Spontaneous Pneumomediastinum due to Hookah Smoking in Children: Two Case Reports

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Abstract	Spontaneous pneumomediastinum (SPM) is defined as free air within the mediastinum without any trauma,
	surgical procedure, medical attention or apparent
	precipitating causes. Pneumomediastinum (PM) is
	divided into two groups: (i) SPM and (ii) secondary PM.
	While smoking is accepted as a risk factor for PM in the
	literature, there is no concrete evidence linking hookah
	smoking with PM. In this article, our purpose is to
	present two children of SPM due to the sole effect of
	smoking hookah – without any other precipitating factor.
	A 15-year-old male presented to the emergency
	department complaining of chest pain and dyspnea. He
	stated that shortness of breath had begun after his most
	recent hookah smoking On the second day of
	hospitalization, the patient was discharged uneventfully.
	A 14-year-old male presented to the emergency

Keywords

- Spontaneous pneumomediastinum
- Hookah
- Children

department complaining of suffering dyspnea for 4 days. It is stated that he had been smoking hookah for two months and that his shortness of breath had begun after his most recent hookah smoking. On the second day of hospitalization, the patient was discharged uneventfully. Although SPM is rare in pediatric-age patients, hookah smoking should be queried. In terms of treatment, conservative therapy is generally sufficient and no sequelae or recurrence is expected in follow-up.

Introduction

Spontaneous pneumomediastinum (SPM) is defined as free air within the mediastinum without any trauma, surgical procedure, medical attention or apparent 2.3 precipitating causes.¹, Pneumomediastinum (PM) or mediastinal emphysema was first described by René-Théophile Laennac in 1819 and SPM was first described by Hamman in 1939.^{1,4,5} In 1964, the first SPM series in children was reported by Thaler.^{1, 4, 5} PM is divided into two groups: (i) SPM and (ii) secondary PM (1). Although the etiology of secondary PM is well known, the etiology of SPM is not clearly understood.^{2, 4}

The frequency of SPM in children is reported to be 1/8000-1/42000 according to various publications.^{1, 2, 3, 5} It is known that SPM tends to present as two peaks: (i) between the ages of 6 months-4 years and between 15-18 years.^{1, 3, 5} Also, it is worth noting that SPM more commonly occurs in males.² Hookah pipes, using hookah tobacco, are mostly referred to as a form of smoking. Despite its centuries-old existence, hookah is still popular among young men in Middle Eastern, Mediterranean, and some Asian countries.²

In this article, our purpose is to present two case studies of SPM due to the sole effect of smoking hookah – without any other precipitating factor.

Case Presentation 1

A 15-year-old male presented to the emergency department complaining of chest pain and dyspnea. Predisposing factors could not be found in the patient's history except for use of hookah for 1 year. There was no history of drug and cigarette use. He stated that shortness of breath had begun after his most recent hookah smoking. On physical examination, it was observed that the patient was tall and under weight with blood pressure of 100/70 mmHg, a pulse of 78 beats/min, respiration at 22/min, at 97%, and oxygen saturation а temperature of 36.4 °C. No other significant findings were evident on examination of the patient's respiratory system; examination using posteroanterior chest radiography also revealed no pathological signs in other systems. Due to the consistency of the patient's chest pain and dyspnea, Computed Tomography (CT) was performed and air observed in the upper and middle mediastinum Figure 1A-B. In the parenchyma window, in sections passing through the upper mediastinum, hypodense free air was observed between the paraosophageal area and the muscle planes Figure 1A-B. The patient was hospitalized in our clinic with a diagnosis of SPM. 2L/min oxygen and analgesic (paracetamol 10 mg/kg) treatment was begun. On the second day hospitalization, chest pain of was decreased. Oxygen saturation increased to 99-100% and respiratory rate decreased to 16-18/min. On the second day of hospitalization, the patient was discharged with some suggestions. After one week, no significant findings were evident in check-up chest radiography.

Case Presentation 2

A 14-year-old male presented to the emergency department complaining of suffering dyspnea for 4 days. It is stated that he had been smoking hookah for two months and that his shortness of breath had begun after his most recent hookah smoking. Aside from this, no other precipitant factors were evident. On physical examination, it was observed that the patient was tall and underweight, with blood pressure at 100/60 mmHg, a pulse of 82 beats/min, respiration of 28/min, oxygen saturation of 92%, and а temperature of $36.7^{\circ}C$ No other significant findings were evident on examination of the respiratory system and an examination of other systems using posteroanterior chest radiography revealed no other pathological signs. The patient's laboratory tests were unremarkable. Due to consistency of the patient's dyspnea, a CT scan was taken and aerial densities were observed in the lower part of the neck and mediastinum, around the trachea and esophagus (Figure 2A-B. The patient was hospitalized in our clinic with a diagnosis of SPM. 2L/min oxygen and analgesic (paracetamol 10 mg/kgtreatment was begun. On the second day of hospitalization, chest pain and dyspnea decreased. Oxygen saturation were increased to 99-100% and respiration decreased to 14-16/min. On the second day of hospitalization, the patient was discharged with some suggestions. After one week, no significant findings were evident in check-up chest radiography.

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Figure 1A-B: In the parenchyma window, in sections passing through the upper mediastinum, hypodense free air were observed between the paraosophageal area and the muscle planes (yellow arrow: free air).

Figure 2A-B: Aerial densities in the lower part of the neck and mediastinum, around the trachea and esophagus (yellow arrow: free air).

Discussion

SPM, which has a benign prognosis, is often seen in young adults and is usually self- limiting and resolves within 3-15 days without sequelae.² Traditionally, atrisk patients are tall and underweight as in spontaneous pneumothorax.¹ However, not all patients described in the literature this characteristic and have other important demographic factors in children have not yet been defined.¹ Chest pain is the most-seen feature in SPM clinics, as well as other symptoms such as neck pain, dysphagia, nausea, dyspnea, fever, vomiting, hoarseness, coughing, weakness, swelling of face and neck, and Hammer's sign (the crackling sound made by air in the mediastinal tissue).^{2, 4, 5} Both of our case-study patients reported only chest pain and mild shortness of breath.

In the literature on children with PM, possible precipitant factors are reported in 70-90% of cases.⁵ PM is thought to be caused by alveolar rupture that develops after an acute increase in intrathoracic pressure.⁴ According to the commonly known Macklin effect, free air can leak into the pulmonary interstitial space from ruptured alveoli.^{2, 3, 6} Free air can then migrate mediastinum, to the submandibular space, retropharyngeal space, and large veins of the neck and esophagus.² Free air may also spread to the pericardium and cause tamponade, causing pneumothorax and subcutaneous emphysema.1,3

Various precipitant factors that may lead to the development of secondary PM have been reported in the literature, such as trauma, foreign body aspiration, medical interventional procedures, bronchopneumonia, bronchiolitis or barotraumas after mediastinitis, cystic fibrosis. cancer. bronchial asthma. cannabis and smoking, cocaine inhalation, Valsalva maneuver (coughing, crying, yelling, lifting weights, activities related to sport and weightlifting).^{2, 4, 5} Asthma is the most common cause in medical history, accounting for 22.2% of all cases.^{1, 3} PM related to spontaneous esophageal or bronchial rupture is rare in pediatric age groups.³ Our patients had not experienced similar attacks or previous medical/surgical procedures and did not suffer from any known diseases. Therefore, our patients were diagnosed as suffering from SPM and no other factors except hookah smoking were identified as predisposing factors.

Hookah smoking is an artificially cooled smoking method that involves the passage of cooled tobacco smoke through aluminum foil filtered through water.² Hookah smoking is more dangerous because 40-100 times more tobacco is consumed in a typical session compared to cigarette smoking and hookah smoke contains many more toxic substances compared to smoking.² However, most hookah smokers believe that hookah smoking is less harmful than smoking cigarettes.² While smoking is accepted as a risk factor for PM in the literature, there is no concrete evidence linking hookah

This open-access article is distributed under the terms of the Creative Commons Attribution Non Commercial 3.0 License (CC BY-NC 3.0). Downloaded from: http://journals.sbmu.ac.ir/irjps smoking with PM.² In physiopathology, it is thought that small ruptures may occur in alveoli due to increased valsalva maneuvers during smoking hookah and this air may leak into the pulmonary interstitial space and from there to the mediastinum. In literature, no other cases of SPM are reported except for two patients who had engaged in hookah smoking at the age of 18.^{4, 7}As far as we know, our patients are the first cases of SPM in the literature that can be associated with hookah smoking in children.

Although it is stated in the literature that bilateral chest X-rays are used to diagnose SPM in most patients, in the present paper, the diagnosis was made using CT in both patients.³No significant indicators were evident on the bilateral chest X-ray in our patients (e.g. the spinnaker sail sign, continuous diaphragm sign, lucent streaks on the left side of the heart and aortic arch).^{1, 5}The commonly seen indicators of SPM in CT scans are subdiaphragmatic air, subcutaneous air, injury to the trachea or esophagus, air space opacities, pulmonary interstitial emphysema or interstitial fibrosis. The Hammer's sign, defined as a crackling sound made by air in the mediastinal tissues, is almost pathognomonic for this condition and is sometimes associated with some decrease in heart sound.⁵ However, the Hammer's sign was not seen in our patients. Bilateral chest X-ray and, when necessary, a CT

scan, are generally sufficient for diagnosis. If a serious underlying cause is suspected, esophagoscopy, bronchoscopy, and barium graphies are often recommended for suitable patients in the diagnostic algorithm.^{3, 4}

In treatment, because of the disease's low visibility, no evidence-based treatment exists.⁴ Due to tachypnea and additional symptoms, patient follow-up may be required in intensive care but most patients can be followed up on the ward.³Neitherof our case-study patients required intensive care and were followed up in the ward. In terms of treatment, oxygen, analgesics, bronchodilator, skin incision, tracheostomy, and medical exploration to evacuate subcutaneous air in some elderly patients have been suggested.^{1, 4, 5}Conservative treatment with rest, oxygen and analgesics were sufficient in our cases. Although most of the articles on SPM do not report recurrence, a minority report otherwise.^{4, 5} Therefore, SPM patients should be warned and followed upto prevent recurrence.

Conclusion

SPM is a rare and generally benign disease among children. It should be considered in pediatric patients presenting with chest and neck pain. Although SPM is rare in pediatric-age patients, hookah smoking should be queried. In terms of treatment, conservative therapy is generally sufficient and no sequelae or recurrence is expected in follow-up.

Ethical Considerations

This study is approved by Ethics Committee of Non-Clinical Researches, Hatay Mustafa Kemal University.

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Conflict of interests

There are no conflicts of interest.

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