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Retrograde Placement of Nasointestinal Tubes in Ivor-lewis Esophagectomy

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Abstract

Background: Placing nasointestinal tubes (NITs) is an important procedure during Ivor-Lewis esophagectomy. This study aims to compare two methods of NITs placement in Ivor-Lewis esophagectomy.

Methods: A retrospective analysis was performed on 106 patients with middle and lower esophageal carcinoma who has undergone Ivor-Lewis esophagectomy in the First Affiliated Hospital of Nanjing Medical University from January 2016 to April 2017. These cases were divided into two groups: anterograde placement of NITs (n=53) and retrograde placement (n=53). Time-consuming, success rate of the NIT placement, postoperative complications and the effect of nutritional support were compared.

Results: All surgery was successfully completed. Compared with antegrade method, retrograde placement of NITs was associated with less time-consuming (14 ± 11 min *vs.* 5 ± 1 min; P<0.001), higher success rate (88.7% *vs.* 100%; P=0.027) and smaller effect on circulation system (13.2% *vs.* 0; P=0.013). There were no differences between two group in serum albumin and prealbumin on postoperative day 1/7 (P>0.05). Incidence rates of postoperative complications and pulmonary infection were no differences between two group (P>0.05).

Conclusion: Retrograde placement of NITs is a convenient method with shorter time, higher success rate and less intraoperative complications, which should be popularized during Ivor-Lewis procedure.

Keywords: Esophageal surgery; Nutrition; Nasointestinal tube

Introduction

Esophageal squamous cell carcinoma (ESCC) has its highest prevalence in China and is ranked third for incidence and fourth for mortality, approximately 70% of global esophageal cancer cases occur in China [1]. The overall 5-year survival ranges from 15% to 25%, and patients diagnosed in the early stages accepted surgical treatment always have better outcomes [2]. The common clinical choice for patients with middle and lower ESCC is esophagectomy including Sweet or Ivor-Lewis procedure [3]. Ivor-Lewis procedure is becoming more attention and popularity, which can be performed with lower rates of postoperative complications and more lymph node retrieval [4].

ESCC is mostly diagnosed in advanced stages, when patients already present with dysphagia and unintended weight loss. Hypermetabolism and abrosia lead to a poor nutritional status in the perioperative period in ESCC patients, this problem is particularly prominent [5,6]. Therefore, strengthening nutrition support plays an important role in the treatment and recovery of these patients in the perioperative period. Nutritional status is also associated with long time survival in resectable ESCC patients [7]. Nutritional supplementation is one of the most significant factors of concern in the management of patients following esophagectomy, and enteral and parenteral nutritional supports are two main methods in clinical practice. A meta-analysis of ten prospective studies investigated the outcomes of parenteral or enteral nutrition after esophagectomy, and suggested there was no significant difference in overall postoperative complication rates, but pulmonary complications and anastomotic leakages were significantly reduced in the enteral nutrition group [8]. Enteral nutritional support immediately after surgery has now become commonplace.

Several types of feeding tubes can be placed at a patient during operation for enteral nutrition; examples include nasointestinal and jejunostomy tubes. Compared with jejunostomy, nasointestinal tube (NIT) is more feasible, less invasive, and shorter time of removing tube. A meta-analysis found that the length of hospital stay, duration of enteral nutrition and the time to resumption of normal oral intake were all significantly shorter in the nasoenteric group compared to jejunostomy group in patients accepted upper gastrointestinal surgical procedures [9]. Therefore, NIT is widely used in patients accepted Ivor-Lewis procedure recently.

However, the optimal methods of NIT placement in Ivor-Lewis procedure for patients with middle and lower ESCC are still uncertain. In this study, we focus on comparing two different methods of NIT placement (anterograde and retrograde procedures), to explore the more suitable method of NIT placement in Ivor-Lewis esophagectomy.

Patients and Methods

Patients

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1964 and later versions. Informed consent or substitute for it was obtained from all patients for being included in the study. 106 patients with middle and lower ESCC undergoing open Ivor-Lewis procedure from January 2016 to April 2017 at the Department of Thoracic Surgery, First Affiliated Hospital of Nanjing Medical University were enrolled into this retrospective study. All patients were accepted NIT placement during operation, and established on the diagnosis by pathological examination. The exclusion criteria included perioperative mortality, history of other cancers, received any anti-cancer therapy before esophagectomy, inability to eat anything more than one week before surgery, severe infection and multiple organ dysfunction syndrome.

Methods of NIT placement

All participants accepted different methods of NIT placement during Ivor-Lewis procedure and were divided into two groups: one group underwent intraoperative anterograde placement of NITs (n=53), and another group underwent intraoperative retrograde placement of NITs (n=53). All the NITs were 10F Flocare polyurethane NITs with guide wire (Nutricia, Wuxi, China). Surgery was performed by consultant thoracic surgeons who had performed at least 400 esophagectomies. The surgical technique of Ivor-Lewis procedure had been described elsewhere [10].

Anterograde placement of NITs during Ivor-Lewis procedure: The patient was placed initially supine, gastric tubulization was complete through an upper midline abdominal incision. The duodenum needed sufficient dissection to ensure that the pylorus could reach the enlarged esophageal hiatus. Then, the patient was positioned in the left lateral decubitus, and a right thoracotomy with a musclesparing incision was made in the fifth intercostal space. After ligating and dissecting the azygos vein, the esophagus was resected. The tubular stomach was delivered into the thorax and a circular stapled end-to-side esophagogastric nastomosis was fashioned in the upper mediastinum. A nasogastric tube and NIT were also inserted from nares, and surgeon need to use the right hand to touch the pylorus from the enlarged esophageal hiatus, and guided the NIT to through the pylorus. The action must be softly and carefully because it may compress the heart and caused arrhythmia and hypotension.

Retrograde placement of NITs during Ivor-Lewis procedure: After the dissection of stomach was completed, cardiac area was cut off. The NIT was placed from the carida to the proximal jejunum under direct vision, and then the proximal joint of NIT was removed. The remainder proximal NIT was folded and ligated then be put into the stomach. Surgeon performed gastric tubulization by using linear cutter stapler, be careful to avoid cutting the NIT in the stomach. Then, the patient was positioned in the left lateral decubitus to perform a right thoracotomy. After resection of esophageal lesion and completion of esophagogastric anastomosis, the folded NIT was pulled out from the incision in the tubular stomach which was used to put into the tubular stapler. Undoing the NIT and ligaturing the proximal of NIT with the distal of gastric tube which was inserted from nostril by the anaesthesiologist. Then, the anaesthesiologist pulled out the gastric tube to take out the proximal of NIT. The surgeon need regulate double tubes to the appropriate position and then change the gloves; the anaesthesiologist fixed double tubes on patient's nose with plasters and reconnected the proximal joint of NIT.

On postoperative day 1, the routine bedside chest and abdomen radiographs were performed on everyone to determine whether the NITs were successfully placed into the jejunum without twisted or reflexed. Parenteral nutritional treatment was given after confirming the NIT is in position. Commercial enteral nutritional emulsions were given to everyone with the dose of 30 kcal/kg/day; the liquid was reduced by half on postoperative day 1.

Observational indexes

Time-consuming, success rate and the effect on circulatory system during NIT placement were recorded in the two groups. Because the retrograde placement procedure has two steps in the abdomen and chest, both of the time-consuming of two steps need to be calculated. Blood biochemical indexes including serum albumin and prealbumin were tested before surgery and on postoperative day 1 and 7. Blood routine test was performed on postoperative day 7 before oral feeding. The postoperative complications including anastomotic fistula, severe wound infection, pulmonary infection, and cardio-cerebral vascular accident were recorded. The other clinical parameters also recorded including age, gender, history of smoking/drinking, preoperative body mass index (BMI), TNM stage (according to the 8th edition AJCC/UICC staging of cancers of the esophagus and esophagogastric junction).

Statistical analysis

Data were expressed as median±interquartile range (IQR) or N (percentage %). Continuous variables were compared using t test or Mann-Whitney U test, while categorical variables were compared using the X^2 or Fisher exact tests, if appropriate. All statistical tests were two-tailed, and $P<0.05$ was considered statistically significant. Statistical analyses were conducted using SPSS 22.0 (SPSS, Inc., Chicago, IL, USA).

Results

Patient characteristics

The study cohort consisted of 106 patients with middle and lower ESCC who has undergone Ivor-Lewis esophagectomy, including 78 men and 28 women, with a mean age of 59.2 yrs (range 36-75 yrs, median 58 yrs). Patient data were presented in Table 1. Their preoperative routine examination, including blood routine, coagulation function, liver and kidney function, were essentially normal. NITs were placed during the surgery and all operations were successfully completed. The duration of surgery was 260.86 ± 82.49 min. There were no significant differences in age, sex, BMI, history of smoking/drinking, TNM staging and operative time between the two groups (P>0.05; Table 1).

Factors	Anterograde (n=53)	Retrograde (n=53)	X^2/Z	P
Age (years)	59 (14.3)	58 (13.8)	-0.897	0.369 a
BMI(Kg/m^2)	19.8 ± 1.9	19.5 ± 2.1	-0.837	0.402 a
Male	40 (75.5%)	38 (71.7%)	0.194	0.659 b

Smoking	32 (60.4%)	34 (64.2%)	0.161	0.689 b
Drinking	26 (49.1%)	29 (54.7%)	0.34	0.56 b
TNM stage			0.693	0.405 b
I-II	34 (64.2%)	38 (71.7%)		
III-IV	19 (35.8%)	15 (28.3%)		
Operative time (min)	264 (116)	247 (115.5)	-1.4	0.161 a

Table 1: Patient characteristics.

Assessment the effects of two different methods

In the anterograde group, the tube placement time was 4-45 min. The success rate of intraoperative NIT placement was 88.7% (47/53). Tubes in 6 cases couldn't pass through the pylorus after repeated attempts during the operation and finally gave up. These patients turned to accept postoperative parenteral nutrition treatment. In these patients with successful placement of NITs, 6 patients developed severe pyloric reflexes or pipe blockage and cannot accepted enteral nutritional treatment, abdominal X-ray examinations confirmed it is because of twisted and reflexed tubes, 2 patients developed increased chyle leakage after nasal feeding, these patients also accepted parenteral nutrition support. Only 39 patients in this group could accept postoperative enteral nutrition support.

In the retrograde group, the placement time was 4-13 min. The success rate of intraoperative NIT placement was 100% (53/53). No twisted and reflexed tubes were found after postoperative abdominal X-ray examination. 3 patients turned to accept parenteral nutrition support, among which 2 patients developed increased chyle leakage and 1 patient complained of unbearable abdominal distension after nasal feeding. 50 patients in this group could accept postoperative enteral nutrition support.

The retrograde placement of NITs, with less time costing, higher intraoperative successful rate (pass the pylorus) and smaller effect on circulatory system, were significantly better than the antegrade method (P<0.05; Table 2). There were no significant difference in WBC on postoperative day 7, preoperative serum albumin/prealbumin and serum albumin/prealbumin on postoperative day 1/7 between the two groups (P>0.05; Table 2).

Factors	Anterograde (n=53)	Retrograde (n=53)	X^2/Z	P
NIT intubation time (min)	14 ± 11	5 ± 1	-7.445	<0.001 a
NIT passed the pylorus during operation	47 (88.7%)	53 (100%)	/	0.027 b
Unavailable NIT after surgery	6 (11.3%)	0 (0)	/	0.027 b
Compressed heart during intubation	7 (13.2%)	0 (0)	/	0.013 b
WBC on postoperative day 7 (×109/L)	6.85 ± 3.44	7.07 ± 4.44	-0.673	0.501 c
Preoperative serum albumin (g/L)	39.7 ± 7.13	43.6 ± 6.28	-1.785	0.074 c
Preoperative serum prealbumin (mg/L)	286.3 ± 29.9	285.6 ± 27.6	-0.578	0.563 c
Serum albumin on postoperative day 1 (g/L)	28.9 ± 4.3	28.2 ± 3.9	-0.654	0.513 c
Serum prealbumin on postoperative day 1 (mg/L)	221.8 ± 21.3	221.7 ± 16.8	-0.414	0.679 c
Serum albumin on postoperative day 7 (g/L)	35.7 ± 4.1	35.6 ± 2.9	-0.515	0.607 c
Serum prealbumin on postoperative day 7 (mg/L)	258.3 ± 15.1	259.6 ± 12.7	-0.439	0.661 c
Pulmonary infection	7 (13.2%)	8 (15.1%)	0.078	0.78 a
Postoperative complications	3 (5.7%)	2 (3.8%)	0.21	0.647 a

Table 2: Comparison between anterograde placement and retrograde placement of NIT.

All the patients were discharged without perioperative mortality, anastomotic fistula, incision infection or other severe cardio-cerebrovascular accidents. After operation, two patients with chyle leakage and one with hoarseness in the anterograde group, and two with chyle leakage in the retrograde group, there was no different in the perioperative complication rate between the two groups (P=0.647).

In addition, no significant difference was observed in the incidence rate of postoperative pulmonary infection between the antegrade (7 cases) and retrograde (8 cases) groups (P=0.78).

Discussion

Currently, surgery remains the mainstay for resectable ESCC, although controversy persists regarding the surgical approach for middle or lower thoracic ESCC [11-13]. Ivor-Lewis and Sweet procedures are two main approaches for middle and lower thoracic ESCC. The Sweet procedure has some advantages over the Ivor-Lewis, such as a shorter operative time and an increase in tolerance from patients [14]. But the Ivor-Lewis procedure becomes more and more common in China because it is more convenient in improving visualization of mediastinal structures, decreasing frequency of recurrent laryngeal nerve injuries [12]. A meta-analysis showed that the Sweet procedure was inferior to the Ivor-Lewis procedure in lymph node dissection [14]. Another randomized controlled trial further found that the Ivor-Lewis procedure could be performed with lower rates of postoperative complications and more lymph node retrieval, and both of them were safe procedures with low operative mortalities [4]. Although some retrospective researches concluded that the long-term survival rates were not significantly different between the two procedures [12,13], the benefit of Ivor-Lewis procedure in long-term outcome was demonstrated recently by a prospective, randomized clinical trial [15], which may attribute to adequate lymphadenectomy (Figure 1).

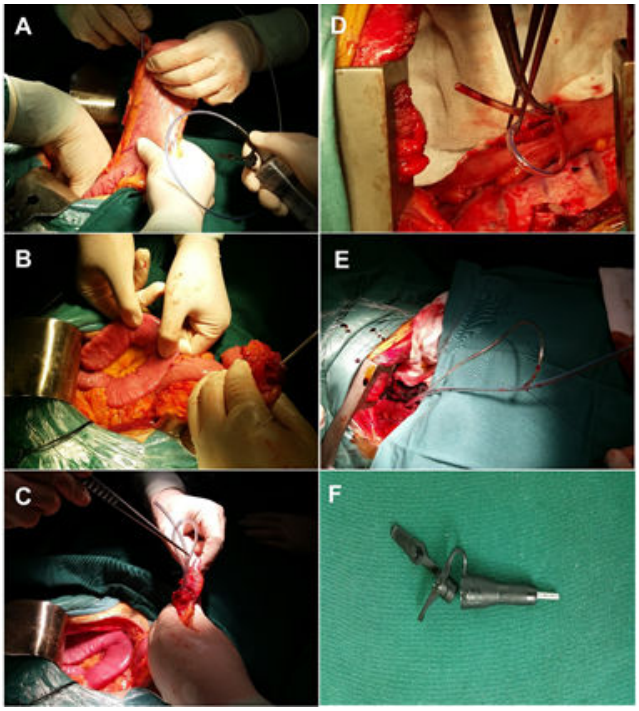

Figure 1: Retrograde placement of NITs during Ivor-Lewis procedure. **A:** The NIT was placed from the carida after the completion of gastral dissociation by an assistant. The surgeon touched the pylorus to help the NIT pass this area by on hand, and taken the stomach body to avoid the fold of NIT by another hand. After the NIT passing the pylorus, another assistant injected normal saline into the NIT to make the placement of NIT smoothly. **B:** The NIT was placed into the proximal jejunum under direct vision. **C:** Left about 15 cm of proximal NIT and removed the proximal joint. The remainder proximal NIT was folded and ligated, then be put into the stomach. Gastric tubulisation was made by using linear cutter stapler, be careful to avoid cutting the NIT in the stomach. **D:** During the thoracic procedure, after resection of esophageal lesion and completion of esophagogastric anastomosis, the folded NIT was pulled out from the incision in the tubular stomach which was used to put into the tubular stapler. Sterile gauzes were put under the gastric incision to avoid gastric juice outflow. **E:** Undoing the NIT and ligaturing the proximal of NIT with the distal of gastric tube which was inserted from nostril by the anaesthesiologist. Then, the anaesthesiologist pulled out the gastric tube to take out the proximal of NIT. The surgeon need regulate double tubes to the appropriate position and then change the gloves; the anaesthesiologist fixed double tubes on patient's nose with plasters and reconnected the proximal joint of NIT. **F:** A proximal joint which was used for nutrient solution input could be reconnected to the NIT.

Inserting the NIT by using the anterograde method is usually difficult because of the heart obstruction and limited esophageal hiatus. Surgeons need to enlarge the esophageal hiatus in the step of abdominal operation to make sure them can explore the pylorus by fingers *via* esophageal hiatus to help the NIT pass the pylorus when the anesthesiologist was inserting the NIT *via* the nostril. Because of the narrow space, this action is easy to compress the heart and cause the variations in heart rhythm and blood pressure, and the surgeons need to pause operation. Even the NIT have passed the pylorus, operators still cannot ensure the tube was not twisted or reflexed in the small intestine because of inserting without indirect vision. Inserting the NIT by using the anterograde method is a difficult and time-consuming operation for inexperience surgeons, sometimes operators have to give up due to many failures. On the contrary, the retrograde method is a simple and flexible procedure for junior surgeons, and the NIT inserting is performing under direct vision with no obstacles, and always be success at the first time. The tube can be adjusted in suitable position without twisted or reflexed, which is important for the postoperative enteral nutrition treatment.

Our results showed that compression symptoms in circulatory system and NIT intubation time in the retrograde group were less than in the anterograde one. However, the rate of NIT passed the pylorus during operation and available NIT after surgery in the retrograde group was higher than in the anterograde one. There were no differences in serum albumin/prealbumin on postoperative day 1/7 in the both group. In other words, nutritional support effect can be guaranteed in the both group.

During placing the NIT by using retrograde method, the surgeon needed to take out the NIT from the stomach and guided the gastric tube by finger in the thoracic procedure. The fear of bacterial contamination in the surgical field were produced because of some operates were performed in the digestive tract. But in clinical practices, we placed sterile gauzes under the gastric incision to avoid gastric juice outflow, used iodophor gauzes to disinfect the operation area, and changed the gloves after NIT inserting in time. These preventive measures could reduce the infection probability. Our results show that postoperative incision infection, anastomosis and WBC on postoperative day 7 did not increased in the retrograde group compared to the anterograde one.

In conclusion, the present study demonstrates that it is more convenient and effective to use the retrograde method for the NIT placement during in Ivor-Lewis esophagectomy, particularly for inexperience surgeons. Our results need to be tested and verified by researches utilizing large samples and multiple centers.

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