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A Case of Spontaneous Pneumomediastinum and Tension Pneumothorax in a Pediatric Patient after Elective Dental Procedure

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Abstract

Subcutaneous emphysema of the head, neck, and mediastinum occurs most commonly in head and neck surgery, tracheal and esophageal injuries, facial skeleton injuries, foreign bodies in the gastrointestinal tract and gastrointestinal neoplasms, pulmonary barotrauma during mechanical ventilation, and after dental procedures, which is extremely rare. The tooth preparation with a high-speed air turbine handpiece allows air to penetrate the mediastinum through the fascial spaces of the neck. Therefore, swelling of the face, neck, and upper body may often be misdiagnosed as an anaphylactic reaction to local or general anesthetics or other preparations used in dentistry.

The paper presents a case of spontaneous pneumomediastinum and tension pneumothorax in a 2½ – year-old child after dental procedure. Dental treatment (extraction of 2 teeth, root canal filling of the mandibular right first molar) was carried out under general anesthesia. Anesthesia maintenance was provided with sevoflurane inhalation sedation, induction with propofol, fentanyl, tracrium. Tracheal intubation was performed on the first attempt, without effort. The course of anesthesia was smooth and uneventful. Tracheal extubation was carried out after surgery. The early postoperative period was uneventful. In two hours, the parents with their child left private health care facility.

Three hours after dental procedure, the parents noticed the child to develop an indurative edema of the right side of the face and neck, and immediately applied to the hospital. The therapy for angioedema was administered. Six hours after beginning therapy, there was observed a crepitation in the neck (circularly) and upper chest. The child was urgently transferred to the Department of Anesthesiology and Intensive Care of the Ivano-Frankivsk Regional Children's Clinical Hospital. Pneumomediastinum was diagnosed via chest X-ray. Diagnostic bronchoscopy was performed under general anesthesia to exclude traumas to the laryngeal mucosa or injuries to the tracheobronchial tree. No visible local damage to the area examined was found. Drainage of the anterior mediastinum was performed emergently to save the child's life. A control chest X-ray taken in two hours showed

right-sided tension pneumothorax; the chest X-ray taken in four hours revealed left-sided spontaneous pneumothorax; the pleural cavities were drained using the Bülau-principle. Considering the increased cost of breathing and hypoxemia, the child was intubated and controlled mechanical ventilation was initiated. On the background of clinical improvement, the child was electively disintubated on the second day. The drainage tubes were removed from the pleural sinuses in 5 days. The control chest X-ray showed an improvement. The child was transferred to the Pulmonology Department and, on the 7th day of hospital stay, it was discharged home after recovery.
Keywords: pneumomediastinum, emphysema, anaphylaxis, children

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Случай спонтанного пневмомедиастинума и напряженного пневмоторакса у ребенка после планового стоматологического вмешательства

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Резюме

Подкожная эмфизема головы, шеи, средостения чаще всего возникает при хирургических вмешательствах на голове и шее, травмах трахеи и пищевода, лицевого черепа, инородных телах и новообразованиях желудочно-кишечного тракта, легочной баротравме при искусственной вентиляции легких и крайне редко после стоматологических процедур. Проникновение воздуха в средостение сквозь фасциальные пространства шеи возникает при препарировании зуба с помощью высокоскоростного турбинного наконечника. Именно поэтому припухлость лица и шеи, верхней половины туловища может быть ошибочно принята за анафилактическую реакцию на местный или общий анестетик или другие лекарства, которые используются в стоматологической практике.

В работе представлен случай спонтанного пневмомедиастинума и напряженного пневмоторакса у ребенка 2,5 года после стоматологического вмешательства. Стоматологическое вмешательство (удаление 2 зубов, пломбирование канала первого моляра снизу справа) выполнялось под общим обезболиванием. Анестезиологическое сопровождение обеспечивалось предварительной седацией ингаляционным анестетиком Севофлюран, индукцией пропофолом, фентанилом, тракриумом.

Интубация трахеи проведена с первой попытки, без особенностей. Плановая экстубация трахеи после окончания операции. Ранний послеоперационный период без особенностей. Через два часа родители с ребенком оставили частное медицинское учреждение. Через три часа после стоматологического вмешательства родители отметили у ребенка отек правой половины лица, шеи, в связи с чем немедленно обратились в стационар. Начата терапия ангионевротического отека. Через 6 часов после начала лечения появилась крепитация в области шеи (циркулярно) и верхней половине грудной клетки. Ребенок срочно переведен в отделение анестезиологии и интенсивной терапии областной детской клинической больницы г. Ивано-Франковска. При радиологическом обследовании диагностирован пневмомедиастинум. С целью исключения травмы слизистой оболочки гортани или трахеобронхиального дерева осуществлена поднаркозная диагностическая бронхоскопия. Видимых локальных повреждений обследуемого участка не обнаружено. По жизненным показаниям в ургентном порядке проведено дренирование переднего средостения. На контрольной рентгенограмме органов грудной клетки через два часа обнаружен правосторонний напряженный пневмоторакс, еще через два часа – левосторонний спонтанный пневмоторакс, по поводу чего выполнено дренирование плевральных полостей по Бюлау. Учитывая высокую цену дыхания, гипоксемию, ребенок заинтубирован и переведен на контролируемую вентиляцию легких. На вторые сутки на фоне клинического улучшения ребенок планово дезинтубирован. Через 5 дней удалены дренажи из плевральных синусов. Контрольная рентгенография в динамике с улучшением. Ребенок переведен в пульмонологическое отделение, откуда выписан на 7-е сутки с выздоровлением домой.
Ключевые слова: пневмомедиастинум, эмфизема, анафилаксия, дети

■ INTRODUCTION

Subcutaneous emphysema of the head, neck, and mediastinum can occur in various diseases. Most cases occur in head and neck surgery, tracheal and esophageal injuries, facial skeleton injuries, foreign bodies in the gastrointestinal tract and gastrointestinal neoplasms, pulmonary barotrauma during mechanical ventilation [1]. Subcutaneous emphysema and pneumomediastinum after dental procedures are rare [2]. Swelling of the face, neck, and upper body may be misdiagnosed as an anaphylactic reaction to local or general anesthetics or other preparations used in dentistry [3]. It should be noted that the tooth preparation with a high-speed air turbine handpiece allows air to penetrate the mediastinum through the fascial spaces of the neck. These high-speed air turbine handpieces are driven by compressed air at 3.5–4.0 kgf/cm^2 and rotate at 450,000 rpm [4]. The communication between the fascial spaces allows the air entering the mandibular region to penetrate the retropharyngeal space and the mediastinum [5]. The air turbine handpiece pumps air under pressure through the disrupted intraoral barrier such as dentoalveolar membrane or root canal. Since the roots of the first, second and third molars are directly related to the sublingual and submandibular spaces, emphysema and pneumomediastinum may develop in this region [6]. The differential diagnosis for patients with a swelling of the face and neck after dental procedures includes pneumothorax, hematoma, anaphylaxis, local allergic reaction, angioedema [7–9]. Coughing, smoking,

vomiting, or expressed anxiety in a patient after dental procedure provoke the development of emphysema and pneumomediastinum.

We present a case of spontaneous pneumomediastinum and tension pneumothorax in a pediatric patient after dental procedure.

■ CASE REPORT

A 2½-year-old child was hospitalized to the Intensive Care Unit of the Ivano-Frankivsk City Children's Clinical Hospital after dental treatment (extraction of 2 teeth, root canal filling of the mandibular right first molar) carried out under general anesthesia. Anesthesia maintenance was provided with inhalation sedation with 8 vol% sevoflurane in an oxygen mixture at a flow rate of 2 l/min via a face mask. The peripheral vein was cannulated. After preoxygenation, propofol at a dose of 1.5 mg/kg, fentanyl at a dose of 50 μg, and tracrium at a dose of 0.3 mg/kg were induced; tracheal intubation was carried out using the tracheal tube with a 4.5-mm internal diameter and a tracheal cuff. Tracheal intubation was performed on the first attempt, without effort. There was initiated mechanical ventilation with the following settings: the fraction of inspired oxygen (FiO_2) – 40%, the positive end-expiratory pressure (PEEP) – 1 mm H_2O, the inspiratory-expiratory ratio (T in/ex) = 2:1, the frequency (f) – 22 bpm. The vital signs during surgery were as follows: heart rate (HR) – 118 bpm, blood oxygen saturation level (SpO_2) - 99%, blood pressure (BP) – 80/40 mm Hg. Tracheal extubation was carried out after surgery. The early postoperative period was uneventful, namely clear consciousness, bilateral breath sounds, stable hemodynamics. The patient was in the postoperative ward under the supervision of the medical personnel, and, in two hours, the parents with their child left private health care facility.

Three hours after dental procedure, the parents noticed the child to develop an indurative edema of the right side of the face and neck (Fig. 1), and immediately applied to the hospital. The child's general condition was moderate; the child was conscious and responded anxiously to the examination; there were no cramps or vomiting; the meningeal signs were negative; breathing rate (BR) – 28 bpm, HR – 125 bpm, SpO_2 – 95%, BP – 65/45 mm Hg. The therapy for angioedema (second-generation antihistamines, systemic glucocorticosteroid (GS) therapy with dexamethasone (8 mg/day), infusion therapy) was initiated. Six hours after beginning therapy, there was observed a crepitation in the neck (circularly) and upper chest. The child was urgently transferred to the Department of Anesthesiology and Intensive Care of the Ivano-Frankivsk Regional Children's Clinical Hospital. The child's general condition was severe; the child was conscious, anergic, and responded anxiously to the examination; the meningeal signs were negative; there were pronounced signs of respiratory failure of restrictive type: BR – 35 bpm, HR – 140 bpm, SpO_2 – 91%, BP – 60/35 mm Hg. Pneumomediastinum was diagnosed via chest X-ray (Fig. 2). Since general endotracheal anesthesia was used, to exclude traumas to the laryngeal mucosa or injuries to the tracheobronchial tree, diagnostic bronchoscopy was performed under general anesthesia. There was found no visible local damage to the area examined. Drainage of the anterior mediastinum was performed emergently to save the child's life. A control chest X-ray taken in two hours showed right-sided tension pneumothorax (Fig. 3, 4); chest X-ray taken in four hours revealed left-sided spontaneous pneumothorax; the pleural cavities were drained using the Bülau-principle. The child's general condition was severe; the child responded anxiously to the examination; the meningeal signs were negative; BR – 44 bpm, HR – 155 bpm, SpO_2 – 92% while delivering 100% oxygen with

Fig. 1. Swelling of the child's right side of the face and neck 3 hours after dental procedure

bubbler humidifier, BP – 70/50 mm Hg. Considering the increased cost of breathing and hypoxemia, the child was intubated; to initiate controlled mechanical ventilation, there were used the Vella ventilator, the synchronized intermittent mandatory ventilation (SIMV) mode and the following settings: FiO2 – 50%, PEEP – 2 mm H_2O, peak inspiratory pressure (PIP) – 15 mm H_2O, T in/ex = 2:1. The therapeutic algorithm included antibiotic

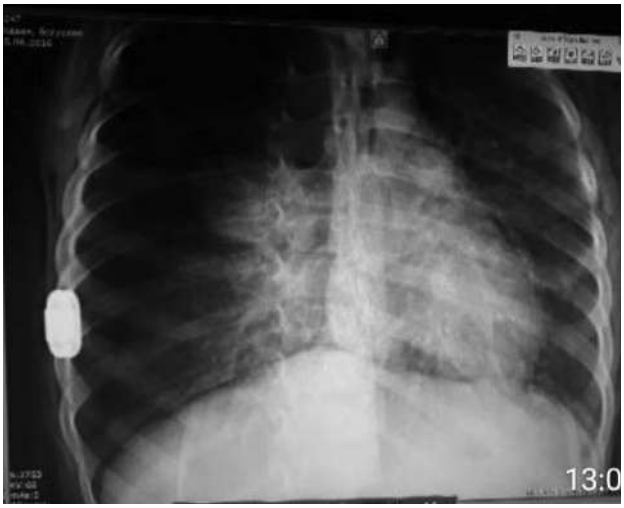

Fig. 2. Pneumomediastinum 16 hours after dental procedure

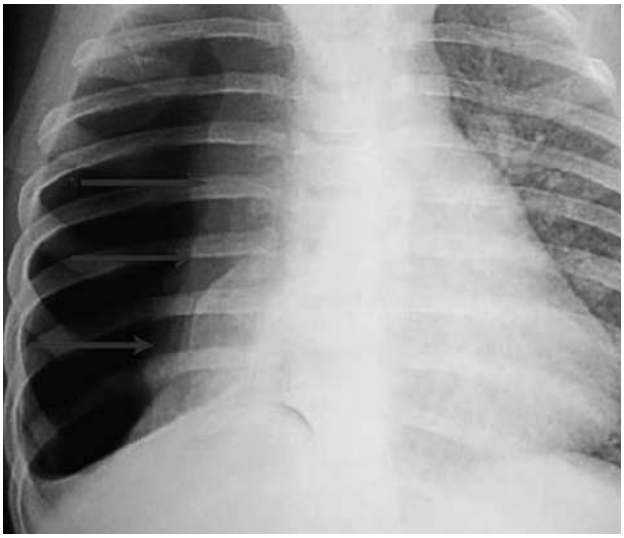

Fig. 3. Right-sided tension pneumothorax 18 hours after dental procedure

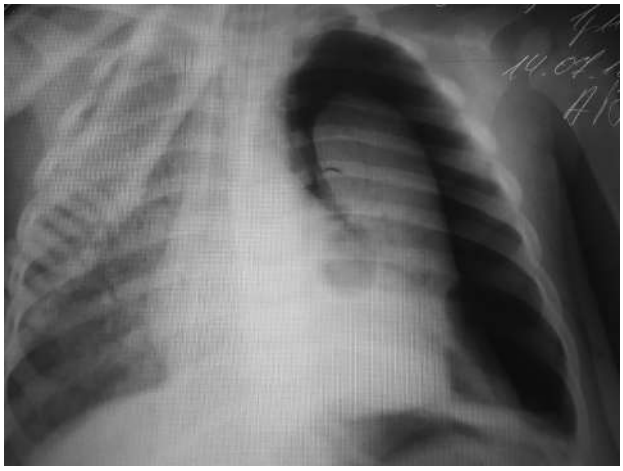

Fig. 4. Left-sided tension pneumothorax 20 hours after dental procedure

therapy, sedation and multimodal analgesia, infusion therapy to maintain normovolemia. On the second day, against the background of clinical improvement and stabilization of the child's condition (normalization of blood gas indicators), it was electively disintubated. The drainage tubes were removed from the pleural sinuses in 5 days. Control chest X-ray showed an improvement (there were no signs of pneumothorax). The child was transferred to the Pulmonology Department and, on the 7th day of hospital stay, it was discharged home after recovery.

■ CONCLUSION

Thus, iatrogenic subcutaneous emphysema is rare in children, and, therefore, it may be untimely diagnosed resulting in severe and life-threatening complications. One should be careful when using turbine and red contra-angle handpieces or when intubating/ventilating children via the Ambu bags of inadequate tidal volume when providing ambulatory anesthesia. If subcutaneous emphysema is suspected, it should be timely diagnosed and eliminated to reduce further complications that may occur in delayed treatment.

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