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Case report

Pneumomediastinum, pneumothorax and subcutaneous emphysema after tracheostomy closure. When less is more

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Abstract. Pneumomediastinum is a threatening complication that might occur after tight surgical closure of tracheostomy is performed. Physiopathology of this condition is based on several factors, including direct trauma to the tracheal wall caused by surgical maneuvers or insufficient closure of soft tissue layers which do not seal air leakage. In this paper we explore this phenomenon by reporting the case of one patient undergoing surgical closure of tracheostomy after two weeks, who later developed subcutaneous emphysema followed by pneumomediastinum. Physiopatology is analyzed and management strategies for this condition are suggested based on our experience. (www.actabiomedica.it)

Key words: Pneumothorax, Pneumomediastinum, Subcutaneous Emphysema, Tracheostomy

Introduction

Pneumomediastinum is often described as a benign condition. However, in some cases, progression into pneumothorax can lead to respiratory impairment. When subcutaneous emphysema occurs in the setting of tracheal manipulation, it may be the first sign observed of airway disruption, and it should raise concern. The prompt identification and the management of such conditions are crucial to ensure patient's safety.

Case Report

We report the case of a 47-year-old woman with impaired performance status (36, 4 Kg - BMI 14,96 kg/m^2) who underwent routine tracheostomy closure and subsequently developed pneumomediastinum, pneumothorax, and subcutaneous emphysema. She had previously undergone a complex surgery for oral squamous cell carcinoma (OSCC) requiring preliminary tracheostomy with the positioning of an endotracheal cannula. The procedure consisted of hemiglossectomy and partial mandibulectomy with bilateral neck dissection and contextual reconstruction with anterolateral thigh (ALT) flap.

In the 14th postoperative day, she was a candidate to routine closure of the tracheostomy. The patient did not present any signs of upper respiratory infection, any underlying pulmonary pathology, chronic cough, or a significant defect in the tracheal wall (> 5 mm) and was deemed to be an appropriate candidate for primary surgical closure of the tracheostomy under local anesthesia.

The procedure was performed according to the "three-layer closure technique"(1): incisions were made around the stomal opening to remove granulation and

fibrin tissue. Superior, lateral and inferior skin flaps were elevated. Strap muscles and soft tissue overlying the trachea were undermined, mobilized, and closed in three layers. Muscles and subcutaneous tissues were closed using absorbable Vicryl 3.0 sutures while the skin was closed using non-absorbable Ethilon 4.0 stitches.

Thirty minutes after the procedure, the patient appeared more agitated and reported significant dyspnea and respiratory distress. Clinical evaluation by the maxillofacial surgeon revealed conspicuous subcutaneous emphysema extending from the upper thorax to the neck and bilateral side of the face. Peripheral saturation, heart rate and blood pressure remained normal at 98%, 90 bpm and 130/70 mmHg, respectively. At patient's physical examination, vesicular murmur sounds were diminished, although present bilaterally.

After opening the previous incision, there was an immediate release of trapped air. Computed tomography (CT) scan of the chest was performed showing large pneumomediastinum with a large right pneumothorax in association with subcutaneous emphysema of the neck, chest, abdomen and right arm (Figure 1).

After thoracic surgeon evaluation, a thoracic drainage was placed in the ipsilateral axillary region. Shortly afterwards, a chest X-ray was taken confirming the correct placement. The next day, in the absence of leakage areas and fluid collection, the drainage was clamped and removed 24 hours later. Chest X-ray showed the bilateral reduction of subcutaneous emphysema and a complete resolution of the pneumomediastinum and pneumothorax. The patient was discharged after one day in stable clinical conditions.

Discussion

In this case, two possible explanations could be considered: 1) direct trauma to the tracheal wall while performing the surgical closure of the defect by various mechanisms, including excessive traction on the trachea and over-tightening of suture knots causing stripping and lacerations of the cartilage wall; 2) inefficient closure of the deep layers, including strap muscles and subcutaneous tissues with air-tight skin closure, allowing the air pressure to take false pathways between neck tissues, resulting in air-entrapment and subcutaneous emphysema.

We performed a literature search in Pubmed and ScienceDirect databases, limiting the search to a period of 10 years using the following query: "tracheostomy AND (pneumomediastinum OR pneumothorax) AND closure". This preliminary search yielded 12 results, but after careful screening of papers performed through abstract reading, only one paper reports pneumothorax after tracheostomy closure in a pediatric patient (2). In the present paper, our aim is to analyze the occurrence of such complication in a case of recently operated patient for OSCC.

Tracheal damage following surgical closure of the tracheostomy can lead to mild consequences, limited to subcutaneous emphysema. However, sometimes complications can be life-threatening. We found little evidence in literature about the pathophysiological mechanism of pneumomediastinum and subcutaneous emphysema following the surgical closure of a tracheostomy (3).

In our case, the more common explanation could be the rupture of the tracheal wall. However, a control CT scan did not show any evidence of it. The Authors deem more reasonable the second hypothesis, according to which deep-layer closure was not performed tightly, allowing the air pressure to pass through less-resistant structures and to reach the subcutaneous loose tissues generating the subcutaneous emphysema with the classical "creeping sound" on palpation.

We believe that a forced expiratory act performed with closed glottis causes a sudden increase of air pressure further enhancing soft tissue detachment. For this patient, in particular, the low body mass index (BMI) of 14.96 kg/m^2 also diminished tissue resistance, allowing even mild air pressures to spread through less resistant sites.

Therefore, in consideration of such complications, especially for fragile patients, we suggest not to proceed with early surgical closure of tracheostomy, but to allow the natural closure of the stoma with progressive fibrosis and collapsing of tissues, limiting an eventual surgical revision to improve the final scar for the aesthetic improvement. A clear example of the concept "less is more".

Figure 1. Chest Computed Tomography (CT) images on the axial (a), coronal (b), and sagittal (c) planes show abundant soft tissue emphysema mainly involving the anterior chest wall, axillae, supraclavicular fossae, lateral cervical regions, and arms. Right pneumothorax (a,b) and pneumomediastinum (b) are also present. Axial (a) and sagittal (c) images well delineate the tracheostomy.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Declarations: This report does not show any personal image of the patient by which the patient is in any way recognizable. All images and data have been anonymized. Approve of Ethics Committees is not required.

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