords into the mouth and thereby providing a guide for oral endotracheal intubation.[2,4]

This method of retrograde transtracheal intubation possesses some unique advantages. The thin-walled needle is considerably less traumatic than those described previously. Because of this, the frequency of damage to the trachea or underlying structures should be decreased. The use of a wire (*vs.* a long-line plastic catheter) decreases the elasticity of the guide while the nasotracheal tube is being inserted thereby minimizing the chance of breaking the introducing catheter. This would allow more control during the time immediately prior to removal of the guide wire. The placement of the guide wire through the side hole of the nasotracheal tube allowed an additional 10–11 mm of nasotracheal tube to be within the trachea prior to removal of guide wire. Because of the short tracheal lengths in the pediatric population, this can be the difference between success and failure of the entire technique. Of final importance is the brief time required for completion of this intubation. Utilization of operating room time is minimal and ability of provide a safe secure airway is enhanced.

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Lidocaine before Endotracheal Intubation: Intravenous or Laryngotracheal?

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Lidocaine, given topically to the larynx and trachea[1] or intravenously,[2] has been shown to blunt the increases in heart rate and blood pressure associated with laryngoscopy and endotracheal intubation. Intravenously administered lidocaine also prevents intracranial hypertension when patients with brain tumors undergo endotracheal intubation.[3] The purposes of this study were twofold: 1) to describe the effects of laryngotracheal lidocaine administration on intracranial pressure, and 2) to determine whether there is a preferred route for administration of lidocaine before endotracheal intubation.

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Key words: Anesthetics, local: lidocaine. Brain: intracranial pressure. Intubation, endotracheal: complications. Heart: pulse rate. Blood pressure: hypertension.

METHODS

Twenty-two patients with brain tumors estimated to be larger than 3 cm in diameter by CAT-scan were studied. All were receiving steroid therapy and were scheduled for elective craniotomy. The protocol was approved by the Human Investigation Committee at the University of Virginia Medical Center, and informed consent was obtained both from the patients and their next of kin on the evening prior to operation. Morphine, 0.1 mg/kg, and atropine, 0.4 mg, im, and diazepam, 0.1 mg/kg, po, were given one hour before arrival in the operating suite. A subarachnoid pressure screw, arterial and central venous catheters were placed using local anesthesia, and pressures were continually recorded. Intracranial compliance was estimated by administering a 1–2 ml bolus of mock cerebrospinal fluid through the subarachnoid screw while the resulting change in intracranial pressure (ICP) was recorded. Once control measurements of ICP, vascular pressures, and heart rate were recorded, arterial blood was obtained for analysis of blood gases and anesthesia was induced with 3 mg/kg thiopental, 1.5 mg/kg

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