

# Subcutaneous Emphysema, Pneumomediastinum, Pneumothorax and Pneumoperitoneum in a Three-Year-Old after Dental Restoration and Multiple Extractions

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## Abstract

Very few adult case reports exist in the anesthesia literature concerning subcutaneous emphysema in a dental setting. Even fewer are pediatric. We report here one such case in a pediatric patient. Different ways to recognize this condition and various means to prevent it are discussed. Anesthesiologists who do dental anesthesia need to be aware of this complication.

## INTRODUCTION

Most cases of subcutaneous emphysema after dental procedures are in adults who do not undergo general anesthesia. Many cases are undiagnosed, misdiagnosed and unreported. Once the patient has been given general anesthesia, either with an oral or nasal endotracheal tube, it is difficult to determine whether the subcutaneous air is a result of anesthesia and positive pressure ventilation or from the high speed dental hand pieces driven by compressed air.

## CASE REPORT

The patient was a healthy 3-year-old female weighing 13kg who had 4 front upper teeth extracted, and a lower left second mandibular molar. She also had multiple pulpotomies, crowns and fillings on 8 other teeth. After mask induction with sevoflurane, oxygen, nitrous oxide and rocuronium, an intravenous was started. Oxymetazoline was sprayed into both nostrils and an uneventful nasal intubation was performed with a 4.5mm nasal Rae tube, MacIntosh 2 blade and a Magill forceps. The dentist wrapped the child's head in a towel to cover the forehead, eyes and most of the nose. The anesthetic course was unremarkable, using sevoflurane, oxygen and nitrous oxide. Oxygen saturation was 100%, end tidal CO<sub>2</sub> was 48 to 49 mm Hg. Controlled ventilation was initiated for a short time and the patient was breathing spontaneously for the last 30 minutes of the case. (Tidal volume was around 120 cc, airway pressure less than

20 cm H<sub>2</sub>O). At the end of the 90-minute case, the towel was removed from the head. Swelling was noted in the cheeks, eyelids and lips. No crepitus was felt and no neck swelling was noted. It appeared as though the patient had angioedema and 4 mg of dexamethasone was given intravenously. The child was crying. In the PACU, the heart rate was 127 beats per minute, respiratory rate 20 per minute, O<sub>2</sub> saturation 99% on 30% O<sub>2</sub> and the temperature was 36 degrees centigrade. About 4 hours postoperatively, the patient was in day stay with stable vital signs, awake, crying, eating and drinking. The nurse noted swelling in the child's neck (eyelid, cheek and lip swelling was slightly less.) Crepitus was now felt in the neck and upper chest. A chest x-ray was ordered and a pediatric intensivist was consulted. The chest x-ray showed a 30% right pneumothorax, small left pneumothorax, a pneumomediastinum and small pneumoperitoneum. Six hours later (patient had eaten postoperative), surgery brought the patient to the OR for bronchoscopy, which ruled out a tracheal tear and a right sided chest tube was placed. The patient remained stable postoperatively with O<sub>2</sub> saturation at 96 to 100 % on room air, heart rate 104-122 beats per minute, and blood pressure 118/62 mm of Hg. She never had any respiratory distress. The chest tube was removed on the third postoperative day and the patient was discharged on postoperative day 4 with no known residual problems. She received 96 hours of intravenous ampicillin/sulbactam, started the night of surgery.

## **DISCUSSION**

Subcutaneous emphysema is defined as air trapped in subcutaneous tissue and submucosa resulting in soft tissue distension (1,2). Depending on the entry location, the air travels through the fascial planes from head to chest or chest to head. It can also travel to the abdomen and extremities (3). The extent to which the air travels depends upon the amount that enters the body and the patient size. After a dental procedure, the air can stay in the gingiva or it can travel upward through masseteric spaces and extend to the buccal and infraorbital spaces. It can travel inferiorly to the submandibular space through the cervical and tracheal fascia to the anterior mediastinum. If the air reaches the mediastinum and the pressure generated is great enough to rupture the mediastinal pleura, it will accumulate in the pleural space (1,4,5).

Although the point of air entry was not known in this case, the most likely source was from the dental drill, which used pressurized air. Dentists at this institution use high speed turbine air drills. The high-speed rotating burrs cause frictional heat. These instruments use pressurized air and water to cool the rotating burrs (6). Dentists also use air-water syringes. These eject both air and water that can be forced below the dermis (7). Irrigants for root canal, especially hydrogen peroxide, also have been implicate (5).

The child's initial swelling was in the cheeks and eyelids. If the pneumothorax was due to positive pressure ventilation, a rare occurrence, the air would have come from the chest and could work its way up to the neck and the head. Initially no swelling was seen in the neck. The intraoperative course was stable. If a pneumothorax had occurred due to positive pressure ventilation, the oxygen saturation would be expected to drop and airway pressure would be high. This did not occur. There was also no evidence of any trauma to the nasopharynx or trachea. The nasal intubation was smooth and atraumatic.

There are, however, reports of infection (neck, mediastinum and pleural spaces) from the oral cavity and contaminated air and water lines (4). Generalized sepsis, tension pneumothorax, cardiac tamponade, venous air embolus, pulmonary embolus, and systemic air embolus to the brain (non-fatal) have been reported (4,6,8). A fatal air embolus has been reported in a child (9). Subcutaneous emphysema after dental work has been reported after extractions – especially mandibular 2nd and 3rd molars, root canal, pulpotomy, restorative dentistry, periodontal therapy and

head and neck surgery (2,3). Five pediatric cases have been reported, ages 22 months to 8 years (2,3,7,10,11).

There are certain guidelines that may be followed to avoid this problem and help make an early diagnosis. If there are facial swellings noted during or after the procedure, feel the area for crepitus, so as not to misdiagnose allergic angioedema most commonly from antibiotics or rocuronium (1). Subcutaneous emphysema is also under diagnosed because it looks like edema after tooth extraction or swelling after injection of local anesthetic (2). Avoid N<sub>2</sub>O as this causes expansion of air filled spaces (3). Use clear plastic drapes to see the face during surgery (3). Intubation trauma should be avoided. While oral intubation is less traumatic than nasal intubation, nasal intubation makes working in the oral cavity easier for the dentist. An endotracheal tube, however, should never be forced through the nose. Dentists should use a rubber dam if possible and avoid injecting air into an empty canal or beyond the canal apex. The drill head should never be covered by the oral mucosa. Tears of the tissue and the periosteum should be avoided (3,5,12). The dentist and OR staff must be cognizant of the wall apparatus pressure settings that drive all dental devices. The pressure should have an upper limit of about 85 psi. If possible, air turbine drills should be replaced by drills driven by an electric motor (4,13).

Treatment of a patient with subcutaneous emphysema should include inhaling 100% oxygen to increase reabsorption of nitrogen by reducing its partial pressure (1). Broad spectrum antibiotics should be administered to cover aerobes and anaerobes from contaminated air and water lines (14). A chest x-ray should be obtained if crepitus is felt, looking for pneumomediastinum and/or pneumothorax. The patient should avoid any maneuver that may increase head pressure and increase the likelihood of air movement to the chest cavity or an air embolus. This includes vomiting, sneezing, coughing, chewing, Valsalva maneuvers and crying (this patient). Playing musical wind instruments or blowing one's nose has also been implicated. This can be accomplished with the use of antiemetics, antitussives and laxatives (5,7,14). The crepitus may not manifest for several hours after surgery or not until the next day (7,15). The crepitus may take as long as one week to resolve (12).

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