Tension Pneumothorax during Dental Anesthesia

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Key Words: ANESTHESIA—maxillofacial. SURGERY—dental. LUNGS—pneumothorax.

Subcutaneous emphysema of the face or neck which may extend into the mediastinum can complicate the use of high-speed air-turbine dental drills (1-5) or dental extractions (1). Pneumopericardium with subcutaneous emphysema has also occurred after maxillary surgery (6). Pneumopericardium, where air may have forced its way through a tear in the mucous membrane of the upper respiratory passages, has been reported to have occurred during a high-speed ride on a motorcycle (7).

This case report describes the development of subcutaneous emphysema of the face, neck, and chest wall with mediastinal emphysema and tension pneumothorax that occurred during conservative dentistry using an air-turbine dental drill.

Case Report

A 4-year-old boy weighing 15 kg with symptomatic homozygous B thalassemia was scheduled for dental fillings and restoration under general anesthesia. The patient’s anemia was managed with three weekly packed red cell transfusions of 200 ml and desferoxamine 500 mg IV three times a week. He had hepatosplenomegaly and the liver edge was palpable 4 cm below the costal margin in the right hypochondrium. The hemoglobin level on the day of the operation was 9.8 g/dl. Anesthesia was induced with thiopental 100 mg IV and tracheal intubation was facilitated with pancuronium 1 mg. Induction was smooth and intubation easy. Maintenance of anesthesia was with nitrous oxide (N₂O) and oxygen; pancuronium supplemented with fentanyl, and intermittent positive pressure ventilation (IPPV).

After 2 hours of surgery, a swelling of the soft palate was noticed. There was no crepitus. The surgeon noted that the gingival tissue appeared to be friable and tended to bleed easily. In the absence of other signs, surgery was continued and the lesion observed. One hour later the peak inflation pressure increased sharply from 20 to 40 cm H₂O. Auscultation of the chest revealed extensive bilateral wheezes. Bradycardia and hypotension developed rapidly and after 2 minutes the blood pressure was no longer recordable. Abdominal distension that was tympanic to percussion was seen and there was extensive crepitus over the neck and chest wall. The liver edge was palpable 3 cm below the level of the umbilicus and it was suspected that the liver had been displaced by increased pressure in the right hemithorax as a result of a tension pneumothorax. A 20-gauge cannula was introduced into the right pleural space in the mid-axillary line in the fourth intercostal space with dramatic results. The heart rate increased from 30 to 150 beats/minute, the blood pressure was recordable at 80/60 mm Hg, and a wheeze was no longer audible. A chest tube was inserted into the right pleural cavity and a chest x-ray was taken immediately afterward. The chest x-ray showed emphysema of the neck, chest wall, and mediastinum, as well as a right-sided pneumothorax. In the neck and chest wall, air had dissected along tissue planes into the fascial sheaths of the sternocleidomastoid and pectoralis muscles.

With the chest drain in place, dental surgery was resumed under N₂O anesthesia and when the procedure was completed, patient was weaned off IPPV 6 hours later. The patient made an uneventful recovery and was discharged on the third postoperative day.

Discussion

This case report is another example of an association between high-speed air-turbine dental drills and tissue emphysema. The turbine is driven by compressed air at 30 psi at about 20,000 rpm. A small jet
of air and water is directed to the drill tip to cool the point. In the older models this jet of air was bled from the turbine, (5) whereas in the newer models air is led to the head of the handpiece by a separate conduit (supplied at 20 psi). Air syringes used to dry dental caries generate a pressure of 20–25 psi and may cause subcutaneous emphysema (2). It has been shown experimentally that death can occur when air is forced into the root canals of dogs (2).

Air enters tissue planes through tears in the oral mucosa or is forced between tooth and gum (1). The subsequent swelling of the floor of the mouth has been mistaken for angioneurotic edema (8), and could pose a differential diagnostic problem: hematoma, abscess, or edema. In this case it is difficult to associate the hemoglobinopathy with the development of tissue emphysema. However, the surgeon noted that the tissue was friable and therefore it could be postulated that the tissues admitted air into the tissue planes more readily. The possibility of pulmonary barotrauma from an intra-anesthetic overpressure accident cannot be ruled out. However, considering that the swelling of the soft palate was noted an hour before the acute cardiovascular collapse occurred, it is likely that air tracked along the fascial planes of the sternocleidomastoid muscle to the mediastinum when a rupture of the mediastinal pleura resulted in pneumothorax. The ability of N₂O to diffuse into body cavities and the use of IPPV may have contributed to the development of tension. There is experimental evidence to show that the pleura is most likely to rupture at two sites with mediastinal emphysema: 1) an area above the root of the left lung and, 2) a fold of mediastinal pleura that lies against the pericardium (9). Although a wheeze often suggests bronchospasm, it can also occur with a pneumothorax (10), probably as a result of distortion of the bronchi.

When subcutaneous emphysema of the neck or face is present, it is possible that emphysema of the mediastinum (and possibly pneumothorax) has also occurred and therefore warrants discontinuation of N₂O and interruption of surgery so that an x-ray of the chest may be taken to assess the extent of “pneumatic dissection.” When possible, surgery should be discontinued because the progression of subcutaneous emphysema to mediastinal emphysema bears potential for the dangerous complication of a tension pneumothorax.

When the dental drill is used, a rubber dam usually prevents the jet of air from playing on soft tissue (4), although in this case tissue emphysema occurred in spite of the rubber dam. Clear plastic drapes allow observation of the patient intraoperatively (2). The occurrence of mediastinal emphysema when there is severe periodontal disease probably justifies prophylactic antibiotic therapy because mediastinitis leading to death has occurred after faciomaxillary surgery (11).

We are grateful to M. Almeida and C. Parzanese for technical assistance and Dr. J.C. Bevan for criticism in the preparation of this manuscript.

References