

Modified Double-tract Reconstruction in Terms of Postoperative Quality of Life in Patients With Early Esophagogastric Junction Adenocarcinoma After Proximal Gastrectomy

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Abstract

Background

Increased reflux symptoms limited clinical application of proximal gastrectomy (PG) in the patients with early adenocarcinoma of esophagogastric junction (AEG). The purpose of this study is to describe a method of modified double-tract reconstruction (DTR) after PG, and to evaluate the feasibility, safety, surgical outcomes, postoperative gut function and nutritional status post operation.

Methods

Prospective cohort data of 25 patients with early AEG who presented to a single tertiary hospital from Jan 2019 to Jun2019 and underwent DTR after PG were analyzed respectively. The data of this prospective cohort included: clinicopathologic characteristics, surgical outcomes, time to first flatus and defecation, Visick Score, degrees and extent of remnant gastritis, Los Angeles Classification in 1-year follow-up.

Results

The mean operation time was 206.54 ± 75.44 min; estimated blood loss was 128.85 ± 48.38 ml; length of proximal and distal resection margin were 2.53 ± 0.83 and 4.86 ± 1.49 cm; and number of retrieved lymph nodes reached 23.54 ± 8.04 . The postoperative complication rate was 8% (n = 2), which were both treated by conservative management. The postoperative gut function improved gradually and the volume of postoperative daily intake could reach over 700ml on 6th POD. The levels of albumin and prealbumin returned to normal status and weight loss also remained steadily at 3-month after operation. The rate of reflux symptoms was 12% (n = 3), which were classified as Visick grade II at 1-year follow-up after operation.

Conclusion

The short-term outcome of this modified DTR was satisfied, which could improve the nutrition status and quality of life post operation.

Trial registration

ChiCTR, ChiCTR 1900024826. Registered 29 July 2019.

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Introduction

The incidence of early gastric cancer (EGC) increased gradually in recent years, which may be caused by raising the self-consciousness to health care and early treatment due to cancer-screening program in our country^[1]. And what's more, according to our nationwide survey, the incidence of adenocarcinoma of esophagogastric junction (AEG) has also increased in last several decades^[2-3]. These trends have increased more interests in surgical treatments on AEG with early stage.

Proximal gastrectomy (PG) was used to be deemed as a standard surgical option for early AEG during former clinical practice, which could preserve physiological function of the remnant stomach. But conventional esophagogastric resection after proximal gastrectomy might induce severe reflux and anastomosis site stricture post-operation which might limit its clinical application^[4-5]. Thus total gastrectomy (TG) was widely performed on most AEG instead of PG. However, in general, TG might result in prolonged food intake restriction and long-term nutritional deficiencies^[6]. But more and more evidence showed that, based on oncological safety, PG was more suitable to early AEG, which could associate with better nutritional status, less body weight loss, low incidence of anemia, diarrhea, dumping syndrome and better quality of life^[7-8].

The double tract reconstruction (DTR) method following PG was first reported by Aikou^[9] in terms of gaining the smooth transfer of larger foods through the duodenal route. But some articles argued food could not always enter the duodenum smoothly and there was no improvement in Visick score in a large portion of patients. We therefore designed some improvements to modify the alimentary tract reconstruction in DTR following PG.

Patients And Methods

Ethics Approval and Trial Registration

Ethical approval was given by local ethics regional board: Shanghai Changhai Hospital Ethics Committee (No. CHEC 2019-087). Registration with approved clinical trials registry, Chinese Clinical Trials Register, was undertaken (ChiCTR 1900024826). Ethics approval and registration were performed before trial commencement.

Patients

From Jan 2019 to June 2019, a total of 25 cases diagnosed with early AEG were preoperatively performed DTR at Shanghai Changhai Hospital, China, which is a tertiary teaching hospital with more than 2,500 beds serving 40,000 inpatients and 1,800,000 outpatients and emergencies each year. The case volumes for gastric carcinoma reach more than 1500 per year.

Preoperative assessments were carried out by endoscopy and biopsy, endoscopic ultrasound and computed tomography (CT) or magnetic resonance imaging (MRI) if necessary. And the eligibility criteria of patients were as follows: (1) gastric cancer was confined within muscularis propria layer (T₁-T₂), (2) no lymph nodes and organs metastases in CT or MRI (N₀M₀), (3) the diameter of tumor was less than 3cm. Additional inclusion criteria were age 18 to 80 years, life expectancy >1 year, and adequate organ functions (leukocyte count >3,500/ μ l, platelet count >100,000/ μ l, hemoglobin >10.0 g/dl, serum creatinine <1.25 times upper limit of normal [ULN], transaminases and alkaline phosphatase <2.5 times ULN or <5 times ULN in patients with liver metastasis, bilirubin <1.5 times ULN, and prothrombin time <12.0 s).

The exclusion criteria of patients were as follows: (1) patients with previous history of abdominal surgery and endoscopic submucosal dissection (ESD), (2) patients with central nervous system involvement or other significant medical conditions.

Procedures for gastrectomy and double-tract reconstruction

The decision to perform laparoscopic operation or open procedure is a judgment decision made by surgeons either before or during the operation. The basic range of surgical resection included the distal esophagus and proximal 1/3 to 1/2 stomach with D1⁺ dissection of lymph nodes (No. 1, 2, 3a, 4sa, 4sb, 7, 8a, 9 and 11p). Intraoperative frozen section examinations were performed to confirm the tumor-negative resection margins. The right gastroepiploic vessels, right gastric artery and suprapyloric veins were preserved.

Gastrointestinal continuity was restored by double-tract method. The jejunum was divided about 15-20 cm below the Treitz ligament and esophagojejunostomy was performed with the distal jejunum by a circular stapler. Jejunojejunostomy was performed about 45 cm below the esophagojejunostomy and gastrojejunostomy was performed 10 cm below the esophagojejunostomy.

Modification in alimentary tract reconstruction

1. Shorten the distance between esophagojejunostomy and gastrojejunostomy, which was set within 10cm.
2. Gastrojejunostomy was performed on the anterior gastric wall.
3. Retrocolic gastrojejunostomy were adopted.
4. Preserve all pyloric vessels and nerves. (Including right gastric artery (RGA), right gastric vein (RGV), right gastro-epiploic artery (RGEA), right gastro-epiploic vein (RGEV), infra-pyloric vein (IPV) and pyloric branches of vagal nerve. (Figure 1)

ERAS program post-operation

All patients underwent an ERAS program which was initially developed through a consensus meeting involving surgeons, oncologists, anesthesiologists and nutritionists. Details are as follows: Preoperative care included counseling before and after admission, avoidance of mechanical bowel preparation, a normal diet until the evening meal of the day before surgery and 1000ml oral rehydration salts intake 3h before surgery. Intraoperative care included transversus abdominis plane block (TAP-block), warming set for all intravenous infusions during operation. Postoperative care included patient controlled analgesia (PCA) in 48 hours after surgery, high flow oxygen for at least 12 hours, analgesia and antiemetic drug use if necessary (no motility agents or opioid antagonists). On postoperative day (POD) 1, nasogastric tube and urinary catheter were usually removed and patients were encouraged to get out of bed for more than 4 hours and drink water or clear soup 50ml per time. From POD 2, patients were encouraged to walk for more than 4 hours and start nutritious powder supplement 100ml per time. From POD 4, patients were encouraged to try semi-liquid diet and stepwise to normal diet. The frequency of food intake was at the patients' discretion. Drainage tube was evaluated and removed from POD 5. Patients were discharged if they had achieved adequate pain relief and semi-liquid food tolerance, free walking ability, and exhibited normal vital signs and laboratory data. The completion of ERAS program included two categories, the first was that patient followed the aforesaid schedule and discharged within 8 days and the second was one or two days delay due to patients' personal reason^[10].

Clinical Analysis, Surgical Outcomes and Nutritional Status

The indicators of clinicopathological characteristics gathered were age, sex, BMI, ASA score, cancer stage, and tumor size. The surgical characteristics were operation time, estimated blood loss, proximal and distal resection margins, and number of retrieved LNs. The surgical outcomes were recovery of gut function which was measured by time to first flatus and first bowel motion, postoperative daily intake, the severity of reflux symptoms (Visick score), remnant gastritis, surgical complications, and length of stay (LOS). The degrees and extent of Remnant gastritis and Los Angeles Classification were evaluated by one same doctor by gastroscope, and the severity of early or late postoperative adverse events was classified according to Clavien-Dindo Classification System.

Follow up

All the patients enrolled were followed up 3, 6, and 12 months post-operation in outpatient department. The characteristics of the patients and their outcomes were obtained by reviewing the electronic medical records and the picture archiving and communication system.

Results

Clinicopathological characteristics of patients enrolled

The clinicopathological characteristics of the patients enrolled were presented in Table 1. The operation time, estimated blood loss and hospital stay were relatively acceptable. And the proximal and distal resection margin and the number of LN harvested were also oncologically safe for early AEG.

Table 1
Clinicopathological Characteristics of Patients with Modified Double-Tract Reconstruction

Sex	Age (year)	BMI	ASA Score
Female: 6 (24%)	63.19±12.30	24.18±3.20	1.42±0.57
Male: 19 (76%)			
Operation Time (min)	Estimated Blood Loss (ml)	Hospital Stay (days)	Tumor Size (cm)
206.54±75.44	128.85±48.38	7.00±1.44	2.09±0.80
Proximal Resection Margin (cm)	Distal Resection Margin (cm)	Siewert Type	Mean of LN Harvested
2.53±0.83	4.86±1.49	Type I: 0 (0%) Type II: 21 (84%) Type III: 4 (16%)	23.54±8.04
Tumor Grade	T stage	N Stage	TNM Stage
Well: 7 (28%)	T1: 18 (72%)	N0: 25 (100%)	Ia: 18 (72%)
Moderate: 14 (56%)	T2: 7 (28%)		Ib: 7 (28%)
Poor: 3 (12%)	T3: 0 (0%)		II: 0 (0%)

Surgical Outcomes, postoperative gut function and nutritional status of patients enrolled

The early postoperative complication rate was 8% (n = 2), including: wound infection (n=1) and pneumonia (n=1), which were treated by conservative management. The postoperative gut function improved gradually, and the volume of postoperative daily intake could reach over 700ml on 6th POD. The levels of albumin and prealbumin returned to normal status and weight loss also remained steadily at 3-month after operation.

The rate of reflux symptoms was 12% (n = 3), which were classified as Visick grade II and also verified by endoscopic evaluation at 1-year follow-up after operation. The degree and extent of remnant gastritis were acceptable. (Table 2)

Table 2

Surgical Outcomes, postoperative gut function and nutritional status of patients with Modified Double-Tract Reconstruction

Leukocyte Count (μl)	Platelet Count ($\times 10^3/\mu$l)	Serum Albumin (g/L)	Serum Prealbumin (mg/L)
1 m: 3609 \pm 1135	1 m: 188.34 \pm 58.99	1 m: 37.46 \pm 3.06	1 m: 152.42 \pm 29.57
3 m: 4776 \pm 985	3 m: 204.58 \pm 72.32	3 m: 40.77 \pm 5.39	3 m: 175.39 \pm 38.61
6 m: 5911 \pm 1529	6 m: 217.74 \pm 79.54	6 m: 44.25 \pm 5.85	6 m: 224.66 \pm 50.93
12 m: 5488 \pm 1412	12 m: 225.53 \pm 82.63	12 m: 45.19 \pm 6.30	12 m: 223.17 \pm 48.74
Weight Loss	Complications	First Flatus (h)	First Defecation (h)
1 m: 4.65 \pm 1.67	Grade 1: 2 (8%)	42.91 \pm 7.16	87.46 \pm 12.29
3 m: 5.35 \pm 1.38	Grade 2: 0 (0%)		
6 m: 4.67 \pm 1.07	Grade 3: 0 (0%)		
12 m: 3.62 \pm 1.09	Grade 4: 0 (0%)		
Postoperative Daily Intake (ml)	Visick Score*	Degrees of Remnant Gastritis*	Extent of Remnant Gastritis*
2 d: 218.46 \pm 41.06	Ⅱ: 22 (88%)	Grade 0: 4 (16%)	Grade 0: 4 (16%)
3 d: 285.38 \pm 63.70	Ⅲ: 3 (12%)	Grade 1: 17 (68%)	Grade 1: 21 (84%)
4 d: 392.31 \pm 86.82	Ⅳ: 0 (0%)	Grade 2: 4 (16%)	Grade 2: 0 (0%)
5 d: 573.08 \pm 96.16	Ⅴ: 0 (0%)	Grade 3: 0 (0%)	Grade 3: 0 (0%)
6 d: 746.15 \pm 107.63		Grade 4: 0 (0%)	
Residual Food*	Los Angeles Classification*		
Grade 0: 17 (68%)	A: 2 (8%)		
Grade 1: 7 (28%)	B: 1 (4%)		
Grade 2: 1 (4%)	C: 0 (0%)		
Grade 3: 0 (0%)	D: 0 (0%)		
Grade 4: 0 (0%)			

* Data was collected at one year post-operation.

Discussion

Compared with TG, PG associated with a better nutritional status, which suggested to be an ideal surgical option to the patients with early AEG. As a result, interest in PG has grown in recent years^[11]. Selecting the best method of reconstruction following gastrectomy has always been the most important problem of postoperative rehabilitation. But esophagogastrotomy was much simpler than other methods because it only included one anastomosis, but high incidence of reflux esophagitis post-operation limited its clinical application. So DTR was deemed as the best method of reconstruction to improve quality of life post operation^[12].

DTR post PG is oncological and surgical safe in early AEG

In most reports, PG was oncological safe for the patients with early AEG, for the recurrence rate post operation is relative low^[13]. And early AEG always associates with relative lower LN metastasis rates (5–20%), especially the LN metastasis along lower part of stomach^[14]. So we deemed it is sufficiently safe to preserve all pyloric vessels and nerves without thoroughly No. 5 and 6 LN resection. So the functional operation was more suitable for the patients with early AEG in clinical practice.

Digestion and absorption of many substances, such as proteins, fats, fat-soluble vitamins, most water-soluble vitamins (except vitamin B12), and selected microelements (iron, potassium) takes place in the duodenum and initial part of the jejunum. Therefore, the maintenance of partial duodenal passage should in theory improve absorption, even in other segments of the bowel^[13]. Therefore DTR was thought to be the best reconstruction procedure with respect to quality of life post operation and anastomosis-related late complications, especially postoperative reflux esophagitis. However, there is still some concern about that, with DTR, most dietary intake might escape into the route of jejunum which may cause these functional benefits of proximal gastrectomy might be similar with total gastrectomy^[15]. To prevent these disadvantages, we aim to modify the anastomosis in DTR, which may allow dietary intake to pass easily through the remnant stomach and duodenal route.

Modifications in DTR could improve gut function and nutritional deficiencies post operation.

Firstly, we shorten the distance between esophagojejunostomy and gastrojejunostomy to alleviate alimentary stasis, which may be induced by relative longer jejunum between two anastomosis. Secondly, gastrojejunostomy was performed on the anterior gastric wall to reduce acid reflux. Retrocolic gastrojejunostomy were adopted to fix the remnant stomach better and easily. Finally, we preserve all pyloric vessels and nerves to reduce the incidence antrum-pylorus edema and restore the gastric motility postoperation.

In this study, we deemed the surgical outcomes of PG with DTR in 25 patients with early AEG were good enough to replace total gastrectomy and esophagogastrostomy after PG. The rate of reflux symptoms was significantly low, and there were no patients greater than Visick score of II. The degrees and extent of remnant gastritis in most of patients were also no severer than Grade 1. The gut function restored quickly and the volume of postoperative daily intake could reach over 700ml on 6th POD. Postoperative gastrography after modified DTR reconstruction showed that contrast medium flowed mainly to remnant stomach which indicated larger foods could transfer through the duodenal route easily to improve postoperative nutritional status.

In summary, the short-term outcome of this modified anastomosis technique in DTR was satisfied, which could transfer larger foods through duodenal route more smoothly and improved the nutrition status and quality of life post operation. The incidence of surgical complications was relative lower. We believe our modified technique is one of feasible, safe, and useful choice for early AEG patients.

Limitations

There was only 25 cases enrolled in this study, for this study was only an initial attempt of novel anastomosis technique. Another limitation is relative short follow up in this study, so we could not evaluate oncological safety of this new modified surgical operation exactly. But all modifications in our surgical procedure were in order to improve the quality of life post operation, which might not affect the oncological safety. Future prospective randomized trials with larger amount cases with long term of follow-up are warranted to validate its clinical usefulness.

Declarations

Ethics Approval and Consent to Participate

Ethical approval was given by local ethics regional board: Shanghai Changhai Hospital Ethics Committee (No. CHEC 2019-087). Registration with approved clinical trials registry, Chinese Clinical Trials Register, was undertaken (ChiCTR 1900024826). Ethics approval and registration were performed before trial commencement. All patients enrolled signed consent form before operation.

Consent for Publication

This manuscript has not been published before or under consideration for publication elsewhere. This contribution has been approved by all co-authors and the responsible authorities at the institution where the work was carried out.

Availability of Data and Materials

All data, materials and operation videos used during the study are available from the corresponding author by request.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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Author Contributions

YK conceived and supervised the study; YK, LTH, CXS, LX, CHT, GX and ZJH performed operations; LX and GX collected the data; LTH and CXS drafted the manuscript. All authors reviewed the results and approved the manuscript.

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Figures

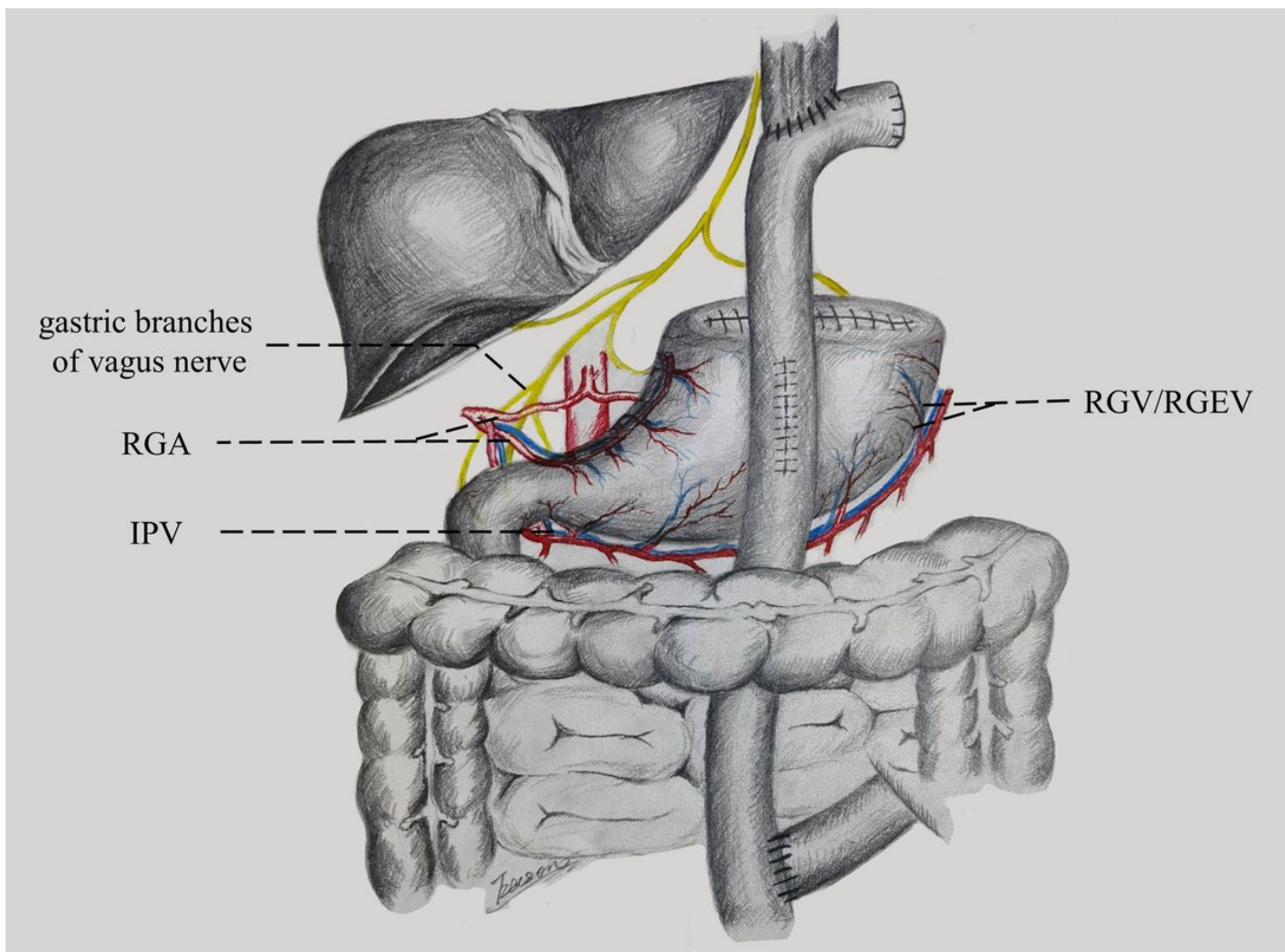


Figure 1

Modification in alimentary tract reconstruction after proximal gastrectomy.