

Dental Complications of Intubation in Pediatric Patients and Its Management

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Abstract Perioperative dental damage is one of the most common anesthesia-related adverse events and is responsible for the greatest number of malpractice claims against anesthesiologists. Minimizing dental injuries begins with the anesthesiologist's preoperative assessment of the patient's dentition and intraoral tissues. Exercising cautionary measures during provocative events, such as laryngoscopy and tracheal extubation, can aid in the prevention of dental trauma. In the event of such an injury, several management tactics can promote a swift and reasonable resolution. Upon discovery of a potentially hazardous dental condition, a consultation with a dentist should be considered before proceeding with the surgical procedure.

Keywords: intubation, dental complications, pediatric patient

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1. Introduction

"The endotracheal tube is the link between our most expensive and our most sophisticated object, our anesthesia machine, and our most delicate and most precious subject, our pediatric patients." Andreas C. Gerber, MD [1].

Endotracheal intubation (ETI) is a rapid, simple, safe and non surgical technique that achieves all the goals of airway management, namely, maintains airway patency, protects the lungs from aspiration and permits leak free ventilation during mechanical ventilation, and remains the gold standard procedure for airway management.

There are many indications for tracheal intubation such as airway protection, maintenance of airway patency, pulmonary toilet, application of positive-pressure ventilation, maintenance of adequate oxygenation, predictable FiO₂ and positive end-expiratory pressure. However, endotracheal intubation is associated with complications, some of them life threatening [2].

Intraoral manipulation is necessary during general anaesthesia involving endotracheal intubation. Although laryngoscopy is a safe procedure and complications rarely occur, intraoral manipulation can produce damage to soft and hard tissues of the oral cavity, patient discomfort and post operative pain. It is therefore essential for anaesthesiologists and the pediatric dentist to be aware of these complications, and to have an effective strategy to prevent and manage these complications when they arise [3]. A large number of complications have been described. It is beyond the scope of this article to deal with each in

detail; emphasis will be laid on the perioperative oral complications associated with endotracheal intubation.

2. Risks of Intubation

As with many things in medicine, there are risks associated with endotracheal intubation: Dental injuries, which vary between 1 in 150 to 1 in 1000 cases, are the most common; cervical or neck problems; laryngotracheal trauma; corneal abrasion; uvular damage, vocal cord paralysis; or esophageal or bronchial intubation. The most serious complication is subglottic injury, which takes the form of stenosis or dilatation, and is manifested through stridor. Studies have shown that between 2–18% of patients will exhibit signs of stridor post-anesthesia [4,5].

3. Tube Selection

To obtain appropriate ventilation and prevent injury in an intubated child, a correctly sized ETT is needed. Multiple age-based formulas have been used to predict the appropriate size of the uncuffed ETT in the pediatric population. For children less than 6 years of age, Slater et al, recommended using the sum of 3.75 + age divided by 4; and for children 6 and up, the sum of 4.5 + age divided by 4. [8,9] These formulae have since been simplified into: 4 + age divided by 4. It has been suggested that for a tighter-fitting tube the base number should be 4.5 + age divided by 4 [5,6,7,8].

4. Complications With Endotracheal Intubation

4.1. Dental Injury

The main injury associated with use of laryngoscopes is damage to the teeth. In the perioperative period, the majority of dental injuries (50%–75%) occur during tracheal intubation [9]. There is a close relationship between difficult intubation and traumatic intubation. In cases of difficult intubation (poor view of the vocal cords), the practitioner tends to increase the lifting forces of the laryngoscope blade, which may lead to damage of the intraoral tissues and osseous structures mainly the maxillary incisors, and particularly the maxillary left central incisor. A difficult intubation may thus become a traumatic intubation. Use of increasing force may induce swelling, bleeding or perforation as the intubation becomes more and more difficult and may turn into a 'cannot intubate' and possibly even a 'cannot ventilate' situation. If intubation fails after three attempts, another technique should be used in accordance with the airway management algorithm [10].

The incidence of dental injuries associated with anesthesia is greater than 1:4500 [11]. Maxillary central incisors are at most risk. 50% of dental trauma happens during laryngoscopy, 23% following extubation, 8% during emergence, and 5% in the context of regional anesthesia. Dental trauma is also associated with LMA devices and oropharyngeal airways. Dental injuries are most common in small children, patients with periodontal disease or fixed dental work, and patients in whom intubation is difficult. Pre-existing dental pathology (protrusion of the upper incisors, carious teeth, parodontosis or periodontitis) should be thoroughly explored before the induction of anesthesia, and the patient must be advised of the risk of dental damage. Although tooth guards may possibly obstruct vision, their use may be indicated in certain situations. The presence of any intraoral appliances should also be confirmed during the preoperative assessment of pediatric patient population. Devices used for breaking the childhood habits of tongue thrusting and thumb sucking often suspend from the hard palate and may interfere with laryngoscopy [12].

Securing a loose tooth is a cautious measure to prevent aspiration and aid in a tooth's retrieval should it become dislodged. A 3–0 silk suture without the needle can be wrapped several times around the gingival margins of the mobile tooth and adjacent teeth for increased stability. The suture can be secured with adhesive tape to the ipsilateral cheek and removed after the procedure upon recovery [9].

Several studies have examined the preventive use of devices that protect teeth during laryngoscopy. Various prefabricated or custom-made mouthguards (i.e., those used preventively in sports) do not guarantee an endotracheal intubation free of dental trauma [13].

Lip injuries include lacerations, hematomas, edema, and teeth abrasions. They are usually secondary to inattentive laryngoscopy performed by inexperienced practitioners. These lesions are annoying to the patient, but are usually self-limited [9].

4.2. Tongue Injury

Macroglossia occurs due to prolonged compression by an ETT or oral airway, leading to ischemia and venous congestion. Obstruction of the submandibular duct by an ETT may lead to massive tongue swelling. Compression injury to the lingual nerve during difficult intubation leading to loss of sensation has been reported. Transient weakness, numbness, or paralysis of the tongue can occur after laryngoscopy, presumably because of pressure on the laryngeal and hypoglossal nerves [14].

Damage to the uvula (edema and necrosis) is usually associated with an endotracheal tube, oro- and nasopharyngeal airways, an LMA, or an alternative supraglottic airway device, or by overzealous use of a suction catheter. Sore throat, odynophagia, painful swallowing, coughing, foreign body sensation and serious life-threatening airway obstruction have been reported. The incidence of sore throat after intubation is approximately 40% and 65% when blood is noted on the airway instruments. Fortunately, pain on swallowing usually lasts no more than 24–48 hours. Topical anesthesia, such as lidocaine jelly, applied to the endotracheal tube does not lessen the incidence of this problem and may actually worsen it [15].

4.3. Temporomandibular Joint Injury

(TMJ) is a rare but serious complication. Rupture of the lateral ligament is possible. TMJ injuries are caused by increasing force during laryngoscopy to optimize the view of the glottis. As a result, limited mouth opening, pain in the joint, lateral deviation of the mandible (in case of unilateral luxation), protrusion of the mandible, and lockjaw may occur. Most of the cases of TMJ injury have not been associated with difficult airway management. In the ASA closed claims database, only 17% of the claims had documented pre-existing TMJ disorders, such as pain [16].

5. Nasotracheal Intubation

Nasotracheal intubation is frequently used in head and neck surgery. Patients with basilar skull fractures or facial fractures (such as LeFort II or III fractures) should not have nasal tubes passed as there exists a danger of inadvertent cranial intubation.

Epistaxis is a common problem, caused by the tip of the ETT traumatizing nasal and pharyngeal mucosa. This may be more common and dangerous in patients with coagulopathy or those receiving anticoagulants. Nasal intubation is relatively contraindicated in such patients.

Attempted passage of a nasotracheal tube can create false submucosal passages. These can progress to retropharyngeal abscesses. It is paramount that the nasal mucosa be vasoconstricted before instrumentation (0.5% phenylephrine). To minimize the chance of nasal injury, a small endotracheal tube that has been lubricated well and presoaked in warm water (to increase its pliability) should be used.

Should epistaxis occur, it is recommended that the endotracheal tube cuff be inflated and remain in the nostril to tamponade the bleeding.

Acute otitis media has been reported to occur in 13% of nasally intubated neonates [17]. Turbinates, adenoids, and tonsils can also be traumatized. Prolonged nasal intubation

can lead to pressure necrosis of the nostrils and septum. Nasal septal abscesses, retropharyngeal abscesses and paranasal sinusitis can occur after intubation.

Paranasal sinusitis occurs due to injury to the sinus ostia followed by oedema, obstruction and infection. It may present as unexplained fever or purulent discharge, is often refractory to antibiotics and may lead to intracranial infection or septicemia [18].

5.1. Fire during Laser Surgery

Lasers are frequently used in oral surgery and to ablate benign and neoplastic tissues in the airway. Laser fire is a very serious complication. The use of special laser guarded or metal tubes is recommended, and all inflammatory materials such as dentures and nasogastric tubes should be removed. One of the most catastrophic events associated with their use is an airway fire, which occurs when the laser ignites the endotracheal tube. The heat and fumes of the burning plastic may cause severe damage to the airway. Treatment consists of immediately disconnecting the circuit from the endotracheal tube and removing the burning tube from the airway. The fire should be extinguished with saline, and the patient should be supported by facemask ventilation. The airway should be evaluated for damage with bronchoscopy [19].

5.2. Precautions to Reduce the Risk of an Airway Fire

-Endotracheal tubes may be protected by wrapping them in non-combustible tapes; alternatively, red rubber or metal non-combustible endotracheal tubes may be used.

-Cuff ignition can be minimized by filling the cuff with saline solution instead of air.

-Nitrous oxide should not be used in laser surgery because it supports combustion.

-inert gases, such as helium or nitrogen, be used instead of nitrous oxide, and that concentrations of oxygen do not exceed 40% [19].

6. Conclusion

Paediatric patients in their first year of life are at increased risk of anaesthesia related complications. Higher incidence of respiratory complications specially inadequate ventilation and hypoxaemia have been observed in this group of population. Prompt diagnosis and management can prevent serious mishaps associated with these complications.

Perioperative dental damage is one of the most common anaesthesia-related adverse events. Given the high incidence of dental damage it is recommended that all patients undergoing a surgical operation under endotracheal intubation should have a pre-operative dental check wherever possible. Clearly, the first dental examination would be conducted by an anaesthetist familiar with the predisposing factors. Where he/she considers there to be a

higher than average risk of dental damage occurring during intubation a more specialised examination should be conducted by a dental surgeon. It may, where appropriate, be possible for remedial dental treatment to be carried out and customised mouth guards to be constructed prior to the operation.

Thorough preoperative assessment is also mandatory to exclude presence of any congenital abnormalities. Strict application of these safety rules and precautions can reduce the rate of anaesthesia related complications and mishaps in paediatric population.

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