

Pneumomediastinum and pneumopericardium as rare complications after retroperitoneal transpsoas lateral lumbar interbody fusion surgery

A case report

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Abstract

Rationale: Pneumomediastinum and pneumopericardium refer to conditions in which air exists within the mediastinum and pericardium, respectively. There is the communication between the mediastinum, pericardium, and retroperitoneum. We present the first report of rare complications (pneumomediastinum and pneumopericardium) after retroperitoneal transpsoas lateral lumbar interbody fusion (LLIF) surgery.

Patient concerns: A 73-year-old female who underwent LLIF using the retroperitoneal approach complained of dysphagia but no other abnormal symptom after surgery.

Diagnosis and interventions: A plain chest radiograph (CXR) taken immediately the following surgery did not show any unusual findings but CXR took on postoperative day (POD) 1 indicated pneumopericardium and pneumomediastinum with abnormal air density along the pericardium and mediastinum with subdiaphragmatic air density. A chest computed tomography revealed bilateral pleural effusion and abnormal air density (pneumopericardium and pneumomediastinum) connected to a large amount of air around the aorta and retroperitoneal space (pneumoretroperitoneum).

Outcomes: The patient complained of no unusual symptom and the CXR on POD 6 indicated that no air density surrounding the mediastinum and pericardium was found.

Lessons: Pneumomediastinum and pneumopericardium should be considered possible complications of LLIF using retroperitoneal transpsoas approach. Such a condition may progress to fatal conditions without early recognition and rapid management.

Abbreviations: CT = computed tomography, CXR = plain chest radiograph, LLIF = lateral lumbar interbody fusion, POD = postoperative day.

Keywords: complication, lateral lumbar interbody fusion, pneumomediastinum, pneumopericardium, retroperitoneal transpsoas approach

1. Introduction

In recent, minimally invasive transpsoas lateral lumbar interbody fusion (LLIF) using a retroperitoneal approach is a widely used,

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effective surgical technique with multiple benefits.^[1,2] Nevertheless, it has been associated with a few complications, the most typical of which is weakness of hip flexor muscle and pain on anterior thigh caused by psoas muscle injury, or retroperitoneal vascular and ureteral injury.^[3–5] However, postoperative pneumomediastinum and pneumopericardium as a result of the migration of air have never been documented. Therefore, the authors report a case of pneumomediastinum and pneumopericardium that occurred after LLIF.

2. Case presentation

A 73-year-old female patient with underlying hypertension, diabetes, and rheumatoid arthritis (treated with oral steroids) was planned staged surgery for degenerative lumbar scoliosis with multilevel spinal stenosis (Fig. 1). LLIF using the left retroperitoneal approach for L2-3, L3-4, and L4-5 was performed (Fig. 2) and there were no notable intraoperative events. The patient complained of dysphagia immediate postoperatively, however, other abnormal signs and findings on plain chest radiograph (CXR) were not observed. CXR took on postoperative day (POD) 1 indicated abnormal air density along the pericardium and mediastinum with subdiaphragmatic air (Fig. 3). Bronchoscopy showed no abnormal findings, such as bronchial injury by intubation tube. A chest computed tomography (CT) revealed

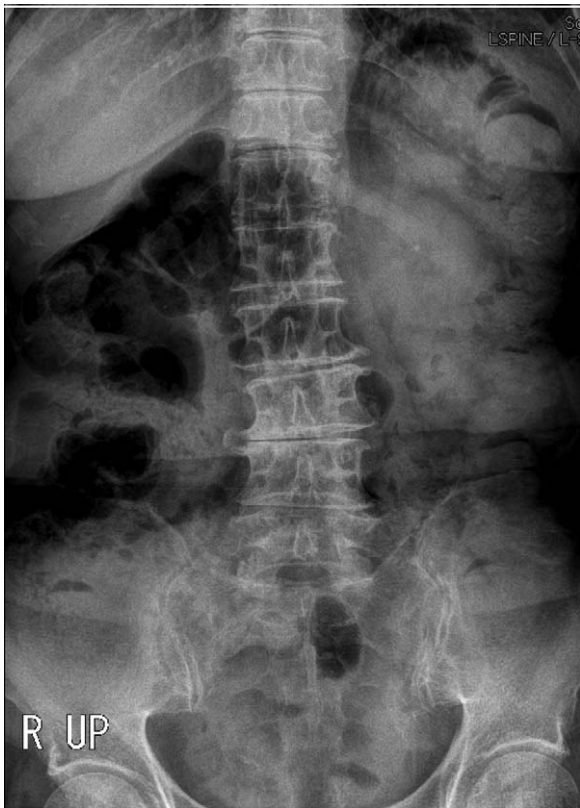


Figure 1. Preoperative plain radiograph of a 73-year-old female patient with degenerative lumbar scoliosis and multilevel spinal stenosis.



Figure 2. Plain radiograph of the lumbar spine after lateral lumbar interbody fusion using retroperitoneal approach for L2-3, L3-4, and L4-5.

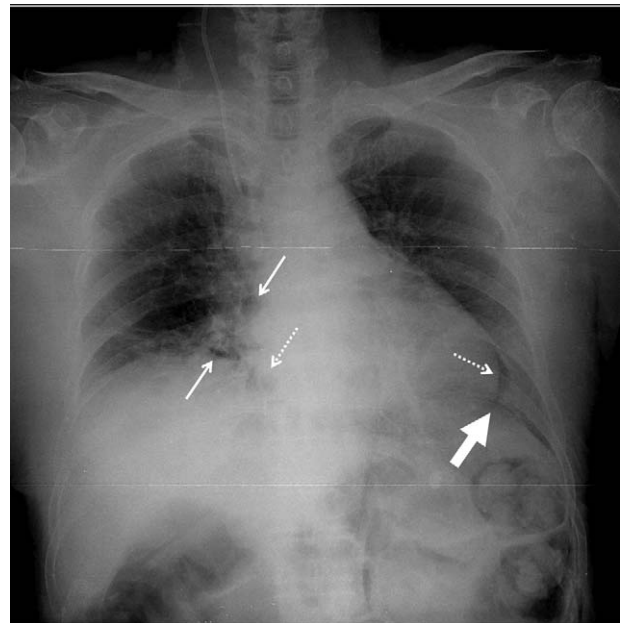


Figure 3. A plain chest radiograph was taken on postoperative day 1 showed pneumopericardium with abnormal air density along the pericardium (dotted arrows), pneumomediastinum with abnormal air in the mediastinum (solid thin arrows), and subdiaphragmatic air in the left side, which was speculated to be retroperitoneal air (solid thick arrows).

bilateral pleural effusion, abnormal air density connected to a large amount of air around the aorta (Fig. 4a) and retroperitoneal space (Fig. 4b). The patient's vital signs remained stable with no unusual symptoms, such as chest pain or dyspnea; accordingly, the patient was monitored closely for 24 hours without further invasive procedures. The CXR on POD 6 indicated that the abnormal air density was not found, and the amount of air was markedly decreased on the chest CT compared to POD 2 (Fig. 5). Posterior instrumentation was performed after the complete disappearance of abnormal air on CXR (POD 7). Abdominal CT on POD 14 (7 days after posterior surgery) also confirmed that air density in the retroperitoneum completely disappeared. The patients signed informed consent for the publication of this case report.

3. Discussion

Common complications of LLIF were weakness of hip flexor muscle and pain on anterior thigh caused by psoas muscle injury, or retroperitoneal vascular and ureteral injury.^[3–5] However, postoperative pneumomediastinum and pneumopericardium have never been documented. In this case, we observed these complications as a result of the migration of air from the retroperitoneum to the mediastinum and pericardium through the narrow connective pathway of a physiological defect in the diaphragm. We reported the radiological evidence of free air migration and serial course of clinical outcomes. This phenomenon is theoretically and anatomically possible, but very rarely observed.

Pneumomediastinum and pneumopericardium refer to conditions in which air exists within the mediastinum and pericardium, respectively.^[6,7] The etiologies of both conditions are not significantly different and can be divided into spontaneous and secondary caused by iatrogenic or traumatic events.

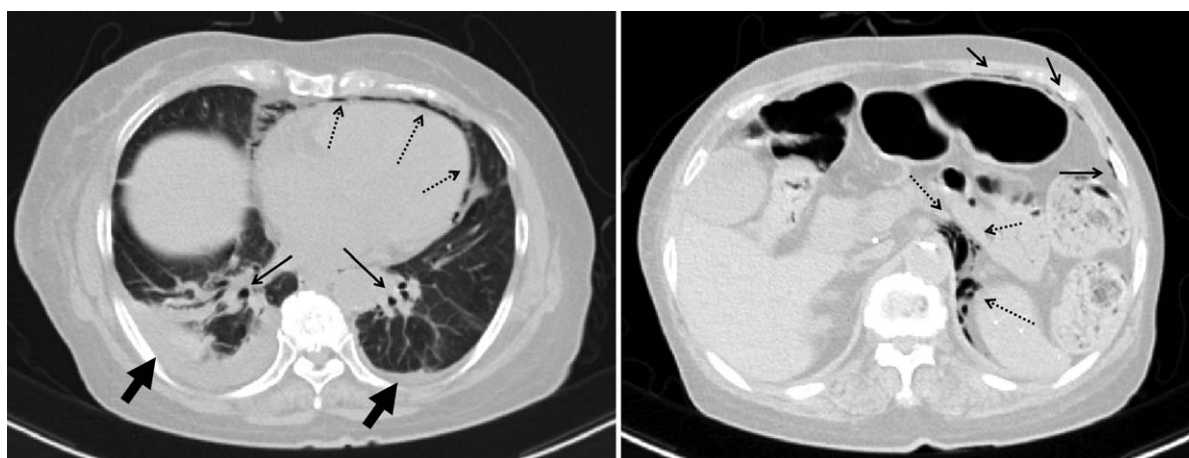


Figure 4. Chest CT (A) showed pneumopericardium and pneumomediastinum along the margins of the pericardium (dotted arrow) and aorta (solid thin arrows) with both pleural effusions (solid thick arrows). Chest CT (B) at thoracolumbar junction level showed left pneumoretroperitoneum is present, including a large quantity of air around the aorta (dotted arrow), with soft tissue emphysema (solid thin arrow). CT=computed tomography.

Anatomically, mediastinum is distinguished by 4 parts; however, it is actually a single space within which air or gas can freely migrate.^[8] Pericardium encloses the heart and roots of large blood vessels and is divided into fibrous and serous layers. The most common cause of pneumopericardium and pneumomediastinum is alveolar rupture caused by respiratory diseases and is not implicated in our case.^[9-11]

The focus of this case is the communication between the mediastinum, pericardium, and retroperitoneum. Endothoracic fascia of pleural cavity and transversalis fascia of the abdominal cavity are separated by the diaphragm, but are partially connected by a physiological defect in the diaphragm; anteromedian and anterolateral gap, sternocostal triangle, and the communication between the aortic and esophageal hiatus.^[8] This connection creates a pathway through which air or disease can transfer between the retroperitoneal and mediastinal space.^[11,12] Because the heart and lungs are connected through the pulmonary artery and vein, and the superior vena cava and aorta must also be connected to the heart, the pericardium cannot

be seen as a completely closed space. It joins the vascular sheath of large blood vessels and the hilum of the lung, which is the entrance for bronchus and large vessels, suggesting that it may serve as a connection pathway through the pleural mediastinal part and hilum opening.

Clinically, most cases of pneumomediastinum are asymptomatic.^[6,7,9-11] However, when symptoms are present, acute severe retrosternal and chest pain that radiates to the neck, back, and arms being the most prevalent. The patients with pneumothorax or potentially fatal tension pneumomediastinum could show dyspnea, cyanosis, fever with mediastinitis or dysphonia, and dysphagia. Physical examinations typically reveal subcutaneous emphysema, though not a pathognomonic symptom, as well as Hamman signs, Beck’s triad, tachycardia, and tachypnea. In most cases, symptomatic treatment is performed with closed monitoring, pain control, and oxygen supplement, in addition to the care of the underlying pathology. Abnormal radiographic findings are returned to normal within a week. However, in malignant cases that progress to fatal conditions, such as tension pneumomediastinum, tension pneumothorax, and cardiac tamponade, emergency decompression must be performed via thoracoscopy or thoracotomy and pericardiocentesis.

To the best of our knowledge, this is the first documented case of pneumomediastinum and pneumopericardium as a complication of LLIF. This outcome should be considered a serious complication that may progress to fatal conditions, which calls for special attention during LLIF.

Author contributions

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Investigation: Hyun Uk Lee, Deokwon Kang, Sung-Woo Choi, Hae-Dong Jang, Byung-Joon Shin.



Figure 5. Chest computed tomography on a POD 6 showed markedly reduced air density compared to POD 2. POD=postoperative day.

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