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## Retropharyngeal air column: a rare complication of tracheostomy

### Odma w przestrzeni zagardłowej: rzadkie powikłanie tracheostomii

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#### Abstract

Although open tracheostomy is considered a relatively safe procedure in otorhinolaryngology, it is not without complications. One of the rare complications of tracheostomy is retropharyngeal emphysema. A 53-year-old woman with bilateral vocal cord palsy underwent emergent open tracheostomy and postoperatively developed violent coughing, tight jaw during chewing, mild neck pain as well as an abnormal sensation of “small bubbles popping underneath her skin.” Careful palpation of the neck revealed crepitus, and lateral cervical radiograph showed extensive subcutaneous emphysema and retropharyngeal air column. A combination of vigorous cough and tight peristomal sutures of the tracheostomy wound was believed to have caused this complication. Conservative management by peristomal suture removal led to near resolution within two weeks.

**Keywords:** subcutaneous emphysema, retropharyngeal air column, complications, tracheostomy

#### Streszczenie

Mimo że tracheostomia techniką otwartą jest uznawana za stosunkowo bezpieczny zabieg otorynolaryngologiczny, nie jest pozbawiona ryzyka powikłań. Wśród rzadkich powikłań tracheostomii wymienia się m.in. odnę w przestrzeni zagardłowej. U 53-letniej pacjentki z obustronnym porażeniem strun głosowych przeprowadzono zabieg tracheostomii techniką otwartą. W okresie pooperacyjnym wystąpiły: gwałtowny kaszel, szczykościsk, łagodny ból szyi, a także objaw opisywany przez pacjentkę jako „pękanie pęcherzyków powietrza pod skórą”. Dokładne badanie palpacyjne szyi wykazało trzeszczenie tkanek (krepitacje). Badanie radiograficzne szyi w projekcji bocznej ujawniło rozległą odnę podskórną w przestrzeni zagardłowej. Za przyczynę wystąpienia powikłania uznano gwałtowny kaszel oraz zbyt mocno zaciśnięte szwy na ranie tracheostomijnej. Leczenie zachowawcze polegające na usunięciu szwów doprowadziło do niemal całkowitego ustąpienia powikłania w ciągu dwóch tygodni.

**Słowa kluczowe:** odma podskórna, odma w przestrzeni zagardłowej, powikłania, tracheostomia

## INTRODUCTION

Subcutaneous emphysema is a known complication following tracheostomy, whereby air is trapped underneath the skin. It can potentially cause compression of the upper airway and great vessels in the upper thorax leading to airway and cardiovascular compromise<sup>(1)</sup>. Subcutaneous emphysema is a rare complication of tracheostomy (1.4%)<sup>(2)</sup>, and the extension of this emphysema to other neck spaces such as retropharyngeal space is even less common. In this paper, we present a case of widespread subcutaneous emphysema and retropharyngeal air column following an emergency tracheostomy in a 53-year-old woman with bilateral vocal cord palsy. We aim to highlight

this unusual complication of tracheostomy, and the importance of cervical imaging to aid the diagnosis.

## CASE PRESENTATION

A 53-year-old obese housewife without comorbidities presented with noisy breathing which had been worsening for the past two years, associated with exertional dyspnoea, hoarseness, voice fatigue, and dysphagia. Otherwise, she did not complain of any neck swelling or nasal symptoms, and had no history of trauma or intubation. On examination, we found biphasic stridor, hoarseness, poor maximum phonation time of 6 seconds, and the presence of laryngeal crepitus. The cough quality was good, and she was able to



Fig. 1. Cervical radiograph showing retropharyngeal air column and subcutaneous emphysema outlining the muscles and fascia of the neck region

count one to ten in a single breath. The laryngoscopic examination showed bilateral vocal cord (abductor) palsy in the paramedian position and bulky bilateral false cords. Other supraglottic structures were normal-looking. The oral examination, nasoendoscopy and otoscopy failed to provide significant findings. The patient underwent emergency tracheostomy under local anaesthesia, immediately followed by laser posterior cordectomy under general anaesthesia.

A day after the operation, she complained of violent coughing, tight jaw during chewing, mild neck pain, and an abnormal sensation of “small bubbles popping underneath her skin” when pressing fingers against her neck. Otherwise, no dyspnoea, pleuritic chest pain or odynophagia were noted. On examination, she was alert, conscious, afebrile, and her vital signs were normal. She was not in respiratory distress. Her face and neck appeared oedematous but non-erythematous, normothermic and non-tender. There was widespread crepitus on palpation surrounding the tracheostomy site, superiorly up to both cheeks and temporal fossae, and inferiorly just below the clavicles and to the upper chest, suggesting extensive subcutaneous emphysema. The tracheostomy tube was *in situ*, with a patent airway and tight peristomal sutures. Otherwise, there was no stridor or trismus, and the cardiopulmonary examination was unremarkable.

The chest radiograph (PA view) obtained showed a relatively clear lung field and no pneumothorax or pneumomediastinum. The most striking feature in the cervical radiograph was the presence of retropharyngeal air column, which indicated massive emphysema extending to the posterior part



Fig. 2. Repeat cervical radiograph showing near-complete resolution of retropharyngeal air column and subcutaneous emphysema

of the neck tissues and planes. Besides the presence of subcutaneous air outlining the muscles and fascia, the retropharyngeal air column extended superiorly to the base of the skull and inferiorly to the thoracic inlet (Fig. 1). The tracheostomy tube was at the level of the vertebral body C7, with the tip of the tracheostomy deep within the trachea. However, a part of the proximal tracheostomy tube, oropharynx and hypopharynx were obscured by the subcutaneous air. The loss of cervical lordosis was also noted.

In the case of the patient, adequate treatment consisted of the immediate removal of the peristomal sutures, close monitoring to detect any sign of infection or respiratory distress, daily measurement of neck circumference, analgesics, nebulised saline, and the application of a heat/moisture exchanger (HME) filter to reduce the cough. Antibiotic therapy was not prescribed in view of stable vital signs and lack of evidence of infection.

The subcutaneous emphysema improved within 24 hours and resolved within five days before the patient was discharged. During the follow-up examination two weeks later, she was asymptomatic with a near-complete recovery, as shown by the repeat cervical radiograph (Fig. 2).

## DISCUSSION

The incidence of retropharyngeal air column (RAC) or retropharyngeal emphysema is unknown. There is more literature reporting subcutaneous emphysema (SE) following percutaneous tracheostomy with the incidence of 1.4%

up to 9%<sup>(2,3)</sup>. A possible mechanisms leading to the development of this complication could involve an injury to the anterior or posterior tracheal wall, excessive dilatation of the anterior tracheal wall, split of the tracheal ring, multiple punctures of the trachea, early introduction of a fenestrated tube or mispositioning of the fenestrated part extraluminally, false tract, dislocation of the tracheostomy tube, and paratracheal placement<sup>(2,4,5)</sup>. Other causes of RAC are iatrogenic (e.g. following a double contrast enema, intubation, dental procedures, and tonsillectomy)<sup>(6-9)</sup>, traumatic (e.g. craniofacial injury, foreign body impaction)<sup>(10)</sup>, infectious (e.g. retropharyngeal abscess)<sup>(11)</sup>, substance abuse (e.g. cocaine, marijuana, heroin and ecstasy)<sup>(12,13)</sup>, and spontaneous (e.g. Boerhaave syndrome and obstructive respiratory problems)<sup>(10,13)</sup>.

SE usually occurs when there is: 1) any disruption of mucosal integrity along the gastrointestinal or respiratory tract, and 2) air being forced into subcutaneous tissue by positive pressure ventilation or Valsalva manoeuvre such as vigorous coughing, vomiting, sneezing, straining and childbirth. In the reported case, there was a breach of the tracheal mucosa by the tracheostomy tube, hence the combination of tight closure of soft tissue peristoma and persistent violent cough by the patient could have forced the air into the subcutaneous region of the neck. The trapped air could not escape via the skin, so it travelled along the path of least resistance which is along the subcutaneous tissue and fascial planes. It has the potential to spread superiorly into the face and pharynx, and inferiorly into the chest wall, mediastinum and pleural cavity<sup>(2)</sup>.

Retropharyngeal space is a potential space bounded superiorly by the base of the skull, anteriorly by the pharynx and oesophagus, posteriorly by the alar layer of deep fascia, laterally by the parapharyngeal space, and inferiorly by the mediastinum (T1–T2)<sup>(11)</sup>. From the anterior, the air in the subcutaneous tissue around the tracheal region could have leaked posteriorly through the parapharyngeal spaces and further extended into the retropharyngeal space, producing an air column (as shown in Fig. 1) via the lateral connection. The clinical importance of the retropharyngeal space is that, in cases involving the spread of descending infection into the mediastinum, it is associated with a high-mortality rate of mediastinitis. The most feared potential sequelae following RAC may include tension pneumothorax, cardiac tamponade, mediastinitis leading to septic shock, air embolism, and airway obstruction<sup>(14)</sup>. Even in a tracheostomised patient, the worst case scenario that can occur is that, if RAC worsens, it can potentially displace or expel the tracheostomy tube out, compromising the airway.

The presentation may vary depending on the cause of RAC, amount or site where most air accumulates. As the air dissects through various fascial planes, the patient may present with severe sore throat, odynophagia, dysphagia, dysphonia, dyspnoea, generalised neck pain, and neck swelling<sup>(13,15)</sup>. The onset can be from hours up to days<sup>(14)</sup>.

Symptoms expected after emergent tracheostomy under local anaesthesia are dysphagia, dysphonia and mild discomfort in the neck region, and it should raise suspicion if the symptoms are accompanied by neck swelling, either with or without pain. Our patient also complained of violent dry cough and tight jaw during chewing. The violent cough could be due to the irritation of the tracheal mucosa when in contact with or rubbing against the tip of the tracheostomy tube. Apart from that, dry cold air from the surrounding atmosphere which comes in contact with the mucosa of the lower respiratory tract may also induce mucosal irritation, hence the cough. The feeling of tight jaw during chewing may indicate that the subcutaneous air might have reached the surrounding tissue of the temporomandibular joint or dissected along the masticator space.

In addition to taking a thorough history, it is crucial to perform a sufficiently detailed physical examination of the patient including palpation of the neck or a suspected area. The presence of crepitus on palpation is pathognomonic of SE, which warrants further investigation to establish the cause, extension of SE or its complications. Besides SE, necrotising fasciitis of the head and neck region caused by a gas-forming organism may also give similar lateral neck radiograph findings. Necrotising fasciitis of the head and neck is rare, usually with rapid progression; the skin appears inflamed with ill-defined border and together with systemic toxicity<sup>(16)</sup>, which is unlikely in this case. The diagnosis of SE can be confirmed by a simple imaging examination such as lateral cervical radiograph. Chest radiograph is necessary to exclude pneumothorax or pneumomediastinum. Retropharyngeal emphysema can be easily mistaken for dilated oesophagus and ignored by junior doctors, as in this case. It is unusual to find a dilated oesophagus in a lateral cervical radiograph of a normal individual. A CT scan can be performed to confirm pneumomediastinum or assess the extent of SE<sup>(17)</sup>. Direct laryngoscopy or bronchoscopy is indicated to check for any tracheal wall injury, especially in cases of percutaneous tracheostomy. In our case, little force was applied to insert the tracheostomy tube into the tracheal lumen, so we did not proceed with endoscopy. Other imaging examinations such as barium swallow are performed in cases of spontaneous retropharyngeal emphysema to rule out any spontaneous oesophageal rupture or foreign body ingestion<sup>(10)</sup>.

The treatment options for SE vary from patient to patient. In general, the treatment for RAC is conservative, with close observation, as the trapped air is usually reabsorbed. Some authors used 100% oxygen to speed up the process of reabsorption<sup>(9)</sup>. However, if decompression is needed, the approach may defer in an “intact neck” and “post-tracheostomy neck.” In an “intact neck,” surgical drains may be required. In contrast, in a “post-tracheostomy neck,” it would be sufficient to remove the peristomal sutures, as shown in this case.

Patients are closely monitored for evidence of infection, respiratory compromise or other subsequent complications. Antibiotics are not routinely given, unless there is evidence of infection or as prophylaxis in wounds suspected of being contaminating with oral bacteria<sup>(14)</sup>, therefore no antibiotic was prescribed in this case. Other supportive treatments include an antitussive, stool softener and anti-emetic, whenever necessary, to avoid Valsalva activities. For patients with severe odynophagia, analgesics and intravenous hydration should be given<sup>(9)</sup>. If indicated, surgical decompression can be done by several techniques – for example by inserting a subcutaneous drain together with active compressive massage from face downward and arms or chest upward, towards the catheter<sup>(1)</sup>. There is no consensus on what drain should preferably be used. The subcutaneous drain can be a trochar-type chest tube (e.g. 20 Fr chest tube)<sup>(1,18)</sup>, silicone Penrose drain with multiple holes<sup>(19)</sup>, Jackson–Pratt drain<sup>(1,18)</sup>, fenestrated angiocatheter<sup>(19)</sup> and Hemovac drain<sup>(18)</sup>. If SE is accompanied by pneumothorax, the first option will be a chest tube, as SE will usually resolve after the pneumothorax is drained out. We did not proceed with any subcutaneous drain because the patient's subcutaneous emphysema showed a significant improvement within 24 hours of removal of the tight peristomal sutures. The expected complete recovery varies from 2 to 14 days<sup>(11,14,20)</sup>. In our case, the signs and symptoms resolved within 5 days, and a near-complete recovery was evidenced by the repeat cervical radiograph during the two-week follow-up. In conclusion, RAC is a rare complication of tracheostomy. Physicians should be aware of this clinical entity and its potential sequelae, able to detect it early, find the possible causes, and manage them accordingly. The diagnosis of SE, and hence RAC, could have been missed if a detailed history and physical examination including palpation of the neck were not performed. Lateral cervical radiograph with chest radiograph were sufficient to detect the SE and RAC in this case. Despite extensive SE and massive retropharyngeal emphysema, it was still manageable with conservative treatment and close observation.

#### Learning points:

- A combination of tight peristomal sutures and vigorous cough post-tracheostomy may result in subcutaneous emphysema, hence they need to be avoided.
- Immediate peristomal suture removal, and treatment with nebulised saline, application of HME filter and analgesics were adequate and life-saving in the reported case.
- Even though retropharyngeal air column is usually self-limiting, it requires close-monitoring for signs of infection, respiratory distress, cardiovascular compromise or subsequent complications.
- Because neck pain, dysphagia and odynophagia are common complaints after tracheostomy, physicians should have a heightened index of suspicion if the symptoms are severe and accompanied by neck swelling or crepitus.
- A chest X-ray together with neck X-ray would be helpful to establish the diagnosis.

#### Conflict of interest

The authors declare that they have no conflict of interest.

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