Case Report

Is laryngeal mask airway general anesthesia feasible for minimally invasive esophagectomy?

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Abstract: Minimally invasive esophagectomy (MIE) has been identified as an oncological method with lower mortality and morbidity. This procedure is usually performed under general anesthesia using double endotracheal tube intubation and one-lung ventilation for a good visualization like other video-assisted thoracoscopic surgery (VATS). However, it is difficult to differentiate weather the postoperative hoarseness is caused by intubation or by recurrent laryngeal nerve injury during operation, and some complications related to intubation also are the focus of thoracic surgeons. Recently, VATS without tracheal intubation were reported to be feasible and safe in a series of VATS procedures, including management of pneumothorax, wedge resection of pulmonary tumors, excision of mediastinal tumors, lung reduction surgery and lobectomy. However, there is no report about its use in MIE. In December of 2012, we successfully applied nonintubated laryngeal mask airway (LMA) general anesthesia in MIE for three patients with esophageal cancer. Here, we retrospectively report the tentative results.

Keywords: Non-intubation; esophageal cancer; minimally invasive esophagectomy (MIE); laryngeal mask airway (LMA)

Submitted Feb 26, 2018. Accepted for publication Mar 07, 2018.
doi: 10.21037/jtd.2018.03.102
View this article at: http://dx.doi.org/10.21037/jtd.2018.03.102

Introduction

Esophagectomy is the cornerstone of the curative treatment of esophageal carcinoma. In the two decades, minimally invasive esophagectomy (MIE) has emerged as an oncological approach with lower mortality and morbidity. Traditionally, thoracoscopic operations are performed under general anesthesia with double-lumen endotracheal intubation and single-lung ventilation. However, conventional general anesthesia may result in numerous adverse effects, such as airway trauma associated with the double-lumen endotracheal tube, ventilator-induced lung injury, and cognitive dysfunction, especially in susceptible elderly patients (1-3). In recent years, some studies indicate that thoracoscopic operations without tracheal intubation can be used for numerous diseases, including pneumothorax, resection of pulmonary nodules, resection of solitary metastases, lung volume reduction and resection of pulmonary lobectomy, to avoid tracheal intubation and associated anesthesia complications (4,5). Here, we report the tentative application of laryngeal mask airway (LMA) anesthesia for MIE procedure in our institution.

Case presentation

Three patients with esophageal carcinoma underwent MIE

Table 1 The perioperative clinical data of the three patients

Variable	Case 1	Case 2	Case 3
Gender, M/F	M	F	M
Age (years)	58	53	65
BMI (kg/m^2)	24.3	23.6	25.1
Concomitant disease	No	No	No
Smoking (number)	Yes	No	No
Neoadjuvant treatment	No	No	No
Histology	SCC	SCC	SCC
Preoperative stage	T2N1M0	T2N0M0	T3N0M0
Tumor location	Upper 1/3	Middle 1/3	Middle 1/3
Total operative time (min)	170	150	180
Thoracic phrase time (min)	60	55	70
Bleeding volume (mL)	30	50	100
Left RLN nodes number	3	5	4
Right RLN nodes number	4	2	2
Total lymph nodes number	24	19	26
Total anesthetic time	210	185	210
Postoperative stage	T2N1M0	T2N1M0	T3N0M0
Postoperative complications			
Pneumonia	Yes	No	No
Thoracic gastric avascular necrosis	No	No	No
Arrhythmia	No	Yes	No
Chylothorax	No	No	No
Delayed gastric emptying	No	No	No
Hoarseness	No	No	No
Leakage of gastroesophageal anastomosis	No	No	No

M, male; F, female; BMI, body mass index; RLN, recurrent laryngeal nerve; SCC, squamous cell carcinoma.

using non-intubation anesthesia approach via LMA in December of 2012. The three patients were selected carefully: besides regular preoperative test, MVV%, FEV_1 and DLCO must be above 70%, 1.6 L/s and 75%. And they must had no cardiac disease history and with normal ECG. Before operation, communication with patients was performed on the anesthesia approach and consent forms were signed.

All the patients were pre-medicated with 50 mg of fentanyl intravenously, and electrocardiography (ECG), oxyhemoglobin saturation, respiratory rate, blood pressure, central venous pressure (CVB) and arterial blood gas analysis were monitored during the MIE procedure. Sedation was then started by intravenous administration of propofol (10 mg/mL) using a target controlled infusion method, with incremental fentanyl injection to maintain the patients in a mildly sedation. During the procedure, atracurium will be added as the manipulation needed and the patients breathed oxygen through LMA and ventilator (tidal volume 5 mL/kg, respiratory rate 18–25/min, FiO_2 1.0) to keep oxygen saturation above 90%.

All the patients underwent MIE (two-field lymph nodes dissection) with extracorporeally gastric conduit creation and two-layer hand-sewn cervical esophagogastric anastomosis. During the thoracic phase of MIE procedure, the patient was put in semi-prone position (left lateral decubitus position with 30° forerake) and artificial CO_2 pneumothorax (intrathoracic CO_2 pressure =8 mmHg) was established. Following that, the patient was put in supine position and the stomach was dissected and made into a gastric tube. The MIE procedure was performed without pyloroplasty.

Results

Three selective patients (2 males, 1 female) at the age of 58, 53 and 65 respectively underwent MIE. Their general clinical data is showed in *Table 1*. In all cases, the lung of operation side collapsed partly and the visualization was satisfied. Atracurium was needed to be used as the manipulation needed. MIE manipulation and lymph nodes resection were easily performed during the procedure. The number of dissected in the operation is equal as usual and the operative time and the bleeding volume did not increase than that in the procedure using intubation. So, technical feasibility was considered excellently in all cases. Intraoperative laryngeal mask displacement occurred in one patient because of the cervical esophageal traction and the position of head during anastomosis procedure. But the SPO_2 was stable and above 90% because the anesthetist observed this condition and modified the LMA position timely. And the monitoring index was showed in *Table 2*, which indicated that patients' physical signs were stable during the operation. The information of *Table 1* reveals the detailed perioperative surgical data, which indicated that there were no postoperative complications occurred and all of three patients were discharged smoothly. After 18-month

Table 2 Intraoperative clinical data of the three patients

Variable	Basic value before artificial pneumothorax	5 min after artificial pneumothorax	30 min after artificial pneumothorax	End of artificial pneumothorax	10 min after the end of pneumothorax
Hear rate					
Case 1	78	86	88	89	79
Case 2	65	71	73	73	68
Case 3	82	92	93	91	85
MAP (mmHg)					
Case 1	83	89	84	85	86
Case 2	72	77	70	72	75
Case 3	95	102	96	98	98
CVP (cmH_2O)					
Case 1	11.2	16.7	11.8	10.3	11.4
Case 2	10.1	14.5	12.6	11.6	11
Case 3	9.0	12.9	11.7	8.5	9.3
PO_2 (mmHg)					
Case 1	235	226	186	192	228
Case 2	256	252	192	203	247
Case 3	210	201	169	177	217
PCO_2 (mmHg)					
Case 1	23	39	42	43	32
Case 2	36	41	45	47	41
Case 3	29	37	44	53	39
pH					
Case 1	7.35	7.35	7.33	7.29	7.34
Case 2	7.40	7.36	7.31	7.30	7.38
Case 3	7.37	7.32	7.26	7.25	7.36

MAP, mean arterial pressure; CVP, central venous pressure.

follow-up, the three patients are alive without recurrence and other complications related to operation.

Discussion

General anesthesia using double-lumen intubation with one-lung ventilation is the standard approach for MIE. However, it may be associated with potential complications related to tracheal intubation and one-lung ventilation. Our team is hammering at fast track surgery of esophageal carcinoma. We have strived for many procedures, including MIE, single-lumen endotracheal intubation anesthesia with two lung ventilation, early oral feeding, shortened postoperative drainage time and nasogastric tube maintain time, to decrease the harmful effect of perioperative iatrogenic manipulation. Non-intubation anesthesia may avoid the potential complications that the intubation may result in, and may be helpful to judge the reason of postoperative hoarseness. The recent study indicated that VATS can be performed with thoracic epidural anesthesia and intrathoracic vagal blockade (6). However, this approach has the potential risk related to epidural

hematoma or spinal cord injury. At the same time, Ambrogi and his colleagues successfully applied LMA in VATS for spontaneous pneumothorax (7). So, we reasoned that the application of LMA in MIE could avoid the potential complications of intubation general anesthesia or epidural anesthesia. Despite the displacement of LMA in one patient and a slight increase of the pressure of CO_2, the changes of intraoperative index were acceptable and there were no serious complications occurred after operation. The data of the three patients in this study suggests that MIE can be feasibly and safely performed with general anesthesia through the use of LMA. During the MIE thoracic procedure, the patients were put in a semi-prone position and artificial pneumothorax with intrathoracic pressure of 8 mmHg was established. The lung almost underwent a complete deflation because of its gravity and pneumothorax. Therefore, the operating space is adequate for thoracoscopic manipulation. During the MIE thoracic procedure, there was no cough reflex that could hamper the surgical dissection for esophagus and lymph nodes. Nevertheless, this happened in 14% of cases with awake epidural technique, which was described in the study of Pompeo and colleagues (8). During the abdominal procedure, adequate muscle relaxant is necessary for accessing the available surgical manipulating space.

The main problems of using LMA in MIE procedure are the displacement of LMA and management of airway. There was one patient of the three got pneumonia and he just was the one whose LMA displaced in the MIE procedure. We think that careful observation of anesthetist could avoid the displacement of LMA and aspiration. So, the anesthetist needs to pay more attention to prevent the displacement of LMA and aspiration. Additionally, the patients in this study are carefully selected. Even then, our first experience reveals that LMA could be safely used for MIE without the risks associated with intubation. On the basis of our preliminary experience, it is surmised that LMA general anesthesia can be used for more patients with some comorbidities, for whom its advantages would be even more considerable.

Cite this article as: Zhang RX, Li Y, Liu XB, Lu XH, Sun HB, Wang ZF, Liu SL, Zheng Y, Liu XF, Wu XX. Is laryngeal mask airway general anesthesia feasible for minimally invasive esophagectomy? J Thorac Dis 2018;10(3):E210-E213. doi: 10.21037/jtd.2018.03.102

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patients for publication of this manuscript.

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