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PNEUMOMEDIASTINUM AFTER INHALATION OF HELIUM GAS FROM PARTY BALLOONS

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□ **Abstract—A previously healthy 16-year-old boy presented to the Emergency Department with a 2-day history of hoarseness, sore throat, and chest tightness. The physical examination was significant for diffuse neck and chest subcutaneous emphysema. A computed tomography (CT) scan of the neck and chest revealed pneumomediastinum after a plain chest X-ray study failed to uncover this finding. The patient reported that 5 days before presentation he forcefully inhaled helium gas directly from multiple party balloons in an attempt to alter his voice. The patient fully recovered over the next 2 days. Spontaneous pneumomediastinum developed in this patient with no underlying lung disease, presumably from air leakage secondary to the excessive elevation of intra-thoracic pressure due to repetitive inhalation of helium gas. Spontaneous pneumomediastinum remains largely underdiagnosed clinically, especially in young, healthy patients.**

□ **Keywords—subcutaneous emphysema; spontaneous pneumomediastinum; inhalation injury**

INTRODUCTION

Pneumomediastinum and subcutaneous emphysema are most often found in the setting of esophageal and chest trauma. These conditions also occur spontaneously in the setting of elevated intra-thoracic pressure as a result of mechanical ventilation, excessive coughing, vomiting, Valsalva maneuver, childbirth, and forceful straining during exercise (1–3). A few cases of pneumomediastinum have been documented in association with cocaine inhalation and marijuana smoking (4,5). This is a case report of pneumomediastinum and subcutaneous emphysema occurring after inhalation of helium gas.

CASE REPORT

A 16-year-old boy presented to the Emergency Department (ED) complaining of sore throat, chest pain, and neck and chest tightness for 2 days. The patient denied fever, chills, cough, shortness of breath, runny nose, congestion, nausea, and vomiting, but stated that his voice had sounded hoarse for 2–3 days. He had some difficulty swallowing due to neck and chest fullness.

Before the onset of his symptoms, the patient was in good health, and had no significant past medical history. He was a high school student. He denied all drug use, and did not smoke marijuana or tobacco. There was no recent history of trauma.

On physical examination, the patient was in no acute distress. The vital signs were normal; the patient was afebrile (temperature 37°C [98.7°F]) and the O_2 saturation was 98% on room air. The oropharyngeal examination was normal with no pharyngeal erythema, petechiae, exudate, peritonsillar mass, or tenderness. The uvula was midline. The neck examination re-

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vealed diffuse subcutaneous emphysema palpated anteriorly from the inferior border of the mandible to the third intercostal space bilaterally, sparing the anterior midline along the trachea. There was palpable subcutaneous emphysema on the posterior head and neck examination from the level of the mastoid processes to the superior scapular border bilaterally. The trachea was midline with no stridor. The chest examination revealed subcutaneous emphysema, as above. There were equal breath sounds bilaterally. The cardiac examination revealed normal heart sounds. There were no signs of trauma to the face, neck, chest, or back.

Upon further questioning, he reported that he attended a picnic about 5 days before our evaluation, at which time he repeatedly inhaled helium gas directly from party balloons. After helium gas inhalation, he would then forcefully hold his breath while speaking slowly to alter his voice.

A plain chest X-ray study confirmed diffuse subcutaneous emphysema in the right and left anterior chest and neck area, but did not demonstrate a pneumomediastinum (Figure 1). A head, neck, and chest computed tomography (CT) scan revealed a pneumomediastinum in the anterior mediastinum (Figure 2), and confirmed the presence of subcutaneous emphysema in the head, neck and chest.

Because the patient had no respiratory difficulty, and was stable in the ED, he was discharged home with instructions to return in 3 days to our urgent care clinic for a follow-up evaluation. When he failed to return to the urgent care clinic, telephone follow-up revealed that his symptoms had resolved within 2 days.

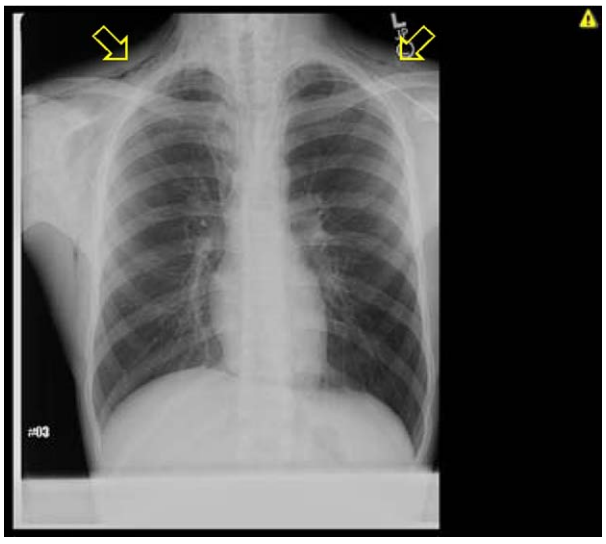

Figure 1. Chest X-ray study showing subcutaneous emphysema (arrows).

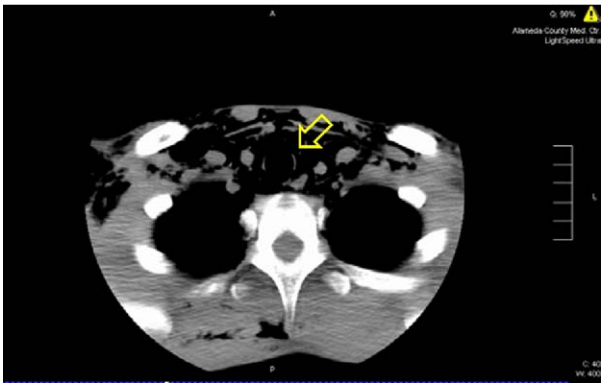

Figure 2. Chest CT scan showing pneumomediastinum (arrow).

DISCUSSION

A spontaneous pneumomediastinum (SPM) is the nontraumatic presence of free air in the mediastinum without underlying disease. This entity is generally a benign and self-limited condition that usually occurs in young people without known disease (6,7). It is associated with an excessive increase in intra-thoracic pressure that leads to rupture of alveoli. The most recognized causes of SPM include mechanical ventilation, drug inhalation, Valsalva maneuver, forceful straining during exercise, repetitive coughing or vomiting, and childbirth. In this case report, a healthy adolescent boy without a history of trauma to the chest or esophagus presented with neck and chest discomfort, dysphonia, and dysphagia after an episode of repetitive, deep inhalation of pressurized helium gas. We concluded that the pneumomediastinum and subcutaneous emphysema had resulted from the inhalation and holding-in of helium gas with a resultant increase in intra-thoracic pressure.

A SPM occurs as a result of an excessive increase in intra-thoracic pressure. This increase in intra-thoracic pressure can cause alveoli to rupture, resulting in air leakage into the terminal lung air spaces. This escaped air travels from the high-pressure alveoli into the adjacent, lower-pressure perivascular interstitium and peribronchial fascial sheath. The air then dissects proximally within the bronchovascular sheath into the mediastinum and the cervical and subcutaneous tissue spaces, resulting in pneumomediastinum and subcutaneous emphysema. A pneumothorax may develop in the setting of pleural rupture (8,9). Considering this mechanism, it is plausible that the repetitive, deep inhalation of pressurized helium gas can create an elevation of intra-thoracic pressure great enough to cause alveoli rupture and resultant pneumomediastinum and subcutaneous emphysema.