

CASE REPORT

OPEN ACCESS

Full open access to this and thousands of other papers at <http://www.la-press.com>.

Spontaneous Transient Lateral Thoracic Lung Herniation Resulting in Systemic Inflammatory Response Syndrome (SIRS) and Subsequent Contralateral Lung Injury

Antony Kaliyadan¹, Amal Kebede¹, Tabassum Ali¹, Michael Karchevsky², Bernard Vasseur³ and Nirav Patel⁴

¹Departments of Internal Medicine, ²Radiology, ³Cardiothoracic Surgery, ⁴Respiratory Specialists, The Reading Hospital and Medical Center, Reading, Pennsylvania 19611, USA. Corresponding author email: tony.kaliyadan@gmail.com

Abstract: Lung herniation is a relatively rare clinical entity that is most commonly either congenital or acquired traumatically. We describe a case of spontaneous lung herniation secondary to acute cough in an obese male smoker complicated by contralateral acute lung injury and systemic inflammatory response syndrome (SIRS). Mechanisms of lung herniation, classification, diagnosis, and management will be discussed.

Keywords: lung herniation, lung hernia, spontaneous, thorax, systemic inflammatory response syndrome, SIRS

Clinical Medicine Insights: Case Reports 2011:4 39–42

doi: [10.4137/CCRep.S7002](https://doi.org/10.4137/CCRep.S7002)

This article is available from <http://www.la-press.com>.

© the author(s), publisher and licensee Libertas Academica Ltd.

This is an open access article. Unrestricted non-commercial use is permitted provided the original work is properly cited.

Case Report

An elderly male patient in his 60's with a 150 pack year history of smoking, chronic obstructive pulmonary disease, hiatal hernia, gastroesophageal reflux disease, and coronary artery disease presented to the emergency room complaining of a three-week history of incessant forceful cough and right-sided chest pain in the absence of trauma. He required emergent uneventful endotracheal intubation and mechanical ventilation for hypoxic respiratory failure upon arrival to the emergency room. Pertinent medications included oral aspirin 325 mg and clopidogrel 75 mg daily.

Physical examination revealed an obese male with a heart rate of 110 beats per minute and blood pressure 135/80 mmHg. Decreased breath sounds over the right lung with overlying severe right anterior chest wall ecchymosis and subcutaneous edema were noted. No clinical signs of heart failure were present on physical exam.

Laboratory testing included an arterial blood gas with a pH 7.28, PaO₂ 107 mmHg (100% FiO₂), PCO₂ 43 mmHg, HCO₃ 20 meq/L, hemoglobin 11.5 g/dL, and white blood cell count 23,100 cm³. Chest X-Ray (CXR) on presentation (Fig. 1) revealed minimal opacity at the right lung base and blunting of the left costophrenic angle. Computed tomography (CT) of the chest (Fig. 2) revealed a dramatic lateral

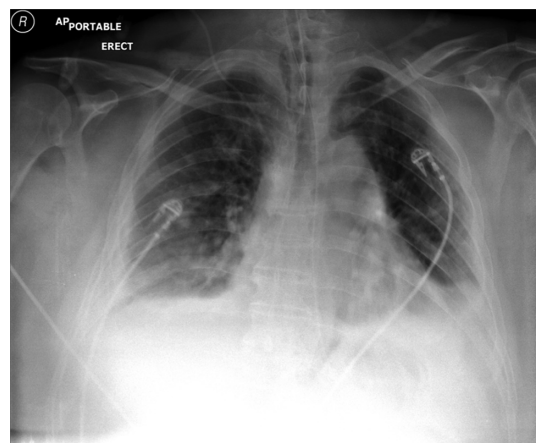


Figure 1. CXR on presentation.

herniation of the right lung at the seventh intercostal space without evidence of any overlying rib fractures. Current radiologic findings were compared to images from a prior CT scan performed five months earlier which demonstrated symmetrically developed thoracic cage muscles without evidence for fracture or herniation.

Initial management in the medical Intensive Care Unit (ICU) included intravenous sedation and low tidal volume ventilation with attention to peak airway pressures and permissive hypercapnea given the high risk for incarceration and potential advancement of the lung herniation. An initial conservative strategy was opted for given the patient's overall co-morbidities

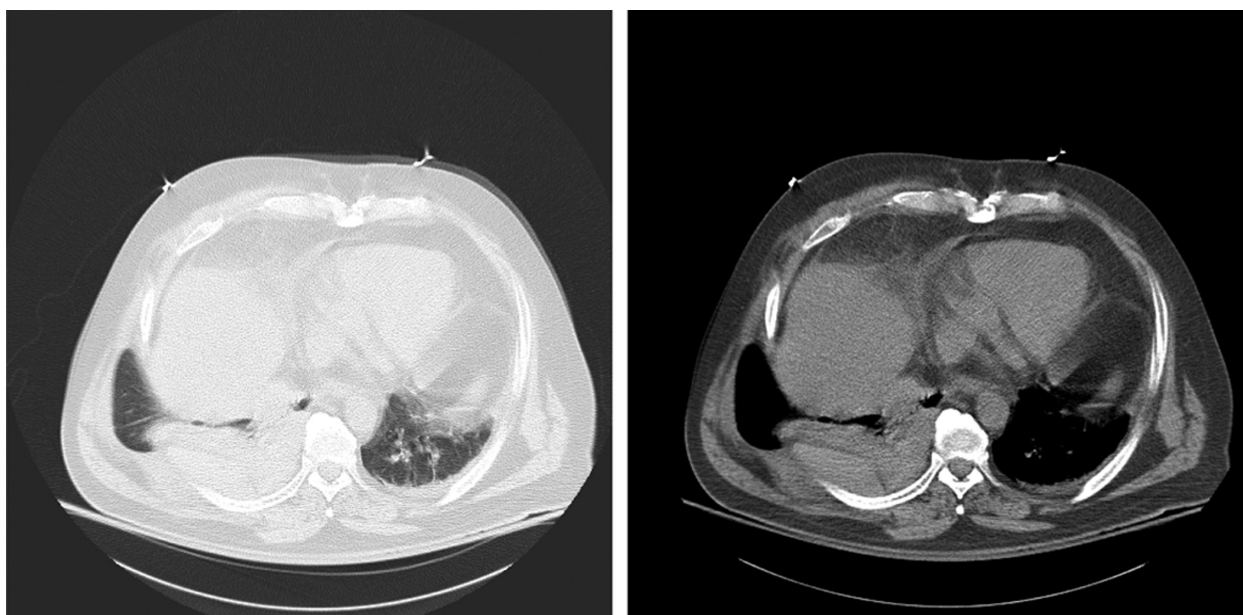


Figure 2. CT of the chest showing lateral lung herniation of the right lung at the seventh intercostal space.



Figure 3. Right anterior abdominal intramuscular hemorrhage resulting in expanding hematoma.

contributing to high surgical risk and having no evidence for impending lung incarceration.

Repeat CT chest in 24 hours revealed multi-lobar infiltrates. The previously identified lung herniation was no longer visualized but an extensive extra pleural collection consistent with a large hematoma remained. Patient remained on intravenous antibiotics during this time but blood and sputum cultures showed no growth of organisms. Repeat chest CT eight days later showed right anterior abdominal intramuscular hemorrhage. Examination showed expanding hematoma (Fig. 3). Radiological studies supported evidence for contralateral acute lung injury, making mechanical ventilation and oxygenation very challenging.

Other ICU complications included persistently high fevers despite broad-spectrum antibiotics, intracerebral hemorrhage due to cerebral amyloid angiopathy, and ST segment elevation myocardial infarction. His hospital course was further complicated by anoxic encephalopathy due to inability to maintain adequate gaseous exchange. Aggressive medical care was stopped after several weeks of ICU care. The patient expired soon after.

Discussion

Lung herniation is an uncommon medical problem with only about 300 cases cited to date.¹⁻³ It has been defined in the literature as a displacement of lung tissue outside the thoracic cavity through a defect in the pleura of the chest wall, diaphragm, or mediastinum.⁴ The Morel-Lavallee system developed in 1845 is used to classify lung hernias on the basis of location

and etiology.⁵ Location is further broken down into cervical, diaphragmatic, and thoracic. The etiology can be either congenital or acquired. If acquired, it may be due to traumatic, spontaneous, pathological, or post-surgical causes.⁵

Spontaneous lung herniation due to coughing is related to a combination of two processes: weakness of the boundaries of the thoracic cavity and increased intra-thoracic pressure. Weakness in the intercostal muscles may be a consequence of corticosteroid use, congenital abnormalities, or trauma; however, chronic cough, Valsalva maneuver, or playing wind instruments can contribute to increased intra-thoracic pressures.⁶ Interestingly, there is a report in the literature of a spontaneous lung herniation after a single cough.⁷

Most patients present clinically with crepitus and a bulging thoracic mass that increases in size with Valsalva maneuver, coughing, or straining. Patients may or may not have pain.⁸ Diagnosis is usually clinical although CT is helpful in delineating the exact size and location of the hernia.⁴ Treatment is still debated in asymptomatic patients, especially given the low incidence of this clinical entity. Surgical intervention is considered to be the treatment of choice if the hernia causes extreme pain, incarcerates the pulmonary parenchyma, or results in infection.⁹⁻¹¹ A conservative, nonsurgical approach is generally recommended for asymptomatic patients; however this dogma may be changing. Surgery may be the treatment option of choice even for asymptomatic patients to prevent complications or extension of the defect into the abdominal wall.¹²⁻¹⁴

This case represents a rare fulminant and atraumatic complication of violent and pervasive coughing. Initially, there was evidence of only unilateral lung herniation which we believe may have contributed to a systemic inflammatory response with contralateral lung injury followed by several ICU complications. We believe that lung injury due to extra-thoracic herniation was complicated by ventilator-induced lung injury. The mechanism of this process relates to cyclical stretching of alveoli which leads to an ensuing cascade of inflammatory processes that are associated with cytokine upregulation.¹⁵ The subsequent leukocyte attraction and activation of polymorphonuclear neutrophils (PMNs) from elevated levels of proinflammatory cytokines including tumor necrosis



factor alpha (TNF)- α , interleukin (IL)-6, IL-8, and IL-1 β which are produced by bronchial, bronchiolar, and alveolar epithelial cells may have led to a systemic inflammatory response and multiple organ dysfunction syndrome (MODS).^{15,16} Furthermore, due to the direct mechanical trauma to the lung parenchyma from herniation, a state of alveolar leakage of proteins may have led to some degree of surfactant dysfunction exaggerating the lung injury.¹⁵ Ventilation and oxygenation were very challenging due to development of bilateral lung injury. While surgery is advised in cases of symptomatic lung herniation, given the patient's multiple co morbidities he was deemed to be a poor surgical candidate.

To the best of our knowledge, this is the first report of unilateral spontaneous lung herniation associated with contralateral acute lung injury. We propose that patients with lung herniation who require mechanical ventilation may benefit from early surgical intervention to reduce the inflammatory response that can predispose to contralateral lung injury, thus minimizing morbidity and mortality.

Disclosures

This manuscript has been read and approved by all authors. This paper is unique and not under consideration by any other publication and has not been published elsewhere. The authors and peer reviewers report no conflicts of interest. The authors confirm that they have permission to reproduce any copyrighted material.

References

1. Sonett JR, O'Shea MA, Caushaj PF, Kulkarni MG, Sandstrom SH. Hernia of the lung: case report and literature review. *Ir J Med Sci.* 1994;163(9):410–2.
2. Munnell ER. Herniation of the lung. *Ann Thorac Surg.* 1968;5(3):204–12.
3. Psathakis K, Mermigkis C, Tsintiris K. Transient lung herniation through a thoracic cage defect: a case report. *Cases J.* 2009;2:7524.
4. Bhalla M, Leitman BS, Forcade C, et al. Lung hernia: radiographic features. *AJR Am J Roentgenol.* 1990;154(1):51–3.
5. Morel-Lavallee A. Hernies du poumon. *Bulletin et Memoires de la Societe de Medicine de Paris.* 1845;1:75–195.
6. Donato AT, Hipona FA, Navani S. Spontaneous lung hernia. *Chest.* 1973;64(2):254–6.
7. Tack D, Wattiez A, Schtickzelle JC, Delcour C. Spontaneous lung herniation after a single cough. *Eur Radiol.* 2000;10(3):500–2.
8. Ross RT, Burnett CM. Atraumatic lung hernia. *Ann Thorac Surg.* 1999;67(5):1496–7.
9. Jastrow KM, Chu D, Jaroszewski D, Huh J, Bakaeen F. Posterior lung herniation after a coughing spell: a case report. *Cases J.* 2009;2(1):86.
10. Habib A, Elsayed H, Dhanji AA, Wood A. Spontaneous combined lung and bowel hernia following an episode of acute bronchitis. *Interact Cardiovasc Thorac Surg.* 2010;10(6):1042–3.
11. Folz RJ, Piantadosi CA, Folz EK. Spontaneous intercostal bulge. *Postgrad Med J.* 1998;74(869):179–81.
12. Brock MV, Heitmiller RF. Spontaneous anterior thoracic lung hernias. *J Thorac Cardiovasc Surg.* 2000;119(5):1046–7.
13. Sloth-Nielsen J, Jurik AG. Spontaneous intercostal pulmonary hernia with subsegmental incarceration. *Eur J Cardiothorac Surg.* 1989;3(6):562–4.
14. Sulaiman A, Cottin V, De Souza Neto EP, et al. Cough-induced intercostal lung herniation requiring surgery: Report of a case. *Surg Today.* 2006;36(11):978–80.
15. Halbertsma F, Vaneker, M, Scheffer GJ, et al. Cytokines and biotrauma in ventilator-induced lung injury: a critical review of the literature. *Netherlands: The Journal of Medicine.* 2005;63(10):382–92.
16. Wilson W, Grande C, Hoyt D. Volume 2. Trauma: Critical Care. Informa Health Care, New York, NY: 2007.

Publish with Libertas Academica and every scientist working in your field can read your article

"I would like to say that this is the most author-friendly editing process I have experienced in over 150 publications. Thank you most sincerely."

"The communication between your staff and me has been terrific. Whenever progress is made with the manuscript, I receive notice. Quite honestly, I've never had such complete communication with a journal."

"LA is different, and hopefully represents a kind of scientific publication machinery that removes the hurdles from free flow of scientific thought."

Your paper will be:

- Available to your entire community free of charge
- Fairly and quickly peer reviewed
- Yours! You retain copyright

<http://www.la-press.com>