REVIEW ARTICLE

AIRWAY MANAGEMENT UNDER CONTROLLED VENTILATION FOR PAEDIATRIC POPULATION: A NARRATIVE REVIEW

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ABSTRACT

Airway management is a crucial part of any surgery done under general anesthesia to provide adequate ventilation and prevent aspiration. Tracheal intubation is considered a gold standard method for this purpose but other methods such as supraglottic airway devices (I-gel and air-Q) have emerged as promising alternatives. This review article compares the differences in the efficacy of these two devices in the paediatric population, as this population is anatomically prone to airway collapse. They are compared in multiple domains and their safety and possible benefits established through literature. The use of SGAs during anesthesia has been supported by many studies and they are considered as effective devices for airway maintenance.

KEYWORDS: Airway, Breathing, Management, Paediatric.

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INTRODUCTION

Airway management is a crucial part of any surgery performed under general anesthesia. Appropriate airway handling provides satisfactory ventilation and protects the lungs against aspiration. Airway care is critical because of the risk of acute hypoxia, which may lead to death or lasting brain damage, if the airway is mishandled.[1] Other approaches, such as supraglottic airway devices, have developed as viable alternatives to tracheal intubation. It was decided to compare the effectiveness of two widely used supraglottic airway devices (I-gel and air-Q) by looking at the pressures used to seal the airway and other factors such as insertion time, the number of times the device was inserted, the use of fibre optics, and complications that occurred after the device was removed.[2] It is imperative to study their differences as they are the current trend in airway management. Specifically, the paediatric age group has been focused upon as there is paucity of studies conducted on this topic in this age group as compared to the adult groups.

PAEDIATRIC AIRWAY

Loss of muscle tone as a result of anesthesia administration means that the patient can no longer keep their airway open spontaneously. Therefore, maintaining the airway is one of the biggest priorities when conducting procedures under general anesthesia as its failure can have dire consequences. This is especially important in the paediatric population as children are not small adults, and awareness and appreciation of the differences in the airway anatomy of adults and

children is critical to effective airway management. In newborns, paediatric anatomy differs from that of adults, according to many studies and literature.[1,2] Children have a bigger head and occiput than adults. In supine posture, this might cause neck flexion and possible airways blockage.[1] According to Wheeler, children's airways are more compliant than adults' and lack cartilaginous support. In the presence of airway blockage, this raises the risk of dynamic airway collapse.[1] Because the nasal apertures are smaller, secretions, edoema, and blood quickly clog them. The fact that newborns must breathe through their noses adds to the difficulty of managing the airway during general anaesthesia.[3] When it comes to airway blockage, children have a bigger tongue, making them more prone to it. Reductions in muscular tone cause the tongue to fall back and impede the route. During inhalation, the tongue may flatten on the soft palate and stay there owing to passive expiration via the nose in supine babies. The epiglottis of the baby is omega-shaped, loose, and protruding rearward. The glottis is situated between C3 and C4. With its narrowest point at the cricoid cartilage, the larynx has been characterised as tapered, unlike the cylindrical adult larynx.[4] The glottis opening is the smallest part of the paediatric airway. Contrary to popular opinion, the airway in children is not constricted at the cricoid cartilage as previously thought.[5] When it comes to its function and the danger of damage, the cartilage of the cricoid is inflexible and can't be expanded. Adults' cartilage is much larger and has a ring around it. As a result, mucosal edoema of the cricoid cartilage will have a devastating effect on the airway. Subglottic stenosis may be caused by prolonged or recurrent tracheal intubation in young children.[2] A new research has reaffirmed that the trachea in babies is short, thin, and inclined posteriorly, which facilitates unintentional endobronchial intubation with head position changes.[5-10]

SUPRAGLOTTIC AIRWAY DEVICES

Laryngeal mask airway (also known as supraglottic airway) is a medical device that maintains a patient's airway open while under anaesthesia or unconsciousness to allow for unimpeded breathing. It also forms a seal around the larynx throughout the procedure. In recent years, they have emerged as a novel and viable alternative to endotracheal intubation, and their use has increased dramatically.[1,11-14]

In the late 1980s, the Laryngeal Mask Airway (LMA) was developed for the delivery of paediatric anaesthetic during operational operations. Because of its effectiveness in providing hands-free airway care in paediatric patients, its use and popularity have grown significantly since then. LMA, on the other hand, has various disadvantages, the most notable of which are the compressibility of the breathing tube and the low cuff leak pressure. As a result of these drawbacks, health-care providers are actively exploring and working toward the development of alternative supraglottic airway devices.[15-23] Many Supraglottic Airway Devices (SGAs) have been developed that can be placed blindly, provide secure oxygenation and ventilation, and some of which have the capability of being converted to an endotracheal tube in an emergency situation. They offer a number of benefits, including higher seal pressures (which allows for more breathing pressure), ease of insertion, the ability to drain stomach contents, and the elimination of cervical spine neck extension in order to view the larynx.When compared to the use of a tracheal tube, there are a number of well-established advantages of using SGAs. The most significant benefits are a lower incidence of sore mouth, less hemodynamic disturbance during anaesthesia induction and maintenance, enhanced oxygenation upon waking, and an improvement in case turnover over the previous method. As a consequence, there has recently been a shift away from the use of a tracheal tube for controlled breathing in patients who are at low risk of aspiration in favour of the use of an SGA.

According to Miller, a frequently recognised categorization for supraglottic airway devices is based on the sealing mechanisms, in which the laryngeal mask airways, I-gel, and air-Q are classified as peri-laryngeal sealers, and the laryngeal mask airways are classified as peri-laryngeal sealers.[15] The classification of airway devices has been the subject of several investigations. For children patients having sinus surgery, the supraglottic devices (LMAs) provide equal protection against blood contamination to an uncuffed endotracheal tube and throat pack,

according to a research comparing laryngeal mask airways with that approach in the paediatric population.[21] Laryngeal Mask Airways (LMAs) have been studied and compared to modern supraglottic airway devices (SGAs) such as Air-Q. [9,10] ILMA's breathing tube is longer, wider, and narrower than Air- Q's, and it has a removable connector that makes it easier to use a standard endotracheal tube (ETT) with Air-Q, whereas in ILMA, the TT is specific and expensive, (high pressure cuffed, reinforced) silicone TT, which is more expensive and difficult to use.[8]

Supraglottic devices (laryngeal mask airways) have been shown to be safe and effective during functional endoscopic sinus surgery, with a final success rate of 97.8% and an intraoperative failure rate of just 0.7%.[20] Safety and efficacy of new supraglottic airway devices must be evaluated against those of already-available options. Few studies have looked at paediatric airway devices, making these comparisons all the more significant. An anaesthetized child having elective surgery will be monitored using two novel supraglottic airway devices (I-gel and air-Q) to determine their efficacy and safety.[24]

An individual supraglottic airway device called the I-gel (I-gel, Intersurgical Ltd.) was made available in paediatric sizes in March 2009 and went on sale officially in January 2010. Essentially, it's a soft gel of a thermoplastic elastomer. The peri-laryngeal and hypopharyngeal structures are intended to be sealed using this device. Instead of an inflated cuff, an insertion port for a stomach tube is included with this device. In addition to its ease of insertion and post-insertion stability, this device also has minimal tissue compression risks. Anecdotal evidence from paediatric trials suggests that the I-gel device is quite simple to implant, with a high likelihood of success on the first try. Allows for greater visibility of the glottis and a faster insertion. [11,25]

Paediatric I-gel comes in a variety of sizes, ranging from 1 to 2.5 ounces, depending on the child's weight. The patient's weight is taken into consideration while determining the I-gel size. A clinical anatomy assessment must be considered against individual anatomical differences.[16] Polyvinyl chloride supraglottic airway systems like Air-Q are also available. New supraglottic airway device that fits the requirements of ideal supraglottic devices, such as simplicity of placement, reliable alignment of the glottic opening, and the ability to continuously oxygenate and ventilate, has been introduced. An oval-shaped, hyper-curved section of the supraglottic region permits the device to be inserted into the trachea.[12] Designed for the hypopharynx, this tube includes a broad, flexible cuff at the bottom. When the cuff's tip touches the epiglottis, it prevents it from obstructing the device's lumen. However, the absence of diaphragm strips allows the endotracheal tube to move freely through this device. It is therefore possible to intubate the patient without direct laryngoscopy using this supraglottic airway device.[17]

The air-breathing Q's tube is shorter; broader; and, because of the detachable connection, it may be used with a conventional tracheal tube. These benefits have been documented by study. [9]The air-Q comes in six different sizes (1, 1.5, 2, 2.5, 3.5, and 4.5) for single-use and four different sizes (2, 2.5, 3.5, and 4.5) for re-use. Consequently, they are available in sizes small enough to be used by tiny children (less than 30 kg). Children's tracheal intubations with cuffed tubes are presently only possible with the use of the Air-Q ILA supraglottic device. [19]

Studies have shown that SGAs like I-gel may be used during anaesthesia for individuals who are able to breathe on their own.[16] As a conduit for tracheal intubation in both adults and children, the original air-Q has been shown to be an effective airway management device.[8,12,17] When it comes to assessing and comparing the sealing performance of airway devices, the airway pressure (Oropharyngeal leak pressure, OLP) at which an air leak occurs is commonly acknowledged. OLP is essential for assessing the airway device's ability to seal. The greater the OLP, the better the seal and the less likely it is that air will leak. Numerous variables influence OLP, including as the device's location, cuff pressure, the head and neck's posture, surgical interventions, and muscle relaxants.[11] It is necessary to address and dispel a number of common myths concerning the use of supraglottic devices in children, including the idea that they are prone to displacement, making them unsuitable for lengthy operations, and the idea that they cannot be used for controlled

ventilation.[11] The I-gel and air-Q systems, on the other hand, have been studied less thoroughly than LMAs, which have been studied extensively.

CONCLUSION

The control of the airway is a critical component of any operation performed under general anaesthesia. The use of tracheal intubation for this purpose is regarded the gold standard, although other approaches, such as supraglottic airway devices, have emerged as viable alternatives. Multiple prospective trials have shown the safety of SGAs, and their potential advantages, such as a decreased risk of voice dysfunction and laryngospasm following emergence, have been observed. Studies on this issue have shown that the use of SGAs such as I-gel during anaesthesia for individuals who are spontaneously breathing is safe and effective. According to the manufacturer, research have demonstrated adults and children using the original air-Q for airway management and tracheal intubation.

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