Pneumopericardium Caused by Perforation of Gastric tube after Esophageal Reconstruction: case report

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A 73-year-old man presented with chest pain and shortness of breath. He received esophageal reconstruction with gastric tube via retrosternal route five years ago due to gastroesophageal reflux disease (GERD) and severe esophageal stricture. At emergency department, the chest radiography and computed tomography (CT) disclosed abnormal air and fluid collection in the pericardial cavity. Under the impression of hollow organ perforation into the pericardial cavity, the patient received emergent pericardiectomy to relieve the cardiac tamponade. Surgery revealed a fistula between the pericardial cavity and the reconstructed gastric tube. Total gastrectomy, feeding duodenostomy and pericardial drainage were performed in the operation. After surgical intervention, the patient recovered uneventfully and was discharged 3 weeks later.

Key words: Esophageal reconstruction, Gastric tube, Perforation, Pneumopericardium

Pneumopericardium indicated air in the pericardial cavity. Reviewing the literature, pneumopericardium have been reported in association with various causes, such as transdiaphragmatic perforation of gastric ulcer [1], blunt chest trauma [2], inflammatory process [3], or after various iatrogenic procedures including pacemaker implantation [4] and cardiac transplantation [5]. Cases of spontaneous pneumothorax and pneumopericardium after heavy lifting have also been reported [6]. Only three cases of pneumopericardium secondary to communication with the reconstructed esophagus have been reported in the literature, two of them died in spite of surgical correction [7, 8]. We herein report a patient of pneumopericardium caused by fistula from the reconstructed esophagus. This patient presented with unusually mild symptoms and good postoperative recovery.

CASE REPORT

A 73-year-old man presented with sudden onset of sharp chest pain and shortness of breath. According to his statement, he had noted intermittent dull chest pain with heart burning for two months, which could be relieved with medications. However, he developed dyspnea and exacerbating chest pain with radiating to back for one day before he was sent to our hospital. Tracing the past history, he had received transthoracic esophagectomy and retrosternal esophageal reconstruction with gastric tube five years ago due to esophageal stenosis resulted from severe gastro-esophageal reflux disease (GERD). Additionally, he had received non-steroid anti-inflammatory drugs for five years due to intermittent attacks of gouty arthritis.

At emergency department, vital signs showed body temperature of 36.3°C, pulse rate of 86/min, respiratory rate of 19/min, and blood pressure of 135/79 mmHg. Clinical examination disclosed symmetric expansion of chest walls and mild decreased...
of bilateral breathing sound. Routine laboratory investigations yielded a white cell count of 10,160/mm$^3$ and segment cell count of 86.3%. Biochemical examinations including creatine kinase, creatine kinase-MB, and cardiac troponin I were all within normal ranges. Chest roentgenogram in the supine position revealed radiolucent shadows along the ascending aorta and outlining the left and inferior cardiac borders (Fig. 1). Subsequent thoracic computed tomography (CT) was performed under the impression of pneumopericardium, which disclosed air and fluid densities in the pericardial space (Fig. 2). The gas shadow was preferentially located anterior to the ascending aorta and the ventricles (Fig. 3). There is neither gas collection nor fat stranding in the mediastinum outside the pericardial cavity.

With the impression of hollow organ perforation with fistula formation to the pericardial space causing pneumopericardium, emergent pericardectomy was performed in order to relieve the cardiac tamponade. Surgery revealed an ulcer crater of 0.7 × 0.8 cm at the posterior wall of the gastric tube.

Figure 1. Supine chest film shows curvilinear radiolucency parallel to the ascending aorta and the left cardiac border (arrow).

Figure 2. Axial contrast-enhanced chest CT reveals status post esophageal reconstruction with gastric tube at the retrosternal space (E). Pericardial air was noted in the anterior superior aortic recess (arrow) (2a), left pulmonary venous recess (arrow) (2b) and anterior to the cardiac ventricles (arrow) (2c).
which penetrated into the pericardial cavity (Fig. 4). About 100 ml pus and debris in the pericardial space was noted. Excision of ulcerated gastric tube was performed with pericardial drainage and construction of the feeding duodenostomy. Histologically, the ulcer crater of the resected gastric tube revealed active infiltration of neutrophils. Transmural inflammation of the ulcer was noted with purulent debris extending from the mucosa to the serosal surface. No evidence of malignancy was seen in the resected specimen. After surgical intervention, the patient recovered uneventfully and was discharged after removal of the pericardial drainage 3 weeks later.

**DISCUSSION**

The pericardium consists of two structures: the fibrous pericardium and the serous pericardium. The

**Figure 3.** Reconstructed sagittal CT with contrast enhancement disclosed the pericardial air located anterior to the ascending aorta (arrow) (3a) and the ventricles (arrow) (3b).

**Figure 4.** Findings at operation. Defects in the posterior wall of the gastric tube (arrow) (4a) and adjacent pericardium (arrow) (4b).
latter is double-layered and consists of the parietal and the visceral layers. The visceral layer surrounds the heart and the parietal layer lines the fibrous pericardium. The pericardial recesses are composed of the reflections of the serosal layers, including transverse sinus, oblique sinus, postcaval recess, left and right pulmonary venous recesses [9, 10].

Most cases of pneumopericardium can be diagnosed by chest radiography. Typically, the chest radiograph shows an area of radiolucency surrounding the cardiac border limited superiorly by the attachments of the pericardium to the vascular pedicles. It is sometime considered difficult to distinguish pneumomediastinum with pneumopericardium with chest radiograph, since they can occur concomitantly. However, several findings can help differentiating these two entities. For example, gas in pneumomediastinum rarely changes distribution while on a decubitus radiograph, but gas in the pneumopericardium will float to the uppermost position in the pericardial space in accordance with patient’s position. Gas in the pneumopericardium will not extend beyond the aortic arch, while gas in the pneumomediastinum can extends upward even to the neck [11].

If the pericardial space is over-expanded with air and/or fluid, the risk of cardiac tamponade or even tension pneumopericardium is high and immediate surgical intervention is indicated.

Contrast radiograph would be helpful to identify the location of the fistula if patient’s general condition bears no risk of suffocation. Endoscopy should be used with caution in this situation, as insufflation of air may exacerbate cardiac tamponade [12].

In most patients, CT scans can provide more information than radiographies, particularly if only small amount of air in the pericardial cavity. In addition, CT is valuable in detecting associated inflammation or abscess in the mediastinum.

In our case, the locations of the trapped air were typical for pneumopericardium in the supine patient: the pericardial space anterior to the cardiac ventricles and ascending aorta (which belongs to the anterior superior aortic recess of the transverse sinus) [9]. These regions are the most anterior parts of the pericardial space in the lying patient and the floating air would be preferentially trapped in these regions. Sagittal reconstruction of the CT images in our case clearly demonstrated gas in these spaces (Fig. 3). After reviewing the literature, the typical locations of air anterior to the root of ascending aorta and cardiac ventricles in the supine position have not been reported before.

Pneumopericardium resulted from abnormal communication of pericardium with stomach due to benign peptic ulcers or penetration of gastric carcinomas have been reported in many papers [13-15]. However, only two reports with three cases of pneumopericardium after esophagogastronomy were found in the literature [7, 8]. The prognosis was poor and two of the three patients died. In our case, the ulceration and perforation of gastric tube was probably due to inappropriate NSAID usage. However, the liability of intrathoracic stomach for ulcer development has been known for years [12]. We proposed that adequate drainage provided by the fistula accounted for the inapparent clinical symptoms in our patient, which is supported by the not-expanded pericardial space in the imaging studies.

In conclusion, pneumopericardium after esophageal reconstruction is a rare condition. Awareness of the radiological features of this entity is important to facilitate prompt diagnosis and treatment.

REFERENCES
Pneumopericardium caused by gastric tube perforation


食道重建術後胃管破裂導致心包積氣: 病例報告

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一位73歲男性病人突發性出現胸痛及呼吸急促之症狀。患者曾在5年前因為嚴重的胃食道逆流合併食道下端阻塞接受過食道重建手術。影像檢查中胸部X光以及電腦斷層攝影均顯示有氣體堆積於心包膜腔內，而懷疑有腸胃道破裂導致心包積氣的可能。手術時證實確有胃管及心包膜腫管之形成。經緊急切除重建之食道以及置放引流管，病人於術後3週平安出院。

關鍵詞：食道重建，胃管，破裂，心包積氣