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Brief Report

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Partial Sternotomy for Secure Esophagogastric Anastomosis in Esophageal Cancer Surgery

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Abstract

Anastomotic leak is a cause of major morbidity following esophageal cancer surgery. One cause of anastomotic leak is inadequate blood flow to the gastric conduit. We have adapted an adjunctive method whereby we approach the cervical anastomosis via a longitudinal incision over the manubrium and upper part of the sternum to make secure anastomosis by anastomosed at the lower part of the gastric conduit with sufficient blood flow when the oral edge of the gastric conduit appears to have inadequate blood supply. We applied this procedure to 5 patients among 70 consecutive patients who underwent cervical esophagogastric anastomosis via the retrosternal route, and there was no anastomotic leak. This adjunctive procedure may be an option to enable secure esophagogastric anastomosis and may contribute to reduced anastomotic leak following esophagectomy.

Keywords: Anastomotic Leak; Esophagogastric Anastomosis; Manubriotomy; Sternotomy

Introduction

Regardless of the spread of recent minimally invasive surgery for esophageal cancer [1], anastomotic leak following esophagectomy is a major complication associated with significant mortality [2]. The most significant risk factor is insufficient blood supply at the oral edge of the gastric conduit. It has been reported that 20% of the gastric fundus relies on blood supply from within the gastric wall [3], while remaining supply of the gastric conduit comes from the right gastroepiploic artery. When we perform gastric conduit reconstructions via the retrosternal route the most common reconstruction method in Japan [4], we sometimes encounter cases without sufficient blood supply to the oral edge of gastric conduit and end up performing non-ideal anastomosis with a resultant high probability of anastomotic leak and subsequent stenosis. Classically, there were two considerable procedures to resolve this issue. One is microvascular anastomosis such as the supercharged gastric conduit or free jejunal flap interposition. The other is colon interposition converted from gastric conduit. However, these procedures were time-consuming and much invasive. We have adopted an adjunctive procedure to approach the anastomosis via the sternum, which involves a longitudinal incision between the manubrium and upper part of the sternum. Here, we describe our technique and report the perioperative outcomes of the 5 patients.

Technique

If insufficient blood flow was observed at the oral edge of the gastric conduit as evaluated by the indocyanine green fluorescein method that we have previously reported [5], additional midline incision was made from the level of prior collar incision to that of second or third intercostal space. After then, midline sternal incision was made from the manubrium to the 2-3cm caudal body. Next, an upper L-shaped sternotomy are carefully performed using a sternal saw from the upper side of the manubrium with caution to not damage underlying blood vessels (Figure 1A).

Figure 1A

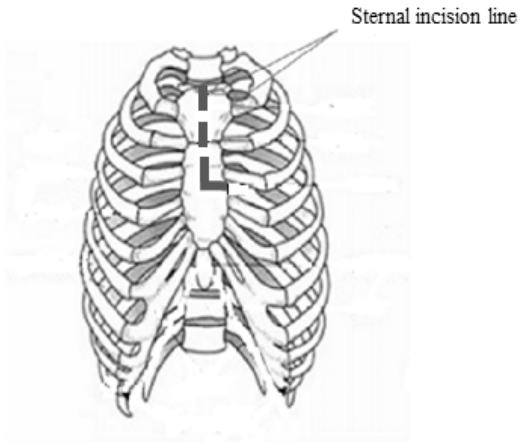

Figure 1A: An upper L-shaped sternotomy are carefully performed using a sternal saw from the upper side of the manubrium with caution to not damage underlying blood vessels (dotted-line).

A small rib spreader is inserted giving exposure of the anterior superior mediastinum. The proximal esophagus is detached up to the neck level from the trachea, with care not to injure the recurrent laryngeal nerve. During this procedure, the elevated gastric conduit is exposed, and the anastomosis can be completed under direct visualization (Figure 1B).

Figure 1B

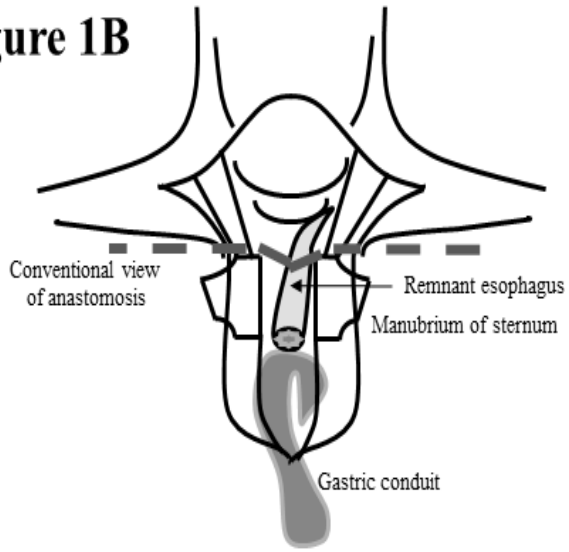

Figure 1B: Scheme of approaching the anastomosis via the sternum. The procedure involves a longitudinal incision of the manubrium (dotted-line) and upper part of the sternum, with better visualization of the proximal part of the gastric conduit. The remnant esophagus is gently pushed from the head through the anterior mediastinum (arrow).

The remnant esophagus is gently pushed from the head through the anterior mediastinum and delivered to the neck, and then anastomosed with the lower part of the gastric conduit with sufficient blood flow by a circular stapler (Figure 2A).

Figure 2A

Figure 2A: The remnant esophagus is end-to-side anastomosed with the sufficient perfusion area of the posterior wall of the gastric conduit using a circular stapler. Divided manubrium (dotted-line).

The extra stomach is resected with a linear stapling device no closer than 2cm to the circular anastomosis and esophagogastrostomy is completed (Figure 2B).

Figure 2B

Figure 2B: The esophagogastric anastomosis is completed. Divided manubrium (dotted-line) and anastomotic line (arrow head).

Bony wax containing vancomycin is applied to the cut edge of the bone to prevent infection. The divided manubrium and sternum is reapproximated with three heavy stainless-steel wires.

Discussion

From January 2010 to July 2017, this procedure was performed for 5 patients among 70 patients undergoing esophagectomy using a gastric conduit via the retrosternal route (Table 1).

Case	Age (years)	Gender	Location of tumor	Operation time (min)	Bleeding (g)	Anastomotic site (Distance from the superior border of the sternum (mm))	Injected analgesic drugs (times)	Complications (Clavien-Dindo classification)
1	70	Male	Lower thoracic	584	313	28	2	Pneumonia (GradeII)
2	46	Male	Upper thoracic	742	820	40	3	None
3	63	Male	Middle thoracic	720	410	24	1	None
4	64	Male	Middle thoracic	668	500	33	2	Stricture (GradeIIIa)
5	60	Male	Middle thoracic	785	666	31	1	None

Table 1: Summary of five patients who underwent esophagogastric anastomosis using retrosternal reconstruction with manubriotomy and partial sternotomy

The patients were comprised of 5 males and the mean age was 60.6 years old (range, 46-70 years old). The tumor locations included upper thoracic (1 patient), middle thoracic (3 patients), and lower thoracic (1 patient). The mean estimated blood loss was 541.8 ml (range, 313-820 ml), and the mean duration of surgery was 699.8 minutes (range, 584-785 minutes). Although anastomotic leak did not occur in any patient, one patient had an anastomotic stricture which required endoscopic dilatation. No other infection-related complications such as mediastinitis or osteomyelitis, which were severe complications associated with manubriotomy and sternotomy, did not occur. No severe postoperative pain was observed. In our adjunctive procedure, the remnant esophagus can be stretched downwards except cases with tumor invasion extending to the cervical esophagus, and the esophagogastric anastomosis is performed at the gastric conduit with sufficient blood flow. This approach allows for excellent visualization of the gastric conduit, its vascular attachments, and all peripheral tissues in the mediastinal region. Although manubriotomy and partial sternotomy have been already reported to create a better view of the upper mediastinum for lymphadenectomy for esophageal and thyroid cancer, or salvage surgery [6], this procedure has not been reported previously to be an optional way to create a secure esophagogastric anastomosis. In conclusion, this adjunctive procedure may be an option to enable secure esophagogastric anastomosis and may contribute to reduced anastomotic leak.

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