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OUTCOMES OF SUBTOTAL STOMACH RECONSTRUCTION WITH ESOPHAGECTOMY FOR ESOPHAGEAL CANCER: AN ANALYSIS OF ANASTOMOTIC COMPLICATIONS AND POSTOPERATIVE QUALITY OF LIFE

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Objective: This retrospective, study aimed to evaluate the safety and feasibility of subtotal stomach (SS) reconstruction with esophagectomy for patients with esophageal cancer (EC), focusing on anastomotic leakage rates and postoperative quality of life (QOL).
Methods: Between January 2012 and September 2023, 320 patients underwent esophagectomy for EC with SS reconstruction. The primary endpoint was the incidence of anastomotic leakage. Secondary endpoints included postoperative morbidities, QOL assessment, and changes in body weight and skeletal muscle mass.
Results: Anastomotic leakage occurred in only two patients (0.67%), while pneumonia was observed in nine patients (3.0%). Fifteen patients (5.0%) experienced anastomotic stenosis necessitating bougienage. Nausea was reported in 11 patients (3.7%), and dumping syndrome in seven patients (2.3%). Dysphagia and early satiety scores were initially elevated post-surgery but gradually improved after six months. Reflux symptom scores showed favorable outcomes. Over five years, there was an average decrease in body weight of -2 ± 3.71 kg (P = .071).
Conclusion: Reconstruction using SS demonstrated a low incidence of anastomotic leakage and favorable postoperative QOL outcomes in patients undergoing EC surgery. This approach holds promise for improving patient outcomes and minimizing complications associated with EC surgery.

KEYWORDS: Anastomotic Leakage, Oesophagal Surgery, Quality Of Life, Reconstruction, Subtotal Stomach.

INTRODUCTION

Multidisciplinary therapy for advanced cases has also improved remarkably (Hosseini et al., 2023). However, postoperative complications of oesophagus Tomy are reported to be 41.9%, and perioperative mortality is 3.4%, higher than that for other surgeries. Once anastomotic leakage

develops after EC surgery, recovery may sometimes be difficult, which extends the hospital stay and physically exhausts the patients (Hosseini et al., 2023). Advances in surgical equipment have increased the use of automatic suture devices to create gastrointestinal anastomoses.

However, the incidence of anastomotic leakage in esophagectomy and reconstruction surgery is over 10%. Avoidance of anastomotic leakage following EC surgery remains an important issue, with various methods reported concerning their safety (Zhong et al., 2021).

Also, because the anastomosis method affects the postoperative quality of life (QOL), multiple devices have been reported to improve swallowing function and prevent reflux. The stomach is often used for reconstruction with oesophagus Tomy for EC.

To ensure a tension-free cervical or intrathoracic anas automatic site and smooth passage of food in the gastric tube, Zhang et al. reported that reconstructing the gastric tube as narrowly as possible will improve the outcome (Deng & Naka, 2007). For over ten years, we have used subtotal stomach (SS) reconstruction and hand-sutured cervical oesophagus-subtotal gastric anastomosis at the neck wound in EC surgery.

To the best of our knowledge, no previous reports have discussed SS procedures' short- and long-term outcomes, such as anastomotic leakage rate, QOL, and changes in body and muscle weight (Misra et al., 2019). The object of the present study was to assess the safety and feasibility of reconstruction using SS in EC surgery (Rodríguez-Carrasco et al., 2020).

2 METHODS

2.1 Patients

All patients were staged preoperatively according to the 7th edition of the American Joint Committee on Cancer tumor-node-metastasis (TNM) classification. Clinical data were collected from a database of included patients at Gifu University Hospital.

2.2|Perioperative management

Before Surgery, nutritional management, rehabilitation, and oral care were introduced from the first visit. A nasogastric feeding tube was inserted into the stomach in patients who could not take solid foods orally, and enteral feeding was administered for 24 hours (McClave et al., 1999).

Further, we added an elemental diet to avoid oral mucosal damage during triple-combination chemotherapy. Just before Surgery started, all patients received intravenous methylprednisolone (250 mg/body). After Surgery, the patient was transferred to the intensive care unit (ICU).

Extubation was performed, and ambulation was started on a postoperative day (POD) 1. A cannula was inserted into the cricothyroid ligament in all patients under local anaesthesia, and regular endotracheal sputum suction was performed. The patient was transferred from the ICU, and enteral feeding via jejunostomy tube was started on POD 2 (Wong & McGuire, 2000).

Swallowing fluoroscopy using gastrografin was performed on POD 6 or 7, and food intake was started. Enteral nutrition via the jejunostomy tube was intermittently administered twice daily and continued for six months after Surgery. In principle, proton pump inhibitors were used six months after Surgery (Johnson et al., 2021).

2.3|Transthoracic esophagectomy procedure

Treatment was following Japanese EC treatment guidelines. Esophagectomy was performed for advanced EC of clinical stages II or III after two courses of neoadjuvant chemotherapy. For patients

with a clinical nearly T4 tumour, Surgery was performed when induction chemotherapy was effective, and resection seemed possible. In this study, the McKeown systemic approach was used for cases in which the upper mediastinal lesion's lymphadenectomy is required, with the primary lesion located from the upper thoracic to the lower thoracic lesion (Tokairin et al., 2021).
We performed a thoracic approach before the cervical and upper abdominal methods. The primary operative procedure was a thoracoscopic subtotal esophagectomy with the patient in the left lower hemi-prone position. Right thoracotomy was selected for clinical T3 cases, but even for these T3 or nearly T4 instances at the first visit, a thoracoscopic approach was selected if preoperative chemotherapy was primarily effective. The azygos vein arch and the right bronchial artery were dissected along the posterior mediastinum route. Three-field lymphadenectomy was performed when the primary tumour was localized in the upper or middle thoracic oesophagus

Gus and upper and cervical lymph nodes were swollen with the lower thoracic tumour. However, two-field lymphadenectomy was performed when the primary tumour was located in the lower oesophagus without swelling of the upper mediastinal and supraclavicular lymph node. Still, additional neck lymph node dissection was performed if metastasis was revealed in the intraoperative frozen rapid histopathological results of lymph nodes around the recurrent laryngeal nerves. We routinely performed complete lymph node dissection around the recurrent la

laryngeal nerves from the upper mediastinum to the cervix as caudally as possible. The substernal route was selected for patients considered likely candidates for postoperative radiation. A jejunostomy was constructed in all cases. In patients undergoing reconstruction via the substernal way, a jejunostomy was inserted via the stomach(Yoshida et al., 2020).

2.4|Reconstruction technique using SS

The abdominal approach was performed via an upper abdominal wall incision with the 9-cm-long axis. A laparoscopic hand-assisted method was used in some patients with thick subcutaneous fat via a 7-cm skin incision. Two surgeons performed reconstruction.

2.4.1|Creation of SS

The proper gastric and right gastroepiploic arteriovenous arcades are preserved. The greater omentum is dissected 5 cm distal to the right gastroepiploic artery.

The greater omentum is studied along the gastric wall from the left endpoints and proper gastroepiploic routes to the top of the left gastric wall. The short gastric artery venous inflow site on the dorsal side of the stomach is also dissected at the stomach wall (Figure 1A). The fusion of the mesocolon to the duodenum is dissected.

We sufficiently separate the anterior pancreatic fascia due to its physiological adhesion to increase the range of motion at the back of the stomach (Figure 1B). We perform Kocher's mobilization to improve the elevation of the SS (Figure 1C). Lymph node dissection of the upper margin of the pancreas and Liga Cian and dissection of the left gastric artery and coronary vein is then performed. The peritoneal incision is extended in the direction of the right diaphragm, and en bloc dissection of the lymph nodes is completed from in front of the aorta.

Lymph node dissection on the left side of the upper pancreas is performed, leading to the cut surface of the left diaphragm. We dissect three branches from the afferent region of the left gastric artery to the efferent direction for lesser curvature lymphadenectomy. The stomach is studied with a

stapler at a distance of about 2-3 cm from the esophagogastric junction (Yoshida et al., 2020).

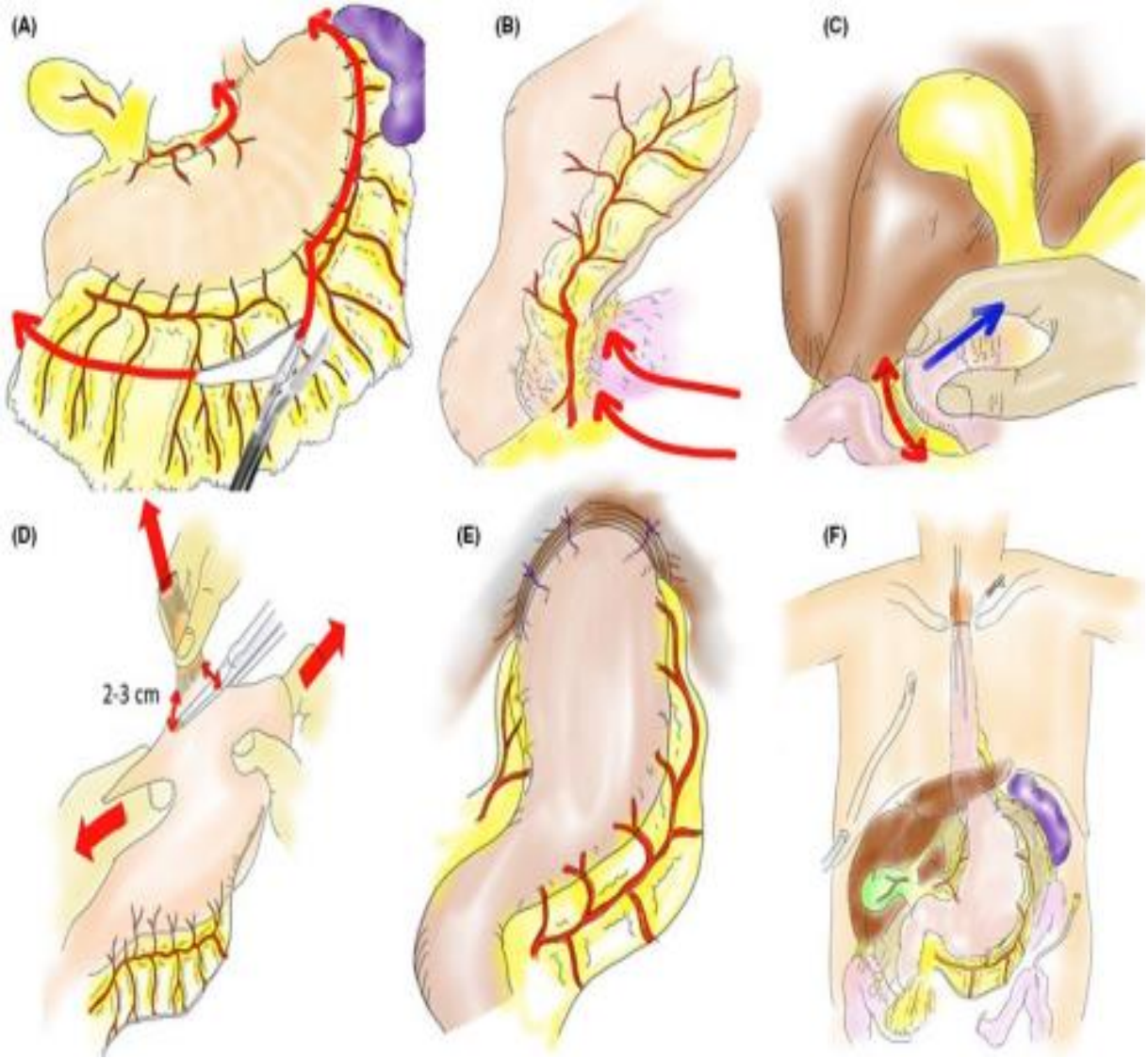


FIGURE 1 How to create a stomach tube. A, On the lesser curvature side, lymph node dissection, including blood vessels of three branches from the afferent region of the left gastric artery, is performed. Then, the greater omentum is dissected at a position about 5 cm distal to the right gastroepiploic artery and from the point of intersection of the left and right gastroepiploic highways to the left side, and the entire greater omentum is then dissected along the gastric wall. B, Separate the anterior pancreatic fascia and physiological gastric adhesion sufficiently to increase the elevation of the gastric tube. C, Kocher's mobilization is required to elevate the stomach enough. D, Stapling: first, the operator fully extends their hands in the lengthwise direction, and then the assistant operator pulls the oesophagus at right angles (this step must be followed). E, After creating the anastomosis, pull the stomach to the ventral side, especially the more excellent curvature side, and secure the gut with three stitches in the crura of the diaphragm. Finally, a 12-french generation catheter is placed as an information drain from the neck to the anastomotic site(Yoshida et al., 2020).

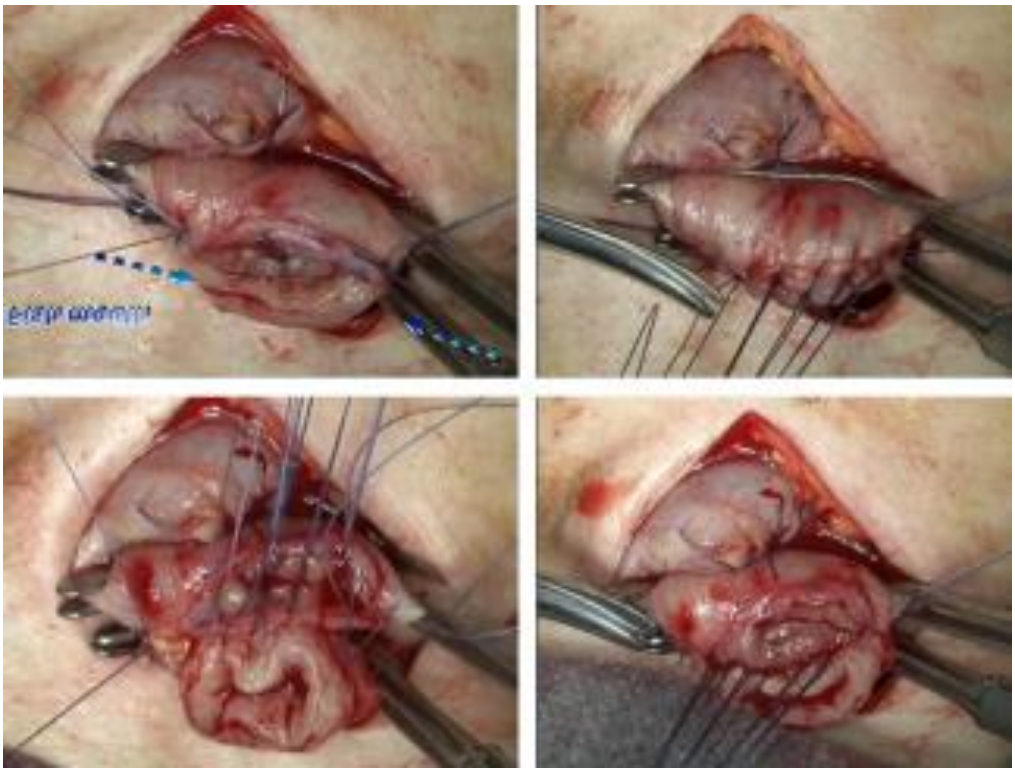


FIGURE 2: Anastomosis of the cervical portion. A Posterior suture: interrupted suturing of the oesophagal outer membrane, muscle layer and gastric seromuscular layer from the left to the right side using about ten needles. B, Lift and pull only the left and right ends of the sutures and cut the remaining sutures. C, Perform running suture of the oesophagal membrane and gastric membrane from the centre to the left side and ligate with suture thread inserted from the outer to inner and inner to outer side at the edge of the left side. Next, perform a running suture from the centre to the right side and suture the edge similarly. At this point, both ends look like a fish mouth. D, Anterior suture: perform interrupted suture with modified Gambee's anterior suture using about 7-8 needles (Yoshida et al., 2020).

The advanced tumour is located mainly in the lower thoracic oesophagus. It slightly reaches toward the abdominal oesophagus, and lesser curvature side lymph node dissection is widely performed except for preserving only the first branch of the right gastric artery. In such cases, we resected the stomach at a distance of 5 cm from the lower end of the tumour to create a SS. In principle, SS reconstruction has not been performed for abdominal oesophagal cancer. When the stomach is dissected, stapling is performed with the operator's hands, fully extending the stomach in the long-axis direction (Figure 1D). The space of the crura of the diaphragm leg is the lateral width of three fingers. The SS is lifted to the neck by gently pushing from the abdomen, rather than pulling the SS firmly in the neck, while simultaneously not twisting it (Yoshida et al., 2020).

2.4.2|Cervical oesophagus-subtotal stomach anastomosis

In the case of two-field dissection, make an oblique incision in the left neck. Use satin sky vascular forceps (04-31-M; Tanaka Medical Instrument Co., Ltd.) to grasp the cervical oesophagus and the SS. From the left to the right side of the posterior wall, ligate and suture the seromuscular layer of the SS and the adventitia muscle layer of the cervical oesophagus with a 3-0 absorbent suture (Figure 2A). As a guide, the left and right edge pitch should be 3 mm, and other pitches should be 4 mm (Figure 2B). A continuous suture of the mucosa and submucosa is performed from the centre of the rear wall to the left side. At the left end, full-layer sutures are added in the order of outer, inner, and outer, ligated with continuous external sutures. Perform the same procedure on the right side of the rear wall. At the end of the posterior wall anastomosis, the anastomosis looks like a fish mouth

(Figure 2C). The anterior border is sutured from left to right with a modified Gambee method (Figure 2D). Then pull the stomach to the ventral side, and secure the SS with three stitches in the crus of the diaphragm to prevent postoperative gastric invasion into the thoracic cavity and excessive dilation in the mediastinum. Take extreme care at this time to pull down the more excellent curvature side of the SS, which tends to be located on the back side by weight. This results in the SS being linearized in the thoracic cavity (Figure 1E). Finally, a size 12 French generation catheter is placed as an information drain from the neck to the anastomotic site(Yoshida et al., 2020)

2.5|Postoperative complications and quality of life measurement

Patients without leakage shadow at gastrografin test POD 6 or 7 or treatment for leakage, including conservative treatment, were defined as having no anastomotic leakage. Other postoperative complications were categorized using the Clavien-Dindo classification.[23] Patient QOL was measured using the oesophagal site-specific module of the validated European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-OES18)[24] at postoperative months 3 and 6, and years 1, 3, and 5. Esophagitis (Yoshida et al., 2020).

TABLE 1 Patient Characteristics and Postoperative Complications (n = 300) **Characteristic**

Variable	**Value**
Area (y)	67.6 ± 9.1
Sex (Male/Female)	252 (84%)/48 (16%)
Performance Status (0/1/2/3)	32 (10.7%)/246 (82.0%)/21 (7.0%)/1 (0.3%)
Tumor location (Ut/Mt/Lt)	43 (14.3%)/171 (57.0%)/86 (28.7%)
Clinical stageb (I/II/III/IV)	72 (24%)/42 (14%)/155 (51.7%)/31 (10.3%)
Histological tumor type (SCC/AC)	295 (98.3%)/5 (1.67%)
Preoperative therapy (CT/CRT/None)	189 (63%)/30 (10%)/81 (27%)
Thoracic approach (Right thoracotomy/Thoracoscopic)	210 (70%)/90 (30%)
Lymph node dissection (Two fields/Three fields)	85 (28.3%)/215 (71.7%)
Route of reconstruction (Substernal/Posterior mediastinal)	49 (16.3%)/251 (83.7%)
Operative time (minutes)a	378 ± 92.0
Blood loss (g)a	183 ± 99.6

Postoperative complications No. (%)

- Early-phase complications
- Anastomotic leakage 2 (0.67)
- Vocal cord palsy 33 (12.0)
- Atrial fibrillation 21 (7.0)
- Delirium 10 (3.3)
- Pneumonia 9 (3.0)
- Chylothorax 9 (3.0)
- Pulmonary thromboembolism 3 (1.0)
- Ileus 3 (1.0)
- Postoperative bleeding 2 (0.67)
- Hepatic portal venous gas 1 (0.33)
- Sick sinus syndrome 1 (0.33)
- Oesophagal hiatal hernia 1 (0.33)
- Air leakage 1 (0.33)
- Reoperation: air leakage, chylothorax, oesophagal hiatal hernia 3 (1.0)
- Hospital mortality 0 (0.0)
- Late-phase complications
- Stenosis of anastomotic site 15 (5.0)
- Nausea 11 (3.7)

- Dumping syndrome 7 (2.3)
- Ulceration of subtotal gastric tube 1 (0.33)
- Abbreviations: Ut, Upper oesophagus; Mt, Middle oesophagus; Lt, Lower oesophagus; SCC, Squamous cell carcinoma; AC, adenocarcinoma; CT, Chemotherapy; CRT, Chemoradiotherapy. Residual oesophagal and gastric cancer were checked routinely by endoscopy every year for five years after Surgery.

Body and skeletal muscle weights were measured using an In Body 720 at pretreatment, after NAC, and at 3 and 6 months and years 1, 2, 3, 4, and 5. QOL surveys and body weight and skeletal muscle mass were surveyed in all patients at prescribed points in 300 postoperative patients. In this study, we aggregated only 5-year survivors, excluding recurrent cases, to observe the QOL and body weight changes using this operative procedure (Yoshida et al., 2020).

2.6|Statistical analysis

Results are expressed as the median (interquartile range) and qualitative variables' percentages.

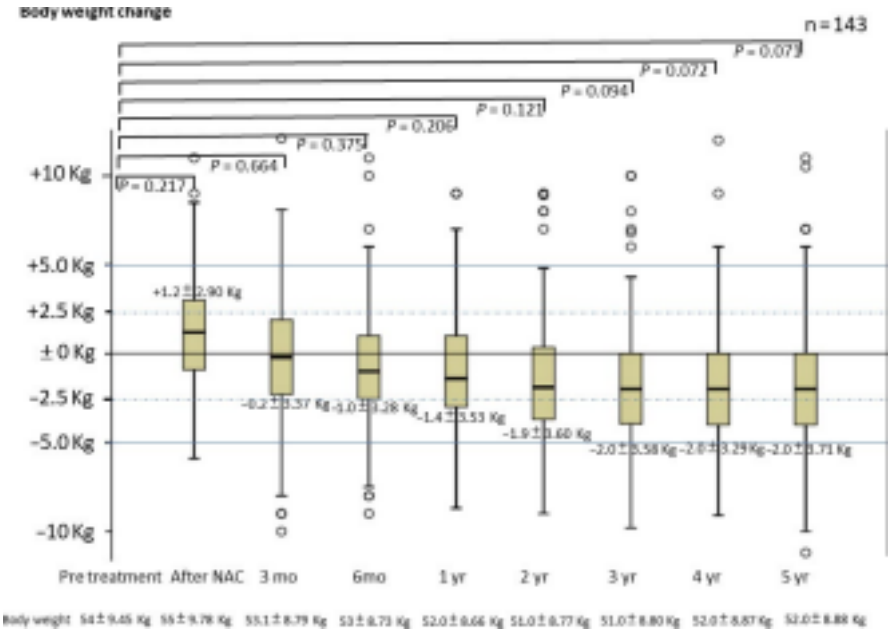


FIGURE 3: Change in body weight

after Surgery Test or Fisher exact test was used for categorical variables, and the nonparametric Wilcoxon rank sum test was used for continuous variables. A P-value < .05 was considered significant. All statistical analyses were performed with the SPSS 20.0 software package (SPSS).

2.7|Ethical considerations

This study was conducted following the World Medical Association Declaration of Helsinki. The review board approved this study of the Gifu University Hospital (Approval no. 2019-170).

3|RESULTS

3.1|Patient characteristics

Between January 2012 and September 2023, 320 patients with EC underwent thoracic esophagectomy at Gifu University Hospital. Seventeen patients were excluded because they underwent reconstruction using ileocolic intestine or jejunum, as were three patients who underwent jejunal reconstruction. Consequently, 300 patients with EC who underwent reconstruction using SS were enrolled in the present study. Patient demographic and clinical characteristics are shown in Table 1. As for histological tumour type, 295 cases (98.3%) were squamous cell carcinoma, and five cases

(1.67%) were adenocarcinoma, in which the primary tumours were located in the lower thoracic oesophagus. (Yoshida et al., 2020)

3.2|Surgical Characteristics

Surgical characteristics are shown in Table 1. The posterior mediastinum route was used in 251 (83.7%) patients, and the substernal course was used in 49 (16.3%) patients. Three-field lymphadenectomy was performed in 215 (71.7%) patients, and two-field lymphadenectomy was performed in 85 (28.3%) patients. Ninety (30%) patients underwent subtotal esophagectomy via thoracoscopy (Yoshida et al., 2020).

3.3|Postoperative complications

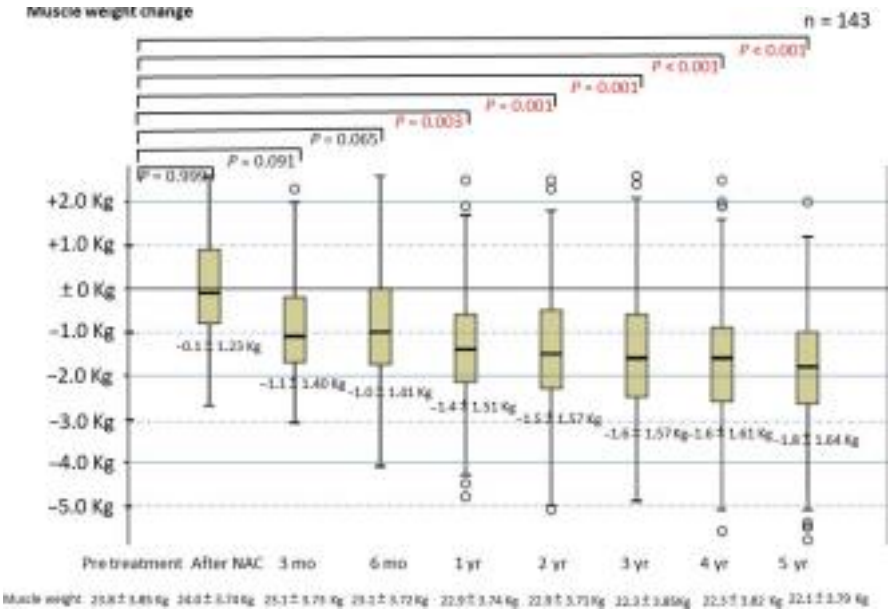
Anastomotic leakage was observed in two patients (0.67%). Other postoperative complications classified as Grade II or more are listed in Table 1. Pneumonia was observed in nine patients (3.0%). Fifteen patients (5.0%) had anastomotic stenosis requiring a bougie. Nausea occurred in 11 patients (3.7%), and dumping syndrome oc
curred in seven patients (2.3%). There was no operative mortality.

3.4|Evaluation of QOL, body weight, and muscle weight

We interviewed and measured 143 patients (123 [86.9%] men and 20 [14.0%] women) who survived for more than five years at the time of this report. Cancer stages of the 143 patients were: I, 55 (38.5%); II, 32 (22.4%); III, 52 (36.4%); and IV, 4 (2.8%) patients. Respective EORTC QLQ-OES18 scores (average ± standard deviation) of these 143 patients at postoperative months 3 and 6 and years 1, 3, and 5 were as follows: dysphagia score: 1.82 ± 0.40, 1.78 ± 0.42, 1.15 ± 0.42, 1.15 ± 0.44, and 1.0 ± 0.1; early feeling of abdominal fullness score: 2.03 ± 0.65, 1.89 ± 0.46, 1.30 ± 0.39, 1.22 ± 0.41, and 1.09 ± 0.38; feeling of reflux score: 1.29 ± 0.37, 1.20 ± 0.32, 1.10 ± 0.11, 1.10 ± 0.09, and 1.09 ± 0.07. Proton pump inhibitors were used for 6.2 ± 2.2 months after Surgery. In the Los Angeles classification,[25,] the incidence of reflux esophagitis occurred with Grade 0/A/B/C/D in 131 (91.6%)/10 (7.0%)/2 (1.4%)/0/0 in the first year. Subsequent observations did not show Grade C or D. Grade A was two (1.4%) in the second year, one (0.7%) in the third year, and two (1.4%) in the fourth and fifth years. Grade B was two (1.4%) in the second year, three (2.1%) in the third year, one (0.7%) in the fourth and fifth years, and Grade 0 in the rest. Figures 3 and 4 show the 143 patients' body and skeletal muscle weights, respectively. The patients' body weights were as follows: pretreat ment, 54 ± 9.45 kg; postoperative year 1, 52 ± 8.66 kg; postoperative year 3, 51 ± 8.80 kg; and postoperative year 5, 52 ± 8.88 kg. Body weight decreased by −2 ± 3.71 kg (P = .071) over the five years, and skeletal muscle weight decreased significantly after one year (P = .03).

4|DISCUSSION

There are various reconstruction methods for EC surgery,[26] and many methods have been investigated regarding blood flow in the stomach.[27] To our knowledge, this is the first report to investigate the short- and long-term outcomes of patients undergoing the procedure of SS. Five factors affect safety and good QOL: (a) the blood vessel network in the stomach; (b) methods to increase the distance to the anastomotic site at the neck,; (c) hand-sewn anastomosis that looks like a fish mouth; (d) straightening of the SS in the thoracic cavity city; and (e) locating the anastomotic site just around the circumference of the sternum and vertebral body. Narrow gastric tube reconstruction and stapled anastomosis are mainly performed in many countries. By using the junction between the left gastroepiploic and short gastric vessels via the splenic hilar vascular arcade, the distal portion of the gastric tube can be suf efficiently nourished. Double-stapling, purse-string, side-to-side lin ear-stapled, and end-to-side hand-sewn anastomosis methods are reported for EC.[28] The most significant benefit of reconstruction using SS is good blood flow. Although it appears advantageous that the length (Reorowicz et al., 2022)



A reconstructed stomach can be extended, but the blood flow at the tip of the narrow gastric tube may not be sufficient. We assume that one cause is blockage of the extensive vascular network in the submucosal layer of the entire stomach when creating a narrow gastric tube.

The stomach has excellent blood flow at the anastomotic site due to the preservation of the network of blood vessels in the stomach wall.[29] Thus, blood flow to the tip is sufficiently maintained using the proper gastric and gastroepiploic arteriovenous arcades as the blood supply and drainage source. Although we did not use indocyanine green (ICG) in 299 cases, we experimentally performed intraoperative bloodstream evaluation of SS using ICG fluorescent imaging in one case (Figure 5). The images show a vascular network under the gastric mucosa, and good blood flows up to the tip of the SS. Thus, we believe good blood flow in the SS is the most significant factor in our minimal suture failure rate of <1%.

The difference between an intrathoracic anastomosis and our technique is that the anastomotic site is located just around the circumference of the sternum and vertebral body, which may reduce leakage. However, there are two disadvantages of reconstruction using SS.

The first is the tension created when raising the SS to the anastomotic site at the neck because the SS has a shorter reconstructed organ length than the narrow gastric tube. However, we can increase the SS sufficiently to the channel by removing physiological adhesions on the posterior side of the storm ach wall and using Kocher's mobilization.

The second is deflection or deformation of the SS in the thoracic cavity. Expansion of the SS in the thoracic cavity can delay emptying the stomach contents.

This may occur because the SS is not pulled sufficiently toward the abdominal side after the cervical anastomosis. Therefore, after anastomosis, we remove the SS toward the abdominal side, especially the more fantastic curvature side of the stomach, straighten it, and then suture the SS to the crura of the diaphragm. This prevents excessive expansions of the SS in the thoracic cavity and intrusion of the reconstructed stomach (Aksoyler et al., 2022).

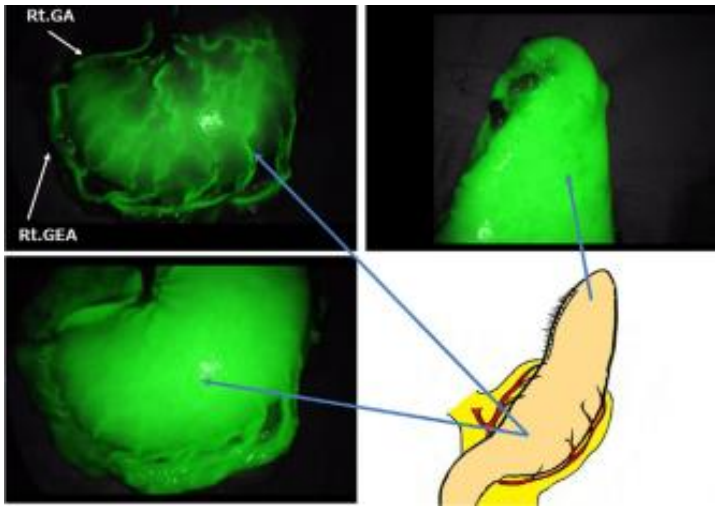


FIGURE 4: Circulatory network in the subtotal stomach as revealed by indocyanine green (ICG) fluorescence method. Rt. GA: right gastric artery, Rt. GEA: right gastro-epiploic artery

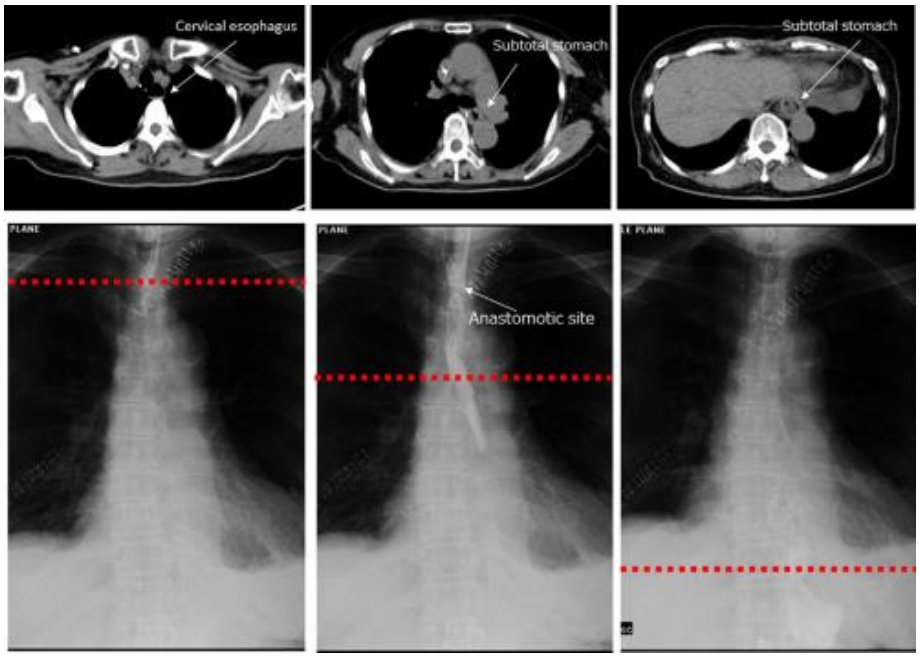


FIGURE 6 Swallowing test using gastrografin after reconstruction along with contrast-enhanced computed tomography. The red dotted line indicates the height of the computed tomography slice. The reconstructed stomach is seen located in the original oesophagal position without bulging, and gastrografin flows straight down

Lowed gastrografin on postoperative oral fluoroscopy flows straight through the thoracic cavity at the original thickness of the oesophagus as if the SS is occupying the original oesophagal position (Figure 6). Finally, and this is not described in any previous report when using SS for oesophagal Surgery, the range of motion of the right hand of the operator who pushes up a large SS toward the anastomotic site is limited unless a minimum 7-cm abdominal open wound is created. Therefore, lifting the SS through the thoracic cavity to the neck is not recommended under complete laparoscopic Surgery. Of course, the abdominal lymph nodes can be dissected under direct vision with an abdominal incision of at least 7-9 cm. Two patients suffered anastomotic leakage in the present study. One patient developed EC after Surgery for rectal cancer and had poor nutritional status according to continuing adjuvant chemotherapy for one year. The second patient suffered severe pneumonia on the first postoperative day and was treated with methylprednisolone steroid pulse therapy at 1000 mg for three days. Some hand sewing methods and instruments used in anastomosis

have advantages and disadvantages. The reasons for our selection of the hand-sewn approach with layer-to-layer anastomosis are as follows: emphasis on the neovascular network; end-to-end anas tomosis eliminates the ischemic area at the anastomotic site; inverting anastomosis by forming a fish mouth by hand-suture that is the basis of intestinal anastomosis; the direct view of the cervical anastomosis site for both the operator and assistant will be instructive for the young surgeons, and it is easy to perform Bougie for anastomotic stenosis because it does not use staples. If the leakage rate is <1%, like in this report, our mechanical anastomosis report can also be considered for SS. Still, hand sewing will be better because SS has a margin of the lifting of about 2.5-3.0 cm in the cervical portion for anastomosis. At that distance, it won't be easy to insert the instrument. Regarding postoperative morbidity, narrow gastric tube reconstruction is considered to cause fewer postoperative lung disorders compared to SS reconstruction.[11] However, pneumonia occurred postoperatively in only nine patients (3.0%) in the present study, indicating that our technique properly prevents SS deflection in the thoracic cavity. Proper postoperative oral care and speech and physiological therapy also help to prevent postoperative lung complications.

Narrow gastric tube reconstruction results in less postoperative reflux and better QOL than whole gastric tube reconstruction. Dysphagia and early feeling of abdominal fullness scores tended to be high after Surgery but gradually decreased after six months. Good results for postoperative reflux symptoms as assessed by the QOL test. If we follow these procedures, we will maintain the benefits of subtotal gastric blood flow preservation, low rate of complaints of duodenogastroesophageal reflux and slow emptying of the intrathoracic stomach. From the QOL questionnaire results, we could see that complaints about those issues were mild, and actual endoscopic findings showed a low rate of reflux esophagitis. The most important difference from the previous reports of SS is that our SS has a width like a narrow gastric tube in the thoracic cavity (Figure 6), and the stomach body is located in the abdominal cavity after anastomosis (Figure 1F). Proton-pump inhibitors were administered for about half a year. The reflex score tends to decrease after stopping the drug, and further administration may not be required (Gjeorgjievski et al., 2021).

The factors for maintaining postoperative weight in patients with EC are the shape of the reconstructed SS and the continuation of oral nutritional supplements from the preoperative to the postoperative period. Although the maintenance of postoperative QOL is greatly influenced by perioperative management, including healthy management and speech and physiological therapy, we believe that SS reconstruction created according to our method is the basis for this.

The body weight of the survivors was maintained for five years after esophagectomy, although skeletal muscle weight was significantly reduced one year after Surgery. Given that the skeletal muscles of the elderly decrease by 3% over two years around the age of 70, this does not seem to be a problem.[30] However, we have started individual nutritional management and physical therapy using a social network service. Patients participate in a network, a completely private social network service called 'Medical Care Station' (Embrace Co., Ltd.), of attending physicians, pharmacists, supervising dietitians, and rehabilitation technicians. Under strong security, all medical staff will postoperatively support the trivial patient's dietary, nutritional, and rehabilitative questions through their mobile phones. In response to the patient's complaints, we provide dietary guidance and reintroduction of physical therapy. Postoperative complaints in most cases are resolved one year after Surgery; however, it is essential to deal individually with the rare patient with a poor understanding of how to eat and the importance of exercise. [31] A jejunostomy tube was inserted into the jejunum in 251 cases. In one case, the operation was performed by wrapping and twisting the intestinal tract at the insertion site. No other troubles, including infectious ones, occurred. When inserting a jejunostomy tube, the following points should be noted in our department. The box is inserted at the 40 cm anal side from the Treitz ligament, and a 20 cm length is inserted into the jejunum. If it is longer than 40 cm, the oral side of the jejunum may be twisted. The tube penetrates the abdominal wall diagonally on the caudal side of the Treitz ligament. This prevents the small intestine from becoming Z-shaped at the inserted site. It is fixed to the abdominal wall after suturing over 10cm by the Witzel method. In the oncological aspect, the local recurrence at the anastomotic site is zero in

300 cases. Regarding the resected distance of the oral stomach for the SS, it is unlikely that the SS would be at risk of recurrence as a reconstructed stomach. In addition, no reproduction of the lymph nodes in the lesser curvature side of the abdomen occurred, which may be due to sufficient lymph node dissection of the more secondary curvature side. This study has several limitations. First, this is a single-institution study. Second, other techniques were not evaluated prospectively. However, among these 300 cases of EC surgery consecutively formed in our institution where SS was intended to be used, no conversion to another technique was made because of problems during Surgery, and there was no change in operative methods, devices, and perioperative management (Losco et al., 2022).

CONCLUSION

In conclusion, this study demonstrates that subtotal stomach (SS) reconstruction following esophagectomy for esophageal cancer (EC) is both safe and effective. Among 320 patients, the anastomotic leakage rate was remarkably low at 0.67%. Other postoperative complications, such as pneumonia (3.0%), anastomotic stenosis (5.0%), nausea (3.7%), and dumping syndrome (2.3%), were managed effectively. Postoperative quality of life (QOL) metrics showed significant improvement, with dysphagia and early satiety scores normalizing within six months and favorable reflux symptom scores. Although there was an average body weight decrease of -2 ± 3.71 kg over five years, it was not statistically significant ($P = .071$), indicating stable long-term nutritional status. Overall, SS reconstruction offers a promising surgical option for EC, with low complication rates and improved postoperative QOL. Future research should focus on refining this technique and comparing it with other methods to validate its efficacy and safety further.

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