

*Case
Report*

Intrapericardial Diaphragmatic Hernia after Coronary Artery Bypass Grafting Using the Right Gastroepiploic Artery Graft: Report of a Case

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Surgeons should be aware of diaphragmatic hernia in obese patients who have undergone coronary artery bypass grafting (CABG) using a gastroepiploic artery graft (GEA), even if the antegastric route is utilized.

We report a case of diaphragmatic hernia, which occurred 88 months after initial CABG. A 64-year-old obese man underwent surgical repair of a diaphragmatic hernia. At initial surgery, the diaphragm was incised vertically and re-sutured, leaving a route for GEA graft. Both the stomach and the lateral segment of the liver were dislocated in the pericardial space. The diaphragmatic defect was closed with a polytetrafluoroethylene patch.

Keywords: diaphragmatic hernia, coronary artery bypass grafting, right gastroepiploic artery

Introduction

In 1987, Pym¹⁾ and Suma²⁾ independently reported their successful clinical application of a right gastroepiploic artery (GEA) graft for coronary artery bypass grafting (CABG). Asai, et al. reported a method of skeletonization of the GEA using an ultrasonic scalpel, in 2002, enabling the harvest of spasm-free arterial conduits in a simple and safe manner.³⁾ The GEA is now widely accepted as an alternative arterial conduit for CABG.⁴⁾ However, a rare complication of diaphragmatic hernia can occur after the employment of a GEA graft in situ. The most common antegastric and antehepatic route has

several advantages including ease of handling, ease of visual inspection for bleeding along the conduit, and possible prevention of diaphragmatic herniation of the stomach because the GEA pedicle passes through the diaphragm, above the left lobe of the liver.

Herein, we report a case of intrapericardial diaphragmatic hernia, which occurred 88 months after initial CABG, using a GEA graft via the antegastric route.

Case

A 64-year-old man was admitted to hospital complaining of epigastralgia together with frequent vomiting, in November 2008. Subsequently, he underwent conventional CABG with the employment of the left internal thoracic artery anastomosed to the left anterior descending branch and GEA graft to the posterior descending artery. At the time of the initial surgery, after the GEA graft was harvested as a pedicle, the diaphragm was incised vertically and re-sutured, leaving a hole as an antegastric route for the GEA graft. Based on the computed tomography scan which revealed an intrapericardial herniation of the stomach (**Fig. 1a**), the patient was referred to our institute. On admission, his coronary arteriography demonstrated complete obstruction of the right

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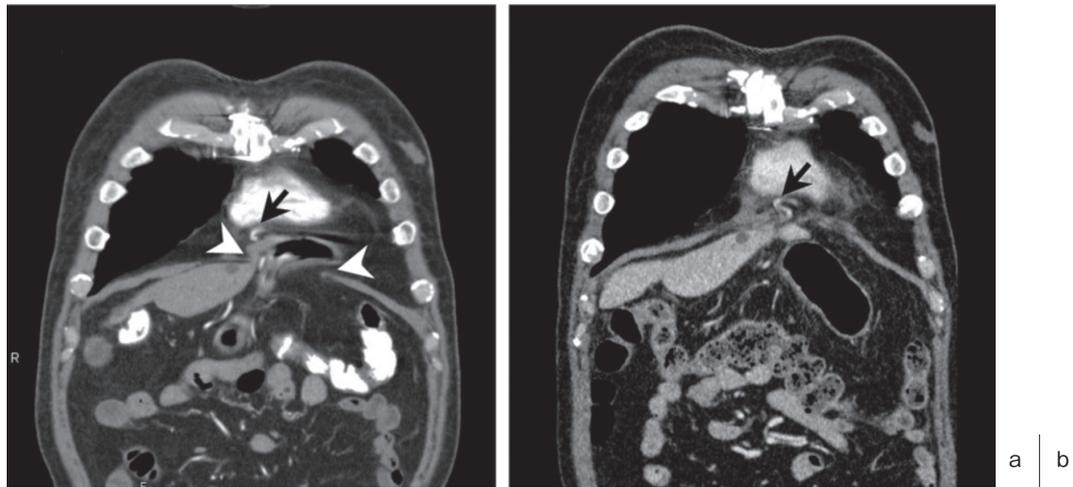


Fig. 1 (a) Three-dimensional multiplanar reformation images obtained by computed tomography (CT) revealed that the stomach and the lateral segment of the the liver was dislocated into the pericardial space (arrowheads) and that the right gastroepiploic artery (GEA) graft was defined as patent (arrow). (b) Postoperative CT scan showed the patent GEA graft (arrow) with no evidence of recurrence of the diaphragmatic hernia.



Fig. 2 Diaphragmatic defect was closed with a 12 × 8 cm of oval-shaped polytetrafluoroethylene patch (arrow).

coronary artery which was entirely dependent on the GEA graft for right coronary blood flow. Therefore, he underwent urgent surgery to repair the diaphragmatic hernia.

The patient's abdomen was entered into through an upper median laparotomy which exposed a large diaphragmatic defect measuring 10 × 5 cm in size. The herniated stomach was easily returned to the abdominal cavity with no ischemic changes; however, the lateral segment of the liver was strongly adhered to the GEA pedicle and

the inferior wall of the heart. The liver was carefully dissected from the GEA pedicle and the heart, and then the diaphragmatic defect was closed with a 12x8 cm of oval-shaped polytetrafluoroethylene surgical membrane patch, leaving a minimal space for the GEA pedicle (**Fig. 2**). The patient recovered uneventfully. A postoperative CT scan displayed the patent GEA graft without hernia relapse (**Fig. 1b**). He was discharged 11 days after surgery.

Table 1 Literature review of diaphragmatic hernia after coronary artery bypass grafting using the right gastroepiploic artery graft

Author	Reported year	Age	Sex	Duration	Chief complains
Caes ⁵⁾	1994	46	M	8 Mo	Left epigastralgia, vomiting
Caes ⁵⁾	1994	45	M	18 Mo	Epigastralgia, vomiting
Pasic ⁶⁾	1994	56	M	29 D	Epigastralgia
Verhofste ⁷⁾	1995	61	M	13 D	Tachypnea
McCaig ⁸⁾	1996	43	M	7 D	Vomiting
Manetta ⁹⁾	1998	56	M	3 Yr	Epigastralgia, vomiting
Ansari ¹⁰⁾	2002	65	M	24 Mo	Epigastralgia, vomiting
Yoshii ¹¹⁾	2003	67	M	34 Mo	Epigastralgia, vomiting
Ikeda ¹²⁾	2005	74	F	3 Yr	Back pain, vomiting, dyspnea
Sasaki ¹³⁾	2006	73	M	18 Mo	Left thoracoabdominal pain
Takiuchi	2010	64	M	88 Mo	Epigastralgia, vomiting

D: days; F: female; M: male; Mo: months; Yr: years

Discussion

Although diaphragmatic hernia is a rare complication in the use of an in-situ GEA graft passing through the diaphragm, its probability should always be considered if a patient has undergone CABG using this specific graft and if such a patient experiences acute abdominal symptoms. The clinical symptoms usually include epigastralgia, vomiting, hiccups, or a combination of these symptoms.⁵⁾ Herniation of the gastrointestinal tract could induce not only visceral complications such as ulceration, bleeding, strangulation, and perforation, but also of impairment of the GEA graft leading to myocardial ischemia.¹¹⁾ Thus, surgical interventions should be immediately considered for this rare situation. Several factors can theoretically lead to the occurrence of a hernia within the diaphragmatic orifice created for the GEA graft. In the presence of risk factors such as persistent cough and obesity, an excessive orifice through which passes the GEA graft most likely causes a diaphragmatic hernia.^{5, 8-10)}

An antegastric and antehaptic route for the GEA graft has been considered to prevent postoperative diaphragmatic hernia effectively, since the left lobe of the liver covers a diaphragmatic orifice for the GEA pedicle. In the present case, intrapericardial herniation of the stomach occurred in spite of the antegastric route, and the left lobe of the liver was also dislocated in the pericardial space. The diaphragm was re-sutured, leaving a minimum hole as a route for the GEA at the initial surgery and our patient developed a diaphragmatic hernia, 88 months after the initial CABG. To our knowledge, the duration from the onset of the hernia in the present case is the longest among all previous reports (**Table 1**).⁵⁻¹³⁾ It

is assumed that severe and prolonged obesity probably induced continuous high intra-abdominal pressure, resulting in hernia formation.

This report does not intend to suggest abandoning the valuable arterial conduit. We simply conclude that cardiac surgeons should consider diaphragmatic hernia as a possible post-operative complication in obese patients who undergo CABG with employment of an in situ GEA graft, even if the antegastric route is chosen.

Disclosure Statement

Takiuchi and other co-authors have no conflict of interest.

References

- 1) Pym J, Brown PM, Charrette EJP, et al. Gastroepiploic coronary anastomosis: a viable alternative bypass graft. *J Thorac Cardiovasc Surg* 1987; **94**: 256-9.
- 2) Suma H, Fukumoto H, Takeuchi A. Coronary artery bypass grafting by utilizing in situ right gastroepiploic artery: basic study and clinical application. *Ann Thorac Surg* 1987; **44**: 394-7.
- 3) Asai T, Tabata S. Skeletonization of the right gastroepiploic artery using an ultrasonic scalpel. *Ann Thorac Surg* 2002; **74**: 1715-7.
- 4) Kamiya H, Watanabe G, Takemura H, et al. Total arterial revascularization with composite skeletonized gastroepiploic artery graft in off-pump coronary artery bypass grafting. *J Thorac Cardiovasc Surg* 2004; **127**: 1151-7.
- 5) Caes FL, Francois B, Van Nooten GJ. Transdiaphragmatic herniation of the stomach after right gastroepiploic artery grafting. *J Thorac Cardiovasc Surg* 1994; **108**: 191-3.

- 6) Pasic M, Carrel T, Von Segesser L, et al. Postoperative diaphragmatic hernia after use of the right gastroepiploic artery for coronary artery bypass grafting. *J Thorac Cardiovasc Surg* 1994; **108**: 189-91.
- 7) Verhofste MA, Tam SK. Diaphragmatic hernia after right gastroepiploic artery coronary artery bypass grafting. *Ann Thorac Surg* 1995; **60**: 458-9.
- 8) McCaig J, Varghese JC, Rees MR. Transdiaphragmatic gastric herniation: A rare complication of CABG using the right gastroepiploic artery. *Clin Radiol* 1996; **51**: 143-5.
- 9) Manetta F, Moons DWO, Bennett EV, et al. Intrapari-cardial herniation of the stomach after use of right gastroepiploic artery for coronary artery bypass grafting. *J Thorac Cardiovasc Surg* 1998; **115**: 479-80.
- 10) Ansari M, Eucher P, De Canniere L. Strangulated giant transdiaphragmatic hernia: A rare complication of coronary artery bypass grafting with the right gastroepiploic artery. *J Thorac Cardiovasc Surg* 2002; **123**: 358-9.
- 11) Yoshii T, Mine S, Yokoyama G. A case of transdiaphragmatic hernia after coronary artery bypass grafting using a right gastroepiploic artery. *J Jpn Surg Assoc* 2003; **64**: 667.
- 12) Ikeda Y, Tobari S, Morita N, et al. Strangulated intrapericardial herniation of the stomach after use of the right gastroepiploic artery for coronary artery bypass grafting. *Interact Cardiovasc Thorac Surg* 2005; **4**: 168-9.
- 13) Sasaki K, Shibuya H, Harada K, et al. A case of transdiaphragmatic hernia after coronary artery bypass grafting using a right gastroepiploic artery. *J Jpn Surg Assoc* 2006; **67**: 776-9.