Hot Topics in Airway Management During Gastrointestinal Endoscopy

Annarita Torino, Daniela Di Martino, Pierluigi Fusco, Umberto Collina, Lucia Marullo and Fausto Ferraro

Department of Anesthesiological, Surgical and Emergency Sciences, Second University of Naples, Italy, Postcode: 80138, Italy

*Corresponding author: Fausto Ferraro MD, Assistant Professor of Anesthesiology, Dept. of Anaesthesiological, Surgical and Emergency Sciences, Second University of Naples, SUN, Piazza Miraglia, 2, 80138 Naples, Italy, Tel: 39-081-5665172; Fax: 39- 081- 5666600; E-mail: fausto.ferraro@unina2.it

Rec date: Oct 6, 2015, Acc date: Jan 5, 2016, Pub date: Jan 12, 2016

Copyright: © 2016 Torino A, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Recently, endoscopic minimal invasive procedures have become commonly practiced. Sedation, and consequently airways management, is a way to respond to the increasing complexity and duration of gastrointestinal endoscopy. Main issues regarding the sedation during gastrointestinal endoscopy are: patient’s safety, comfort and tolerance to the procedure. This results simultaneously in a good examination quality. The best method to assure airways safety is still debated; it should always be tailored to the patient, to his comorbidity and to the particular procedure to be done, and has to be accepted by the whole medical team. This article provides an update on the available devices and methods of airway management during gastrointestinal endoscopy.

Keywords: Gastrointestinal endoscopy; Airway management; Endoscopy mask; Gastro laryngeal tube; Laryngeal mask airway; Robertazzi nasopharyngeal airway; Endotracheal tube

Introduction

In the last decades gastrointestinal endoscopy has become a commonly used minimal invasive procedure in the clinical practice. Based on the different complexity level of the operative endoscopic procedures the role of sedation is getting increasingly relevant.

Table 1: Levels of sedation and anesthesia.

<table>
<thead>
<tr>
<th>Minimal sedation (anxiolysis)</th>
<th>Moderate sedation (conscious sedation)</th>
<th>Deep sedation</th>
<th>General anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsiveness</td>
<td>Normal response to verbal stimulation</td>
<td>Purposeful response to verbal or tactile stimulation</td>
<td>Purposeful response after repeated or painful stimulation</td>
</tr>
<tr>
<td>Airway</td>
<td>Unaffected</td>
<td>No intervention required</td>
<td>Intervention may be required</td>
</tr>
<tr>
<td>Spontaneous ventilation</td>
<td>Unaffected</td>
<td>Adequate</td>
<td>May be inadequate</td>
</tr>
<tr>
<td>Cardiovascular function</td>
<td>Unaffected</td>
<td>Usually maintained</td>
<td>Usually maintained</td>
</tr>
</tbody>
</table>

Sedation is a drug induced consciousness depression which aim is to relieve patient's anxiety and pain, and to induce amnesia of the intervention in order to improve the examination's outcome and the patient's compliance [1,2].

Sedation may be classified in four stages: minimal, moderate, deep sedation and general anesthesia (Table 1); they correspond to different stages of consciousness, airway protective reflexes and respiratory function impairment. Since the operatory field is shared with the endoscopist, a dedicated airway management is mandatory when deep sedation or general anesthesia are necessary [3].

Table 2: Patient, procedure, and operator dependent variables affecting the sedation stage.

<table>
<thead>
<tr>
<th>Patient variables</th>
<th>Procedure dependent variables</th>
<th>Operator dependent variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Invasiveness level</td>
<td>Duration</td>
</tr>
<tr>
<td>State of health</td>
<td>Discomfort</td>
<td>Skills</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>Duration</td>
<td></td>
</tr>
<tr>
<td>Level of anxiety</td>
<td>Decubitus</td>
<td></td>
</tr>
<tr>
<td>Pain tolerance</td>
<td>Need of immobility</td>
<td></td>
</tr>
<tr>
<td>ASA score</td>
<td>Stimulation of reflexive areas</td>
<td></td>
</tr>
<tr>
<td>Collaborate capability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Patient, procedure, and operator dependent variables affecting the sedation stage.

This is to avoid procedural compliances such as: hypoxia, hypercapnia and aspiration of gastric contents [4,5]. To choose the sedation stage it is necessary to consider patient dependent variables, procedure dependent variables and operator dependent variables [6] showed in Table 2.

Generally, quick and easy diagnostic and therapeutic procedures are easily performed in moderate sedation. Deeper stages of sedation are needed to allow more difficult, painful and longer interventions, such as ERCP.

In addition, when moderate sedation becomes inadequate because of procedural variables, and/or patient's management is difficult, deep sedation and general anesthesia should be used without any hesitation [2,7]. Although a standard protocol does not already exist, a strategy tailored on every single clinic setting could be considered the best strategy. This method allows a good quality of the procedure and
improves patient's compliance, thus determining patient's and physician's satisfaction [8].

Conscious sedation

During moderate sedation, also called "conscious sedation" (Table 1), the airways protective reflexes are preserved [4] and so, dedicated airway management devices could be unnecessary. According to the SpO₂ monitoring, the enrichment of the inspired air with low oxygen flux through nasal cannulas could be provided. This stage of sedation is the most used to perform minimally invasive and quick endoscopic procedures.

Deep sedation and general anesthesia

During these stages of sedation (Table 1) the airway protective reflexes and respiratory function are impaired [1]. Thus, airway management with dedicated devices is needed. This clinical setting requires anesthesiological skills. Deep sedation and general anesthesia are indicated in lengthy and/or invasive procedures and in poorly compliant patients [2,4].

Airway Management

A correct, proper and safe airway management begins with the evaluation of the patient's medical history, of his comorbitidy, his bodily habitus, and his anthropometric parameters predictive of difficult airway. The ASA Task Force [1] proposed a list of prognostic factors of suspected difficult airway (Table 3).

Specific anthropometric parameters, predictive of difficult airway, are shown in Table 4. Mallampati score (Figure 1) is a high precision predictive indicator of difficult intubation. It evaluates the possibility to visualize: the base of the uvula, faucial pillars and soft palate. These are related to the patient’s anatomical features, and to the difficulty level of airway management that will be find at the laryngoscopy.

Difficulty levels increase from the Class I to the Class IV [9]. The expectation of difficult or impossible endotracheal intubation can be based on the severe divergence from the norm of just one parameter or on the mild but concurrent alteration of more parameters [10-12].

Table 3: Evaluation of prognostic factor of suspected difficult airway.

| Congenital or acquired disease of the nose, tongue, theet, temporomandibular joint and cervical spine | Previous narcosis with and without endotracheal intubation | Obesity, snoring and obstructive sleep apnea | Previous tracheotomy/previous prolonged intubation and/or difficult airway report |

Table 4: Anthropometric parameters predictive of difficult airway.

| Mobility of the neck and its shape | Mandibular hypoplasia or micrognathia | Mobility of the temporomandibular joint | Interdental distance | Conditions of theeth, denture fixed or mobile, protrusion of the incisors, dimension of the tongue in relation to the oral cavity | Chin-Tyroid Distance | Mallampati score | Mandibular protrusion test | Chin-Sternum distance |

Table 1: Mallampati score.

Airway Management Devices

Airway management devices in gastrointestinal endoscopy are listed in Table 5.

Table 5: Airway management devices in gastrointestinal endoscopy.

Face Mask Ventilation: Endoscopy Mask (VBM Medizintechnik GmbH; DEAS)
Supraglottic devices: Robertazzi nasopharyngeal airway Laryngeal Mask Airway Gastro Laryngeal Tube (VBM Medizintechnik GmbH)
Endotracheal Tube Not armored Armored

Endoscopy Mask (VBM Medizintechnik GmbH, Sulz, Germany; DEAS, Italy)

Face Mask ventilation [13-15] (Figures 2-4) is a device that allows simultaneous ventilation of the patient during Fiberoptic Intubation, Bronchoscopy, GI Endoscopy procedures, Trans-Esophageal Echocardiography [13,16]. It increases the patient comfort and the quality of the procedure; it is ideal for diagnostic endoscopic procedures of short duration [16,17]. This kind of mask is provided of a specifically designed Guedel and biteblock to protect equipment from damage, it is for single use without any risk of infection or contamination, it is available in different sizes.

Figure 2: Endoscopy Mask (VBM Medizintechnik GmbH, Sulz, Germany).

Figure 3: Endoscopy Mask (DEAS, Italy).

Figure 4: Face Mask ventilation. Simultaneous ventilation and the patient during endoscopy.

This device allows application of continuous positive airway pressure (CPAP) [18] to prevent or overcome obstruction and airways collapse during sedation for upper endoscopy [19]. Ventilation through this device has been compared with spontaneous ventilation via nasal insufflations, in a prospective study conducted in patients receiving propofol sedation [20]. Results showed fewer episodes of oxygen desaturation in the Endoscopy Mask group. In pediatric patients undergoing upper gastrointestinal endoscopy, this kind of mask allows to administer inhalational anesthetic drugs [21]. Using this kind of mask it could be necessary to use lubricants to avoid drag. Silicone lubricants, such as EndoLubeTM, are preferable to water-based products which rapidly dries to a thin film. The endoscope should always be preloaded through the mask before the procedure; then the patient should be preoxygenate using a standard mask and once he is ready, the endoscope can pass into the esophagus and the mask can be fixed to the patient's face. Once operators have reached familiarity with endoscopy mask in easy cases, their use should be reserved for selected cases in reason of their high cost. It doesn't require anesthesiological improved skills.

Robertazzi nasopharyngeal airway

It is a simple supraglottic device used to deliver high oxygen flow through the nasopharynx; it could be positioned after topical anesthesia or when the patient is already sedated. It consists of a nasopharyngeal cannula, an oxygen connector and a strap from a bite block necessary to avoid its dislodgment [22]. It has different sizes; choosing the right size avoids wrong positioning related problems such as failure when a short airway does not pass the velopharynx, or such as cough or laryngospasm when a long airway contacts vocal cords or arytenoids. This system is highly helpful in reducing the episodes of oxygen desaturation during endoscopy [22]; Müller et al. in their prospective, randomized trial conclude that the routine placement of a nasopharyngeal airway can reduce the frequency of hypoxemic events during endoscopic sedation with minor risks for nasopharyngeal injury [23].

Laryngeal mask airway

Laryngeal Mask Airway (LMA) is a supraglottic airway device. It is a plastic tube with a distensible oval cuff at the end; it is placed through the mouth with its tip in the lower pharynx just close to the upper oesophageal sphincter. In this way it is possible to seal the larynx without crossing the glottis (Figure 5). In a meta-analysis conducted earlier in 1995 by Brimacombe at al., endotracheal tube was considered as the gold standard to protect airways during gastroscopy, although they had already found the same frequency of lung aspiration both with the endotracheal tube than with the LMA in selected cases [24]. In more recent comparative study between the use of LMA versus Endotracheal Tube during endoscopic retrograde cholangiopancreatography (ERCP), using a 13 mm diameter endoscope, Osborn et al. [25] did not notice significant differences, except for the extubation time that resulted shorter for the LMA. According to this study, LMA can be advantageously used in endoscopic procedures without any obstacle to the endoscope insertion and displacement problems. After its placement, the LMA is moved to the left side of the mouth, then the endoscopist puts a classic bite block into the right side of the mouth; bite block allows the endoscope to pass through the mouth without any risk of its damage by teeth. Once the endoscope is inserted, it should move past the LMA and then into the oesophagus [25]. During this procedure, the operator should search for the tip of the LMA which lies in the upper oesophageal sphincter. To avoid drag and out movement of the device, it is recommended to use silicone lubricated gastroscope. In pediatric patients the LMA has been successfully used during endoscopy upper procedures performed with small diameter gastroscope [26,27].
LMA, such as the other supraglottic devices, has the advantage of avoiding intubation's stress and the need of neuromuscular blocking drugs, of decreasing anesthetic dose, extubation, recovery and discharge time [28,29]. Furthermore the LMA can be reusable after adequate sterilization and it does not require improved anesthesiological skills [30].

On the basis of the quoted studies, we can assert that the airway management with LMA is safe and effective. Although, in patients at high risk of vomiting, such as full stomach, LMA and other extraglottic devices do not exclude the risk of inhalation [31]. In these cases, the endotracheal tube should be preferred.

Gastro laryngeal tube (VBM Medizintechnik GmbH, Sulz, Germany)

Gastro Laryngeal Tube (Figure 6) is a supraglottic airway device for ventilation, specific for gastro intestinal endoscopy use, it is used to assure airway patency in adults in spontaneous breathing or under mechanical ventilation when deep sedation or general anesthesia are needed for complex gastrointestinal endoscopic procedures. It is provided of two channels, one for ventilation and one for the passage of the gastroscope. It has a proximal cuff that stabilizes the tube, it is placed in the pharynx and occludes the oropharynx and nasopharynx, and a distal cuff that occludes the oesophagus preventing pulmonary aspiration [31]. Since the two high-volume, low-pressure cuffs are interconnetted, they are inflated by a single valve placed on the pilot balloon until reaching a pressure of 60 cm H₂O. The Gastro Laryngeal Tube is a latex free silicone tube, it has an endoscopic channel with an inner diameter of 16 mm that allows the passage of a maximum 13.8 mm diameter endoscope. The endoscope’s internal diameter starting from 2.5 to 9.0 mm.

Endotracheal tube

The endotracheal tube is a polyvinyl chloride (PVC) tube with a low pressure and high volume cuff at its end. The clinic use of the tube is usually decided considering the base of the internal diameter which limits the air flux. The factor that bounds the choice of the size is the grading of the rim of the glottis in adults and the underglottis region in children. They are product with scale measures of 0.5 mm of the internal diameter starting from 2.5 to 9.0 mm. The depth suggested for the positioning, referred to the point of the tube, must be evaluated in every patient in order to the wide variability in the length of the windpipe. To facilitate the right positioning of the tube there is a radiopaque line over the cuff that should be placed immediately after the vocal cords. Once the tube has been inserted, the cuff must be inflated to give the right airways protection without any lateral compression of the trachea. The armored endotracheal tubes are wire-reinforced tubes, they are are quite flexible but yet difficult to compress or kink. Their use is reserved to surgical procedures of the head or the neck or anytime when there is a serious probability of kneeling. In males an 8.0 mm diameter endotracheal is suggested, in females a 7.0 mm diameter is preferred, since females glottis is usually smaller. The tube size in the pediatric patients can be evaluated by the formula 16 plus Age/4. General anesthesia and neuromuscular blocking drugs are needed to get the tracheal intubation properly, and to perform this procedure improved anesthesiological skills such as confidence with the use of laryngoscopes and fibroscopes are necessary [30]. The times of induction, awakening, recovery room and discharging are longer than other airway management procedures, but, nowadays it is the standard for airways protection from the risk of lung aspiration [31].

Table 6 resumes different authors’ use of airways devices in children or adults according to endoscopic procedure, level of sedation and anesthesiological skills of the operators.
Complications related to every gastrointestinal endoscopic procedure. Be methodologically programmed by including it in the protocol of his comorbidities, his bodily habitus and, last but not least, his will and compromise. So, after a careful clinical evaluation of the patient from the anesthetist and from the endoscopist, the first step is the risk stratification. Then, there is the need to elaborate a tailored therapeutic and operative therapy, adapt to the single procedure and the single patient. Although at our knowledge there are no specific evidence based procedures, we should know, have available and use the different airway management devices and we should consider the wide selection of therapeutic options at our disposal. This could lead to maximize the positive outcome and to avoid or, in any case, to reduce the complications related to every gastrointestinal endoscopic procedure. For these reasons we believe that the airway management should not be left to chance but it must be placed in the foreground and it should be methodologically programmed by including it in the protocol of every endoscopic procedure.

Conclusions

Until today there is no validated protocol of sedation and consequent airway management standardized to the endoscopic procedure to perform. As we have already reported, the necessity of different depth sedation, and the consequent airway management is influenced by a lot of variables: patient, procedure and operator dependent. Considering all the factors listed above, it would be better to adopt a procedure of close collaboration and communication between the anesthetist, the operator and the patient. It would be also necessary to consider the procedure to be done, its invasiveness (pain, reflex stimulation, bleeding, duration) but also patient’s special needs, his comorbidities, his bodily habitus and, last but not least, his will and his compliance. So, after a careful clinical evaluation of the patient from the anesthetist and from the endoscopist, the first step is the risk stratification. Then, there is the need to elaborate a tailored therapeutic and operative therapy, adapt to the single procedure and the single patient. Although at our knowledge there are no specific evidence based procedures, we should know, have available and use the different airway management devices and we should consider the wide selection of therapeutic options at our disposal. This could lead to maximize the positive outcome and to avoid or, in any case, to reduce the complications related to every gastrointestinal endoscopic procedure. For these reasons we believe that the airway management should not be left to chance but it must be placed in the foreground and it should be methodologically programmed by including it in the protocol of every endoscopic procedure.

Conflict of Interest

Annarita Torino, Daniela Di Martino, Pierluigi Fusco, Umberto Collina, Lucia Marullo and Fausto Ferraro have not received fees for serving as a speaker, they have not received research funding from any organization. They do not own stocks and/or shares in any organization. They do not own patents.

References


15. DEAS. Product Catalogue.


Table 6: Resume of authors’ use of airways devices according to endoscopic procedure and level of sedation.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Ref</th>
<th>Year</th>
<th>Endoscopic Procedure</th>
<th>Population</th>
<th>Level of sedation</th>
<th>Administration of sedation</th>
<th>Airway Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osborn</td>
<td>[23]</td>
<td>2002</td>
<td>ERCP</td>
<td>Adults</td>
<td>Deep</td>
<td>Anesthesiologist</td>
<td>Laryngeal Mask Airway</td>
</tr>
<tr>
<td>Orfei P</td>
<td>[26]</td>
<td>2002</td>
<td>EGDS</td>
<td>Children</td>
<td>Moderate</td>
<td>Anesthesiologist</td>
<td>Laryngeal Mask Airway</td>
</tr>
<tr>
<td>Fabbri C</td>
<td>[31]</td>
<td>2012</td>
<td>ERCP</td>
<td>Adults</td>
<td>Deep</td>
<td>Anesthesiologist</td>
<td>Gastro-Laryngeal Tube</td>
</tr>
<tr>
<td>Muller M</td>
<td>[22]</td>
<td>2014</td>
<td>Colonoscopy and EGDS</td>
<td>Adults</td>
<td>Conscious sedation</td>
<td>Non-Anesthesiologist</td>
<td>Nasopharyngeal Airway</td>
</tr>
</tbody>
</table>


