Radiology Case Reports

Volume 5, Issue 4, 2010

Pulmonary interstitial emphysema in an adult with metastatic choriocarcinoma

Garrett Colby, MD, and Christian Cox, MD

Although typically seen in neonates, barotrauma is a well-established complication of mechanical ventilation in other populations as well, particularly associated with the use of high peak pressures and continuous positive airway pressure. Complications range from subpleural bleb development to life-threatening pneumothorax. We report a case of barotrauma in an adult that initially presented as pulmonary interstitial emphysema; it was seen surrounding choriocarcinoma metastases during computed tomography evaluation for worsening respiratory distress.

Introduction

Pulmonary interstitial emphysema (PIE) is a rare presentation of barotrauma in adults. As with all barotrauma, mechanical ventilation leads to hyperinflation of the lungs, resulting in alveolar rupture. Most commonly, the air dissects centrally into the mediastinum and subsequently the subcutaneous tissue, where it can often be diagnosed by conventional radiography. In addition, pneumomediastinum can extend into the pleural space or retroperitoneum, leading to pneumothorax or pneumoretroperitoneum, respectively. PIE can also occur if air collects along the perivascular spaces. Most commonly seen in neonates who develop respiratory distress syndrome (RDS), PIE is seen infrequently in adult patients. We report a case of PIE diagnosed in an adult patient who was undergoing computed tomography (CT) evaluation for worsening respiratory distress. The findings of PIE were made obvious only by the presence of numerous pulmonary metastases from the patient's underlying testicular choriocarcinoma.

Citation: Colby G, Cox C. Pulmonary interstitial emphysema in an adult with metastatic choriocarcinoma. *Radiology Case Reports*. (Online) 2010;5:331.

Dr. Colby is a radiology resident at Tripler Army Medical Center, US. Dr. Cox is staff radiologist in the Department of Radiology at Madigan Army Medical Center, US. Contact Dr. Cox at christian.cox@amedd.army.mil.

Competing Interests: The authors have declared that no competing interests exist.

DOI: 10.2484/rcr.v5i3.331

Case report

A 38-year-old male with metastatic choriocarcinoma was referred to our department from the intensive care unit for evaluation of worsening respiratory distress with noncontrast computed tomography (CT) of the chest. The patient was mechanically ventilated for worsening acute respiratory distress syndrome (ARDS), and a chest tube had recently been placed for pleural effusion. Self-removal of the chest tube had resulted in a small pneumothorax and subcutaneous emphysema, which had been discovered the day before the CT examination. However, the precise etiology of the ARDS was unknown. Possibilities included increasing pulmonary metastatic disease, pulmonary embolism, bleomycin toxicity, pneumonia, and/or worsening pneumothorax.

Using a General Electric Lightspeed Pro 16-slice CT scanner, helical imaging was performed without the use of contrast. Reformations were done in both the transverse and coronal planes at 5-mm intervals. The CT examination again demonstrated numerous metastatic pulmonary nodules as well as the airspace and interstitial opacities concerning for infection (Fig. 1). However, these findings had not significantly changed since a CT pulmonary angiogram obtained nine days before (Fig. 2). As compared to the recent chest radiographs, the small pneumothorax and subcutaneous emphysema were also without change. However, there had been interval development of concentric lucencies surrounding many of the metastatic nodules. In addition, there were very subtle areas of perivascular lucencies (Fig. 1).

As the pneumothorax was attributable to the recent, unexpected removal of the chest tube, before this CT examination there had been no suspicion—either clinically or

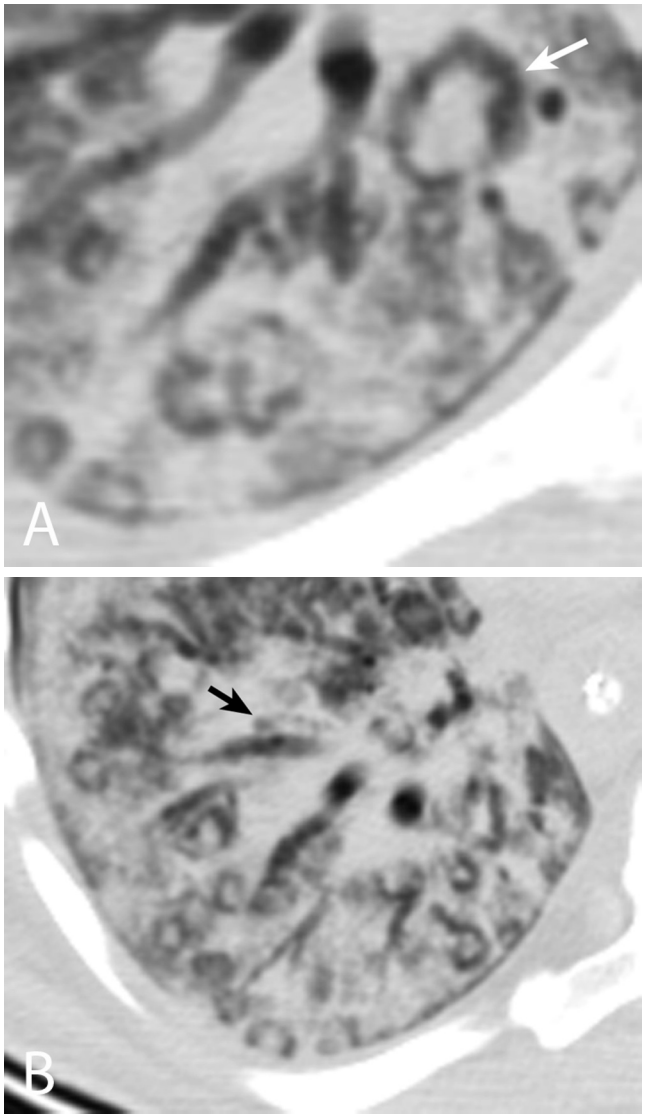

Figure 1. 38-year-old male with metastatic choriocarcinoma. A. Coned-down transverse CT image of the lung demonstrates lucent halos surrounding numerous nodules, predominantly seen in the right lower lobe, indicating pulmonary interstitial emphysema. B. A perivascular lucency can also be seen adjacent to a right lower lobe bronchus, also indicating the presence of interstitial gas.

radiographically—for barotrauma. These findings of pulmonary interstitial emphysema were conveyed to the patient's providers. However, due to continuing respiratory distress, the ventilator settings could not be adjusted. The patient went on to develop massive barotrauma. A CT examination performed one week later demonstrated severe subcutaneous emphysema, pneumomediastinum, and pneumoperitoneum (Fig. 3). A pneumothorax persisted despite the presence of three chest tubes.

Discussion

Barotrauma secondary to mechanical ventilation is caused by development of a pressure gradient between the alveoli and the pulmonary interstitium, eventually leading to alveolar rupture with dissection of air into the bronchovascular bundles and interlobular septa (1). Influencing factors include the time course of mechanical ventilation as well as peak airway pressures greater than 30 cm of water (2). In addition, the condition of the lung parenchyma plays an important role. The severity of ARDS and the presence of underlying chronic lung disease can weaken the interstitium, increasing the likelihood of rupture (1).

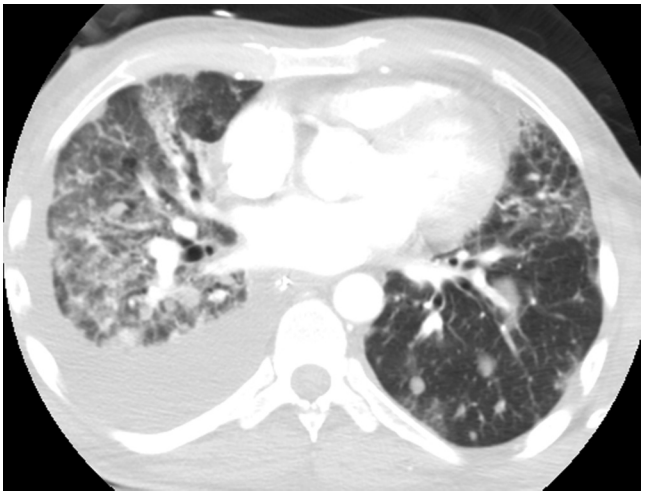

Figure 2. 38-year-old male with metastatic choriocarcinoma. Transverse CT image from a CT pulmonary angiogram obtained 9 days prior. Again demonstrated are the numerous pulmonary nodules of metastatic choriocarcinoma. However, the lucent halos are absent. Also seen is the large right pleural effusion for which a chest tube was placed, leading to the initial, trace pneumothorax.

Once in the interstitium, the air follows a low-pressure gradient centrally into the mediastinum—a process known as the Macklin effect (2). From the mediastinum, the air can continue to dissect into areas of relative low pressure to include the subcutaneous tissues, the pleural space, or even the retroperitoneum (1). If large enough, pneumomediastinum and/or pneumothorax are potentially life-threatening. Therefore, as it is the initial sign of barotraumas (3), the early detection of PIE can prevent the development of additional, possibly fatal, complications. Additionally, PIE—even in the absence of additional barotrauma—can disrupt pulmonary perfusion and ventilation (4) as well as predispose the patient to secondary infection (3).

Although PIE is the first manifestation of barotrauma, it is rarely diagnosed radiologically. That is due, in part, to its transient nature. Interstitial air quickly passes to the mediastinum or is reabsorbed (3). Moreover, imaging findings by conventional radiography are subtle and difficult to detect.

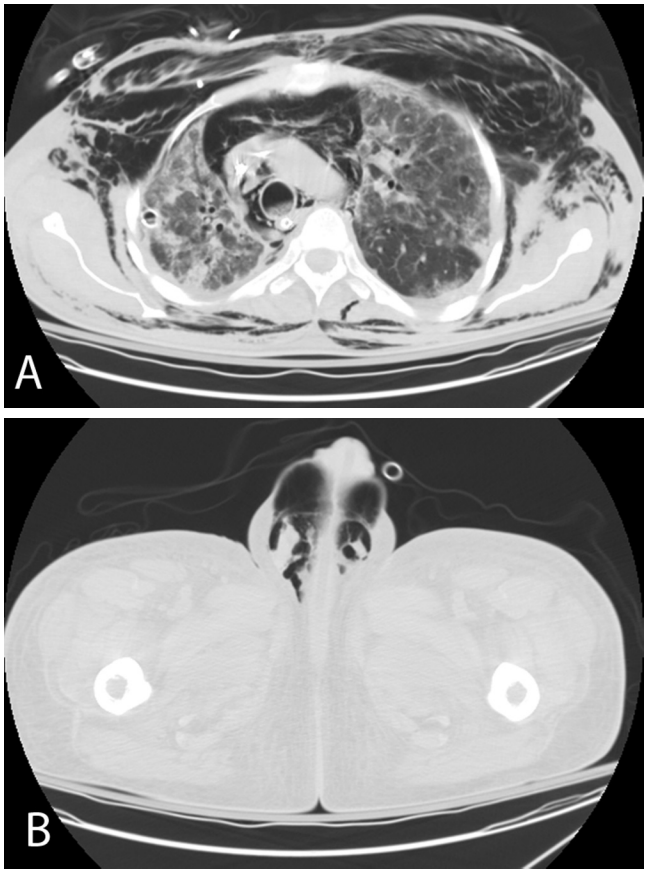

Figure 3. 38-year-old male with metastatic choriocarcinoma. A. Transverse CT images of the chest and mediastinum obtained seven days later demonstrate interval development of severe pneumomediastinum and massive subcutaneous emphysema. B. The subcutaneous emphysema has dissected inferior into the inguinal canals and scrotum.

The presence of underlying lung disease and subcutaneous emphysema adds to the difficulty (1). When present, conventional radiographic findings include parenchymal and subpleural cysts, perivascular halos, intraseptal air, and linear lucencies extending to the mediastinum (2). CT findings are more readily identifiable and include air tracking along the bronchovascular sheaths (5), parenchymal stippling, and cysts (3).

In this case, the otherwise subtle findings of PIE were highlighted by the presence of metastatic nodules centered within the pulmonary interstitium. Rather than being absorbed rapidly or dissecting promptly to the mediastinum, the air instead collected around the nodules, resulting in a characteristic lucent halo. This allowed the diagnosis of PIE as an early manifestation of barotrauma. Although the development of severe pneumomediastinum and pneumothorax could not be prevented in this patient, this case emphasizes the need for the radiologist to remain vigilant in the detection of PIE in mechanically ventilated patients so as to avoid progression to potentially life-threatening complications.

References

1. Macia I, Moya J, et al. Spontaneous pneumomediastinum: 41 cases. *Euro J of Cardio-Thor Surg*. 2007; 31(6): 1110-1114. [PubMed]
2. Thoongsuwan N, Stern EJ. Pulmonary interstitial emphysema. *Current Problems in Diagnostic Radiology*. 2002; 31(2): 63-64. [PubMed]
3. Satoh K, Kobayashi T, et. Al. CT Appearance of Interstitial Pulmonary Emphysema. *J Thorac Imaging*. 1995; 11: 153-154. [PubMed]
4. Kemper AC, Steinberg KP, and EJ Stern. Pulmonary interstitial emphysema: CT Findings. *AJR*. 1999; 172: 1642. [PubMed]
5. Demura Y, Ishizaki T, et al. Persistent diffuse pulmonary interstitial emphysema mimicking pulmonary emphysema. *Thorax*. 2007; 62: 652. [PubMed]