



Rare Complication Following Use of High-Speed Air Drill During Dental Treatment: Orbital, Mediastinal, and Cervicofacial Subcutaneous Emphysema and Pneumothorax

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Abstract

Subcutaneous facial emphysema following dental procedures is a rare complication resulting from the infiltration of high-pressure air. We report the case of a 45-year-old woman with cervical subcutaneous emphysema, pneumomediastinum, and pneumothorax occurring after restorative dentistry treatment of her left second molar using an air-tribune drill. These complications were caused by the penetration of high-pressure air through the gingival sulcus. Remarkably, the patient achieved full recovery after a brief period of conservative treatment.

Keywords: Dental Treatment; High-Speed Air Drill; Pneumomediastinum; Pneumothorax; Subcutaneous Emphysema

Introduction

Subcutaneous emphysema refers to the inadvertent accumulation of air within the subcutaneous layer of the skin due to air leakage from other body cavities and spaces. Air naturally migrates into areas of lower tension, gradually accumulating until sufficient pressure develops to dissect along adjacent planes. This leakage may not immediately raise clinical concerns, but it can pose significant risks, including extensive subcutaneous spread and subsequent respiratory or cardiovascular collapse. Although subcutaneous emphysema following dental procedures is rare, the most common cause of pneumomediastinum after dental treatment is the use of air-powered turbine handpieces. Only six cases of pneumomediastinum following endodontic treatment were reported between 1960 and 2008 [1].

We reviewed literature published between 2009 and 2024 via the PubMed database using the search term “pneumomediastinum

dental procedure”. In total, we selected 53 articles based on their abstract and full-text version. Among these, 24 cases involved pneumomediastinum following dental treatment using a high-speed air drill. Notably, only two patients developed pneumothorax, similar to our case [2,3].

Clinically, pneumothorax can be defined as the accumulation of gas between the parietal and visceral pleurae. While pneumothorax may not always present as a medical emergency, it can lead to respiratory distress, tension pneumothorax, shock, circulatory collapse, and potentially fatal outcomes. Of the various causes of dyspnoea during a dental procedure, pneumothorax is a rare but serious complication [4].

Two distinct pathways facilitate the entry of high-pressure air into subcutaneous tissue. First, air can permeate through osseous tissues. Notably, bone destruction resulting from pathologic lesions

or iatrogenic injury poses a significant risk for subcutaneous facial emphysema. Second, air can infiltrate through periosteal and submucosal tissues. Excessive manipulation of the mucoperiosteal flap during surgical extraction can lead to emphysema through subperiosteal dissection with high-pressure air. Factors such as the use of gingival retraction cords and periodontal disease can contribute to the loosening of the gingival sulcus, facilitating the entry of high-pressure air into subcutaneous soft tissue [5].

Subcutaneous emphysema typically manifests as a soft, skin-coloured swelling that arises shortly after dental treatment. It is crucial to differentiate this complication from others that also lead to increased volume, such as hematoma, allergic reactions, and angioedema. Cervicofacial swelling is commonly accompanied by crepitation. Features indicative of pneumomediastinum include dyspnoea with a brassy voice, chest or back pain, and the characteristic Hamman's sign, which involves crunching and bubbling sounds accompanied with cardiac pulsation.

Treatment for this complication in mild to moderate cases typically involves bed rest and administration of antibiotics to prevent secondary infections. Administration of 100% oxygen can also expedite the resolution of emphysema by enhancing air absorption. However, severe cases, such as mediastinitis, pneumothorax, cardiac tamponade, and air embolism require immediate medical attention due to potentially fatal outcomes.

Even in the absence of respiratory symptoms, these complications underscore the severity of subcutaneous emphysema, which can gradually spread to other structures, leading to dyspnoea. This highlights the importance of careful monitoring and performing computed tomography (CT) [6].

Case Report

A 45-year-old previously healthy woman presented to the emergency department with recent onset swelling of the entire face and neck. Shortly after the dentist began using an air-turbine drill on the patient, she experienced respiratory difficulty. The swelling progressively worsened over several minutes, preventing the dentist from stopping the drill before the emphysema reached the mediastinum and lungs. Suspecting an allergic reaction, the dentist administered corticosteroids and antihistamines. Subsequently, the patient was referred to the emergency department by the doctor.

Upon arrival at the emergency department, the patient had a blood pressure of 95/70 mmHg, heart rate of 53 beats/min, temperature of 36.1°C, and oxygen saturation of 100% in ambient air. The electrocardiogram revealed normal sinus rhythm, and the complete blood test yielded no abnormal findings.

Physical examination revealed significant soft tissue swelling extending from the left periorbital region to the thoracic region up to the apex of the left lung. Crepitation was noted on the left side of the neck, extending along the neck, cheek, and periorbital area. Lung auscultation revealed clear sounds bilaterally.

An emergent whole-body CT revealed marked pneumomediastinum, associated with bilateral extensive air flaps located between the soft tissues of the axillary region, neck tissues, and facial massif. Aerial traces were detectable cranially up to the left orbital region and both cheeks. Pneumothorax was also observed in the upper anterior-medial sectors of the left hemithorax. No pulmonary parenchymal lesion or pericardial effusion was identified.

Following consultation with chest surgeons, the patient was

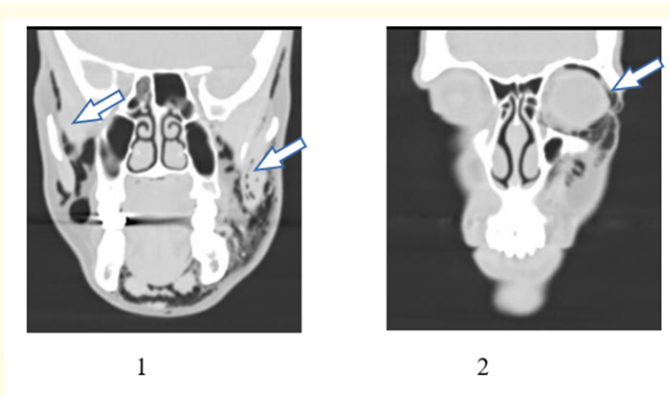


Figure 1 and 2: Coronal views shows diffuse soft tissue emphysema in the masticator space especially on the right [1], the emphysema of the right orbital cavity [2].

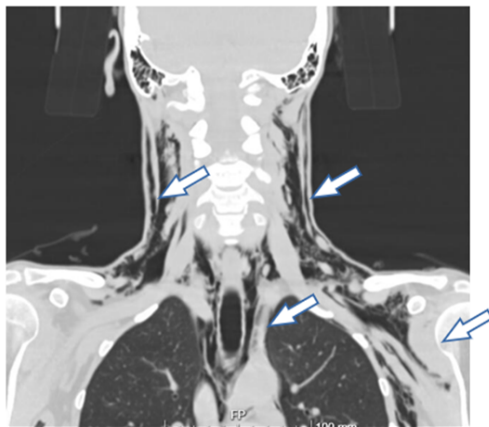


Figure 3: Coronal view shows cervical emphysema in the peripharyngeal space and superior mediastinum.

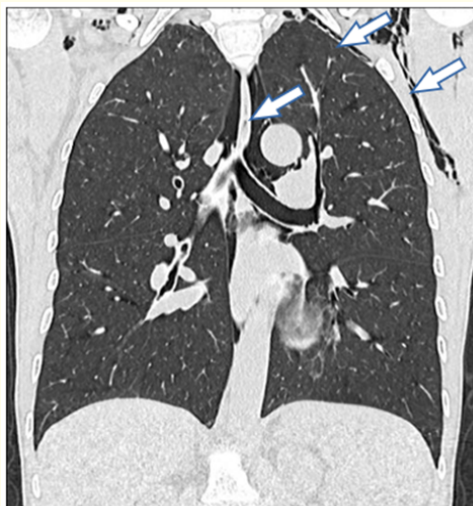


Figure 4: Coronal view of the chest revealed pneumomediastinum, subcutaneous emphysema and pneumothorax

promptly hospitalized for monitoring. High-flow oxygen was administered as a conservative treatment to promote the resorption of trapped air by reducing the surrounding partial pressure [7]. The patient was monitored for 3 days and initiated on a water diet. The infectious disease specialist agreed with our decision to initiate prophylactic antibiotic treatment with 1g amoxicillin and clavulanic acid three times a day for 6 days to prevent infection by oral flora.

She was discharged 3 days later when the swelling and crepitus had subsided. Blood tests yielded no signs of inflammation, and the follow-up X-ray revealed complete air resorption.

Physical and radiographic examinations performed 11 days after discharge revealed complete resolution of the clinical and radiological findings. The crepitus and swelling resolved within 4 - 5 days.

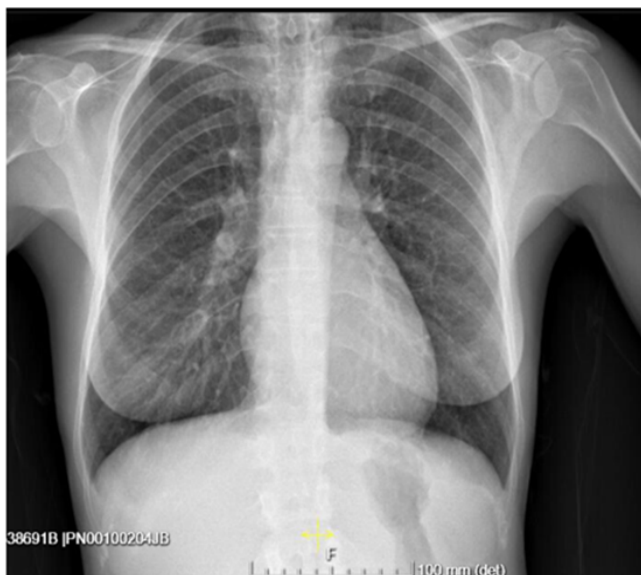


Figure 5: *Pneumomediastinum and emphysema phenomena are reducing in extent subcutaneously.*

Discussion

Our case suggests that emphysema after dental treatment predominantly affects females and is associated with molar tooth treatment [7] indicating the need to monitor for this complication.

In most patients, emphysema resolves with the administration of antibiotics and bed rest [6]. However, in severe cases where emphysema extends to the mediastinum and thorax, infection or mediastinitis can occur, which in turn can lead to fatality. Antibiotic use is crucial for preventing these complications. Failure to promptly treat pneumomediastinum could result in acute infection, leading to acute mediastinitis, which is associated with a mortality rate of 25 - 50%. Cardiac failure and air embolism can also occur and may lead to fatalities [5].

Our patient presented at the emergency department with breathing difficulties caused by pneumomediastinum and pneumothorax. Notably, these conditions did not affect normal cardiac and respiratory functions. To prevent cardiac and respiratory dysfunction, we engaged in careful clinical observation and completed serial CTs and X-rays to evaluate her clinical status and ensure optimal management.

Interestingly, despite the severity of our patient's initial presentation, her condition resolved with a relatively conservative treatment approach involving hospitalization for only 3 days, oxygen administration via goggles, and prophylactic antibiotic use.

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