TECHNICAL NOTE

Esophagogastric reconstruction using remnant stomach with a single vessel pedicle: Technique and outcomes

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Abstract

Esophageal cancer with a history of distal gastrectomy is a clinical problem. To our knowledge there have been no reports of remnant stomach fed from the left gastroepiploic artery being used in esophageal reconstruction. We, herein, report four cases of esophagogastric reconstruction using remnant stomach with a single left gastroepiploic vascular pedicle. It is more functional to use the remnant stomach than other replacements. Meanwhile, the gastric conduit fed from the left gastroepiploic artery showed sufficient vascularity and stable gastroesophageal anastomosis. The technique and outcomes in follow-up have proven feasible and save time.

Introduction

Esophageal reconstruction in patients with a history of distal gastrectomy has frequently been reported. One acceptable option is using the remnant stomach. However, there has been debate about which sources of blood supply the residual stomach is fed from. In previous literature, the left gastroepiploic artery was seldom considered as a preserved source of blood supply.¹ Is it possible or valuable? We report four cases of esophagogastric reconstruction using the remnant stomach with a single left gastroepiploic vascular pedicle.

Patients

From January 2009 to December 2012 in our department, six patients with esophageal carcinoma and a history of distally partial gastrectomy for their benign gastric lesions underwent esophagectomy. One patient whose esophageal tumor was located at the middle third of the thoracic segment underwent esophageal subtotal resection, followed by colonic substitution. Reconstruction in another patient with gastroesophageal junction (GEJ) cancer was achieved by jejunal Roux-en-Y after a total gastrectomy. In the remaining four cases, esophagoplasty was employed using the remnant

stomach. The preserved left gastroepiploic vascular pedicle was the single source of blood supply to the gastric stump.

All patients were subjected to gastroscopy and diagnosis was confirmed preoperatively by biopsy. Enhanced computed tomography (CT) scans and ultrasonic endoscopies were performed to determine the clinical stage of the esophageal tumor according to the 7th edition of the International Union Against Cancer-American Joint Committee on Cancer (UICC-AJCC) Tumor Node Metastasis (TNM) Classification for esophageal cancer. The absence of distant metastasis was ensured, while tolerance to surgery was assessed. No preoperative chemotherapy or radiotherapy was undertaken. Upper gastroenterography showed the mode of prior gastroenterostomy and size of the remnant stomach. Preoperative preparation was similar to conventional esophagectomy. Bowel preparation is critical to avoid accidental transversion to colonic esophagoplasty. The clinical profiles are displayed in Table 1.

Surgical technique

In two of the cases, the procedure was carried out via thoraco-abdominal incision, which extended the abdominal incision to the left thorax. In the other two cases, a median abdominal incision was made without performing thoracotomy in order

Table 1 The clinical profiles of the patients

	Case 1	Case 2	Case 3	Case 4
Age	67	56	54	70
Gender	Male	Male	Male	Male
Admit date	Oct 2009	Jun 2011	May 2012	Dec 2012
History	PU	PU	PU	Perforated PU
Mode of surgery	Billroth I	Billroth I	Billroth II antecolic	Billroth II Retrocolic
Interval (year)	24	17	2.5	9
Location†	GEJ (40)	Distal (38)	GEJ (41)	Distal (38)

†In parentheses represent the distance from incisor tooth to the upper margin of the esophageal tumor (cm). PU, peptic ulcer.

ensure the stability of respiration and circulation. In these two cases, resection and gastroesophageal anastomosis was performed in the posterior mediastinum via an incision of the diaphragm anterior to the esophageal hiatus. The posterior mediastinum and subcarinal lymph nodes were exposed by anteriorly retracting the heart. Anastomoses and lymphadenectomy followed the same procedure as a thoracotomy.

The abdomen and thorax were explored to exclude metastatic disease. Some adhesions in the abdominal cavity were found. After mobilization of peripheral adhesions it was estimated that the residual stomach was sufficient for the procedure. The gastric stump, gastroduodenal anastomosis or afferent and efferent loops of jejunum were fully mobilized, as well as the transverse colon. The right gastroepiploic and gastric vessels were divided previously. The left gastric artery and short gastric vessels were divided at the origin. The left gastroepiploic artery was mobilized and preserved with the marginal vascular arcade integrated. Peritoneal lymph nodes were en bloc dissected which included lymph nodes around the cardia of greater and lesser curvature, in ligamentum hepatogastricum, left gastric artery, splenic artery, splenic hilar, and celiac trunk lymph nodes. Mobilization of the hiatus and distal esophagus was completed with a diaphragmatic radialized incision if necessary. Sleeve resection along the lesser curvature was performed up to the gastric fundus to manufacture the gastric conduit (Fig 1). The length of the gastric conduit was measured 18 cm~25 cm from tip to exit. We confirmed that there was adequate vascularity of the gastric conduit by the left gastroepiploic arcade and of the ramus anastomoticus from the gastroduodenostomy or gastrojejunostomy. The thoracic esophagus was en bloc mobilized with periesophageal and subcarinal lymph nodes. It was then transected 5 cm above the tumor. The gastric conduit was pulled up into the posterior mediastinum. The esophago-gastric end-to-end anastomosis was created by a 25 mm circular stapler introduced through an anterior gastrotomy to the top of the gastric conduit. In all cases anastomoses was performed at the level just below the azygos arcade (Fig 2). It is critical to ensure there is no tension in the anastomosis or

Figure 1 Sketch of manufacture of the gastric conduit.

obstruction of the afferent or efferent loops. The diaphragmatic incision was sutured with the gastric conduit fixed at the hiatus. Chest drainage was used in the two thoracotomy cases, while a mediastinal tube was used in the non-thoracotomy cases.

Outcomes

There was no postoperative mortality and no serious complications (e.g. stomal leak, pyothorax, pneumonitis, active bleeding, respiratory failure, circulatory collapse, anastomotic obstruction, reoperation, and so on) occurred within 30 days of the surgery. Total parenteral nutrition was used postoperatively until oral intake. A liquid diet was launched once gastrointestinal function was regained. A general diet was achieved within one month after surgery. Gastroesophageal reflux was present in all cases and proton pump

Figure 2 Postoperative double contrast barium meal of case 4.

Table 2 The outcomes of surgical therapy

	Case 1	Case 2	Case 3	Case 4
Approach	T&A	T&A	MA	MA
Operation time (min)	135	150	120	120
Bleeding (mL)	400	200	350	400
Histologic type	Adenocarcinoma	SCC	SCC	SCC
P stage				
Tumor	2	3	2	1
Node	0 (0/16)	1 (4/21)	1 (2/15)	0 (0/18)
Metastasis	0	0	0	0
Incisal margin	(-)	(-)	(-)	(-)
Postoperative hospital stay	15	9	9	8

Bleeding, operative bleeding; MA, median abdominal incision; P stage, pathological stage; SCC, squamous cell carcinoma; T&A, thoracoabdominal incision.

inhibitors (PPI) were required. A gastroscopy revealed esophagitis of 1~2 grades in case 1 and case 2 one year after surgery.

Pathological examination revealed histological subtype and pathological staging. The specimen of tumors and lymph nodes demonstrated oncologically radical resection. The results of surgical therapy are shown in Table 2.

Follow-up included thoracoabdominal CT scans, double contrast barium meal or gastroscopy, and examination to exclude distant metastasis. Case 1 has survived three years without evidence of recurrence or dysfunction. Case 2 underwent adjuvant chemo/radio-therapy and survived 16 months until hepatic metastasis occurred. Case 3 was treated with adjuvant chemotherapy was followed-up regularly. Case 4 did not agree to adjuvant therapy but was non-symptomatic and in ascending nutritional status at three months after surgery. Continued follow-up of cases 3 and 4 was not possible.

Discussion

There is a higher incidence of esophageal cancer in patients who have undergone a gastrectomy.² In particular, the proportion of lower third esophageal tumors in patients who have had a gastrectomy is significantly higher compared to the general population.³ Esophagitis caused by gastro-duodeno-esophageal reflux is considered an inducer to subsequent esophageal cancers in the post-gastrectomy period.⁴ Surgical intervention has been generally accepted as the preferred therapy as postoperative prognosis is no worse than for patients who have not undergone a gastrectomy.^{5,6} Esophageal cancer with a history of gastrectomy poses a challenge as to what substitute is best for alimentary reconstruction.

The literature details various replacements. Colonic transplantation is the preferred substitution by the majority of surgeons, owing to its reliability and acceptable survival rate.^{7,8} Jejunal interposition reconstruction is used less frequently in cases with concomitant colonic diseases.^{9,10} This procedure is not adapted for all cases because it is considered time-consuming and includes additional anastomoses. It has

been reported that surgical stress and complications induced by colonic substitution might be associated with poorer survival rates.¹¹ Total remnant gastrectomy followed by jejunal Roux-en-Y reconstruction may be a simpler and safer option.¹² However, total gastrectomy does not maintain better oncological results and postoperative quality of life is inferior in contrast to proximal gastrectomy.^{13,14}

Surgeons are reconsidering the use of remnant stomach in esophagoplasty. Shiryajev reviewed the history and different methods of esophagoplasty using the gastric stump¹ and found that utilization of the remnant stomach for esophagoplasty was a less well developed procedure, but should be investigated further. It is more functional to use the remnant stomach than other replacements.

In our study, four cases of esophageal carcinoma with a history of distal gastrectomy underwent esophagectomy. The remnant stomach with the left gastroepiploic vessel preserved was employed to accomplish intrathoracic esophagoplasty.

The right gastric and gastroepiploic vessel had been divided previously. The left gastric vessel must be dissected combined with the lymph nodes around the celiac trunk. The short and posterior gastric arteries should not be saved unless the spleen and tail of the pancreas were transposed to the thorax.¹⁵ It is insufficient from an oncological point of view and causes disturbance of the physiologic equilibrium to do so.

In contrast to the short gastric artery, the left gastroepiploic vessel has a longer course, therefore, the greater curvature is relatively easy to ascend. In the residual stomach, the left gastroepiploic artery could be mobilized and saved if the gastric conduit fed from it is lengthened sufficiently. This procedure enabled the subsequent esophagoplasty. Our experience shows that the technique is feasible and saves time.

The marginal branches along the greater curvature communicated with the intramural microvascular network. They offered adequate blood supply to the narrow gastric conduit created on the base with the greater curvature. The replacement displayed abundant vascularity. No stomal leak or stricture was detected in follow-up. Hemoperfusion from the

jejunal loops and microvascular reconstitution were also important factors related to transportation.¹⁶ Preservation of the left gastroepiploic vessel would facilitate these processes.

From an oncological point of view, this procedure is sufficient for early stage cases of esophageal cancer. The range of proximal gastrectomy includes lesser subtotal curvature, the cardia and fundus, and the distal esophagus up to over 5 cm above the upper margin of the tumor in cases where the tumor is located at the distal esophagus or GEJ. The lymphadenectomy of peritoneal cavity and inferior mediastinum is similar to conventional distal esophagectomy.

There are limitations to this procedure. The vital principle is ensuring the stability of gastroesophageal anastomosis. If tension in the anastomosis is present, stomal leak becomes a risk. A large portion of the remnant stomach is necessary to ensure the success of this procedure. Patients with highly located tumors or who have undergone subtotal gastrectomy are not eligible for this treatment. Reconstruction by Roux-en-Y or colonic interposition should be adopted, unless it is confirmed that the gastrojejunostomy or gastroduodenostomy are unobstructed.

The vascularity of the remnant stomach was estimated mainly by appearance. Although the results of surgery in the study indicated the absence of ischemia, CT angiography should be helpful preoperatively. It is essential that vascularity of the remnant stomach fed from the left gastroepiploic vessels is confirmed or esophagogastroplasty should be abandoned.

Another limitation is that the lymph nodes of the superior mediastinum are not involved in this procedure. Therefore, in cases of later stage disease, a two-phase approach should be applied.

To summarize, the technique discussed in this report provides an additional option of esophageal reconstruction for the gastric stump. Patients may be eligible for this procedure under the following criteria: (1) the tumor is located at the distal esophagus or GEJ; (2) clinical stage N0/N1; (3) the residual stomach is large enough; (4) efficient gastric emptying function; and (5) the gastric conduit fed from the left gastroepiploic artery presents enough blood supply during surgery. The remnant stomach should not be utilized in cases of: (1) high located tumor; (2) major involvement of the gastric stump; (3) tension at the anastomosis; (4) uncertain vascularity of the gastric tube; or (5) lymphadenectasis in the superior mediastinum.

Conclusion

There are few reports on the technique of using the remnant stomach in reconstruction. Our study proves that the procedure is feasible. However, strict indications and multifold preparation should be insisted upon. Further evidence is desired to evaluate this procedure.

Disclosure

No authors report any conflict of interest.

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