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Original Article

Usefulness of Endoscopic Evaluation After Esophageal Reconstruction Surgery

Chia-Hung Tu[1], Jaw-Town Lin[2], Ching-Tai Lee[2], Chi-Ming Tai[2], Tsung-Hsien Chiang[3], Chi-Yang Chang[2], Hung-Chi Chen[4]

Objectives: Esophageal reconstruction after esophagectomy poses risk of tissue graft-related complications and development of tumors. Despite the demand for rigorous postoperative surveillance, the role of endoscopy has not been shown. This study aims at evaluating the usefulness of postoperative esophagogastroduodenoscopy for long-term follow-up.

Methods: Data from all patients who underwent esophagogastroduodenoscopy at least 21 days after esophagectomy and esophageal reconstruction surgery at E-Da Hospital from July 2005 to January 2009 were retrospectively analyzed.

Results: Thirty patients (27 males and 3 females, mean age = 52.1 years) were enrolled. Twenty-four of them underwent esophagectomy for malignancy. Colon grafts, jejunum grafts, and gastric tubes were employed for reconstruction. For 8 patients, endoscopy failed to examine the entire esophageal conduit because of luminal stricture or redundancy. Among the remaining 22 (73%) patients, endoscopy detected new cancers in the remnant esophagus in 4 patients and colon graft adenomas in 3 patients. Endoscopic therapeutics included clearance of impaction, feeding tube placement, percutaneous endoscopic gastrostomy, and dilatation of strictures. There were no endoscopy-related complications.

Conclusions: Esophagogastroduodenoscopy is useful and safe in the postoperative diagnosis and management of late tissue graft complications for patients having received esophagectomy and esophageal reconstruction surgery. It is also valuable for tumor detection and its versatile therapeutic applications.

Key words: reconstruction, postoperative, endoscopy, remnant esophagus, tissue grafts

After esophagectomy, the surgical defect is reconstructed to form an esophageal conduit to maintain the continuity of digestive tract. Esophageal reconstruction requires

From the [1]Department of Internal Medicine, National Taiwan University Hospital, Taipei; [2]Department of Internal Medicine, E-Da Hospital, I-Shou University, Kaohsiung; [3]Department of Internal Medicine, Far Eastern Memorial Hospital, Taipei; [4]Department of Surgery, China Medical University Hospital, Taichung, Taiwan.
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Address reprint and correspondence to: Dr. Chi-Yang Chang, Department of Internal Medicine, E-Da Hospital, I-Shou University, 1, Yida Road, Jiaosu Village, Yanchao District, Kaohsiung City 82445, Taiwan.
Tel: +886-7-6150011, Fax: +886-2-23947899, E-mail: chiyang1112@gmail.com

the transposition of stomach (gastric pull-up), intestinal graft, or musculo-cutaneous graft to replace the esophagus.[1,2] Despite continuous refinements over decades, this technique is still associated with high risk of graft-related complications such as graft necrosis, leakage, fistula, stricture, or impaction.[3,4] Local recurrence of primary esophageal cancer and development of metachronous cancer in the remnant esophagus are constant risks for cancer patients undergoing esophagectomy.[5] Moreover, the intestinal graft carries with its potential risk of cancerous change as a late complication.[6,7] Failure to detect these complications during follow-up may lead to severe or even fatal outcomes. Therefore, a rigorous postoperative surveillance is always justified. Although a number of diagnostic modalities have been used in this setting, none of them is universally advocated for clear superiority. Contrast esophagography, computed tomography, positron emission tomography, radionuclide scintigraphy, esophageal manometry, and video-fluoroscopy have been shown to be useful for postoperative surveillance and functional assessment.[8-13]

Esophagogastroduodenoscopy (EGD) of the reconstructed esophagus is advantageous for direct observations and its therapeutic potential. It has been utilized in the management of complications shortly after surgery and anastomotic strictures developed in later period.[3,14] However, its usefulness is questioned for concerns of postoperative anatomical alterations, tortuousness and redundancy of tissue grafts, luminal stricture, and food retention. Although early endoscopy within 21 days after esophagectomy and reconstruction has been proposed to evaluate graft integrity and viability,[15] long-term surveillance EGD has not been advocated as a postoperative routine.[16,17]

To date, the clinical utility, safety, and successful rate of EGD to examine the tissue graft after esophageal reconstruction surgery are largely unclear. This paucity of scientific evidence precludes the advent of legitimate recommendations. In the present study, we retrospectively analyze the endoscopic results on esophageal conduits among patients long after esophagectomy and esophageal reconstruction in a plastic surgery referral center to evaluate the usefulness of EGD as a postoperative follow-up modality.

Patients and Methods

For this retrospective study, we analyzed the accumulated EGD data at E-Da Hospital from July 2005 to January 2009. Data from all patients who underwent EGD at least 21 days after esophageal reconstruction surgery were collected. When a patient underwent more than one EGD within the study period, only the first procedure was included. Moreover, only the first postoperative EGD for each patient was adopted for analysis. Patients were specified by age, gender, preoperative diagnosis, source of graft used for reconstruction, time interval between esophageal reconstruction and EGD, endoscopic findings, the type of endoscope used, and procedure-related complications. Endoscopic biopsies and therapeutic procedures were also included when applicable. The ethics committee of E-Da Hospital approved the study protocol before its implementation (Case Number: E-MRP-095-028).

Esophageal reconstruction after esophagectomy was carried out for both benign and malignant conditions. Patients being prepared for resection of primary tumors were screened for concurrent tumors in the esophagus, stomach, or donor-site intestines before surgery. Stomach, intestine, and skin are possible sources of tissues used to repair the esophageal defects. Intestinal flaps, which may be free colon, ileocolon, or free jejunum flaps, were harvested for isoperistaltic, end-to-end anastomoses.[18] A gastric pull-up technique to build a gastric tube was sometimes employed when there was a large esophageal defect.[19] Depend-

ing on the surgical defects, the pharyngeal portion was sometimes reconstructed as well. Whenever necessary, microsurgical techniques were applied to tissue transfers to improve blood supply and graft survival.[20]

Results

A total of 30 patients underwent their first post-surgical EGD at E-Da Hospital during the study period. This included 27 male and 3 female patients. Their mean age was 52.1 years (range: 32-70 years). All 30 received surgical procedures by a single surgical team at E-Da Hospital (Dr. H.-C. Chen and his group). Of the 30 patients, 10 had received esophageal reconstruction surgery after esophagectomy for hypopharyngeal cancer, 6 for corrosive esophageal stricture, 5 for esophageal cancer, 3 for laryngeal cancer, 2 for double-primary cancers (one with Barrett's esophagus coexisting with esophageal adenocarcinoma and gastric cancer, and another with oral cancer and esophageal cancer), 1 for oral cancer, 1 for oropharyngeal cancer, 1 for nasopharyngeal carcinoma, and 1 for epiglottic cancer. Colon grafts, either free colon or ileocolon flaps, were used for reconstruction in 21 patients. Other sources were jejunum for 6 patients, stomach (gastric tube reconstruction) for 2 patients, and dual-graft (colon and jejunum by staged reconstruction) for 1 patient. The most common reason for EGD was dysphagia (n=14), followed by postoperative surveillance (n=7), abdominal pain (n=3), upper gastrointestinal bleeding (n=2), food impaction (n=2), fish bone ingestion (n=1), and chronic cough (n=1). Intervals between EGD and esophageal reconstruction ranged from 21 days to 20 years, with a median of 365.5 days and a mean of 3.4 years.

Standard endoscopes (GIF-Q260, GIF-H260, and GIF-H260Z; Olympus Optical Co, Ltd, Tokyo, Japan) with maximum diameters of 9.2 to 10.8 mm were used for EGD in 26 patients. For the other 4 (13%) patients, a thin endoscope (GIF-XP260; Olympus Optical Co, Ltd, Tokyo, Japan) designed for pediatric use with a maximum diameter of 6.5 mm was required to pass through the strictures and reach the stomach. The esophageal conduits could not be completely examined due to severe strictures or difficult, redundant loops in 8 (27%) patients.

Of the 8 patients, 6 underwent alternative investigations, including 4 esophagographic examinations and 2 successful attempts of subsequent EGD. The remaining two patients with incomplete esophageal examination needed no more investigation because EGD had provided sufficient diagnostic information. Both of them had dysphagia, in whom EGD not only confirmed substantial anastomotic strictures impeding the passage of endoscopes, but also guided further management with balloon dilatation at regular intervals.

Regarding the 22 patients for whom the entire esophageal conduit was completely examined, four (18%) were found to harbor squamous cell carcinoma in their remnant esophagus (Figure 1), six (27%) had peptic ulcers, four (18%) had erosive esophagitis,

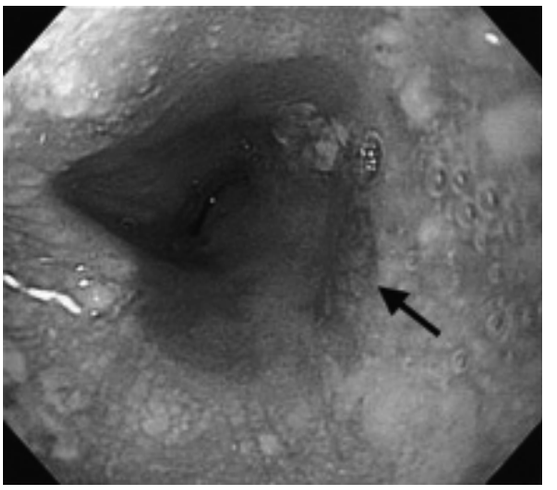

Fig. 1 Early stage metachronous tumor in remnant esophagus. A 5 mm flat area of discoloration (arrow) was detected in the upper esophagus, proximal to the interposed colon graft. A biopsy on the lesion confirmed squamous cell carcinoma.

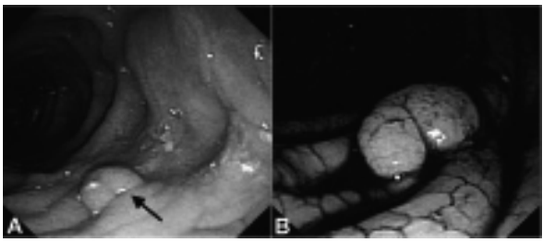

Fig. 2 Colon graft polyp. (A) EGD detection of a 5 mm adenomatous polyp (arrow) on the colon graft 17 years after esophageal reconstruction surgery. (B) The gross features of the lesion were further delineated by spraying of contrast dye (2% indigocarmine).

Table 1. Findings of the first postoperative EGD for 22 patients who underwent esophagectomy and esophageal reconstruction surgery.

Endoscopic findings	n (%)	Source of tissue grafts		
		Colon (n=17)	Jejunum (n=3)	Stomach (n=2)
Esophageal squamous cell carcinoma	4 (18)	4	0	0
Colon graft adenoma	3 (14)	3	0	0
Peptic ulcer	6 (27)	4	1	1
Erosive esophagitis	4 (18)	4	0	0
Esophageal candidiasis	1 (5)	1	0	0

EGD, esophagogastroduodenoscopy.

and one was afflicted with candidiasis. Three patients with colon interposition had adenomatous polyps arising from the grafts (Figure 2, Table 1). Three patients with dysphagia were cleared of their impacted food residue in the colon graft segment during endoscopy. Two sessions of EGD aided in the placement of nasogastric feeding tubes. Endoscopic balloon dilatation of anastomotic strictures, fish bone removal, and percutaneous endoscopic gastrostomy were done for the other three patients, respectively. There were no procedure-related complications in the 30 patients.

Discussion

This study has reviewed the results of the 30 patients who underwent EGD up to 20 years after esophagectomy and esophageal reconstructions. Complete EGD examination over the entire esophageal conduit was achieved in 73% of the patients. Esophageal cancers were detected in the remnant esophagus of 4 patients and adenoma in the colon grafts of other 3 patients. In addition to diagnosis, endoscopic intervention was successful on 7 occasions. There were no procedure-related complications. To our knowledge, this is the first case-series systematically describing a role for EGD long after esophageal reconstruction surgery.

In the present study, the high incidence (18%) of second primary tumor in the remnant esophagus may be explained by a high proportion of patients with head and neck cancer. Our result is comparable to that of a previous study reporting a 22% probability of developing a second metachronous cancer 5 years after treatment for initial head and neck cancer.[21] Cancers in the head, neck, and esophagus share a similar squamous epithelial origin and carcinogenic influence. This “field cancerization” theory justifies the indispensable need for identifying a possible second primary tumor in the region of the head, neck, and esophagus, either at the time of diagnosis of the primary tumor or during post-treatment follow-up.[22] Similarly, patients undergoing esophageal reconstruction for corrosive strictures have increased risk of cancer occurring in the remnant esophagus.[23] In our study, 1 of the 3 patients with remnant esophageal cancer had a history of corrosive ingestion 20 years earlier.

Neoplastic growth in the colon grafts used for esophageal reconstruction has only been reported sporadically.[6,7] However, this condition may be more prevalent than it has generally been considered. Three (14%) of the 21 colon grafts in our study developed adenomatous polyps by 1 to 20 years after reconstructions, comparable to a recent report of an 18% incidence of colon adenoma among healthy subjects.[24] Our finding suggests that the transfer of colon tissue to a different physiologic environment may not preclude its inherent

propensity to develop tumors. In fact, at least 10 cases of adenocarcinoma arising in the interposed colon have been reported in the literature.[25] This result supports the rationale of surveillance EGD in the late postoperative period after colon interposition.

Postoperative contrast esophagography is frequently utilized to confirm the integrity of the esophageal conduit and to detect tumors.[9,13,17] This modality is attractive because of its convenience, non-invasiveness, low-cost, and sensitivity in detecting leakage and fistula. In practice, however, its usefulness is reduced by the presence of impacted food, tortuosity of the conduit, poor ability to detect non-protruding lesions, and lack of therapeutic capability. According to our results, the weakness of esophagography can be overcome by the utilization of EGD. Food particles and fluids are readily removed or mobilized during endoscopy. Tortuosity and twisted loops can be solved by endoscopic reduction. EGD detects lesions like superficial tumors, small polyps, candidiasis, erosive esophagitis, and shallow ulcers, which are easily overlooked on contrast esophagography.

The therapeutic advantages of EGD in the present study included placement of feeding tubes, creation of a percutaneous gastrostomy, dilatation of strictures, and removal of impactions. The patients were benefited by avoiding prolonged parenteral nutrition, unnecessary laparoscopic gastrostomy or enterostomy, and additional surgery. Moreover, we noticed an additional advantage of EGD in evacuating impacted food particles within the colon grafts. For the three patients with colon interposition undergoing EGD for dysphagia, the impacted materials were typically firm and compact. After endoscopic clearance, the patients enjoyed lasting relief and resumed good swallowing function. The propensity of food impaction in the transposed colon can be attributed to non-physiological motility, as well as the substantial water-absorptive function of colonic tissue to condense and solidify transiting food.[26] For patients with colon interpositions, we advise adopting the eating habit of full chewing, plenty of water for moistening, and swallowing only small boluses each time.

Four patients in our study required the use of a thin endoscope of 6.5 mm width to pass beyond the luminal stricture and achieve complete examinations. However, EGD still failed to examine the entire esophageal conduit in up to 27% of patients. Several new types of endoscope designed for trans-nasal EGD have been commercialized, with a caliber as small as 4.9 mm.[27,28] Although they are much thinner, their usefulness for the reconstructed esophagus needs further testing due to reduced maneuverability and limited therapeutic competence.

Several limitations of our study are the consequences of its retrospective design. The procedure time and patient-acceptance of EGD were not recorded. The source of tissue grafts used in our patients was unbalanced, with up to 70% colon grafts and no musculocutaneous grafts. Although a stratified analysis is preferable due to the wide range of procedures, primary diagnoses, and indications for EGD, the size of our study is apparently insufficient.
Being a safe tool with versatile diagnostic and therapeutic utilities, EGD deserves a central role in the physician's armamentarium in the postoperative management of esophageal reconstruction. A prospective study with larger sample size, updated equipment, and stratified analyses will be needed in future studies.

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References

1. Davis PA, Law S, Wong J: Colonic interposition after esophagectomy for cancer. Arch Surg 2003; 138:303-8.
2. Coleman JJ 3rd: Reconstruction of the pharynx and cervical esophagus. Semin Surg Oncol 1995; 11: 208-20.
3. Briel JW, Tamhankar AP, Hagen JA, et al: Prevalence and risk factors for ischemia, leak, and stricture of esophageal anastomosis: gastric pull-up versus colon interposition. J Am Coll Surg 2004; 198:536-41.
4. Mansour KA, Bryan FC, Carlson GW: Bowel interposition for esophageal replacement: twentyfive-year experience. Ann Thorac Surg 1997; 64:752-6.
5. Chon AM, Peppard SB: Multiple primary malignant tumors of the head and neck. Am J Otolaryngol 1980;1:411-7.
6. Liau CT, Hsueh S, Yeow KM: Primary adenocarcinoma arising in esophageal colon interposition: report of a case. Hepatogastroenterology 2004; 51:748-9.
7. Roos D, Busch OR, Van Lanschot JJ: Primary colon carcinoma in a colon interposition graft after oesophageal resection. Ned Tijdschr Geneeskd 2007;151:2111-4. (In Dutch;English abstract)
8. Cooke DT, Lin GC, Lau CL, et al: Analysis of cervical esophagogastric anastomotic leaks after transhiatal esophagectomy: risk factors, presentation, and detection. Ann Thorac Surg 2009;88:177-84.
9. Bemelman WA, Taat CW, Slors JF, et al: Delayed postoperative emptying after esophageal resection is dependent on the size of the gastric substitute. J Am Coll Surg 1995;180:461-4.
10. Doki Y, Okada K, Miyata H, et al: Long-term and short-term evaluation of esophageal reconstruction using the colon or the jejunum in esophageal cancer patients after gastrectomy. Dis Esophagus 2008;21:132-8.
11. Higuchi I, Yasuda T, Yano M, et al: Lack of fludeoxyglucose F 18 uptake in posttreatment positron emission tomography as a significant predictor of survival after subsequent surgery in multimodality treatment for patients with locally advanced esophageal squamous cell carcinoma. J Thorac Cardiovasc Surg 2008;136:205-12.
12. Sutton R, Sutton H, Ackery DM, et al: Functional assessment of colonic interposition with 99Tcmlabeled milk. J Pediatr Surg 1989;24:874-81.
13. Moerman M, Fahimi H, Ceelen W, et al: Functional outcome following colon interposition in total pharyngoesophagectomy with or without laryngectomy. Dysphagia 2003;18:78-84.
14. Kim HK, Choi YH, Shim JH, et al: Endoscopic evaluation of the quality of the anastomosis after esophagectomy with gastric tube reconstruction. World J Surg 2008;32:2010-4.
15. Maish MS, DeMeester SR, Choustoulakis E, et al: The safety and usefulness of endoscopy for evaluation of the graft and anastomosis early after esophagectomy and reconstruction. Surg Endsoc 2005;19:1093-102.
16. Hogan BA, Winter DC, Broe D, Lee MJ: Prospective trial comparing contrast swallow, computed tomography and endoscopy to identify anastomotic leak following oesophagogastric surgery. Surg Endosc 2008;22:767-71.
17. Ajani J, Bekaii-Saab T, D'Amico TA, et al: Esophageal cancer clinical practice guidelines. J Natl Compr Canc Netw 2006;4:328-47.
18. Chen HC, Mardini S, Yang CW: Voice reconstruction using the free ileocolon flap versus the pneumatic artificial larynx: a comparison of Endoscopy after Esophageal Reconstruction 5 patients' preference and experience following laryngectomy. J Plast Reconstr Aesthet Surg 2006; 59:1269-75.
19. Silver CE: Gastric pull-up operation for replacement of the cervical portion of the esophagus. Surg Gynecol Obstet 1976;142:243-5.
20. Chen HC, Tang YB: Microsurgical reconstruction of the esophagus. Semin Surg Oncol 2000;19:235-45.
21. Schwartz LH, Ozsahin M, Zhang GN, et al: Synchronous and metachronous head and neck carcinomas. Cancer 1994;74:1933-8.
22. Muto M, Hironaka S, Nakane M, et al: Association of multiple Lugol-voiding lesions with synchronous and metachronous esophageal squamous cell carcinoma in patients with head and neck cancer. Gastrointestinal Endosc 2002;56:517-21.
23. Kiviranta UK: Corrosion carcinoma of the esophagus developing at the site of lye stricture. Cancer 1953;6:1159-64.
24. Liou JM, Lin JT, Huang SP, et al: Screening for colorectal cancer in average-risk Chinese population using a mixed strategy with sigmoidoscopy and colonoscopy. Dis Colon Rectum 2007;50:630-40.
25. Hwang HJ, Song KH, Youn YH, et al: A case of more abundant and dysplastic adenomas in the interposed colon than in the native colon. Yonsei Med J 2007;48:1075-8.
26. Kunzelmann K, Mall M: Electrolyte transport in the mammalian colon: mechanisms and implications for disease. Physiol Rev 2002;82:245-89.
27. Lee YC, Wang CP, Chen CC, et al: Transnasal endoscopy with narrow-band imaging and Lugol staining to screen patients with head and neck cancer whose condition limits oral intubation with standard endoscope (with video). Gastrointest Endosc 2009;69:408-17.
28. Maffei M, Dumortier J, Dumonceau JM: Self-training in unsedated transnasal EGD by endoscopists competent in standard peroral EGD: prospective assessment of the learning curve. Gastrointest Endosc 2008;67:410-8.