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Postoperative sore throat: the importance of the position of the airway device

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Airway management is a core business for anesthetists, intensivists and physicians involved in respiratory medicine. Patients may need to undergo surgery and diagnostic or therapeutic procedures with different airway devices ranging from oral and nasal endotracheal tubes (ETTs) and supraglottic airway devices (SADs). More specialized devices can be used such as NIM (neural integrity monitor) tubes during dissection of head and neck tissue (e.g. neck dissection) and when laryngeal nerves could be injured (e.g. thyroid surgery); as well as double lumen tubes (e.g. Robertshaw or Mallinkrodt tube for lung separation), reinforced (wired) tubes (to prevent kinking), and oral- and nasopharyngeal airways (to keep the airway patent and prevent falling back of tongue in unconscious patients). Flexible, nasal, north-facing, soft seal cuffed preformed ETTs (to avoid nasal bleeding), and flexible curved centered, tapered distal cuff geometry that is designed to facilitate easy, non-traumatic intubation using soft-tip tubes (e.g. Parker Flex-Tip ETT) are two examples of specifically designed ETTs to reduce trauma during tracheal intubation.

It is known that insertion of airway devices results in a high incidence of postoperative trauma of the airway, with sore throat and hoarseness following tracheal intubation (62%) and insertion of SADs (49%) [1]. The aim of this Editorial is to review the reasons why the incidence of postoperative sore throat is so high and to provide advice/guidance to decrease this high occurrence.

Indications for airway devices

All airway devices have the intention to facilitate a patent airway, to secure the airway during unconsciousness, and to allow gas exchange and supply of additional oxygen. They are indicated in anesthesia and resuscitation of the unconscious patient. Endotracheal tubes are inserted to allow artificial ventilation using different ventilation strategies as well as mechanical ventilation in the intensive care settings for short-term (e.g. postoperative ventilation and direct suctioning of the trachea) and long-term artificial ventilation. The latter is frequently indicated in patients with respiratory infections or multi-organ failure, specific infections (e.g. acute epiglottitis, tetanus, and diphtheria), anaphylaxis and angioneurotic oedema. SADs are usually indicated for surgical interventions of shorter duration, where muscle relaxation is not a priority. The SADs are often applied in patients undergoing day case surgery.

Endotracheal tubes

Typically, endotracheal tubes are curved molded tubes, shaped to curve behind the tongue, lifting it away from the posterior pharynx. All airway devices intend to increase the distance between the posterior aspect of the tongue and the posterior pharyngeal wall. In the awake patient, there is a clear distance allowing spontaneous breathing. In the (semi) unconscious patient this distance narrows significantly (e.g. causing snoring) or blocks it completely (resulting in obstruction of the airway).

In the past, ETTs were made up of latex (Indian rubber) with a low volume, high pressure cuff, which often caused allergies and a high incidence of postoperative sore throat. Currently, single use disposable ETTs are preferred as they offer several advantages: a) hypoallergic material (PVC or silicone); b) disposable (less chance of infection); c) transparent (easy visualisation of blockage due to secretions, blood, pus), although this is not always the case; and d) high volume, low pressure cuff with the intent to reduce trauma to the airway. These tubes come in various sizes, ranging from 5.0 to 9.0 mm (internal diameter) for adults, with smaller sizes for the paediatric population.

Laryngoscopes and insertion techniques

Since the early 1940s, the anaesthetic community has used Miller (straight) and Macintosh (curved) blades for standard intubation with a classic laryngoscope. Variations were added in the form of a flexible tip laryngoscope (McCoy style) by tilting the tip for elevation of the epiglottis, resulting in less risk of airway trauma in cases of difficult intubations.

The arrival of the videolaryngoscope has made airway management much simpler with a high success rate in laryngoscopy and tracheal intubation [2,3]. However, manufacturers of videolaryngoscopes have marketed several types of videolaryngoscopes with curved and acute angled blades. The anesthetist needs to verify which videolaryngoscope is best for a specific patient, as not all videolaryngoscopes will achieve the same outcome. The design of the blade can make insertion of an airway device more or less difficult as the blade can limit the available space in the oropharynx when inserting the device and potentially cause trauma to the surrounding structures [4]. This is especially important when considering trauma to the palatopharyngeal fold if the ETT is inserted blindly by looking only at the monitor screen.

Videolaryngoscopy helps in an atraumatic insertion of the airway device under indirect vision ("what we see, we can do better"), allows the entire anaesthesia team to follow the intubation act on the monitor and if necessary, allows the assistant to identify a potential problem

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early [3]. Videolaryngoscopes with recording options further help in documenting the intubation process and can be used for didactic and teaching activities. Videolaryngoscopy is also beneficial in nasal intubation. Indeed, blind nasal insertion of an ETT results in a high incidence of nasal bleedings and postoperative sore throat [5].

There are a multitude of factors to consider when selecting the type of anesthesia and techniques used during insertion of the airway device to help reduce the risk of developing postoperative sore throat. Issues to consider include depth of general anesthesia, use of muscle relaxants or inhalation anesthetics and applying topical anesthesia to the vocal cords and trachea using a local anesthetic spray which helps to reduce haemodynamic responses such as hypertension, tachycardia and arrhythmia following intubation. Other factors include allowing enough time for the anesthetic to take effect before intubation, use of adequate cuff pressure in cuff pilot of the tube, performing a smooth extubation, and methods to reduce the incidence of coughing on ETT, accumulation of secretions, and use of an awake intubation technique. Adequate fixation of the tube using tape around upper and lower lips and avoiding traction on the tube during surgery are also important steps in avoiding postoperative sore throat.

Complications

Coughing, laryngospasm and bronchospasm often occur as a result of an inadequate level of anesthesia. This can lead to desaturation, hypercapnia, hypoxemia and increased risk of aspiration.

A traumatic insertion of the airway device can result in bleeding and oedema formation of the oropharynx/larynx e.g.: bruised lips, trauma to tongue, pharyngeal mucosa, palate and palatopharyngeal fold, and teeth (chipping, dislodgement). Further risks include fracture or dislocation of cervical spine vertebra dislocation, and trauma to arytenoid cartilages and vocal cords. Other potential complications include esophageal or endobronchial intubation and it is possible to inadvertently cause pressure necrosis of laryngeal structures resulting in nerve palsy and hoarseness. Nasal intubation may cause epistaxis and damage to polyps or adenoids. Bacteraemia can also occur from nasal obstruction (e.g. nasal sinuses). Long term consequences of tracheal intubation are: granuloma formation of the vocal cords, and laryngeal and tracheal stenosis for which a tracheostomy may be needed. Tube obstruction, kinking, malfunction, ignition (e.g. during laser therapy), and cuff perforation (creating a leak around the ETT) are other examples of complications that can be observed.

Supraglottic airway devices (SADs)

SADs are very popular devices used in the majority of patients undergoing surgery, i.e. 60% vs 35% for ETTs [6,7]. SADs are very forgiving devices as even when not positioned optimally, they often still function satisfactorily. Fortunately, SADs avoid most of the ETT complications, however, there is one major disadvantage: SADs lack the mechanical protection from regurgitation and aspiration of gastric content. Furthermore, laryngospasm, coughing and sore throat are frequently encountered problems.

SADs come in two generations; first generation SADs have only a ventilation hole and the 2nd generation SADs feature ventilator and gastric channels with a clear separation of the two. The latter produce a higher oropharyngeal airway leak pressure and hence, protect better against aspiration.

50-80% of all SADs inserted, no matter which brand, result in malpositioned airway devices. This can be due to the distal cuff not blocking the esophagus, folding over backwards or sitting across the vocal cords. The rim of the proximal cuff can misalign with the tip of the epiglottis and the epiglottis can be folded double sideways or downfolded in the bowl of the SAD, resulting in leakage or complete obstruction of the airway. This results in inadequate gas exchange, poor capnogram and oxygen desaturation. All existing SADs of whatever brand can cause one or more of the above malpositions.

Vision-guided insertion of SADs allows immediate compensation by manoeuvring the device in the correct position using jaw thrust [7]. Insertion using a videolaryngoscope, in the hands of a trained practitioner, virtually rules out the risk of a malpositioned airway, which helps in reducing the incidence of postoperative sore throat.

Interventions used during airway device insertion to reduce the incidence of postoperative sore throat

Methods of intervention used for *nasotracheal intubation* to reduce the incidence of epistaxis and sore throat include the use of an ETT with: a) a reduced internal diameter; b) thermo-softening of the ETT; c) specific ETT tip design for nasal intubation; d) bubble-tip design; e) Parker Flex-Tip design; f) RAE tube/Wendl tube, with esophageal stethoscope; g) lubricated ETT; and h) pre-treatment with vasoconstrictor nasal drops or sprays [5].

Some methods of intervention used for *orotracheal intubation* to reduce the incidence of postoperative sore throat include: a) adequate pre-oxygenation of the lungs and adequate positioning of the patient before induction of anesthesia by raising the head 5-10cm with a block, ring or pillow to allow flexion of the neck or the ramped position in obese patients; b) use of vision-guided insertion of ETTs, whereby the ETT is guided towards the vocal cords and trachea; c) use of a videolaryngoscope which has a wider angle of view (60°), as opposed to the classic laryngoscope (15°) [8], which allows better laryngoscopy views and results in higher first attempt intubation success rates; d) insertion of the tube should be gentle, avoiding any trauma to the oropharynx/larynx; e) the vocal cord guide (one or two black lines on the wall of the ETT) should be placed adequately at the level of the trachea so that the tip of the ETT is positioned above the bifurcation while the cuff sits just down the vocal cords but not across the vocal cords; f) adequate inflation of the pilot cuff gives an airtight seal however, it is important to ensure that the intracuff pressure of ETT is limited to 15-30 cm H_20, avoiding both under- and overpressure, also during maintenance of anesthesia; g) if possible, the use of BURP (backward upward and rightwards pressure) and cricoid pressure manoeuvres should be avoided as both result in a significant decrease in the area under the vocal cord opening, and hence contribute to the trauma of the vocal cords during forced intubation; h) adequate anesthesia, including muscle relaxants and pain relief, is important to consider; i) practitioners should try to limit the number of attempts, use a non-traumatic intubation technique and ask for assistance in difficult cases; j) the use of airway adjuncts (e.g. Magill forceps, Frova intubating bougie) is an important consideration and having rescue airway devices (plan A-B-C) ready at hand is highly important. The use of a SAD allows to buy time in the event of a 'can't intubate, can't oxygenate' scenario, so that one can prepare for the next step in airway management. Correct fixation of the tube with adhesive tape to the upper and lower lip prevents the ETT from dislocation of its position (either too deep or too superficial), and preventing surgeons or equipment causing kinking or obstruction of the airway is vital. Careful confirmation of the exact position of the ETT can be done by auscultation, chest expansion, bag movement, adequacy of SpO_2, blood gases and presence of capnogram

and end-tidal CO_2. If required, a chest X-ray can be used to identify the radiopaque marker which helps to accurately visualise the position of the ETT within the trachea, above the bifurcation. Adequately preparing equipment such as Bonfils and a Flexible Tip Video bronchoscope and the preparation of the patient with a difficult airway are very important. Some potential airway difficulties include: limited mouth opening, limited neck movement, morbid obesity, congenital or acquired limitations of mouth opening, deviated or narrowed trachea, stiff joints and arthritis. Finally, be prepared for an awake fiberoptic intubation.

Videolaryngoscopy has now become more and more the standard intubation technique for the normal and the difficult airway, for elective and emergency intubations, for adults and children, for the anticipated and non-anticipated difficult airway.[3] As most patients would prefer to undergo an ETT insertion under general anesthesia, the indications for awake fiberoptic intubation will decrease further. It allows a gentle intubation technique under indirect vision on a monitor screen. Videolaryngoscopy should be used to insert all airway devices, including ETTs, SADs, nasogastric and orogastric tubes and temperature probes [7-10]. Only by visual confirmation of the exact position of all airway devices, a further reduction in the incidence of postoperative sore throat can be realized. Videolaryngoscopy has demonstrated that downfolding of the epiglottis occurs during ETT insertion, with the epiglottis trapped between the tracheal wall and the tube. Obviously, a position lasting several hours will cause trauma (oedema) to the epiglottis, which may contribute to the incidence of airway trauma and sore throat.

Vision-guided insertion is also a useful technique to insert SADs. A vision-guided insertion of SADs, using an "insert-detect-correct-as-you-go technique" resolves virtually all problems of malpositioning during insertion of the airway device [6,7]. Malpositioned SADs result in increased postoperative sore throat, something we all wish to avoid in the patients under our care. Further care should be taken by using the correct size SAD and the correct inflation of the cuff (40-60 cm H_20) during the maintenance phase of anesthesia.

In conclusion, several techniques are used to insert airway devices in and around the larynx. Vision-guided insertion of ETTs, SADs and other adjuncts is a valuable technique to insert and correctly position the airway device, but also to reduce the incidence of postoperative sore throat.

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