

## CASE REPORT

## General Medicine

# Extensive subcutaneous emphysema treated with subcutaneous angiocatheters

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**Funding and support:** By *JACEP Open* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see [www.icmje.org](http://www.icmje.org)). The authors have stated that no such relationships exist.

All listed authors contributed to the preparation of this manuscript.

This material has not been previously presented.

**Abstract**

Subcutaneous emphysema (SCE) seen in the emergency department is usually the result of traumatic chest injuries, surgical complications, or invasive airway procedures. SCE is usually a self-limiting phenomenon involving the chest wall and neck, though may progress to involve the deeper tissues leading to respiratory and cardiovascular compromise. Emergent intervention is indicated in such cases of extensive SCE, though the ideal approach to its management is not known. We report a case of successful decompression of extensive SCE using subcutaneous placement of angiocatheters.

**KEYWORDS**

extensive subcutaneous emphysema, massive subcutaneous emphysema, subcutaneous emphysema

## 1 | INTRODUCTION

Subcutaneous emphysema (SCE) is defined as the air underneath the dermal layers of skin.<sup>1</sup> SCE is often the result of invasive airway procedures, traumatic chest injuries, or surgical complications. Of significance to emergency physicians is that 3% to 10% of intubated patients will experience barotrauma and approximately 20% of chest tubes placed will result in SCE.<sup>2,3</sup> Although typically a self-limiting condition involving the chest wall and neck, SCE may progress to involve deeper structures, possibly resulting in impairment of respiration and cardiovascular compromise.<sup>4</sup> Emergent intervention is indicated in such cases of extensive SCE. Interventions described for the treatment of extensive SCE have included various surgical drainage techniques, though the ideal approach to its management is not known.<sup>5-8</sup> In this case report, we describe the successful decompression of extensive SCE using subcutaneous placement of angiocatheters.

Supervising Editor: Faheem Guirgis, MD.

## 2 | CASE

A 62-year-old man presented to the emergency department (ED) complaining of progressive neck swelling with difficulty swallowing and voice change over the previous 3 days. The symptoms had begun after removal of a pigtail catheter that had been placed for treatment of a pneumothorax incurred during the percutaneous biopsy of a right lung mass. On physical examination, he was in obvious discomfort with extensive tissue distension and subcutaneous crepitus of the neck and chest wall. His voice was high pitched and muffled. Computed tomography of his chest and neck revealed extensive SCE of the anterior chest wall with pneumomediastinum and a small residual right pneumothorax. The SCE extended into several deep soft tissues of the neck, including the retropharyngeal space to the level of the skull base (Figure 1).

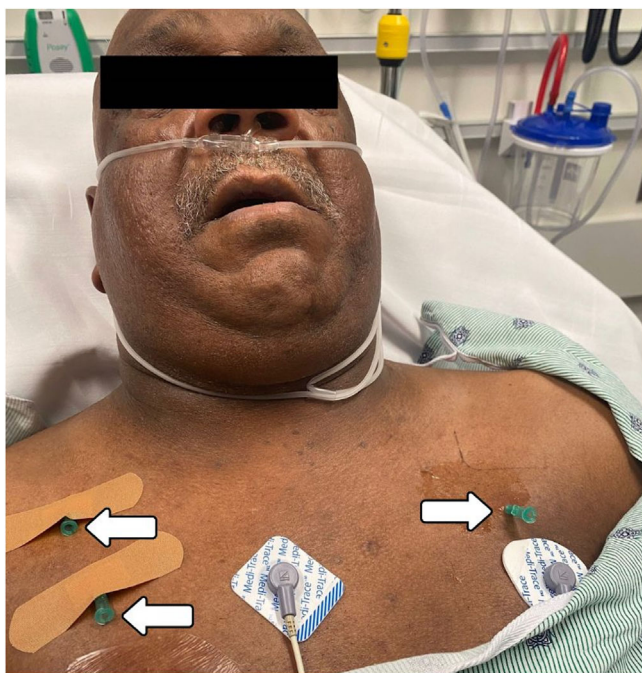
Three 18-gauge angiocatheters were placed into the subcutaneous tissue of his anterior chest wall in an attempt to reverse the progression of his symptoms (Figure 2), and massage of the chest wall was

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**FIGURE 1** Computed tomography showing extensive subcutaneous emphysema of the anterior chest wall (white arrow) extending into the soft tissues of the neck including the retropharyngeal space (black arrow) with resultant compression of the hypopharynx.



**FIGURE 2** The patient after placement of three subcutaneous angiocatheters in the anterior chest wall (arrows).

performed to enhance decompression of the SCE. The patient was admitted to the hospital and reported significant improvement of his symptoms within hours of placement of the angiocatheters. On hospital day 2 the patient's voice returned to normal, and chest x-ray showed decrease in the size of the right-sided pneumothorax without chest tube placement. The angiocatheters were removed and he was discharged home on hospital day 3 in good condition.

### 3 | DISCUSSION

There are several reported noninfectious causes of SCE, with traumatic injuries, pneumothorax with background chronic obstructive pulmonary disease, iatrogenic causes related to surgical procedures, and barotrauma being the most common.<sup>4</sup> It is estimated that approximately 77% of patients who undergo laparoscopic procedures will develop SCE, although not always clinically detectable.<sup>1</sup> The subcutaneous air can travel along pressure gradients, spreading to the head, neck, chest, and abdomen by connecting fascial and anatomic planes. Patients undergoing positive pressure mechanical ventilation are at increased risk for this phenomenon.<sup>1</sup> The terms "extensive subcutaneous emphysema" and "massive subcutaneous emphysema" have been used to describe SCE causing palpable cutaneous tension, palpebral closure, pneumoperitoneum, dysphonia, or dysphagia.<sup>9,10</sup> Left untreated, this condition can progress to airway compromise, impaired ventilation, tissue necrosis, obstructed venous return from the head and neck, and pneumomediastinum resulting in cardiac tamponade.<sup>1,5,9,10</sup> In this case, endotracheal intubation could have been performed in light of the known presence of air in the retropharyngeal space and the patient's symptoms of airway compromise. However, positive pressure ventilation would likely have worsened the SCE and pneumothorax.

The presence of extensive SCE warrants emergent intervention to decompress the subcutaneous tissue.<sup>4-7</sup> Several novel techniques have been described to achieve this goal, each with advantages and disadvantages. Placement of subcutaneous thoracotomy tubes, pigtail catheters, Penrose drains, and Jackson-Pratt drains have all been described in the treatment of extensive SCE.<sup>3,4,6-8,9,11</sup> Blowhole skin incisions with and without overlying negative pressure wound therapy devices have also been described.<sup>4,7,10-13</sup> Kiefer et al. described successful resuscitation during a cardiac arrest caused by extensive SCE by cutting "gills" in the anterior chest wall to release the SCE.<sup>14</sup> Compressive massage may also be used to expedite evacuation of the SCE.<sup>4,11</sup> Controlling the source of air entering the subcutaneous space is necessary in the treatment of extensive SCE and can be achieved with the placement of a chest tube in the presence of pneumothorax.<sup>4,6</sup> As with our patient, a chest tube may not be necessary with small pneumothoraces of less than 20% of the pleural space.<sup>6</sup> High-flow oxygen is a well-described adjunct treatment of extensive SCE, facilitating resorption of nitrogen and diffusion of gas particles from the distended tissues.<sup>1,4</sup>

Johnson et al attempted to determine which technique achieved maximal resolution of extensive SCE—infraclavicular skin incisions, subcutaneous drain insertion, or suction on in situ chest drains, and concluded that without comparative studies, no definite conclusion could be reached.<sup>11</sup> Use of subcutaneous angiocatheters, both plain and fenestrated, in the treatment of extensive SCE is not unprecedented.<sup>4,9,15,16</sup> Unlike other described techniques, plain angiocatheters are readily available in the ED, their use is minimally invasive, and there is no need for other equipment.

## 4 | CONCLUSION

Although rare, extensive SCE is a potentially life-threatening condition that requires emergent intervention. Several techniques have been described to facilitate the rapid decompression of the subcutaneous tissue in extensive SCE. Subcutaneous placement of angiocatheters offers a simple, effective, and minimally invasive means to achieve this goal.

## ACKNOWLEDGMENTS

No financial support was used in the preparation of this manuscript.

## CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to report.

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**How to cite this article:** Carleton L, Eilbert W, Grant R. Extensive subcutaneous emphysema treated with subcutaneous angiocatheters. *JACEP Open*. 2023;4:e13054. <https://doi.org/10.1002/emp2.13054>