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First experience of using gastro-laryngeal intubation to provide ventilation in advanced endoscopic procedures

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Abstract

Anaesthetic management of advanced endoscopic interventions requires some improvements. The objective of our research was to assess the advantages and disadvantages of using gastro-laryngeal intubation when performing advanced endoscopic procedures and compare it with standard anaesthetic strategies. There were examined 175 consecutive patients. Three anaesthetic tactics including intravenous sedation with spontaneous respiration, intravenous anaesthesia with endotracheal intubation and artificial pulmonary ventilation, and intravenous deep sedation with an intubation using gastro-laryngeal tube and assisted ventilation were used. Anaesthesia using the gastro-laryngeal tube was found to have significant advantages compared to other types of anaesthesia. This method is safe for patients allowing us to control the adequacy of ventilation and protect the airways against aspiration improving the anaesthesiologist and endoscopist's working conditions. Conclusions. Anaesthetic management of transduodenal endoscopic surgery using the gastro-laryngeal tube reduces the incidence of complications of the respiratory system and blood circulation. The incidence of hypoxic episodes was lower compared to anaesthesia with the preservation of spontaneous ventilation. The use of the gastro-laryngeal tube facilitates the procedure performance by the anaesthesiologist and endoscopist and is well tolerated by patients.

Keywords: Endoscopic Procedures, Anaesthetic Management, Gastro-Laryngeal Tube

Introduction

Over the last few decades the frequency and complexity of the upper gastrointestinal endoscopy has considerably increased ^[1]. Topical anaesthesia which is used in minor diagnostic endoscopic procedures is unable to provide satisfactory conditions to perform leading-edge advanced endoscopic surgeries. The use of anaesthesia with endotracheal intubation more adequately meets the requirements of endoscopic surgery. However, it has some disadvantages ^[2]. In particular, the presence of endotracheal tube in a patient's oropharynx creates some difficulties when manipulating the endoscope. Also endotracheal anaesthesia is accompanied by prolonged recovery. To overcome these difficulties the gastro-laryngeal tube (G-LT) was developed ^[3].

The Aim of the Research

The aim of the research was to assess the advantages and disadvantages of using gastro-laryngeal intubation when performing advanced endoscopic procedures and compare it with standard anaesthetic strategies based on a three-year experience in using the G-LT.

Materials and Methods

175 patients who underwent endoscopic surgeries for obstructive jaundice of different genesis were included in a prospective study. Patients with multiple organ dysfunction syndrome and severe comorbidities which could affect the results of the analysis were excluded from the study. The average age of patients was 53.12±8.6 years, 73% of them were females. Three anaesthetic tactics were used. 56 patients of Group I received intravenous sedation (midazolam+propofol+fentanyl) on the background of spontaneous breathing oxygen-air mixture. Patients of Group II (n=62) received intravenous anaesthesia (midazolam+propofol+fentanyl+atracurium) with standard endotracheal intubation (TI) and artificial pulmonary ventilation (APV). Patients of Group III (n=65) received intravenous analgo-sedation (midazolam+propofol+fentanyl) and were ventilated with the synchronized intermittent mandatory ventilation (SIMV) mode using the gastro-laryngeal tube (G-LT).

The gastro-laryngeal tube (G-LT, VBM Medizintechnik GmbH, Germany) is a double-lumen endotracheal tube which is inserted through the mouth of the anaesthetized patient so that distal end of its central endoscopic channel opens into the esophageal lumen and provides a

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smooth introduction of the fiberscope, and the holes on the front side of the G-LT are placed in front of the entrance to the larynx. Pharyngeal and esophageal cuffs provide the isolation of both channels. Thus, spontaneous or mechanical ventilation of the patient through the lateral channel which does not impede the performance of endoscopic procedures is provided. The use of the G-LT allows us to perform deep sedation and use special modes of artificial pulmonary ventilation if necessary. It creates permanent access for monitoring indicators of breathing rate and does not limit the possibility of manipulating the endoscope.

During the anaesthetic management the indicators of blood oxygen saturation (SpO₂), partial pressure of end-tidal carbon dioxide (PetCO₂) and bispectral index (BIS) were identified. To make a non-invasive assessment of cerebral oxygenation in patients with hepatic encephalopathy the dynamics of changes in the indicators of bilateral cerebral oximetry (rSO₂) was investigated.

Table 1: Mean intraoperative values of the adequacy of ventilation

Indicator	Group I	Group II	Group III	p (I-II)	p (II-III)
SpO ₂ (%)	88.1±0.2	98.1±2.1	98.2±3.1	0.56	0.004
PetCO ₂ (mmHg)	47.30±0.55	38.4±2.4	39.8±3.4	0.01	0.01
rSO ₂ (%)	49.5±0.1	78.4±1.1	77.8±1.8	0.65	0.006
BIS	43.6±2.2	42.3±3.5	65.6±2.4	0.62	0.01

Clinically significant hypoxia was not found in patients of other groups. Laryngospasm was registered in 4.5% and bronchospasm 1.1% of patients belonged to Group I only. The cardiovascular system during anaesthesia was characterized by arterial hypertension and tachycardia. Arterial hypertension (systolic BP>180 mmHg) was detected in 25.5% of patients of Group I, 11.7% of patients belonged to Group II and 7.4% of patients of Group III, and tachycardia with a rate of more than 120 beats per minute was registered in 15.3% of patients of Group I, 4.9% of patients belonged to Group II and 2.3% of patients of Group III. Correction of arterial hypertension was provided deepening anaesthesia and making a bolus injection of urapidil and acceptable heart rate was provided injecting esmolol. Thus, hemodynamic disorders were practically not dependent on the depth of general anaesthesia which was confirmed by the bispectral index values being 43.6±2.2 and were registered more often in patients of Group I. Detected changes were caused by inadequate spontaneous ventilation, insufficient neurovegetative protection and secondary negative effect of hypoxia and hypercapnia. In addition, in patients of Group I the lowest mean values of cerebral oximetry (49.5±0.1%) were detected indicating intensified oxygen extraction by tissues under the conditions of reduced systemic arterial oxygenation (SpO₂=88.1%) and increased cerebral blood flow secondary to hypercapnia. Thus, an imbalance between delivery and consumption of oxygen by neurons due to a reduced cerebral oxygenation detected in Group I among patients with hepatic encephalopathy almost certainly leads to its aggravation and the development of cognitive disorders. Therefore, it requires an effective correction – breathing support when performing endoscopic interventions.

Thus, general anaesthesia using the G-LT when performing synchronized intermittent mandatory ventilation in case of transduodenal endoscopic surgeries is much safer compared to general anaesthesia with preserved spontaneous breathing of the patient and is effective alternative to endotracheal intubation in securing the safety and quality of anaesthesia.

Results and Discussion

Mean values of the adequacy of ventilation during an endoscopic procedure (Table 1) were the best in patients of Groups II and III. In Group I the indicators were significantly worse (p<0.05). According to the obtained results the largest number of complications was observed among patients of Group I. Transient hypoxemia (a reduction in SpO₂ < 90 %) was found in 19.5% of patients of Group I, 3.9% of patients belonged to Group II and 2.2% of patients of Group III. In addition, the difference in the incidence of this complication among patients of Groups I and III was statistically significant: p<0.005. Some patients of Group I developed hypoxemia during the induction of anaesthesia despite oxygen inhalation through the nasal catheters. In 16.1% of patients hypoxemia was eliminated using cardio pulmonary resuscitation and increasing the flow of oxygen. In 3.4% of patients after removing the endoscope mechanical ventilation via a face mask was performed. In 1.3% of patients endotracheal intubation was performed.

Conclusions

1. Anaesthesia with preserved spontaneous breathing is accompanied by a high incidence of hemodynamic disorders, significant stress load for the anaesthesiologist and inconvenient working conditions for the endoscopist, leads to the progression of hepatic encephalopathy and may result in postoperative cognitive dysfunction.
2. Anaesthesia with endotracheal intubation is accompanied by a low incidence of complications. However, it requires the use of neuromuscular relaxants resulting in the prolongation of the recovery period.
3. Anaesthetic management of endoscopic surgery using the gastro-laryngeal tube minimizes the incidence of complications of the respiratory system and blood circulation. The incidence of hypoxic episodes is lower compared to the anaesthesia with the preservation of spontaneous ventilation (p<0.005). The use of the gastro-laryngeal tube facilitates the procedure performance by the anaesthesiologist and endoscopist and is well tolerated by patients.

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