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Case Report

Closure of Ventricular Septal Rupture through a Left Thoracotomy in a Patient with a History of Esophageal Reconstruction

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A 73-year-old man who had undergone esophagectomy and retrosternal gastric tube reconstruction for esophageal cancer 8 years prior was transferred to our hospital for the treatment of an acute myocardial infarction. Emergent percutaneous coronary intervention for the left anterior descending artery (#7) was successfully performed. However, echocardiography revealed a ventricular septal rupture (25×27 mm). Seventeen days after admission, the rupture was successfully treated with a double-patch closure via a left anterolateral thoracotomy to avoid a surgical injury to his retrosternal gastric tube. Determining the best surgical approach to the heart is important for safe cardiac surgery in patients after esophageal reconstruction.

Key words: acute myocardial infarction, ventricular septal rupture, retrosternal gastric tube reconstruction, esophageal cancer, left anterolateral thoracotomy

Ventricular septal rupture is one of the most critical complications of acute myocardial infarction, and often requires an emergent surgery. However, in the patients who have undergone surgery for esophageal cancer, the typical approach of a median sternotomy introduces the risk of injury to reconstructed gastrointestinal tracts running in a pre-sternal or retrosternal position. Here we report a case in which a double-patch closure for ventricular septal rupture was successfully performed through a left anterolateral thoracotomy in a patient with a history of esophagectomy and retrosternal gastric tube reconstruction for esophageal cancer.

Case Report

A 73-year-old man was transferred for the treatment of acute coronary syndrome. He felt general fatigue 3 days prior and also felt chest and shoulder discomfort the day before the consultation. He underwent esophagectomy and retrosternal gastric tube reconstruction for esophageal cancer 8 years prior (Fig. 1A). Computed tomography scans revealed that the feeding arteries of the gastric tube ran just behind the sternum (Fig. 1B). Because emergent coronary angiography revealed the total occlusion of the left anterior descending artery (#7), percutaneous coronary intervention (PCI) was performed. A XIENCE Sierra stent (2.5×48 mm, Abbott Japan LLC, Tokyo, Japan) was successfully inserted in the left anterior descending

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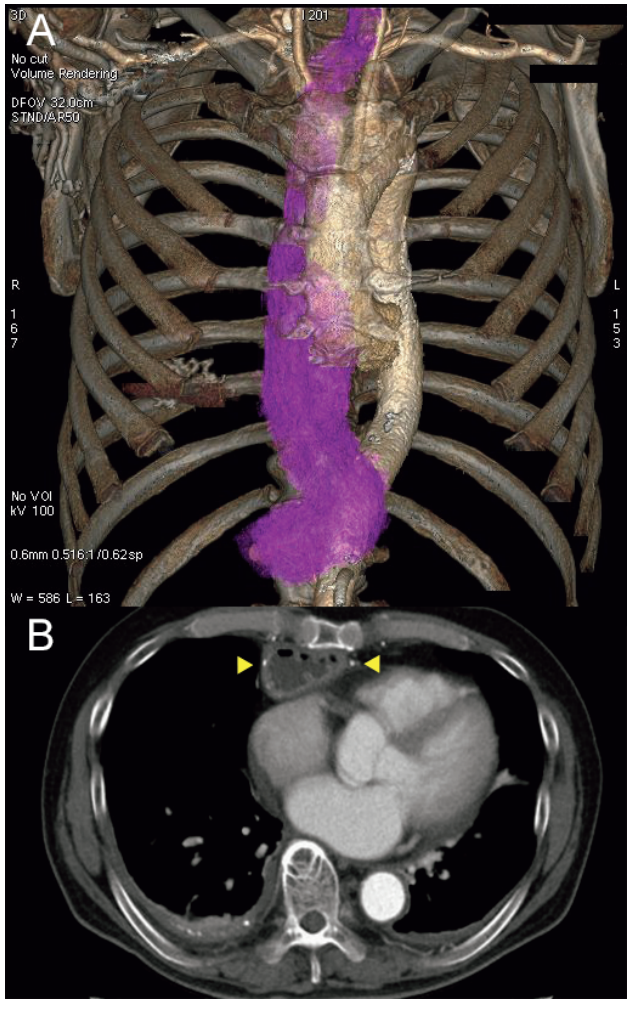

Fig. 1 A, Three-dimensional computed tomography showed the reconstructed gastric tube running behind the sternum; B, The feeding arteries (yellow arrowheads) of the gastric tube ran immediately behind the sternum.

artery (#7). Although his brain natriuretic peptide (BNP) level after PCI was very high, at 693 pg/mL, his post-PCI course was uneventful. However, echocardiography performed 5 days after PCI revealed a ventricular septal rupture (25×27 mm) (Fig. 2). After diagnosis of ventricular septal rupture, continuous intravenous infusion of human atrial natriuretic peptide was started. Since the patient was hemodynamically stable, we were able to wait for scarring of the infarct area before performing surgery. His preoperative BNP level was 779 pg/mL.

Seventeen days after admission, closure of the rupture was performed under general anesthesia. With the

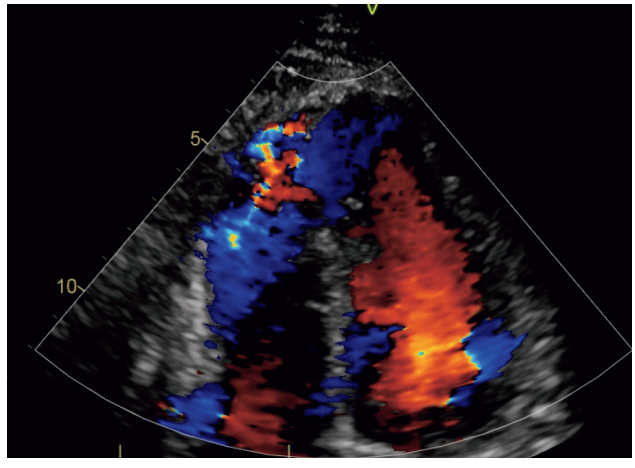

Fig. 2 Echocardiography demonstrated a ventricular septal rupture (25×27 mm).

patient in a supine position, a left anterolateral thoracotomy via the 5th intercostal space was performed to prevent surgical injury to the gastric tube or its vasculature, and the 4th and 5th rib cartilages were cut off to obtain a sufficient surgical field of view. Aortic cannulation was performed under direct vision through the thoracotomy (Fig. 3A). Cardiopulmonary bypass was established between the ascending aorta and the right atrium via right femoral vein cannulation. After cross-clamping of the ascending aorta, cardiac arrest was induced by antegrade cardioplegia. The body temperature was cooled to 33°C. Rupture closure was performed through a left ventriculotomy. To close the rupture, two Hemashield Woven Double Velour Fabric patches (Getinge AB, Göteborg, Sweden) were sutured using the sandwich technique (Fig. 3B) [1]. The left ventriculotomy was closured with mattress and over-and-over sutures using 3-0 Prolene (Ethicon, Johnson & Johnson Medical Ltd., Tokyo, Japan). The weaning of cardiopulmonary bypass was uneventful. The durations of aortic cross-clamping and cardiopulmonary bypass were 122 and 177 min, respectively. He was discharged 11 days after the operation. Echocardiography before discharge revealed no residual shunt.

Discussion

Median sternotomy is the standard approach to the heart in cardiac surgery. However, a history of reconstructive surgery for esophageal cancer may be an obstacle to performing cardiac surgery with a median

sternotomy. In esophageal cancer surgery, the resected esophagus is typically reconstructed using a gastric tube or intestine. There are 3 possible methods of the reconstruction: pre-sternal, retrosternal and posterior mediastinal routes. If a patient has undergone pre-sternal or retrosternal reconstruction, a median sternotomy would introduce the risk of injury to the reconstructed gastrointestinal tract.

There are several reports of surgical approaches to the heart for cardiac surgery in the patients after esophageal reconstruction (Table 1). Hirose *et al.* reported a case of coronary artery bypass grafting (CABG) via left anterolateral thoracotomy in a patient with a history of retrosternal gastric tube reconstruction [2]. La Francesca *et al.* also reported the left thoracotomy approach for CABG in a patient after substernal colon interposition [3]. Wakasa *et al.* reported a case of aortic valve replacement via left thoracotomy [4]. In our case, we chose a left anterolateral thoracotomy to obtain a sufficient surgical field of view because we planned to close the rupture through a ventriculotomy of the left ventricular free wall. It has been reported that congenital ventricular septal defect closure can be performed safely through left anterolateral thoracotomy, even in patients complicated with coarctation of the aorta [5]. Indeed, left thoracotomy may be the most appropriate approach for closure of ventricular septal rupture regardless of the patient's history or pre-existing condition.

Right thoracotomy is also performed in patients with gastrointestinal reconstruction. Fukunaga *et al.* reported a case of right thoracotomy for aortic valve replacement in a patient after retrosternal gastric tube reconstruction [6]. Mazzitelli *et al.* also reported an aortic valve replacement via the right parasternal thora-

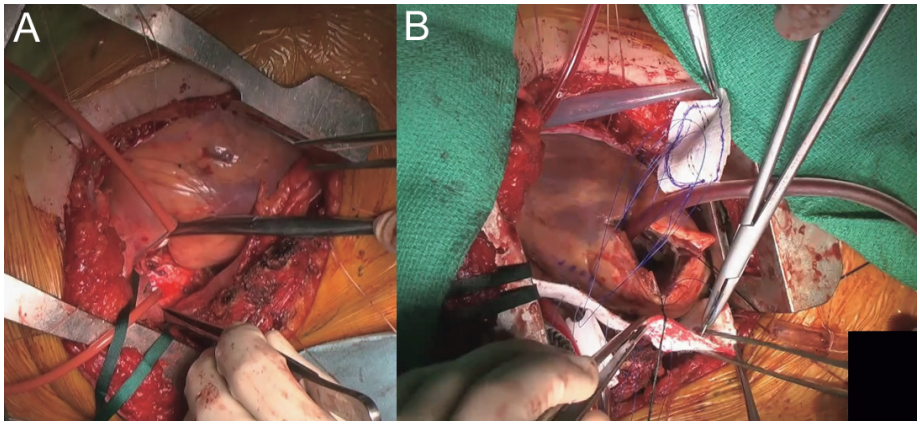

Fig. 3 **A**, Aortic cannulation was performed under direct vision; **B**, Ventricular septal rupture was closed using the sandwich technique.

Table 1 Reports of cardiac surgery after esophageal reconstruction

Approach	Reconstruction(Route/Organ)	Cardiac surgery	Urgent/Elective	References
Left thoracotomy	Retrosternal/Gastric tube	CABG	Urgent	Hirose *et al*. [2]
	Substernal/Colon	CABG	Elective	La Francesca *et al*. [3]
	Substernal/Gastric tube	AVR	Elective	Wakasa *et al*. [4]
Right thoracotomy	Substernal/Gastric tube	AVR	Elective	Fukunaga *et al*. [6]
	Retrosternal/Gastric tube	AVR	Elective	Mazzitelli *et al*. [7]
	Retrosternal/Gastric tube	LA myxoma resection	Elective	Pomerantzeff *et al*. [8]
Median sternotomy	Pre-sternal/Jejunum	CABG	Urgent	Nishi *et al*. [9]
	Retrosternal/Gastric tube	AVR	Elective	Matsuda *et al*. [10]
	Substernal/Gastric tube	CABG	Urgent	Kashiyama *et al*. [11]

CABG, coronary artery bypass grafting; AVR, aortic valve replacement; LA, left atrium.

cotomy in a patient after retrosternal reconstruction [7]. Pomerantzeff *et al.* reported surgical resection of left atrial myxoma via a right anterolateral thoracotomy in a patient with a retrosternal gastric tube [8]. Right thoracotomy seems to be easier for the establishment of cardiopulmonary bypass and/or the approach to aortic valve or left atrium compared to the left thoracotomy. However, in some cases, such as the distal anastomosis in CABG, surgical field of view may become narrower from a right than from a left thoracotomy.

There have also been reports of successful cases of median sternotomy in patients with gastrointestinal reconstruction. Nishi *et al.* reported a case of CABG via median sternotomy in a patient with pre-sternal jejunum reconstruction [9]. Matsuda *et al.* reported an aortic valve replacement via median sternotomy in a patient with retrosternal gastric tube reconstruction [10]. Kashiyama *et al.* demonstrated a successful off-pump CABG via median sternotomy in a patient with retrosternal gastric tube reconstruction [11]. Although median sternotomy can obtain sufficient surgical field of view in most cases of cardiac surgery, surgeons must be vigilant regarding the possibility of surgical injury to the reconstructed gastrointestinal tract.

We report a case of successful left thoracotomy approach for the closure of a ventricular septal rupture in a patient with a history of retrosternal gastric tube reconstruction. Surgical approaches to the heart in the patients after esophageal reconstruction remain an unresolved topic. Determining the best surgical approach to the heart may be essential to successful cardiac surgeries in the patients with a history of esophagectomy and reconstruction.

References

1. Yamasaki T, Fujita S, Kaku Y, Katagiri J and Hiramatsu T: Modified double patch repair with infarct exclusion technique for ventricular septal perforation: a case study. J Cardiothorac Surg (2018) 13: 17.
2. Hirose H, Amano A, Yoshida S and Takahashi A: Coronary artery bypass graft after esophagogastrectomy. Eur J Cardiothorac Surg (1999) 15: 729–731.
3. La Francesca S, Ruvolo G, Greco E, Speziale G and Marino B: Left thoracotomy for coronary revascularization after esophagoplasty with substernal colon interposition. Tex Heart Inst J (1995) 22: 200–201.
4. Wakasa S, Ooka T, Kubota S, Shiiya N, Murashita T and Matsui Y: Aortic valve replacement through left thoracotomy after esophageal operation. Ann Thorac Surg (2008) 86: 1668–1670.
5. Chu SH, Chou NK, Chou TF and Wang SS: Left anterolateral thoracotomy for simultaneous correction of ventricular septal defect and coarctation of the aorta. Tex Heart Inst J (1994) 21: 158–160.
6. Fukunaga N, Okada Y, Konishi Y, Murashita T, Yuzaki M, Shomura Y, Koyama T and Fujiwara H: Aortic valve replacement after esophagectomy with substernal gastric tube and total laryngectomy with tracheostoma. Ann Thorac Surg (2012) 94: 271–273.
7. Mazzitelli D, Bedda W, Petrova D and Lange R: Right parasternal approach for aortic valve replacement after retrosternal gastropexy. Eur J Cardiothorac Surg (2004) 25: 290–292.
8. Pomerantzeff PMA, Veronese ET, Dinato FJ and Jatene FB: Resection of Left Atrial Myxoma in a Patient with Retrosternal Gastric Tube: a Case Report. Braz J Cardiovasc Surg (2017) 32: 438–441.
9. Nishi H, Mitsuno M, Tanaka H, Ryomoto M, Fukui S and Miyamoto Y: Coronary revascularization through a median sternotomy after pre-sternal jejunum reconstruction for esophageal carcinoma. Ann Thorac Surg (2009) 88: 667–669.
10. Matsuda H, Okada M, Yamashita C, Sugimoto T and Watanabe Y: Aortic valve replacement after retrosternal gastric tube reconstruction for esophageal cancer. Jpn J Thorac Cardiovasc Surg (1999) 47: 234–236.
11. Kashiyama N, Toda K, Miyagawa S, Nishi H, Yoshikawa Y, Fukushima S, Yoshioka D, Masashi K, Saito T and Sawa Y: Off-pump coronary artery bypass grafting via median sternotomy in a patient with a history of esophagectomy with substernal gastric tube reconstruction: report of a case. Surg Today (2015) 45: 1190–1193.