

Cardiac Tamponade Due to Bleeding as a Potential Lethal Complication After Surgery for Esophageal Cancer

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Abstract. *Background: Cardiac tamponade, due to bleeding in the pericardial space after esophagectomy for esophageal cancer, is an extremely rare complication and may be associated with sudden hemodynamic instability that can lead to death unless there is prompt diagnosis and appropriate treatment. Case Report: A 76-year-old man underwent sub-total esophagectomy via a cervico-right thoracoabdominal approach and reconstruction with a gastric tube through the retrosternal route. On postoperative day 4, the patient developed hypotension due to cardiac tamponade caused by bleeding into the pericardial space and he had a decreased level of consciousness. Pericardial resection and open drainage via a minimal left anterior thoracotomy was performed that resulted in hemodynamic improvement followed by an uneventful recovery. Conclusion: Cardiac tamponade due to postoperative bleeding, which is a rare but life-threatening complication, should be considered as a cause of hemodynamic instability in the early postoperative period after esophagectomy.*

Radical esophageal resection remains the only curative treatment for esophageal cancer. However, esophagectomy with reconstruction of the esophagus is invasive and associated with a considerable risk of life-threatening complications, such as anastomotic leakage, respiratory failure, recurrent laryngeal nerve palsy and chylothorax (1). Postoperative cardiac failure due to arrhythmia and myocardial infarction is also a significant complication after

esophagectomy, while cardiac tamponade is a very rare and unusual complication (2), that can cause severe hemodynamic instability resulting in high mortality unless there is prompt diagnosis and appropriate treatment (3). We describe a rare case of cardiac tamponade due to bleeding in the pericardial space after esophagectomy that required emergency surgical treatment. In this case report, we discuss the management of this unusual but life-threatening complication.

Case Report

A 76-year-old man with a 1-year history of dysphagia and chest pain was diagnosed with squamous cell carcinoma of the middle and lower third of the thoracic esophagus. Clinical staging showed T3N0M0 Stage IIA based on the TNM classification defined by the UICC. After 2 courses of neoadjuvant chemotherapy with 5-fluorouracil (5-FU) plus cisplatin (CDDP) he underwent sub-total esophagectomy via a right thoracotomy. The procedure also included laparoscopy-assisted reconstruction with a gastric tube through the retrosternal route with cervical anastomosis and lymph node dissection. Pathological staging showed T3N0M0 Stage IIA and the pathological response of the primary tumor to chemotherapy was grade 1b. The patient had no intraoperative complications. His early postoperative recovery course was uneventful and he remained hemodynamically stable. However, in the afternoon on postoperative day (POD) 4, he felt ill and had a decreased level of consciousness (Japan coma scale of III-100). His vital signs were as follows: blood pressure of 54/42 mmHg, pulse of 102 beats/min and oxygen saturation (SpO₂) of 90% with 10 lt/min oxygen via face mask. His peripheral hemoglobin level was 10.7 g/dl and this was slightly less than the value (11.5 g/dl) in the morning of POD 4. The platelet and coagulation data were within the normal range (platelet count, 282×10³/μl; PT-INR, 1.08; APTT, 23.3 sec). He was not treated perioperatively with any antiplatelet or anticoagulant medication. The chest X-ray revealed cardiomegaly (Figure 1b) compared to that in the morning of POD 4 (Figure 1a), while

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Key Words: Cardiac tamponade, esophageal cancer, postoperative complication.



Figure 1. Chest X-rays of the pericardial effusion. (a) In the morning of POD 4 after esophagectomy; (b) In the afternoon of POD 4 during the initial attack. Cardiomegaly (arrows) was observed; (c) The cardiothoracic ratio decreased on POD 5 after pericardial resection and drainage.

chest computed tomography (CT) (Figure 2) and echocardiography demonstrated a massive pericardial effusion, which suggested cardiac tamponade. Cardiogenic shock due to cardiac tamponade was considered to be the cause of his hemodynamic instability. Although volume infusion and inotropic support were initially successful in restoring hemodynamics, an emergent reoperation was considered necessary because of hypotension. Percutaneous ultrasound-guided drainage *via* the subxiphoid approach was not chosen to prevent injury of the gastric tube located at the retrosternal route. A pericardial resection (3.5×3.5 cm) and open drainage *via* a minimal left anterior thoracotomy in the fifth intercostal space were performed (Figure 3). There was effusion in the pericardial space and 200 ml of deep red fluid were removed. The drainage resulted in hemodynamic improvement; the central venous pressure decreased from 15 mmHg to 6 mmHg. After flushing the pericardial space with sterile saline, persistent bleeding was not recognized and the site of earlier bleeding could not be detected in the operative field. The cardiothoracic ratio decreased after the reoperation (Figure 1c). The drains in the pericardial space and left thoracic cavity were removed on POD 7 and 10, respectively, with no sign of subsequent bleeding. His remaining hospitalization course was uneventful, except for a minor leakage of the cervical anastomotic site. The patient was discharged home on POD 33. At 5 months after discharge, he remained in good health and there was no tumor recurrence in the absence of adjuvant chemotherapy.

Discussion

Cardiac tamponade is very rare; a previous study reported only one case of cardiac tamponade after surgery for thoracic esophageal carcinoma in 277 patients (2). Moreover, in 1,000 consecutive patients who underwent esophagectomy for

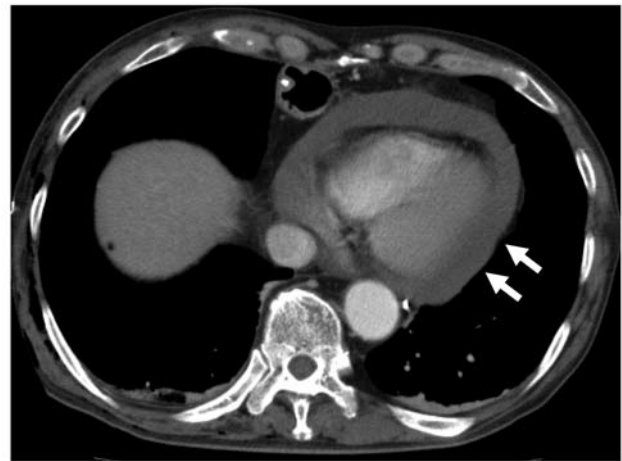


Figure 2. Chest CT demonstrating massive effusion (arrows) within the pericardium.

esophageal cancer in our Institute, we have not experienced cardiac tamponade as an early complication (4). Even after open heart surgery, the incidence of cardiac tamponade is only about 1% (5). Esophagectomy may result in increased pressure on the pericardium from the surrounding tissues, such as the gastric tube (6, 7), herniated omentum (8), mediastinal haemorrhage (9) or interposed colon (10), which shows the same clinical symptom as cardiac tamponade. However, there have been only a few reports of cardiac tamponade due to pericardial fluid associated with esophagectomy for esophageal cancer (2, 11-15) (Table I). In these previous series, death occurred in 2 of 6 (33.3%) cases. The causes of early cardiac tamponade were bleeding on POD 0 (11, 13), pericarditis on POD 4 (12) and chyle

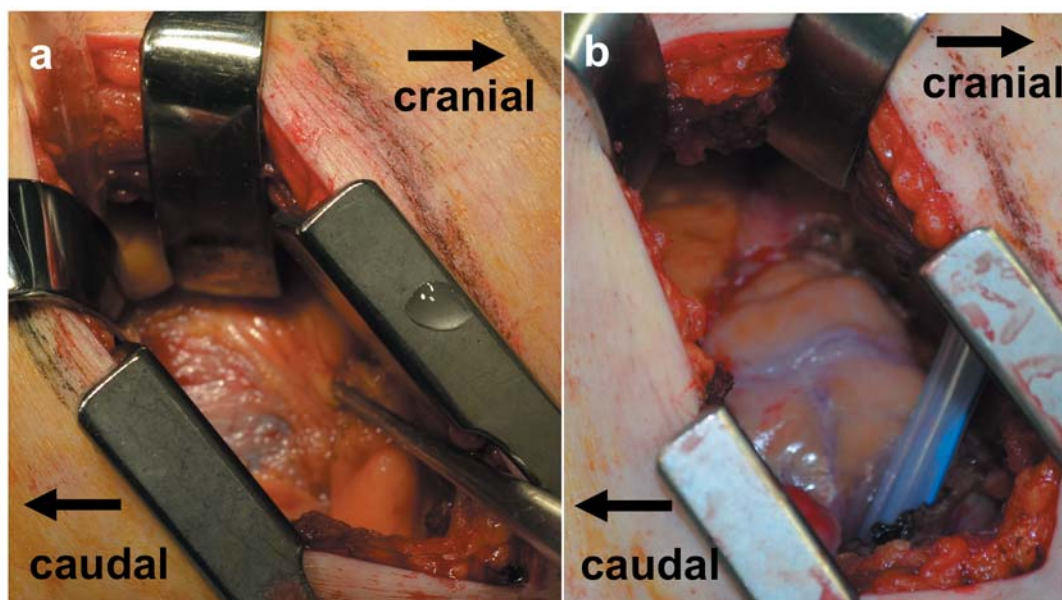


Figure 3. Intraoperative findings of pericardium and heart via a minimal left anterior thoracotomy. (a) Pericardium was tense due to blood in the pericardial space before drainage; (b) A pericardial resection and drainage was performed and the drain was placed in the pericardial space.

leak on POD 13 (14). A gastric tube ulcer penetrated into the pericardial space at 20 months after esophagectomy (15) and this was the cause of late cardiac tamponade. In terms of cardiac tamponade due to postoperative bleeding, only two cases have been previously reported (11, 13); tamponade occurred on POD 0 in both cases, causing death in one case. The operative procedures for esophagectomy in these two cases were a left thoracoabdominal approach and blunt dissection *via* a cervico-abdominal approach, respectively. The retraction of the heart during the operation was considered a cause of bleeding in the pericardial space in both cases. In the current case, cardiac tamponade occurred on POD 4 after esophagectomy and poststernal gastric tube reconstruction was performed *via* a cervico-right thoracoabdominal approach; the onset of bleeding was later than in the previous two reports. Since our patient did not carry a high bleeding risk based on the laboratory data, the vulnerability of the pericardial vessels due to mechanical trauma from dissection of the esophagus and lymph nodes around the pericardium in the thoracic cavity or the surgical procedure in the retrosternal space may have caused bleeding in the pericardial space even though the pericardial space was not handled directly.

Acute cardiac tamponade with hemodynamic collapse requires emergent percutaneous drainage or surgical removal of pericardial fluid (16). In the current case, the removal of 200 ml of pericardial effusion was not as large as the amount of previous reports; however, even this amount can be fatal if

not removed. In our case, cardiac tamponade was successfully treated by pericardial resection *via* a minimal left anterior thoracotomy, which is a safe and effective procedure (17) with minimal morbidity and does not injure the phrenic nerve or heart. This procedure is especially useful in patients with serious general condition, such as hemodynamic instability due to cardiac tamponade. Although percutaneous ultrasound-guided drainage *via* the subxiphoid approach is more common and less invasive in the usual case (3), this procedure should be avoided to prevent injury of the gastric tube and right gastroepiploic vessels, which supply blood flow and drain the gastric tube in cases where the antesternal or retrosternal route is used after esophagectomy.

In our case, we could not determine if vessels in the pericardial space were injured during surgery. Therefore, procedures in the thoracic cavity or retrosternal space should be performed with gentle manipulation to prevent excess pressure on the pericardium, especially in cases of advanced esophageal cancer of the middle or lower thoracic esophagus adjacent to the pericardium. Moreover, in the early postoperative period after esophagectomy, chest X-ray, chest CT scan and echocardiography should be performed rapidly when there is hemodynamic instability to rule-out cardiac tamponade, even if it did not occur during the immediate postoperative period. It is important for surgeons to consider cardiac tamponade as a postoperative complication whenever intraoperative manipulation around the heart is performed. Rapid recognition and emergency drainage is essential to

Table I. Reported cases of cardiac tamponade due to pericardial fluid associated with esophagectomy for esophageal cancer.

| Year (reported) | Age | Gender | Operative procedure for esophagectomy | Reconstruction organ | Reconstruction route | Period after esophagectomy | Procedure of drainage | Volume in pericardial space | Contents in pericardial space | Etiology | Outcome | Reference |
|-----------------|-----|--------|---|----------------------|-----------------------|----------------------------|--|-----------------------------|------------------------------------|--|---------|--------------|
| 1989 | NA | NA | NA | NA | NA | POD 7 | None | 300 ml | NA | NA | dead | (2) |
| 1998 | 47 | M | Left thoraco-abdominal approach | Stomach | Posterior Mediastinal | POD 0 | Pericardial resection <i>via</i> reopened incision | 300 ml | Blood | Bleeding from a small epicardial vein | Alive | (11) |
| 2005 | 69 | M | Cervico-right thoraco-abdominal approach with median sternotomy | Gastric tube | Retrosternal | POD 4 | Subxiphoid pericardiocentesis | 340 ml | Bloody serous fluid (Hb 0.1 mg/dl) | Pericarditis | Alive | (12) |
| 2007 | 50 | M | Blunt dissection <i>via</i> cervico-abdominal approach | Gastric tube | NA | POD 0 | Pericardial resection <i>via</i> transhiatal approach | NA | Blood | Bleeding from a small cardiac vein | Dead | (13) |
| 2009 | 45 | F | Ivor-Lewis procedure | Gastric tube | Posterior Mediastinal | POD 13 | Subxyphoid pericardiocentesis | 300 ml | Chylous fluid | Chyle leak | Alive | (14) |
| 2013 | 66 | M | NA | Gastric tube | Retrosternal | 20 months | Pericardial resection <i>via</i> left thoroscopic approach | large amount | Purulent fluid | Gastric tube ulcer penetrated into the pericardial space | Alive | (15) |
| 2014 | 76 | M | Cervico-right thoraco-abdominal approach | Gastric tube | Retrosternal | POD 4 | Pericardial resection <i>via</i> minimal left anterior thoracotomy | 200 ml | Blood | Bleeding from epicardial vessels (possible) | Alive | Current case |

NA, Not available.

prevent a sudden and fatal outcome before the amount of blood in the pericardial space reaches a critical level.

In conclusion, although cardiac tamponade due to postoperative bleeding is rare, this life-threatening complication should be considered as a cause of hemodynamic instability in the early postoperative period, as well as the immediate postoperative period after esophagectomy.

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Received September 6, 2014

Revised October 2, 2014

Accepted October 8, 2014