



Massive Subcutaneous Emphysema After Multiple Tracheal Intubation

Ching Chih Liu^{1,2,*}

¹Department of Emergency and Critical Medicine, Fu Jen Catholic University Hospital, College of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan

²Department of Emergency Medicine, Taiwan Adventist Hospital, Taipei, Taiwan

Early confirmation of tracheal injury is crucial while encountering massive subcutaneous emphysema in emergency department to prevent patients from serious morbidity or mortality. Clinicians often underestimate the difficulty of tracheal intubation, especially for inexperienced physician. We highlight that the use of video laryngoscopy-assisted tracheal intubation or ultrasound for difficult airway management. An 80-year-old woman presented to emergency department because of diffuse subcutaneous emphysema in her chest and neck after multiple attempts of intubation. Subcutaneous crepitus was palpated in the chest and neck. The chest X-ray showed diffuse subcutaneous emphysema in chest wall and neck. The computed tomography revealed paratracheal air, focal defect at right posterior aspect of lower trachea and subcutaneous emphysema, pneumomediastinum and pneumoretroperitoneum. Bronchoscopy demonstrated the presence of 2 cm in length longitudinal laceration wound above the carina. She refused surgical intervention and was treated conservatively. Most patients with tracheal injury may present with subcutaneous emphysema and respiratory distress. Diagnosis could be made based on the findings of computed tomography and bronchoscopy examination. Early recognition could prompt surgical intervention and empirical antibiotics administration to preclude immediate acute respiratory distress.

Key words: *subcutaneous emphysema, tracheal injury, computed tomography, bronchoscopy*

Case Report

An 80-year-old woman with known history of asthma presented to a suburban hospital with respiratory failure. She was transferred to our emergency department because of diffuse subcutaneous emphysema in her chest and neck after multiple attempts of intubation. Vital signs were as follows: blood pressure = 98/61 mmHg; pulse rate = 121 beats/min; respiratory rate = 31 breaths/min; body temperature = 38°C.

Physical examination showed diffuse palpable subcutaneous crepitus in the chest and neck. Supine anteroposterior chest radiograph showed diffuse subcutaneous emphysema in chest wall and neck (Fig. 1).

Laboratory results were remarkable for leukocytosis of white blood cell (WBC) = 16,250/mm³. Arterial blood gas analysis with non-rebreather mask 100% oxygen revealed pH = 6.8, HCO₃ = 35.2 mmol/L, partial pressure of CO₂ (pCO₂) = 192.7 mmHg, partial pressure of O₂ (pO₂) = 41.1 mmHg. Prompt video tracheal intubation was preformed, and computed tomography (CT) revealed paratracheal air, focal defect at right posterior aspect of lower trachea and severe subcutaneous emphysema in thoracic and upper abdominal walls, pneumomediastinum and pneumoretroperitoneum (Fig. 2). Emergent bronchoscopy demonstrated the presence of 2 cm in length longitudinal laceration wound above the carina (Fig. 3). She

Received: October 13, 2017; Revised: December 19, 2017; Accepted: February 8, 2018.

*Corresponding author: Ching Chih Liu, Department of Emergency and Critical Medicine, Fu Jen Catholic University Hospital, College of Medicine, Fu Jen Catholic University, No. 69, Guizi Rd., Taishan Dist., New Taipei City 243, Taiwan. E-mail: jamesliu1223@gmail.com

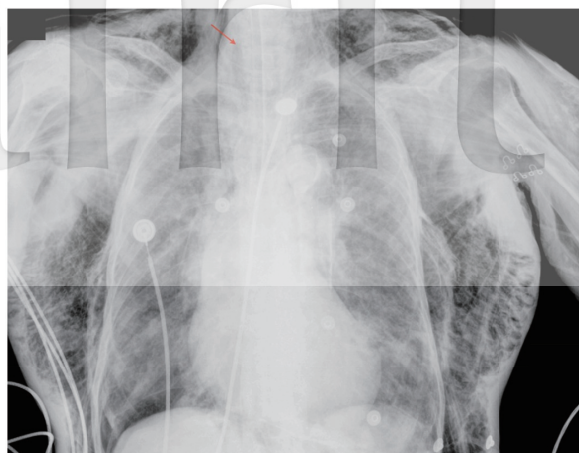


Fig. 1. Supine anteroposterior chest radiography shows pneumomediastinum (arrow) and diffuse subcutaneous emphysema in chest wall and neck.

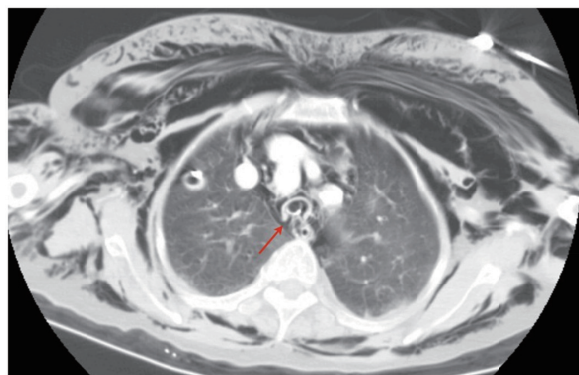


Fig. 2. Computed tomography (lung window) shows subcutaneous emphysema and focal defect at right posterior aspect of lower trachea with paratracheal air (arrow).

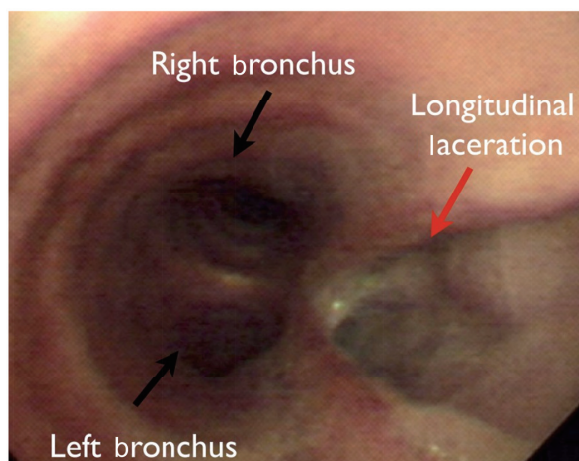


Fig. 3. The bronchoscope showing a 2 cm in length longitudinal laceration above the carina (red arrow).

was admitted to intensive care unit with conservative treatment as surgical intervention was refused.

Discussion

The iatrogenic tracheal injury occurs in one of every 20,000 orotracheal intubation, and 15% of all cases encountered in emergency department practices.¹ The potential circumstances for the iatrogenic tracheal rupture include multiple intubation attempts, improper tube size, use of a stylet, or malposition of the tube such as tracheal tube protruding beyond the tip of the tube.¹ The risk factors that contribute to subcutaneous emphysema include multiple forced attempts, inexperience of clinician, overinflation of the cuff, congenital tracheal abnormalities, advanced age, and female sex. When comparing emergency intubation with elective intubation, there is a three-fold increasing risk of death.^{2,3} Most of them died of immediate acute respiratory distress or subsequently secondary infection.

Therefore, early recognition could prompt surgical intervention and empirical antibiotics administration to prevent further morbidity. CT scan should be chosen initially for early diagnosis, as having 85% sensitivity for detecting tracheal tear, and providing additional information such as degree of pneumothorax, or pneumoretroperitoneum. Chen et al. reported CT findings in patients with tracheal injury showing paratracheal air in 73% of them, pneumothorax in 76%, pneumoretroperitoneum in 15%, and pneumopericardium in 7%.² Traditionally, surgical repair has been the mainstay treatment of subcutaneous emphysema, but recently more articles showed conservative treatments would benefit more in patients with small rupture, less than 2 cm, and with no air leakage on spontaneous breathing. However, rupture over 2 cm in length remain controversial, and has not yet been reached on consensus. In addition, one systemic review revealed high mortality of surgical repair in critically ill patients, up to 71%.³ To date, the best management of intubation-related tracheal injury was conservative management in less than 2 cm in length. Our patient's bronchoscopy demonstrated the presence of 2 cm in length longitudinal laceration wound above the carina with critical condition. Therefore, surgical approach was indicated but patient refused due to personal reason.

Clinicians often underestimate the difficulty of tracheal intubation, especially for inexperienced phy-

sician. We highlight that the use of video laryngoscopy-assisted tracheal intubation or ultrasound for difficult airway management. Video laryngoscopy may reduce the failed intubation, especially among patients with presenting with difficult airway. Moreover, video laryngoscopy provides better glottic view and reduce laryngeal trauma.⁴ Upper airway ultrasound recently has been applied to emergency daily practice. It is non-invasive, reproducible, and valuable for evaluation of difficult airway management in anatomy distorted patients due to trauma or pathology. Hui and Tsui⁵ showed that using sublingual ultrasound could predict difficult intubation, and this method has a high positive likelihood ratio of 21.6 and negative likelihood ratio of 0.28. This method could alert the clinicians the potential complication they might encounter before intubation.

In summary, massive subcutaneous emphysema is a rare complication from forceful intubation, and carries a high morbidity and mortality. Clinician should be aware this potential complication while intubation, especially in emergency department, hence the increasing risk of death threefold comparing to the elective intubation. Training and education in difficult airway management is important to improved patient safety in emergency situation. Modern technology such as ultrasound and video laryngoscopy may reduce the failed intubation, especially among patients with presenting with difficult airway.

Competing Interests

All the authors declare that they have no competing interests.

Author Contributions

Dr. Liu made the substantive contribution to the design and drafting of the manuscript.

References

1. Chang CY, Cheng SL, Chang SC. Conservative treatment of severe tracheal laceration after endotracheal intubation. *Respir Care* 2011;56:861-862. doi:10.4187/respcare.00891
2. Chen JD, Shanmuganathan K, Mirvis SE, Killeen KL, Dutton RP. Using CT to diagnose tracheal rupture. *AJR Am J Roentgenol* 2001;176:1273-1280. doi:10.2214/ajr.176.5.1761273
3. Miñambres E, Burón J, Ballesteros MA, Llorca J, Muñoz P, González-Castro A. Tracheal rupture after endotracheal intubation: a literature systematic review. *Eur J Cardiothorac Surg* 2009;35:1056-1062. doi:10.1016/j.ejcts.2009.01.053
4. Lewis SR, Butler AR, Parker J, Cook TM, Smith AF. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. *Cochrane Database Syst Rev* 2016;11:CD011136. doi:10.1002/14651858.CD011136.pub2
5. Hui CM, Tsui BC. Sublingual ultrasound as an assessment method for predicting difficult intubation: a pilot study. *Anaesthesia* 2014;69:314-319. doi:10.1111/anae.12598