CASE REPORT

Spontaneous pneumomediastinum caused by nebulization of bronchodilators in a young child

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Summary  We describe a young girl presenting with fever, cough, and respiratory distress. Shortly after resisting nebulization of bronchodilators she developed a spontaneous pneumomediastinum and subcutaneous emphysema.

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KEYWORDS
Spontaneous pneumomediastinum; Subcutaneous emphysema; Children; Nebulization; Bronchodilators

Introduction

Pneumomediastinum is defined as free air or gas within the mediastinum originating from the alveolar space or the conducting airways. The term “spontaneous pneumomediastinum” (SPM) is reserved for cases of pneumomediastinum not related to ruptures of the airway secondary to chest trauma, endobronchial procedures, mechanical ventilation, or chest surgery. SPM is a rare, infrequently reported syndrome especially in young children.\textsuperscript{1,2}

Case report

A previously healthy 2-year-old girl was evaluated because of a 5-day history of fever, ear and throat aches and dry cough with dyspnoea. On physical examination signs of respiratory distress were noted such as expiratory grunting. Her body temperature was 39.5 \textdegree{}C, heart rate 160/min, respiratory rate 30/min and transcutaneous oxygen...
saturation 96% in ambient air. Rhinitis, tonsil hypertrophy and cervical lymphadenopathy were present. Auscultation of the chest revealed diffuse wheezing in addition to slightly decreased breath sounds on the left. The initial chest radiograph (not shown) showed only bilateral hyperinflation. Laboratory studies revealed an increased level of C-reactive protein (55.4 mg/l; reference value: <10 mg/l) and mildly elevated leucocytes (18.5 x 10.9/l; reference value: 5–15 x 10.9/l). The differential diagnosis at that time included viral or bacterial infection and asthma. Blood cultures were taken and intravenous antibiotic treatment was initiated. Because of progressive dyspnoea and diffuse wheezing, prednisolone (2 mg/kg intravenously) and inhaled salbutamol were started, without any effect. The girl fiercely resisted nebulization and had to be restrained. This resulted in acute respiratory distress. The transcutaneous oxygen saturation decreased to 92% despite administration of 2 l/min 100% oxygen via nasal prong. In addition, subtle swelling of the neck was noted. A chest radiograph showed a consolidation of the left upper lobe with mediastinal free air (Fig. 1).

The patient was transferred to a pediatric intensive care unit. Computer tomography of the chest revealed a pneumomediastinum (Fig. 2) with extension of free air into the subcutis of the neck combined with compression of the left upper lobe. Because of persistent consolidation of the left upper lobe and to rule out foreign body inhalation bronchoscopy was performed. This showed diffuse inflammation of the airways with severe production of purulent mucus and a complete obstruction of the left upper lobe bronchus. Mucus was suctioned. No signs of traumatic rupture of the airway or inhaled foreign bodies were noted.

Two days later the supplemental oxygen was discontinued and she was discharged home. The swelling of neck and face had disappeared. Bacterial cultures of blood and bacterial and viral cultures of bronchiolar lavage fluid and a nasopharynx swab remained negative. Chest radiography showed complete resolution of the pneumomediastinum and of the consolidation of the left upper lobe.

Discussion

We describe a young girl presenting with fever, cough, and respiratory distress. Shortly after resisting nebulization of bronchodilators she developed a SPM and subcutaneous emphysema.

SPM in children is primarily associated with bronchial obstruction caused by asthma, bronchiolitis, foreign body aspiration, space-occupying lesions, and infections.1–5 The estimated incidence of SPM varies between 1:800 and 1:42,000.2 The diagnosis is made using frontal chest radiography and in selected cases chest computerized tomography.4,6 In children under the age of four, as in our case, it is mandatory to perform a bronchoscopy to exclude inhalation of foreign bodies.1,7 In general, SPM will spontaneously resolve. Patients should avoid strenuous physical activity and maneuvers that create forced expiration, such as coughing and straining. The most frequent respiratory trigger in relation to the development of SPM is coughing, but vomiting, strenuous exercise and crying may cause alveolar distension as well.8,9 Inhalation of bronchodilators is essential in the treatment of children with an acute asthma exacerbation. However, the differentiation
between viral-induced wheezing and asthma remains difficult in small children and bronchodilators are frequently used on a trial basis. This treatment should only be continued if it results in improvement of symptoms without substantial side effects, and provided it is tolerated by the patient. In our patient, inhalation of salbutamol resulted in coughing and fierce resistance to treatment. This was followed by clinical deterioration and the development of SPM. We assume that resistance to nebulization combined with coughing increased intra-alveolar pressure. The mucus-induced obstruction of the upper left bronchus noticed at bronchoscopy in our patient may have functioned as a valve with even further distention of the terminal airways and alveoli resulting in SPM. To our knowledge this is the first report that suggests a relation between resistance to inhalation of bronchodilators and the development of SPM.

In conclusion, SPM should be considered in young children presenting with acute dyspnoea. It can be complicated by subcutaneous emphysema. Resistance to treatment, especially nebulization of bronchodilators, in children may increase airway pressure significantly and cause airleak syndromes. Resistance to nebulization is often a sign of lack of effect in children and should lead to careful evaluation of this treatment. Although rare, clinical worsening during nebulization of bronchodilators should prompt an evaluation for possible new complications such as SPM and not merely more medication.

Message box

- SPM should be considered in young children presenting with acute dyspnoea.

- Although rare, lack of effect or clinical worsening during nebulization of bronchodilators should prompt an evaluation for possible new complications and not merely more medication.
- If a pneumomediastinum is identified in a young child, bronchoscopy should be considered to rule out aspiration of a foreign body.

References