Case report

Incidental finding of lung hernia in a patient with a remote history of empyema status post video-assisted thoracoscopic surgery

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**ABSTRACT**

Lung hernia, the protrusion of pulmonary tissue outside of the thoracic cage, is a rare radiologic finding. The exact incidence of this condition is not well documented. The etiology is either secondary to underlying congenital conditions which weaken the supporting structures of the thoracic wall or more commonly, post-surgical changes. In this report, we describe the case of a 58-year-old male trauma patient who was involved in a motor vehicle collision. Computed tomography of the head, neck, body, and upper extremities was negative for acute injury, but an incidental left-sided herniation of the lingula between the fifth and sixth intercostal spaces was identified. Computed tomography is superior for identifying lung herniations as chest radiographs may not visualize the defect. Upon further investigation, the patient had a remote history of pneumonia complicated by empyema treated by video-assisted thoracoscopic surgery (VATS). This history, coupled with the absence of traumatic injury to the thorax as well as the presence of pulmonary scarring suggests that the lung herniation was likely chronic and secondary to the VATS procedure. The patient was discharged home without surgical intervention. Asymptomatic lung herniations are typically managed conservatively, but patients and physicians should be aware of the risk of lung hernia after VATS as well as associated complications including strangulation or pulmonary infarct.

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**INTRODUCTION**

Lung herniation, defined as an extension of lung parenchyma outside of the thoracic wall, is relatively rare, with only a few hundred published reports of the condition since approximately 1500 A.D. [1]. Lung herniation is classified based on anatomical location: thoracic (most common), cervical, and diaphragmatic (least common) [1–4]. Herniation of the lung is also classified according to congenital and acquired causes. Congenital herniations occur in 20% of cases and are typically

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due to fascial defects in the thoracic or cervical regions. Acquired herniations may be spontaneous but are most often secondary to chest trauma or thoracic surgery [1,4–6].

Regardless of the inciting event, lung herniation occurs secondary to a combination of weakened supporting structures and increased intrathoracic pressure; a thoracic wall defect alone is usually insufficient to result in lung herniation [2,7]. Other predisposing factors include chronic cough, obesity, chronic obstructive pulmonary disease, chronic corticosteroid use, diabetes, malnutrition, neoplasm, or inflammatory processes [4–7]. In this report, we describe a case of asymptomatic lung herniation in a trauma patient with a history of video-assisted thoracoscopic surgery (VATS).

**Case report**

Our patient is a 58-year-old otherwise healthy male who presented to the emergency department after a motor vehicle collision in which he was rear-ended at approximately 45 miles per hour. He endorsed constant aching pain in the neck, back, and left shoulder. He otherwise denied chest pain and shortness of breath. Medical history was significant for a back surgery 35 years prior. Home medications were Tylenol and ibuprofen as needed.

The patient was anxious and hyperventilating on arrival. Vital signs showed mild tachycardia and tachypnea but were otherwise stable. Body mass index was 29. Physical exam was significant for tenderness of the paraspinal muscles, thoracic midline spine, left shoulder, and left elbow. Cardiopulmonary and abdominal exams were unremarkable. Lungs were clear to auscultation bilaterally with symmetric breath sounds and equal chest rise without left-sided chest tenderness, mass, or crepitus.

Labs were significant for VBG pH 7.46, pCO2 30, and bicarbonate 21 consistent with hyperventilation. Focused assessment with sonography for trauma exam and radiographs of the bilateral upper extremities were unremarkable. Chest radiograph showed an ill-defined increased parenchymal density in the lateral left lower lobe of the lung with an associated small pleural effusion. An area of lucency was visualized in the deep soft tissues of the left chest wall (Fig. 1). No pneumothorax or rib fractures were identified. Computed tomography (CT) of the chest, abdomen, and pelvis was significant for herniation of the lingula through the left fifth and sixth lateral intercostal spaces with associated ground-glass changes and underlying pulmonary architecture distortion (Fig. 2). No other focal lesions of lung parenchyma were seen. CT of the head, neck, and thoracic/lumbar spine showed no acute injury.

In light of the radiographic findings, further investigation revealed that our patient had an episode of pneumonia in 2017 complicated by empyema, requiring VATS and an 18-day hospitalization. He denies symptoms such as chest pain, shortness of breath, or cough since the procedure.

The patient's findings at this visit were most consistent with whiplash injury. He was given one liter of normal saline bolus, intravenous and oral pain medications, and lidocaine patches in the emergency department. The patient was discharged home with multimodal pain control and outpatient orthopedics follow-up.

**Discussion**

Lung herniation is a rare complication of VATS and is believed to occur because the intercostal port sites are often not sutured during chest wall closure [1,6,7]. A published case series of 650 VATS procedures mostly done for lung lobectomies found that lung herniation occurred in three patients, which is an incidence of less than 0.5% [7]. One published report describes lung herniation complicated by VATS for a persistent spontaneous pneumothorax unresponsive to chest tube placement [6].
Aside from VATS, our patient had several risk factors for lung herniation including a history of severe lung infection and acute trauma. The lingula herniation was most likely a result of prior VATS rather than the acute motor vehicle accident trauma due to lack of symptoms and absence of acute injury on imaging. His Body mass index was just below the range of obesity classification but it would be reasonable to assume that his body habitus may have contributed to increased intrathoracic pressure [4]. It is also possible that the empyema itself contributed to the development of the herniation. One report described a case of intercostal lung herniation secondary to necrotizing Klebsiella pneumonia resulting in rib erosion [8].

Lung herniation often occurs anteriorly because intercostal spaces in this region are relatively wide and there is a lack of external intercostal muscle support in the parasternal region [7,9]. Interestingly, one report described an anterior lung herniation that occurred after cardiopulmonary resuscitation [10]. Posterior herniations are rare because the paraspinal muscles usually prevent herniation but occasionally occur between the eighth and ninth ribs. This is thought to be due to the lack of support from the trapezius, latissimus dorsi, and rhomboid muscles at this location in the thorax [4,11]. Lateral herniations are also uncommon due to the presence of both internal and external intercostal muscles but may occur with trauma [5]. One report described lung herniation occurring at the site of a previous chest tube placement [4].

The presentation of lung herniation can range from completely asymptomatic to experiencing pleuritic chest pain, chronic cough, and/or dyspnea [2,5,7]. A soft bulge, which may or may not be tender, may be appreciated on exam. The bulge can grow with inspiration or Valsalva maneuver and shrink with expiration [2,5,12]. It may also be hyper-resonant and associated with subcutaneous emphysema or ecchymosis [5,9,13]. Other clinical signs include thoracic asymmetry, a palpable defect in the thoracic cage, and asymmetric chest wall movements [6,10,12]. As noted above, our patient did not present with these findings.

Radiographs may show extension of lung parenchyma extending outside of the thoracic cage with increased lucency and/or hazy airspace opacities in the soft tissues, as with our patient [11,12,14]. However, chest radiographs may be normal in cases of more subtle herniation. Lung herniation may be more easily visualized if the patient performs Valsalva maneuver [2,15]. Ultrasound is less commonly done, which may show a defect in an intercostal muscle and visualization of a hernia with forced expiration [2,5]. CT has superior sensitivity compared with other imaging modalities and will show protrusion of the lung parenchyma through an intercostal space [7,12,15]. Pleural effusion may also be visualized, as well as hemothorax or rib fractures secondary to trauma [10,12,13]. If the herniation is secondary to surgery, CT may identify the location of herniation through the chest wall at the site of previous port placement [6]. CT is a valuable tool for identifying hernia location and dimensions, defect size, and overall structure of the thoracic cage and pleural space [4].

Careful examination of the CT of our patient provides additional information regarding the natural history of the herniation. First, there are no associated acute thoracic injuries in the vicinity of the hernia to suggest acute traumatic herniation. Second, the herniated parenchymal demonstrates geographic ground-glass opacity with sharp margins and underlying architecture distortion, findings favor chronic scarring over contusion. Known complications of lung hernia include strangulation and infarction. The most distal portion of the herniated lung demonstrates a relatively normal appearance whereas most of the scarring is present at the thoracic wall. Since tissue infarcts are most pronounced at the distal ends, we assume an absence of strangulation in our case.

Surgical reduction is strongly recommended for symptomatic hernias. Common indications include pain, increasing size, and respiratory difficulty [1,2,6]. Asymptomatic hernias are often managed conservatively with pain control as needed [2,5,7]. However, the risk of lung incarceration and strangulation leading to permanent damage is still of concern. Physicians need to be aware of this complication of VATS so patients can be instructed to seek medical care if symptoms develop.

Patient consent

Informed consent was obtained from the patient on June 28, 2021 by Dr Jason Lee.

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