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The Clinical Picture

A 47-year-old man with chest and neck pain

He had COPD and smoking history of 50 pack-years

FIGURE 1. Nasopharyngeal radiography shows bilateral extensive subcutaneous emphysema, more on the right side.

FIGURE 2. Lateral nasopharyngeal radiography shows air-tracking within the mediastinum and into the retropharyngeal space (arrow).

A 47-year-old man presented with acute shortness of breath and chest and neck pain, which began after he heard popping sounds while boarding a bus. The pain was right-sided, sharp, worse with deep breathing, and associated with a sensation of fullness over the right chest.

His medical conditions included controlled hypertension, gastroesophageal reflux disease, and chronic obstructive pulmonary disease (COPD). The COPD was managed with an albuterol inhaler only. He had a 50-pack-year history of smoking, and he drank alcohol occasionally.

On arrival, he was in mild respiratory distress, but his vital signs were stable. We could hear wheezing on both sides of his chest and feel subcutaneous crepitation on both sides of his chest and neck, the latter more on the right side. The rest of the examination was unremarkable.

Results of a complete blood cell count and metabolic panel were within normal limits. Because of the above findings, nasopharyngeal radiogragraphy was ordered (**FIGURES 1 AND 2**).

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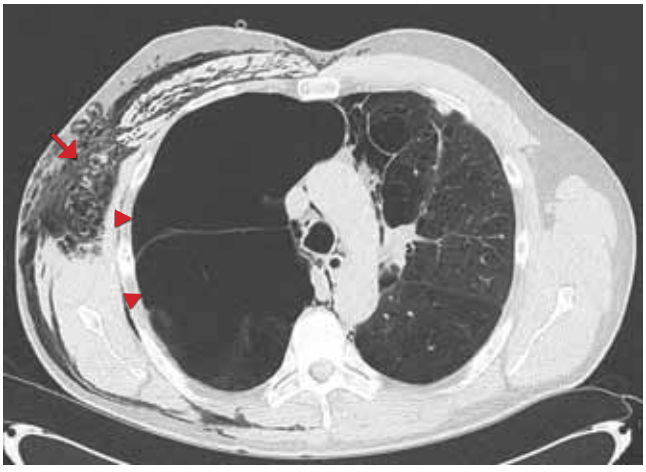

FIGURE 3. Computed tomography of the chest shows extensive subcutaneous emphysema of the right lateral chest wall (arrow), large bullae in the right upper lobe (arrowheads), and pneumomediastinum.

FIGURE 4. Chest radiography 3 weeks after bullectomy shows improvement of subcutaneous emphysema, with persistent, extensive, bilateral pulmonary emphysema.

Q: What is the most likely cause of this presentation?

- ☐ Esophageal rupture
- ☐ Gas gangrene
- ☐ Asthma exacerbation
- ☐ Ruptured emphysematous bullae

A: This patient had a history of COPD, which put him at risk of developing bullous emphysematous bullae that can rupture and cause subcutaneous emphysema. His nasopharyngeal radiograph (**FIGURE 1**) showed bilateral extensive subcutaneous emphysema. His lateral nasopharyngeal radiograph (**FIGURE 2**) showed air-tracking within the mediastinum and into the retropharyngeal space (arrow). Computed tomography (**FIGURE 3**) showed extensive subcutaneous emphysema in the right lateral chest wall (arrow) and large bullae in the right upper lobe (arrow heads). As for the other possibilities:

Esophageal ruptures and tears are iatrogenic in most cases and usually occur after endoscopic procedures, but they can also occur in patients with intractable vomiting. Computed tomography often shows esophageal thickening, periesophageal fluid, mediastinal widening, and extraluminal air. However, in most cases, it is seen as pneumomediastinum and subcutaneous emphysema.[1]

Gas gangrene is a life-threatening soft-tissue and muscle infection caused by *Clostridium perfringens* in most cases.[2] The pain is out of proportion to the findings on physical examination. Patients usually have toxic signs and symptoms such as fever and hypotension. Our patient was hemodynamically stable, with no changes in skin color.

Severe exacerbations of asthma can lead to alveolar rupture, pneumothorax, and subcutaneous emphysema, although this is a rare complication. Air can dissect along the bronchovascular sheaths into the neck and cause subcutaneous emphysema, or into the pleural space and cause pneumothorax. Our patient had no history of asthma and plainly had emphysematous bullae.[3]

Subcutaneous emphysema can resolve spontaneously, but serious cases call for surgery

SUBCUTANEOUS EMPHYSEMA

Subcutaneous emphysema is a collection of air within subcutaneous tissues. It usually presents as bloating of the skin around the neck and the chest wall. It is often seen in patients with pneumothorax.

The most common cause of subcutaneous emphysema is traumatic injury to the chest wall, such as from a motor vehicle accident or a stab wound,[4] but it can also occur spontaneously in patients who have severe emphysema

with large bullae. As the emphysema progresses, the bullae can easily rupture, and this can lead to pneumothorax, which can lead to subcutaneous emphysema. Primary spontaneous pneumothorax and subcutaneous emphysema can occur in people who have unrecognized lung disease and genetic disorders such as Marfan syndrome and Ehler-Danlos syndrome.[5] Other causes include iatrogenic injury, *Pneumocystis jirovecii* pneumonia (common in patients with human immunodeficiency virus infection), and cystic fibrosis. Pneumothorax occurs in about 30% of cases of *P jirovecii* pneumonia,[6] and in about 6% of patients with cystic fibrosis.[7] Bronchocutaneous fistula is an extremely rare complication of lung cancer and can cause subcutaneous emphysema.[8] Tuberculosis is another possible cause.[9]

Subcutaneous emphysema mainly presents with chest or neck pain and wheezing. In severe cases, air can track to the face, causing facial swelling and difficulty breathing due to compression of the larynx. Also, it can track down to the thighs, causing leg pain and swelling.[10]

On examination, subcutaneous emphysema can be detected by palpating the chest wall, which causes the air bubble to move and produce crackling sounds. Most cases of subcutaneous emphysema are diagnosed clinically. Chest radiography and computed tomography help identify the source of air leak. Ultrasonography is usually used in cases of blunt trauma to the chest as part of the Focal Assessment With Sonography for Trauma protocol.[11]

Subcutaneous emphysema can resolve spontaneously, requiring only pain management and supplemental oxygen.[12] In severe cases, air collection can lead to what is called "massive subcutaneous emphysema," which requires surgical drainage.

Our patient had large emphysematous bullae in the apical region of the right lung that ruptured and led to subcutaneous emphysema. After placement of a chest tube, he underwent right-sided thoracotomy with bullectomy. His postoperative course was uneventful, and he was discharged a few days later. Three weeks later, repeated chest radiography showed resolution of his subcutaneous emphysema (**FIGURE 4**).

REFERENCES

1. **White CS, Templeton PA, Attar S**. Esophageal perforation: CT findings. AJR Am J Roentgenol 1993; 160:767–770.
2. **Aggelidakis J, Lasithiotakis K, Topalidou A, Koutroumpas J, Kouvidis G, Katonis P**. Limb salvage after gas gangrene: a case report and review of the literature. World J Emerg Surg 2011;6:28.
3. **Romero KJ, Trujillo MH**. Spontaneous pneumomediastinum and subcutaneous emphysema in asthma exacerbation: the Macklin effect. Heart Lung 2010; 39:444–447.
4. **Peart O**. Subcutaneous emphysema. Radiol Technol 2006; 77:296.
5. **Chiu HT, Garcia CK**. Familial spontaneous pneumothorax. Curr Opin Pulm Med 2006; 12:268–272.
6. **Sepkowitz KA, Telzak EE, Gold JW, et al**. Pneumothorax in AIDS. Ann Intern Med 1991; 114:455–459.
7. **Flume PA, Strange C, Ye X, Ebeling M, Hulsey T, Clark LL**. Pneumothorax in cystic fibrosis. Chest 2005; 128:720–728.
8. **Yalçinkaya S, Vural AH, Göncü MT, Özyazicioglu AF**. Cavitary lung cancer presenting as subcutaneous emphysema on the contralateral side. Interact Cardiovasc Thorac Surg 2012; 14:338–339.
9. **Shamaei M, Tabarsi P, Pojhan S, et al**. Tuberculosis-associated secondary pneumothorax: a retrospective study of 53 patients. Respir Care 2011; 56:298–302.
10. **Sherif HM, Ott DA**. The use of subcutaneous drains to manage subcutaneous emphysema. Tex Heart Inst J 1999; 26:129–131.
11. **Wilkerson RG, Stone MB**. Sensitivity of bedside ultrasound and supine anteroposterior chest radiographs for the identification of pneumothorax after blunt trauma. Acad Emerg Med 2010; 17:11–17.
12. **Mattox KL, Allen MK**. Systematic approach to pneumothorax, haemothorax, pneumomediastinum and subcutaneous emphysema. Injury 1986; 17:309–312.

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