Ileo-right hemi-colonic cervical pull-up on a non-supercharged ileocolic arterial pedicle: A technical and case report

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Abstract

Esophageal reconstruction can be challenging when stomach and colon are not anatomically intact and their use as esophageal substitutes is therefore limited. Innovative individual approaches are then necessary to restore the intestinal passage. We describe a technique in which a short stump of the right hemicolon and 25 cm of ileum on a long, non-supercharged, fully mobilized ileocolic arterial pedicle were used for esophageal reconstruction to the neck. In this case, a 65 year-old male patient had accidentally ingested hydrochloric acid which caused necrosis of his upper digestive tract. An emergency esophagectomy, gastrectomy, duodenectomy, pancreatectomy and splenectomy had been performed in an outside hospital. A cervical esophagostomy and a biliodigestive anastomosis had been created and a jejunal catheter for enteral feeding had been placed. After the patient had recovered, a reconstruction of his food passage via the left and transverse colon failed for technical reasons due to an intraoperative necrotic demarcation of the colon. Our team then faced the situation that only a short stump of the right hemicolon was left in situ when the patient was referred to our center. After intensified nutritional therapy, we reconstructed this patient's food passage with the right hemicolon-appach described herein. After treatment of a postoperative pneumonia, the patient was discharged from hospital on the 26th postoperative day in a good clinical condition on an oral-only diet. In conclusion, individual approaches for long-segment reconstruction of the esophagus can be technically feasible in experienced hands. They do not always require arterial supercharging or free intestinal transplantation.
Key words: Esophageal cancer; Esophageal trauma; Esophageal reconstruction; Gastric pull-up; Colonic interposition

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Core tip: Esophageal reconstructions are more challenging than usual when the stomach and the colon are not available as substitutes for esophageal replacement. In this case, hydrochloric acid had caused severe caustic injuries to the upper digestive tract requiring esophagectomy, gastrectomy, duodenectomy, pancreatectomy and splenectomy in a 65-year-old patient. The initial reconstruction failed, leaving only a short stump of the right hemicolon in situ. We then reconstructed the intestinal passage utilizing this short part of the right hemicolon and 25 cm of ileum on a long, non-supercharged, fully mobilized ileocolic arterial pedicle.

INTRODUCTION

Malignant tumors of the esophagus and the esophagogastric junction, as well as caustic injuries and perforations are among the prime indications for resections of the esophagus. All esophagogastric resections with reconstruction are associated with significant morbidity and mortality. A gastric tube is preferably used to reconstruct the food passage after esophagectomy as it usually comes along with a reliable blood supply and only one single anastomosis is necessary for reconstruction. The situation becomes more difficult when the stomach is not available for reconstruction. In these cases, either a pedicled colonic or jejunal interposition or a free jejunal graft can be used. Pedicled interposition grafts always come along with limitations of the blood supply. This is especially relevant towards the oral part of the graft, which - if insufficient - can lead to anastomotic leakage or, in the worst case, to partial or complete necrosis of the pull-up. Necrotic complications then frequently lead to life threatening secondary problems. Recently published studies demonstrate the benefit of additional arterial and venous supercharging, which may improve the blood supply of the graft or pull-up and can therefore reduce the incidence of graft loss and anastomotic leakage\(^{[1-4]}\).

When the initial reconstruction fails and a salvage operation with limited intestinal resources for reconstruction has to be planned, the situation can be further complicated. This case report introduces an individual approach of a secondary reconstruction of the food passage with an ileo-right hemi-colonic cervical pull-up on a non-supercharged ileocolic arterial pedicle after a first colonic reconstruction had failed.

CASE REPORT

A 65-year-old male patient had accidentally ingested hydrochloric acid which caused a necrosis of his upper digestive tract. In an emergency surgery, an esophagectomy, gastrectomy, duodenectomy, pancreatectomy and splenectomy were performed (Figure 1A and B). At the end of this first operation, a cervical esophagostomy and a choledocho-jejunostomy were created. Furthermore, a jejunal catheter for enteral feeding was inserted.

One month later, an exploratory laparotomy was performed due to a massive pneumoperitoneum and suspected bowel perforation diagnosed in a routine chest X-ray after the placement of a central venous catheter. During surgery, pneumatosis coli without perforation were detected, most likely based on an antibiotic-associated colitis (C. difficile toxin negative). Colon resection was renounced due to missing clinical symptoms and a planned esophageal reconstruction via a colonic interposition. Instead, a protective loop ileostomy was formed and reversed three months later.

After the patient had recovered, five months after the first surgery, a reconstruction of the food passage with a colonic pull-up using the transverse and descending colon was attempted. The reconstruction failed due to an intraoperative ischemic demarcation of the colon, leaving only a short oral part of the ascending colon and approximately 40 cm of the descending colon in situ (Figure 1C, D and E). The colonic remnants were connected via a colo-colonic anastomosis.

Eight months after the first surgery, the patient contacted our team seeking alternative reconstruction options for his intestinal passage. In the meantime, the patient was in a poor nutritional condition (BMI 16.1) and was fed exclusively via the jejunal catheter. The patient was admitted to our surgical ward for an intensified nutritional therapy to improve his body weight and constitution. Furthermore, an angiography of the patient’s mesenteric arteries was performed, which revealed a sufficient blood supply of the remaining right hemicolon and the terminal ileum via the ileocolic artery (Figure 2). Fortunately, the ileocolic artery formed a tight loop with the terminal jejunal branch of the superior mesenteric artery, which was used later as described below. The patient was discharged from hospital for further home-based nutritional therapy and readmitted for surgery two months later.

After readmission, the patient’s food passage was reconstructed via a retrosternal ileo-right hemi-
colonic cervical pull-up on a non-supercharged ileocolic arterial pedicle. During surgery, the ileocolic region and the remaining ascending colon were mobilized and the ileum was transected about 25 cm proximal to Bauhin's valve. The ileocolic artery was fully mobilized to its origin from the superior mesenteric artery by meticulous micro-preparation and then dissected to use the full length of both branches of the artery. After a sufficient blood supply of the pedicled graft was ensured, the ileum was pulled up to the neck retrosternally and anastomosed end-to-side in an iso-peristaltic fashion to the esophageal stump with a tension-free running manual suture. To achieve this position, the ileocolic artery was turned upwards to a 180° angle. The stump of the ascending colon was then anastomosed end-to-side to the proximal end of the jejunum. Finally, the neo-terminal ileum was anastomosed to the stump of the remaining descending colon (Figure 1F).

The following day, a scheduled second look laparotomy was performed to confirm a sufficient blood supply of the interposition graft. During the postoperative course on the intensive care unit the patient developed severe pneumonia, which was treated with antibiotics, chest tubes and intensified respiratory and positioning therapy. After further stabilization, the patient could be transferred to the general ward on the 13th postoperative day. Stepwise return to a normal diet was well tolerated. A contrast X-ray swallow showed a smooth passage of a soft bolus. The patient was discharged from hospital in a good clinical condition on the 26th postoperative day on an oral-only diet.

During the following months, the patient suffered from episodes of dysphagia, recurrent nausea and air...
regurgitation. Additional work-up showed significant dilatation of the pulled-up cecum so that another operation became necessary. Intraoperative assessment revealed that the cecal part of the pulled-up pedicled graft had moved downwards significantly (likely due to gravital challenge in an upright position) from the thoracic cavity through the diaphragm into the abdomen. The cecum was massively dilated and seen as the cause for dysphagia and bowel obstruction as the distal anastomosis was kinked (Figures 3 and 1G). Hence, the ileocecal region was resected and an ileo-jejunal anastomosis was created (Figure 1H). No further complications occurred in the postoperative course and the patient was discharged from hospital on the 12th postoperative day.

A few months later, the patient complained about new symptoms of dysphagia, which were due to a stenosis of the ileo-jejunoanastomosis. The stenosis could successfully be dilated by endoscopic balloon dilatation. Similar symptoms reappeared, this time due to intraabdominal and retrosternal adhesions that were removed in yet another reoperation via a re-laparotomy and a lower partial sternotomy.

During the whole treatment episode at our hospital, the patient had regular appointments with our nutritional experts who adjusted his diet to his special needs (including the substitution of pancreatic enzymes and vitamins). In the last outpatient follow-up examination 32 mo after reconstruction, the patient's bodyweight was still below average (BMI 17.5) but stable under oral-only food intake without the need for additional enteral or parenteral nutrition and no symptoms of dysphagia (see timeline, Figure 4). He lives an independent life.

**DISCUSSION**

In selected cases where the stomach cannot be used for reconstruction of the enteric passageway after esophagectomy, several techniques have been described: pedicled colonic grafts have the advantage that longer conduits can be formed to reconstruct the passage up to the neck when compared to pedicled jejunal grafts. On the downside, colonic enterobacteria pose a higher risk for pulmonary complications in the postoperative course and stenoses and graft redundancy are more frequent in colonic than in jejunal interpositions. Pedicled jejunal grafts are limited in length due to the shorter mesenteric arcades. Moreover, the diameter of the jejunum is usually more congruent to the diameter of the esophagus and jejunal grafts fit easier through the thoracic inlet in case of retrosternal pull-up. Other advantages of jejunal grafts are a better food transit due to the physiologic peristalsis of the jejunum and a lower risk for intrinsic disease such as hemorrhage or the development of graft carcinoma.

All grafts to restore the intestinal continuity after near-total esophagectomy need to be moved up to the cervical esophagus without major tension. This is usually more difficult for jejunal than for colonic grafts and becomes the more complicated the longer the distance to the esophageal stump is. Tension to the anastomosis regularly results in an insufficient blood supply of the graft and can lead to anastomotic leakage or graft necrosis, the most feared complications of these procedures. Thus, supercharging techniques have been introduced using additional arterial and venous anastomoses to vessels located in the neck or chest regions. Several studies demonstrated the benefit of this approach showing that it can improve blood supply to the graft and consequently reduce the incidence of graft necrosis and anastomotic leakage.

Since the introduction of the supercharging technique, pedicled jejunal grafts with these anastomoses have become more relevant in the reconstruction of esophageal defects and some authors prefer the jejunum instead of the colon for these purposes. However, supercharging is technically challenging and requires microvascular anastomoses, which come along with another array of possible vascular complications.

In case of limited esophageal defects, free jejunal or colonic grafts are an alternative with good postoperative results. Right hemi-colonic pull-ups can also be used for esophageal replacement when long enough. In our case, only a short stump of the right hemi-colon was left. Hence, a far longer segment of the terminal ileum had to be chosen to gain enough length for a pull-up to the neck. Accomplishing this without arterial supercharging would have been inconceivable without a previous angiography of the mesenteric arteries with meticulous planning on how to gain maximum length out of it. Using the full length of the ileocolic artery finally made this pull-up possible in the reported case. We thus suggest that preoperative angiography of the mesenteric vessels...
Initial operation

05/2012

06/2012

09/2012

04/2013

10/2012

01/2014

06/2014

Formation of a loop ileostomy due to pneumatosis coli

Reversal of loop ileostomy

Secondary reconstruction with ileo-right hemi-colonic cervical pull-up

Reconstruction with transverse and descending colon fails

Colon redundancy, resection of the cecal part of the pulled-up graft

Endoscopic balloon dilatation of a stenosis of the ileo-jejunostomy

Re-operation with removal of intraabdominal and retrosternal adhesions

Figure 4 Timeline. Initial operation: Indigestion of hydrochloric acid with consecutive esophagectomy, gastrectomy, duodenectomy, pancreatectomy and splenectomy. Creation of a cervical esophagostomy, a choledo-jejunostomy and placement of a jejunal catheter.

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