



Reoperative surgery for colon conduit failure: a major challenge in esophageal reconstruction

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Colon interposition is a second-line reconstructive option after esophagectomy for carcinoma, caustic or peptic lesions refractory to dilatation, perforation or trauma, and end-stage achalasia (1); in other instances, such as prior gastrectomy, necessity of concomitant gastrectomy for synchronous gastric tumors, extensive gastric damage from caustic ingestion, proximal squamous-cell carcinoma, or failures of previous gastric pull-up, the stomach may not be available as a first-choice conduit or an extra-long graft may be required to reach the hypopharynx (2). The most typical colon transplant is a long graft with an upper intrathoracic or neck anastomosis, and location of the anastomosis depends on the route of colon interposition. A retrosternal route and a cervical esophago-colic anastomosis is generally preferred in patients with “hostile” mediastinum from previous thoracotomy or radiotherapy, or as a second-stage “bypass” procedure following emergency esophagectomy or esophageal exclusion and diversion (3). Rarely, when the retrosternal route is not viable due to previous sternotomy, the colonic graft can primarily be placed antesternally through a subcutaneous tunnel.

Use of the colon as an esophageal substitute is a formidable surgical challenge and requires accurate patient selection and surgeon’s expertise. Patients with a history of inflammatory bowel disease, extensive diverticulosis, and colon polyps should be carefully investigated with colonoscopy and barium enema. Preoperative angiography can help to identify patients with occluded or stenotic inferior mesenteric artery, or variant mid-colic artery

anatomy; in these individuals, a right colic or a jejunal conduit should rather be used. On the other hand, the left colon vascularized by the ascending branch of the left colic artery and with a highly dependable venous drainage provided by the marginal Riolan’s arcade represents the best esophageal substitute in most circumstances (4). Intraoperative indocyanin-green angiography can be useful to prevent failures of colon grafts by identifying the vascular pattern and indicating the optimal anastomotic site (5).

In large case series, the reported clinical outcomes of colon interposition as a primary esophageal replacement are satisfactory, with 0–2% graft loss between, 0–13% anastomotic leak, 0–7% mortality, and 0–32% early or late reoperations (6–9). Also, the long-term quality of life and alimentary satisfaction are excellent after colon interposition in selected patients (10). A recent systematic review and meta-analysis including 27 observational studies and a total of 1,849 patients showed that the pooled morbidity and mortality was significantly less for left versus right colonic conduits, and the retrosternal route of placement was associated with the lowest pooled morbidity and mortality (11).

Reoperations and salvage surgery after failures of primary reconstruction with both a gastric or colon conduit are even more challenging than primary procedures (8,12). A multidisciplinary approach involving the plastic surgeon or the head and neck surgeon together with the general and thoracic surgeon is required to provide expertise for the performance of local myocutaneous flaps or free-flaps, most commonly the radial forearm flap, to cover the defects

resulting from acute or chronic ischemia of the proximal graft. An alternative procedure, i.e., supercharge by microvascular augmentation of a pedicled jejunal loop, was first reported by Longmire in 1947 (13) and Androsov (14). The jejunum has an intrinsic reliable blood supply that can be enhanced by the supercharged technique, but it may not easily reach the hypopharynx due to the pattern of the vascular arcade and loop redundancy. A number of published series have shown the feasibility and safety of this procedure in over 200 patients. Super-charge can be used as a preventive or rescue procedure, and can be performed through a subcutaneous or trans-thoracic route. It has also been shown that this procedures compares favorably with gastric conduits (15-17). Use of supercharged colon segments was first described by Fujita in 1997 (18), and the largest series has been reported by Kesler *et al.* (19). In rare circumstances, microvascular augmentation by anastomosis of the left gastroepiploic artery with the transverse cervical artery has been performed after gastric pull-up (20). Long-pedicled jejunal interposition requires good surgical judgment and superior technical skills. The first jejunal branch is preserved, and the second, third, and fourth branches are divided close to their origin from the superior mesenteric artery. When the mesentery of the graft is long enough to reach the cervical esophagus it may be necessary to perform one or more segmental resections to align the bowel on a straight axis and avoid redundancy. Free jejunal grafts are a suitable alternative to long-pedicled grafts for reconstruction of the cervical esophagus (21,22). A short jejunal segment is harvested, and microvascular anastomoses are performed in the neck. This will provide a tubular graft to replace an hypopharyngeal-esophageal segment or can be used as on onlay patch to cover a partial defect. Use of free jejunal grafts in patients undergoing pharyngolaryngoesophagectomy for cancer is reported to be safe even in patients who received previous chemoradiation therapy (23).

The case series reported by Horvath *et al.* (24) well highlights the technical difficulties of re-establishing alimentary tract continuity in patients presenting for elective reconstruction following colonic conduit necrosis or late ischemic stricture. The study by Horvath *et al.* adds proof to the concept that the ability to rescue after critical complications of esophageal reconstruction requires a high-volume center, a multidisciplinary surgical team, a tailored approach, and a motivated patient (25,26). Compared to the current literature on this subject, the case-series format gives detailed clinical and technical information and adds

excellent illustrations that provide a pathway to the astute surgeon to deal with such challenging situations. Besides the successful clinical outcome in all three patients, a unique feature of this report is the use of a free jejunal flap by a tailored surgical approach (substernal, presternal, and median sternotomy route) to repair the consequences of the failed colon interposition. The paper by Horvath *et al.* is really worth reading and instructive. The detailed description of patients clinical histories and the addition of tips and tricks of surgical technique from the “real-world” experience of a very experienced and skilled surgical team account for the high educational value of this study.

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