CASE REPORT

A Case of Spontaneous Pneumomediastinum Following Exacerbation of Bronchial Asthma in Adolescents

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ABSTRACT

Lack of knowledge in the management of spontaneous pneumomediastinum condition is attributable to its scarcity. Hypothetically, this condition arose during the exacerbation of bronchial asthma, leading to a recurrent forceful cough that increased the intraalveolar pressure and alveoli perforation. We present a 14-year-old boy with three days history of progressively worsening shortness of breath and chest pain radiating to the neck following exacerbation of bronchial asthma. Clinically, he was stable, despite remarkable subcutaneous emphysema over the anterior chest wall and the neck. Lung examination was unremarkable. There was substantial radiological evidence of subcutaneous emphysema, pneumomediastinum, pneumopericardium and pneumorrhachis. He was managed expectantly with oxygenation, control of bronchial asthma symptoms and analgesia. Subsequently, his symptoms resolved, and a complete resolution was seen as evident by radiological assessment. Spontaneous pneumomediastinum with pneumopericardium, pneumorrhachis and subcutaneous emphysema is a rare condition that requires prompt identification to prevent if from becoming a life-threatening condition.
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Keywords: Pneumomediastinum, Subcutaneous emphysema, Pneumorrhachis, Pneumopericardium, Tracheal perforation.

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INTRODUCTION

Spontaneous pneumomediastinum is a rare condition, even rarer if it occurred concurrently with pneumopericardium and pneumorrhachis. It demonstrates two peak incidences, under seven years of age and adolescence, with the latter primarily due to exacerbation of bronchial asthma (1). This condition is postulated to be caused by ruptured marginally situated alveoli as a consequence of remarkably high intraalveolar pressure, especially in obstructive airway diseases (2). Its rarity has been attributed to our poor understanding of this condition. We want to share our experience in managing this rare condition.

CASE REPORT

A 14-year-old boy with a known case of bronchial asthma presented to the emergency department complaining of acute onset of shortness of breath and chest pain. The patient has been having cough and upper respiratory tract infection (URTI) symptoms since three days ago, requiring frequent usage of metered-dose inhaler (MDI) salbutamol and a visit to the general practitioner for a nebulizer and denied any fever. Sharp, centrally located chest pain started on day 3 of illness, radiating to the left apical area and worsening with inspiration. Otherwise, he denied any recent trauma, smoking, usage of vape or inhalation of recreational drug. Clinically, he was anxious; tachypneic with a respiratory rate of 25/min and oxygen saturation (SPO2) of 97% under room air. Chest examination demonstrated equal but reduced air entry bibasally with occasional rhonchi and no crepitation was appreciated. The trachea was centrally located. Subcutaneous crepitus was felt over the upper chest extending to the left apical and neck area, consistent with subcutaneous emphysema. Cardiovascular examination was unremarkable. Erect chest x-ray demonstrated pneumomediastinum with pneumopericardium with no ribs fracture or pneumothorax (Fgiure 1). Subsequent computed tomography scan of the thorax showed suspicious tracheal perforation at the left posterior region with pneumomediastinum, pneumopericardium,

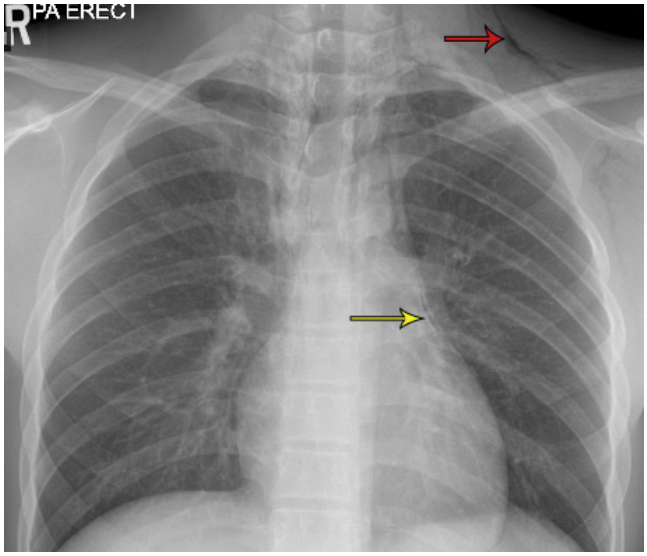

Figure 1: Erect posterior-anterior chest x-ray taken upon admission. It showed subcutaneous emphysema (red arrow) and pneumopericardium (yellow arrow) with no concurrent pneumothorax

pneumorrhachis and subcutaneous emphysema (Figure 2 & 3). The patient was managed supportively with nasal prong oxygen of 3 l/min, close monitoring for respiratory distress and frequent nebulizer. Clinical improvement was seen after 24 hours. A complete radiological resolution of subcutaneous emphysema was seen from an erect chest x-ray performed after 72 hours (Figure 4). Medical team expertise was sought to optimize his bronchial asthma symptoms. He was discharged home after three days of admission. Subsequent repeat computed tomography of the thorax in 2 months showed a complete resolution of pneumomediastinum, pneumopericardium with no residual defect seen in the tracheal structure.

DISCUSSION

Spontaneous pneumomediastinum, pneumopericardium, pneumorrhachis following

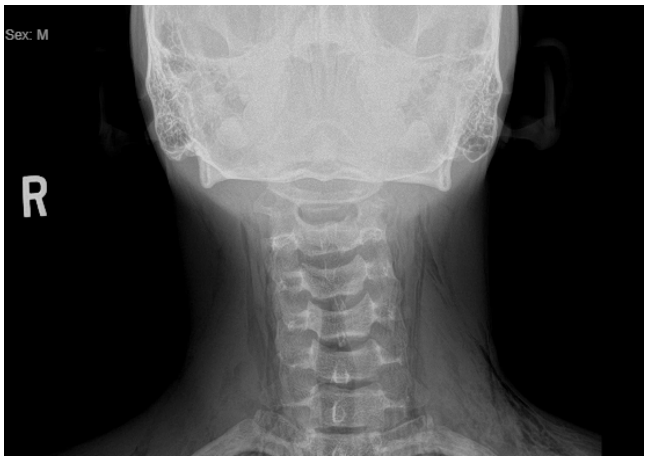

Figure 2: Posterior-anterior x-ray of the neck, showing extensive subcutaneous emphysema extending to bilateral neck region

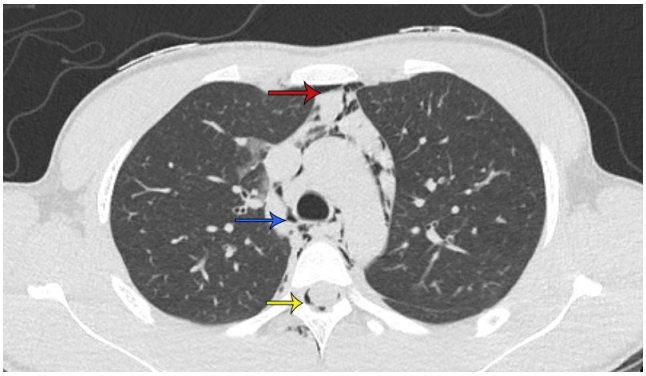

Figure 3: Transverse view of computed tomography of thorax showing presence of air between sternum and anterior pericardium (red arrow), pneumomediastinum (blue arrow) and pneumorrhachis (yellow arrow).

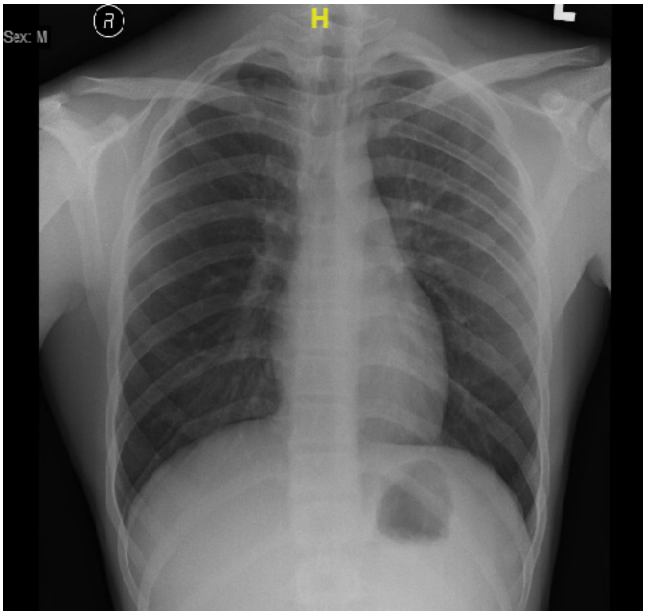

Figure 4: Posterior-anterior erect chest x-ray taken after 3 days of admission following clinical resolution of subcutaneous emphysema. It showed radiological resolution of subcutaneous emphysema.

exacerbation of bronchial asthma is a rare condition. To date, there is no consensus addressing its management. It was postulated that this condition arises from alveolar rupture following a remarkable rise in airway pressure which consequently extended to the pericardium, pleura and cervical subcutaneous tissue through the escape of air in bronchovascular fascia (2). Besides, tracheal perforation has been implicated as the cause of spontaneous pneumomediastinum, especially among asthmatic children, where raised intratracheal pressure following a vigorous cough or Valsalva lead to perforation at its preexisting weakened part of the trachea, most likely from undiagnosed tracheomalacia following chronic usage of the steroid (3). As in our patient, his symptoms were preceded by a bout of violent coughing due to exacerbation of bronchial asthma. Other causes such as trauma or inhalation of recreational drugs were ruled out. The clinical examination further supports acute exacerbation of bronchial asthma as evidenced by

the presence of rhonchi and reduced air entry. This is further supported by the computed tomography of the thorax and spontaneous perforation of trachea following acute exacerbation of bronchial asthma has been implicated as the cause of his condition.

Early diagnosis is paramount, as delay in diagnosis inevitably leads to a life-threatening event due to airway compromise. No consensus has been made regarding the best modality to diagnose this condition. Patients with clinical suspicions of spontaneous pneumomediastinum should be investigated further with an erect posteroanterior view chest x-ray to exclude pneumothorax. Typically, clinical suspicion is confirmed by the presence of a gas shadow between the left heart border and the mediastinal pleura (2). The radiolucency appearance in erect chest x-ray is attributable to the presence of air in the mediastinum. Commonly, 3 cardinal signs are appreciated in the posterior-anterior erect chest x-ray, namely, a prominent shadow of the heart, presence of radiolucency at the subcutaneous layer on chest and neck region, and radiolucency at superior mediastinum. Infrequently, the bilateral hemidiaphragm may appear connected by the presence of radiolucency at the inferior border of the heart and the bronchial wall may appear replicated (double bronchial sign). Nonetheless, the lateral view of the erect chest x-ray is proven to be more sensitive in detecting the minute presence of air in the mediastinum by showing radiolucency between the anterior pericardium and the posterior border of the sternum. Hence, in utilising erect chest x-ray as an initial diagnostic radiological modality, it is impertinent to perform in both posterior-anterior and lateral view. Nevertheless, computed tomography scan has increasingly replaced chest x-ray in diagnosing this condition, and innovation such as computed tomography simulation bronchoscopy is getting more acceptable and less invasive. Owing to its rarity, to date, no study has been made to assess its sensitivity in this condition. Bronchoscopy has been the gold standard in managing such conditions, but owing to less expertise in our centre and its invasiveness, we did not pursue this option for this patient.

The management of spontaneous pneumomediastinum and its sequela are primarily conservative. It consists of treating the underlying cause such as asthma, bed rest, analgesia, oxygen supplement, broad-spectrum antibiotics and avoidance of Valsalva manoeuvre are recommended measures (4). Chest tube insertion is indicated in a case with concurrent pneumothorax. Resolution of subcutaneous emphysema can be successfully achieved by utilising nitrogen washout theory, where the patient is administered with high oxygen concentration supplementation (5). In the case of progressive subcutaneous emphysema, subcutaneous drainage may be considered besides reappraising the magnitude of injury and cause (2). Clinical improvement often can be seen at 1.8 days (2). Any deviation from the expected clinical course, such as fever, leukocytosis and worsening pain, should raise diagnostic suspicions of mediastinitis with ensuing relevant investigation and prompt management. Invasive investigation such as bronchoscopy is not usually performed unless as an adjunct for subsequent management as most cases were successfully managed expectantly. Our patient was successfully managed conservatively with no immediate complications. He was managed with prophylactic antibiotic (augmentin), analgesia as per WHO pain ladder and nasal prong oxygen 3 litres per min. Salbutamol nebuliser was given 4 hourly on the first day then tapered according to his clinical sign. He was started with metered-dose inhaler budesonide, 2 puffs, twice daily for prevention of subsequent asthma attacks. Clinical resolution of his subcutaneous emphysema can be seen on day 2 of admission and he was discharged home on day 5. The patient was well for three months follow up with no respiratory or neurological sequelae.

CONCLUSION

Spontaneous pneumomediastinum with pneumopericardium, pneumorrhachis and subcutaneous emphysema is a rare condition that requires prompt identification to prevent a life-threatening condition. Lack of consensus in the investigation and management of this condition is attributed to its scarcity. A high index of clinical suspicion with appropriate imaging modality and familiarity of its signs on erect posterior-anterior chest x-ray will expedite the diagnosis and management of this condition. Those patients managed conservatively should be monitored closely for any sign of mediastinitis to hasten confirmatory investigation and management thus mitigating its dreadful outcome.

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REFERENCES

1. Lee C-Y, Wu C-C, Lin C-Y. Etiologies of spontaneous pneumomediastinum in children of different ages. Pediatrics & Neonatology. 2009;50(5):190-5. doi: 10.1016/S1875-9572(09)60062-0.
2. Takada K, Matsumoto S, Hiramatsu T, Kojima E, Shizu M, Okachi S, et al. Spontaneous pneumomediastinum: an algorithm for diagnosis and management. Therapeutic advances in respiratory disease. 2009;3(6):301-7. doi: 10.1177/1753465809350888.
3. Claes I, Van Schil P, Corthouts B, Jorens PG. Posterior tracheal wall laceration after blunt neck trauma in children: a case report and review of the

literature. Resuscitation. 2004;63(1):97-102.
4. Singh A, Kaur H, Singh G, Aggarwal S. Spontaneous pneumomediastinum with pneumopericardium, surgical emphysema, pneumothorax, and epidural pneumotosis: a rare association. Journal of natural science, biology, and medicine. 2014;5(1):201. doi: 10.1016/j.resuscitation.2004.04.016.
5. Ristagno RL, Hiratzka LF, Rost Jr RC. An unusual case of pneumorrhachis following resection of lung carcinoma. Chest. 2002;121(5):1712-4. doi: 10.1378/chest.121.5.1712.