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PNEUMOTHORAX PRIMARY SPONTANEOUS IN HEALTHY TALL AND THIN MALE SECONDARY TO SMOKING: A CASE REPORT AND LITERATUR REVIEW

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Abstract

Background
Primary Spontaneous Pneumothorax (PSP) refers to the collapse of a lung without the presence of any underlying disease and commonly observed in tall, thin young men, with smoking as an under-recognized risk factor. The management of PSP can vary significantly across different health centers. This case report highlights a young man with a pneumothorax without an underlying illness who initially gets treatment with a chest tube due to his smoking habit.

Case
This study focused on a 19-year-old man complaining of sudden right chest pain. The patient was a smoker for the past 4 years, and examination showed hypersonic and vesicular loss on the right side. The laboratory tests revealed normal limits and the sputum indicated the absence of tuberculosis. Chest X-ray showed an avascular radiolucent area in the right lung and a Chest CT scan confirmed the presence of a hypodense area of air density in the right hemithorax. Diagnosis of right PSP was made, and managed using a chest tube drainage on admission. After four days of treatment, he exhibited improvement and discharged. A recurrence of pneumothorax was not discovered in the subsequent six-month period of follow-up.

Conclusion
Despite being a rare disorder, PSP should be considered during the physical examination of patients. It is also important to reassess the risk factors that can contribute to the onset of pneumothorax. The clinicians should be able to identify PSP and emphasise tall, thin, and young men at greater risk of pneumothorax in a pulmonary emergency.

Keywords: spontaneous pneumothorax, young, smoking, pulmonary emergencies

Introduction

The presence of pleural cavity air characterizes Pneumothorax, which is located between the chest wall and the lungs. Furthermore, it can occur due to various factors, such as spontaneous leakage in the lung parenchyma or as a secondary effect of underlying diseases.[1] This condition can be further divided into two categories based on its cause, namely primary spontaneous pneumothorax (PSP) and secondary spontaneous pneumothorax (SPP).[2] PSP refers to cases where pneumothorax transpires without an underlying lung disease. It is commonly observed in medical practice, particularly among young adults and adolescents, who do not have any preexisting condition or triggering event. PSP is commonly found in tall, young, and thin men, and is often attributed to the rupture of blebs or bullae in the pleura.[2] The incidence of this condition varies based on gender and age, ranging from 7.4-18 and 1.2-6 cases per 100,000 population annually in men and women, respectively.[3]

The rupture of subpleural blebs or bullae in the apical segment of the upper or lower lobe is linked to the most frequent PSP mechanism. Smoking has been identified as the most significant risk factor, and the amount of cigarettes smoked per day increases the possibility of the condition. Furthermore, smoking can induce bronchial abnormalities, such as inflammation or obstruction in the distal airways, which contribute to the development of blebs in the lung parenchyma adjacent to the pleura.[4]

This study presents the condition of a 19-year-old man who reported chest discomfort, lasting for the past 24 hours and a 4-year smoking history. Furthermore, this case highlights the importance of early detection and initial management of PSP in the absence of an evident cause. Complete resolution was achieved in the patient through timely intervention, thereby preventing complications that can affect the quality of life in the future and facilitating an earlier return to physical activities.

Case Illustration

A 19-year-old man presented with right-sided chest pain, which started one day before hospitalization. The pain was described as a pressure-like sensation and it was not influenced by activity. Furthermore, the patient did not complain of shortness of breath but there was discomfort when breathing for the past one day. Further examination revealed the absence of restlessness, but there had been coughing without sputum for the past three days. There was no fever, loss of appetite, weight loss, night sweats, or previous medical history. A family history of allergies was denied and there was no previous medication use. The patient was a student with a height of 172 cm and a weight of 55 kg (body mass index 18.9 or within the normal range). There was a history of smoking for the past 4 years with a mild Brinkman index, but no consumption of marijuana, illicit drugs, or alcohol.

On physical examination, the patient appeared calm with a normal level of consciousness, 125/82 mmHg blood pressure, 98 beats per minute heart rate, 24 breaths per minute respiratory rate, and 37.0°C temperature. During pulmonary examination, hyperresonance on percussion and decreased vesicular breath sounds were observed in the right hemithorax. Laboratory tests at Dr. Zainoel Abidin Hospital revealed 15.8 g/dL Hemoglobin, 46% Hematocrit, 8,400/mm^3 Leukocytes, 350,000/mm^3 Platelets, 3% Eosinophils, 0% Basophils, 0% Band neutrophils, 57% Segmented neutrophils, 31% Lymphocytes, 9% Monocytes, 11 mg/dL Urea, 0.9 mg/dL Creatinine, 14.10 seconds Prothrombin time (PT), 20.10 seconds activated partial

thromboplastin time (aPTT). Furthermore, sputum testing using Rapid Molecular Test showed MTB (Mycobacterium tuberculosis) Not Detected. Chest X-ray revealed a collapse of the right lung with a large radiolucent area in the right hemithorax, as shown in Image 1. Furthermore, a thoracic CT scan showed a hypodense area with air density in the right hemithorax, as shown in Image 3. Based on these findings, the patient was diagnosed with right-sided primary spontaneous pneumothorax.

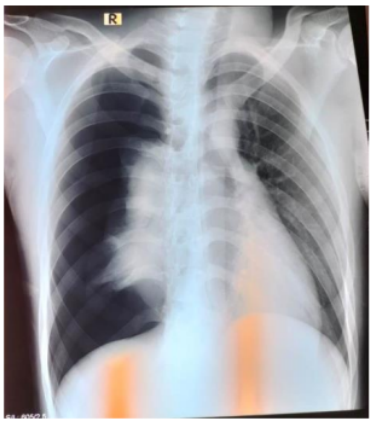

Figure 1. Photo Thorax at the time of admission to the hospital

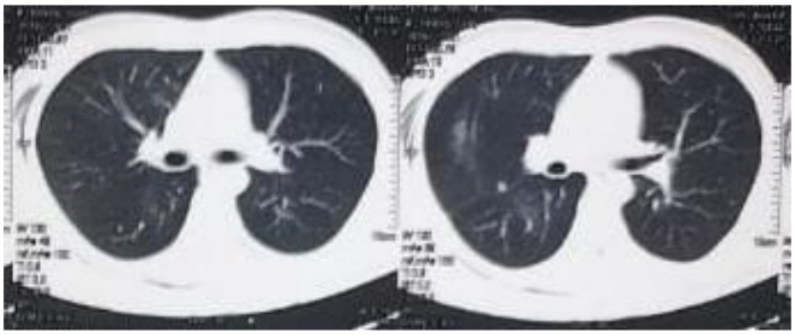

Figure 2. Thoracic CT Scan after chest tube performed

The patient was managed with a chest tube, also known as water-sealed drainage (WSD), in the right hemithorax to remove air from the pleural cavity. After 4 days of treatment, with no further fluctuations observed in the WSD, a physical examination revealed the presence of vesicular breath sounds in the right and left lungs. The chest X-ray showed the absence of a collapsed line in the right lung. Subsequently, the patient was discharged in a healed condition, as shown in Figure 3.

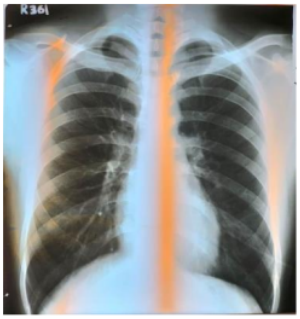

Figure 3. Photo Thorax at the time of discharge from the hospital

The patient was followed up for 6 months and clinical evaluation showed that there were no symptoms or signs of recurrent pneumothorax. A chest X-ray evaluation was performed and the results showed that the lung and heart conditions were within the normal limits, as shown in Figure 4.

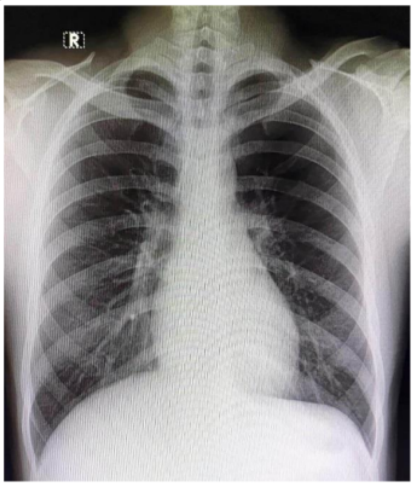

Figure 4. Follow-up photo Thorax after 6 months

Discussion

In this case, there was significant uncertainty regarding the source of air in the right pleural cavity at hospitalization. Furthermore, most cases of sudden-onset pneumothorax in the thorax did not show any visible fractures in the chest wall on chest X-ray. Although there were suspicions of a ruptured bleb due to the patient's smoking habit for the past 4 years, it was difficult to confirm this condition. The chest X-ray confirmed the initial suspicion, and the CT scan findings showed a case of primary spontaneous pneumothorax (PSP).

PSP had an incidence rate of 7.4-18 cases per 100,000 people per year in males and 1.2-6 cases in females. It often occurred in males, individuals with a tall body posture, and frequent smokers. PSP could also occur at rest, thereby removing the need to avoid physical activity. Spontaneous pneumothorax in patients with underlying lung disease was classified as

secondary spontaneous pneumothorax (SSP). This classification was made because they had differences in prognosis and management.[5]

Patients with PSP often complained of sharp ipsilateral chest pain and mild dyspnea. Furthermore, the physical examination findings depended on the volume of air in the pleural cavity. In this condition, breath sounds were often decreased or absent, with hyperresonant percussion. The most common cause of spontaneous pneumothorax was the rupture of subpleural blebs or lung bullae.[6] Upon the suspicion of pneumothorax, the patient must be taken to a medical care center, and a chest X-ray was mandatory as the initial diagnostic examination.[7]

The first step in managing this condition was deciding on the necessary intervention or whether the patient could be managed conservatively with observation alone. In patients with large or symptomatic pneumothorax, the British Thoracic Surgery (BTS) recommended the use of various treatment methods. BTS defined a large pneumothorax as >2 cm measured from the visceral pleura visible on the lateral chest wall at the level of the hilum on chest X-ray. Furthermore, it was recommended that in some patients with this type but minimal symptoms, conservative management could be pursued.[8] In this case, a large pneumothorax with dyspnea symptoms was found. The patient was then followed up with a chest tube intervention aimed at draining air from the pleural cavity and reducing dyspnea.

Some patients with small pneumothorax (<15% of total lung volume) could only be observed without the need for hospitalization.[9] However, further chest X-rays were needed to assess the potential expansion of the condition. If there was no progression and the vital signs were stable, the patient could be safely discharged home. Weekly chest X-ray evaluations must also be performed until complete resolution was achieved, which usually occurred within 2 weeks. If air leakage persisted with progressive collapse or unresolved pneumothorax, a chest tube procedure was an alternative treatment option. Feden et al. suggested that in cases where the pneumothorax was >20% of total lung volume or the patient exhibited unstable vital signs, immediate admission to the hospital emergency room and evacuation of air from the pleural cavity with a chest tube must be performed.[10]

Spontaneous pneumothorax could occur without prior trauma or iatrogenic injury. Therefore, the air in the pleural cavity could originate from the connection between the alveolar space containing air from the lung and the pleural cavity.[11] Although PSP was generally considered to occur without underlying lung disease, there was ample evidence to suggest that it had a minor locus in the lung.[12] Several references indicated some risk factors were associated with PSP, such as:

1. **Body Mass Index (BMI)**

PSP occurred more frequently in tall, thin patients with low body mass index (BMI), as well as smokers. After the first episode, the risk of recurrence in PSP patients was higher compared to tall individuals.[13]

PSP patients were frequently ectomorphic (tall and slender) from childhood on, but between the ages of 11 and 14, there were noticeable height increases relative to national standard values. The pleural pressure increased from the base to the apex of the lung, according to numerous investigations. Therefore, levels in the lung apex were higher in people with tall

statures. This was because the pressure had a high correlation with surface area, and increased levels in the apex tended to cause the formation of blebs and bullae.[3]

Based on previous studies, triggering factors for increased intrapleural pressure could be attributed to changes in atmospheric pressure, physical activity, and exposure to loud music, leading to acute changes in transpulmonary pressure due to sound energy exposure.[14]

2. **Smoking**

Tobacco smoking remained the most important risk factor for PSP. A retrospective study in Stockholm assessed the smoking rates of 138 patients hospitalized over 10 years and compared them with a large contemporary random sample. The results that 88% of PSP cases occurred in people with positive smoking status. Compared to non-smokers, the relative risk of spontaneous pneumothorax increased by ninefold in women and 22-fold in men who smoked. Furthermore, there was a strong dose-response relationship between the risk of pneumothorax occurrence and the number of cigarettes smoked per day. Small airway abnormalities stimulated by smoking (cigarette smoke) could lead to the development of subpleural blebs.[15]

3. **Bleb and Bullae**

Blebs and bullae were known as emphysema-like changes (ELC). Blebs are characterized as tiny, air-filled sacs or vesicles of the visceral pleura brought on by air in the interstitial space. It typically had a diameter of about 1 cm and was frequently developed between the internal and exterior elastic lamina of the pulmonary pleura. Bullae, or subpleural emphysematous bullae, on the other hand, were bigger air pockets that were >1 cm and were strongly marked by thin walls (1 mm).[16]

4. **Microscopic Abnormalities, Inflammation.**

Microscopic evaluation of the lung tissue from PSP patients having lung excision revealed fibrotic changes as well as persistent distal airway damage with lymphocyte and macrophage infiltrating. Furthermore, in apparently healthy lungs, persistent inflammation may result in the development of ELC.[17]

5. **Pleural Porosity**

The concept of pleural porosity involved air leakage from the alveoli into the pleural cavity through thin pores in the visceral pleura.[18] In some cases, including this current patient, no macroscopic lesions were found based on CT scans. Furthermore, this supported the suspicion of pleural porosity as the cause of PSP when air leaked from the thinned visceral pleura, and not just from blebs or bullae. Several studies had been carried out to compare autofluorescence thoracoscopy in 12 PSP patients and 17 healthy subjects who underwent sympathectomy and had no lung disease or previous pneumothorax. Based on previous studies, fluorescein was known to emit green fluorescence under ultraviolet light. Before the procedure, patients were asked to inhale nebulized fluorescein, and subpleural green fluorescence was found under ultraviolet light in the peripheral lung area. This indicated that the inhaled substance approached the lung surface, which was a normal condition in thoracoscopy. The least normal lesions were found in PSP patients with ELC, indicating the occurrence of air leakages at the sites of blebs or bullae macroscopically.

6. **Abnormal Elastolysis**

Elastolysis referred to the imbalanced degradation of elastic fibers in the lungs, causing the tissues to become more "fragile. The degeneration of elastic fibers and the development of

porous elastofibrotic layers could result from chronic peripheral airway inflammation. Additionally, there was proof of a disparity between the oxidant-antioxidant mechanism and the protease-antiprotease pathway. Endopeptidases known as matrix metalloproteinases (MMPs) were capable of rupturing the barrier separating the pulmonary cells from the alveoli. In addition to asthma and COPD, MMP-2 and MMP-9 were thought to be harmful in various lung conditions.[19]

Immunohistochemistry on the pulmonary tissues revealed elevated MMP-2, 7, and 9 expression in PSP cases. In 91 pneumothorax subjects, some studies also discovered elevated expression of MMP-2 and MMP-9. Furthermore, individuals with recurrent pneumothorax episodes were reported to have increased expression of MMP. Apart from the excessive expression of MMPs potentially damaging lung tissue, protective factors also became depleted, leading to increased fragility of the lung tissue.

7. **Hereditary Disorders.**

Based on previous reports, several hereditary conditions had been shown to be associated with a tendency to pneumothorax, such as connective tissue diseases (Marfan syndrome, Ehlers-Danlos syndrome, or other mutations of the folliculin gene), defects with cystic patterns or emphysema development (Birt-Hogg-Dube syndrome (BHD), alpha-1 antitrypsin deficiency), and metabolic conditions (such as Homocystinuria). Although uncommon, people who had a family record of accidental pneumothorax frequently needed additional testing since episodes of spontaneous pneumothorax may be a sign of these genetic disorders.[20]

Management[21,22]

Treatment for PSP patients had two goals, namely air evacuation and preventing recurrence, as well as avoiding complications, such as trapped lung due to thickening of the visceral pleura.

1. **Conservative**

For patients with minimal or no symptoms, observation could be performed, with the condition that easy access to medical care was available in case of worsening, leading to lung collapse.

2. **Pleural Aspiration or Chest Tube Drainage.**

Aspiration could be used as initial management for PSP patients, specifically in younger patients (<50 years old) with moderate-sized secondary pneumothorax (1-2 cm in size). The rate of pneumothorax recurrence after aspiration was nearly the same as after chest tube insertion. Furthermore, chest tube insertion was the most commonly performed surgical procedure in the thorax. This procedure was often carried out to re-expand the collapsed lung (lung re-expansion).

3. **Pleurodesis**

Pleurodesis aimed to create adhesion between the visceral and parietal pleura to prevent the recurrence of pneumothorax. It was often carried out by instilling irritant chemicals (chemical pleurodesis) or performing cart mechanical abrasion (mechanical pleurodesis), as well as parietal pleurectomy. Based on previous studies, talc poudrage was the most commonly used method in Europe due to its cost-effectiveness. It could be used to achieve the desired diffuse chemical pleurodesis to prevent PSP recurrence. However, there were some limitations,

such as in cases of visceral pleural rupture, where immediate referral for resection of the leaking lung parenchyma was recommended.

4. **Video-assisted thoracoscopy (VATS)**

VATS allowed minimally invasive access to the pleural cavity and was preferred over open thoracotomy for pneumothorax management.

Conclusion

PSP commonly occurred in young, tall, thin men with stable clinical presentations, often with mild chest pain complaints. In this case, various diagnostic tests had been performed, and the results were normal. Furthermore, a history of smoking was the only risk factor that triggered PSP in this patient. Conservative management could be considered for small PSPs measuring less than 20%, while chest tube placement was recommended for larger pneumothoraces. This patient in this study was treated using definitive management involving a chest tube, which re-expanded the lung completely without recurrence.

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