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FIBEROPTIC BRONCHOSCOPY VERSUS VIDEO LARYNGOSCOPY IN PEDIATRIC AIRWAY MANAGEMENT

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SUMMARY – The primary goal of pediatric airway management is to ensure oxygenation and ventilation. Routine airway management in healthy pediatric patients is normally easy in experienced hands. Really difficult pediatric airway is rare and usually is associated with anatomically and physiologically important findings such as congenital abnormalities and syndromes, trauma, infection, swelling and burns. Using predictors of difficult intubation should be mandatory preoperative assessment in pediatric patients. Difficult airway algorithm for pediatric patients has to consist of three parts: oxygenation (A), tracheal intubation (B), and rescue (C). According to this new algorithm, if conventional direct laryngoscopy fails, we have to use alternative glottic visualization device. Do we really need video laryngoscopy? If we look at numbers, we might estimate that conventional laryngoscopy is successful and effective in around 98.5% of cases. Do we need to replace Macintosh laryngoscope with video laryngoscope completely in our routine practice? Should video laryngoscope be available to replace fiberoptic intubation in pediatric airway management? According to the algorithm, fiberoptic-assisted tracheal intubation combined with extraglottic airway devices is the standard of care. Establishment of protocols for equipping and maintaining airway trolleys and regular training in their use must be provided to avoid tissue hypoxia in children with compromised airway.

Key Words: *Anesthesia; Airway Management – Instrumentation; Intubation, Intratracheal – Instrumentation; Laryngoscopes; Video Recording; Child*

Introduction

A good airway management technique is an essential skill for the anesthesiologists. The unanticipated and anticipated difficult airways are challenges for experienced anesthesiologist hands. They are important contributor to both patient morbidity and mortality[1]. Significant advances in our understanding of airway assessment, difficult airway algorithm, new modes of guidelines for pediatric airway management and development of new airway devices suitable for pediatric patients have occurred in the past decade. The use of video laryngoscopy by anesthesiologists for airway management of pediatric patients has been possible for less than a decade and continues to grow[2]. Some anesthesiologists have incorporated the use of video laryngoscopy into their routine airway management of the pediatric patient. Some anesthesiologists have reserved video laryngoscopy for difficult pediatric airway according to the algorithm[3]. On the other hand, fiberoptic intubation is still the gold standard for anticipated difficult airway management in children. This article reviews the role and place of new equipment and techniques used in difficult pediatric airway management.

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Discussion

Routine airway management in healthy pediatric patients is normally easy in experienced hands[4]. Really difficult pediatric airway is rare and usually is associated with anatomically and physiologically important findings such as congenital abnormalities and syndromes, trauma, infection, swelling and burns[5].

Adult difficult airway management techniques, such as awake or invasive approaches to airway management, often cannot be applied to children because of inadequate cooperation[6]. Intubations in children are performed under general anesthesia or deep sedation[7,8]. As we know, the primary goal of pediatric airway management is to ensure oxygenation and ventilation. From the physiologic aspect, children have higher rates of oxygen consumption than adults and significantly shorter period of apnea that can be safely tolerated. Planning and preparation is the most important factor for successful airway management in children.

General principles for the management of unanticipated difficult intubation during routine induction of anesthesia are as follows[9]:

Maintenance of Oxygenation and Ventilation are Crucial

- Attempts at rigid laryngoscopy should be performed in optimal conditions.
- Multiple and prolonged attempts at laryngoscopy are associated with morbidity and will not be fully apparent until fiberoptic examination (or extubation); therefore, we have to limit the number of attempts to four.
- Blind techniques have a failure rate and are potentially traumatic.
- We have to awake the patient and postpone the surgery if possible.
- In the failed intubation, increasing hypoxemia and difficult ventilation scenario in the paralyzed patient, optimize ventilation by using firstly the two handed ventilation technique and/or the cLMA. If these techniques fail, one must resort to invasive techniques such as cannula cricothyroidotomy.
- Cannula cricothyroidotomy requires a high pressure ventilation source with a reducing valve.
- Training in these techniques is essential.

A huge number of intubation devices have been introduced commercially since the appearance of Macintosh/Miller blades in the 1940s[10]. Conventional or direct intubation method ('direct' laryngoscopy) is performed with Macintosh laryngoscopes, with special features for pediatric or neonatal patients, different sizes and Miller blade. In direct laryngoscopy, the idea is always to obtain a straight line of sight between the anesthesiologist's eye and the larynx, by positioning correctly the patient's lifting, pressing and levering oropharyngeal structures as to obtain direct laryngeal visualization[11]. The McCoy levering laryngoscope is a step further in direct laryngoscopy[12]. The McCoy laryngoscope comes in pediatric sizes on a Seward blade (sizes 1 and 2) and on a Macintosh blade for adult practice (sizes 3 and 4). The levering tip on the Macintosh blades is larger than that on the Seward blades and may not be suitable for small children[13]. One more step further, advanced and technically newer laryngoscopy is video laryngoscopy where anesthesiologists intubate on the monitor; it is an indirect intubation method ('indirect' laryngoscopy)[14]. Like its predecessors, video laryngoscopy also requires mouth opening[15]. There are four video laryngoscopes available for airway management in pediatric practice for neonates and children: GlideScope (Verathon Medical Inc., Bothell, WA, USA); Truview (Truphatek, Netanya, Israel); Cmac (Karl Storz, Tuttlingen, Germany); and AirtraqTM (Prodol, Vizcaya, Spain). The first three devices are unchanneled devices often requiring use of styletted tube to perform intubation. Airtraq is the only one channeled, thus not requiring styletted tube.

Laryngoscopy is rarely difficult in pediatric patients, with a low incidence of success of 1.35% in children as compared with 5.8% in adults[1,2,16]. Now, my question is: do we really need video laryngoscopy? If we look at numbers, we might admit that conventional laryngoscopy is successful and effective in around 98.5% of cases, so performance of any competitor should be compared with this result, keeping in mind the real cost/benefit ratio, with a theoretical little or no advantage in low risk patients[4,17]. If we take into account a common problem for anesthesiologists in video laryngoscopy, excellent view of the glottis but still trouble with advancing the tube into the trachea, longer time to intubate and the fact that studies were performed on manikins, simulators in clinical sce-

nario, training on humans being quite limited with a negligible value in the clinical realm, the expected demonstration of video laryngoscopy superiority to conventional laryngoscopy still remains a topic of debate[3,18].

We have already mentioned that pediatric difficult intubation is usually predictable as it is associated with important anatomic abnormalities, quite frequently due to inherited causes or congenital syndromes[18]. In these cases, the use of flexible fiberoptic bronchoscopy (combined with airway devices such as laryngeal mask airway (LMA) allowing passage of fiberoptic bronchoscope) remains the standard of care, although it requires specific training and skill. The problem then encountered is how to remove the LMA and bronchoscope without dislodging the endotracheal tube (ETT). Various ways of achieving this have been suggested. Many techniques include the use of two connected ETTs joined either by wedging the two together, taping them together, or with an adapted female-to-female connector[19-21]. Another possibility is the use of the overlength Croup tube made by Portex[22]. A long J-tipped guide wire can be inserted *via* the suction channel into the trachea and the fiberoptic scope and LMA carefully removed[23]. An ultrathin fiberoptic bronchoscope is lubricated with saline and a Cook airway exchange catheter (Cook UK Ltd., Letchworth, England) is fitted over it. The loaded bronchoscope is passed through the LMA and into the larynx and the airway exchange catheter advanced under direct vision into the trachea. The LMA is then removed and the tracheal tube railroaded over the catheter into the trachea[24].

The last but not the least, we should never forget that we have to provide adequate oxygenation[4]. So, expected or unexpected difficulty means oxygenation impairment, none of these devices, video laryngoscopes or fiberoptic bronchoscopy, could be the solution, but fast and early use of alternative ventilation strategies, first of which remains the use of extraglottic devices[12,25].

Conclusion

Video laryngoscopy is shown to have promising characteristics. We believe that video laryngoscopy will one day become a standard device used for all routine intubations and not only for those that are predicted to be 'difficult'. Only in that way (daily skill training with our patients) we will have good sense in our hands, security, precision and speed in intubations. The difficult airway algorithm guidelines may have to be adjusted to include new tools in our practice.

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Sažetak

FIBEROPTIČKA BRONHOSKOPIJA PREMA VIDEO LARINGOSKOPIJI U ZBRINJAVANJU PEDIJATRIJSKOG DIŠNOG PUTA

M. Karišik, D. Janjević i *M. Sorbello*

Primarni cilj u upravljanju pedijatrijskim dišnim putem je osigurati oksigenaciju i ventilaciju. Upravljanje dišnim putem kod pedijatrijskih bolesnika je rutina u rukama iskusnog pedijatrijskog anesteziologa. Problematičan dišni put kod pedijatrijskih bolesnika je rijetkost i vezan je za anatomske i fiziološke nalaze kao što su kongenitalne anomalije i sindromi, traume, infekcije, oticanje i opekline. U prijeoperacijskoj pripremi pedijatrijskih bolesnika obvezno je korištenje prediktora za procjenu dišnog puta. Algoritam za teški dišni put kod pedijatrijskih bolesnika sastoji se od tri dijela: oksigenacije (A), intubacije (B) i spašavanja (C). Prema ovom algoritmu, ako se konvencionalnom laringoskopijom ne uspije vizualizirati glotis i realizirati intubacija, potrebno je koristiti alternativne alatke za vizualizaciju glotisa i intubaciju bolesnika. Ako se pogleda statistika, konvencionalna laringoskopija je uspješna i učinkovita u oko 98,5% slučajeva. Trebamo li zamijeniti Macintosh laringoskop video laringoskopom u našem svakodnevnom radu s pedijatrijskim bolesnicima? Je li video laringoskopska (indirektna) intubacija dostojna zamjena za fiberoptičku intubaciju kada je pedijatrijski dišni put u pitanju? Prema algoritmu fiberoptička intubacija u kombinaciji sa supraglotičnim alatkama za zbrinjavanje pedijatrijskog dišnog puta je standard. Uspostava protokola za opremanje, upravljanje i održavanje dišnih putova kod pedijatrijskih bolesnika te redovita obuka u uporabi alatki za zbrinjavanje dišnog puta je neophodna.

Ključne riječi: *Anestezija; Dišni put - instrumentacija; Intubacija, intratrahealna – instrumentacija; Laringoskopii; Video snimanje; Dijete*