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Pneumothorax, pneumomediastinum, subcutaneous emphysema and pneumorrhachis as complications of common flu

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Summary

Background:

Spontaneous pneumomediastinum is an uncommon benign condition that is occasionally associated with subcutaneous emphysema and occasionally with pneumothorax, but is rarely associated with pneumorrhachis (air within the spinal epidural space).

Case Report:

We describe the case of a 20-year-old man and discuss a classification system of pneumorrhachis and its pathoanatomy, clinical and radiological presentation and management based on a detailed review of the previous literature. The pathophysiology is multifocal and diagnosis is state-of-the-art, as free intra-spinal air collection and coexistence of it both should be differentiated. Computed tomography with reconstruction of imaging is the method of choice for investigation. Symptoms associated with pneumorrhachis are due to its cause and origin and rarely due to pneumorrhachis, itself. Neurological symptoms and signs due to pressure effect are rarely found, but were present in our case. The management requires a multidisciplinary regimen and has to be individualized. The case was successfully managed conservatively, except for intercostal drainage for symptomatic pneumothorax. The patient stayed at rest and his symptoms improved within a few days. Seven days later the intraspinal air and pneumomediastinum were spontaneously resolved on follow-up chest computed tomography. In spontaneous pneumomediastinum, pneumorrhachis is self-limiting and benign.

Conclusions:

The same management is advised in spontaneous pneumomediastinum with or without pneumorrhachis in non-complicated, asymptomatic cases.

key words:

air • epidural space • non-traumatic • subcutaneous emphysema • traumatic

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BACKGROUND

Pneumorrhachis (PR), 'air within the spinal epidural space', occurs in a variety of settings, including skull and spinal fractures, epidural abscess, epidural anaesthesia, lumbar puncture, and traumatic pneumothorax and pneumomediastinum [1]. Although it is rare, there have been documented cases in the literature in which bronchial asthma also contributed in development of PR [2]. The common cold leads to PR very rarely. PR is an entity in which increase in the intra-alveolar pressure secondary to vigorous cough leads to rupture of alveoli, resulting in air leaks in the peribronchovascular space, where it follows a path of least resistance to the mediastinal and pleural spaces via rupture of the mediastinal pleura. Facial planes further help air to enter the posterior mediastinum to the epidural space [2]. We report a recently encountered case of a young adult with common flu-associated spontaneous pneumomediastinum, subcutaneous emphysema and pneumothorax (not due to previous injury or surgery), complicated with PR.

CASE REPORT

A 20-year-old man consulted his family physician with history of sore throat, mild fever, malaise and dry cough for 3 days, for which he had received symptomatic treatment. He did not have a history of atopy, allergic bronchitis or asthma. The next day he developed neck swelling, along with headache and breathlessness. On evaluation he was found to have surgical emphysema, and chest radiography showed subcutaneous emphysema, pneumomediastinum and pneumothorax. Computed tomography not only confirmed the presence of pneumomediastinum, mild left pneumothorax and air in the subcutaneous plane of the trunk and neck, but also demonstrated a linear radiolucent stripe in the spinal canal corresponding to epidural emphysema (pneumorrhachis) (Figure 1, 2). Examination revealed a well-built and moderately nourished young male with normal temperature and pulse. The patient did not have any significant neurologic signs or symptoms except for mild headache. His general condition remained good except that his arterial blood oxygen saturation slightly decreased to 95%. There was extensive surgical emphysema over the chest wall, neck, face, upper arms and upper abdomen, with diminished air entry at the left hemi-thorax. Hemogram and biochemistry were within normal limits. Left side thoracic drainage catheter with a trocar (Romsons, GS-5030) was inserted with an underwater seal and he was put on a non-rebreathing mask with high oxygen flow for 2 days. Over the next few days he improved, subcutaneous emphysema resolved, the left lung expanded completely and headache subsided. The chest drain was removed on the 4th day of insertion and he was discharged on the 5th post-admission day. Spirometry was performed after 4 weeks of discharge, and revealed normal to lung ventilator function and volumes.

DISCUSSION

PR (air within the spinal canal), was first described by Newbold in 1971; intraspinal pneumocele, pneumo saccus, aerorachia, pneumomyelogram and epidural pneumato-sis are other terms used in practice [3]. This condition has been increasingly recognized after availability of spiral CT,

but most often it is accidentally detected, since it is difficult for clinicians to distinguish air in the spinal canal (epidural space or subarachnoid space) [3,4]. Radiology may help differentiate between these conditions. In the subarachnoid space air may be located both anterior and posterior to the spinal cord, while in the epidural space air is seen predominantly in posterior and/or lateral distribution.

A search of the relevant literature yielded 86 cases in 71 different articles reported through 2005, and 14 cases associated with violent coughing due to bronchial asthma and/or acute bronchitis [1,2]. To the best of our knowledge, no cases with PR secondary to common flu have been reported. There have been some reported cases of PR secondary to cardiopulmonary resuscitation, airway obstruction due to foreign body aspiration, physical exertion, marijuana inhalation and forceful emesis. Some cases of epidural PR secondary to traumatic head, cervical, thoracic, abdominal and pelvic injury were also reported.

Various pathways of air entry into the spinal canal are postulated. A hypothetical pathway was proposed in PR with violent coughing, which increases intrathoracic pressure, as well as probable rupture of a peripheral pulmonary alveolus by increase intra-alveolar pressure by coughing against a closed glottis. This initial event leads to leakage in the peribronchovascular interstitial space, which dissects further and finds a path of least resistance from the mediastinum to facial planes of the neck. There are no facial barriers to prevent communications of the posterior mediastinum or retro-pharyngeal space with the epidural space [1,2]. Thus, air freely communicates via the neural foramina and collects in the epidural space. The distribution and location of air within the spinal canal depends entirely upon the site of air entry, volume, rate and intraspinal space and patient position [1]. The dissected air preferentially collects in the posterior epidural space, as there is low resistance from loose connective tissue as compared with the anterior space where a rich vascular network occupies space [2,5].

Anatomical classification includes internal pneumorrhachis (intradural, subdural or subarachnoid space) and external pneumorrhachis (extradural, intraspinal or epidural air). External pneumorrhachis are innocuous, and while internal (presence of air in subarachnoid space) pneumorrhachis is commonly found in association with air within the cranial vault, basal skull fracture and dural tear, and predict as a marker of severe trauma [1]. Differentiation is between the two is difficult, but is made easier with the help of spiral CT [4]. This differentiation is important, as the mechanism and causes of air entry are different and have different clinical implications for management. Epidural PR may be broadly classified into iatrogenic, non-traumatic and traumatic [2,5]. Iatrogenic occurrences are the most common and result from the administration of epidural anesthesia. Traumatic and non-traumatic cases both are rare, but traumatic cases are usually associated with external findings; PR is a marker of severe injury but is not of much clinical importance [1,4,5]. Depending upon cause, origin and effect of PR, It further classify into primary or secondary pneumorrhachis [1].

Intraspinal air is mostly non-symptomatic and clinically unspecific. PR is primarily a radiological diagnosis, not a



Figure 1. Sagittal multiplanar reformatted spiral computed tomographic (Soft tissue window) view demonstrating pneumorrhachis at cervical and dorsal spine.

clinical one [1,3–5]. Clear guidelines regarding diagnostic and therapeutic intervention are currently not available, and PR is usually more often diagnosed with sophisticated imaging techniques [1,2]. Work-up should include roentgenograms and spiral CT of the spine. Chest roentgenograms in lateral view might help to identify air in the spinal canal. Radiolucency along the spinal canal is a very important sign in the detection of PR, as PR itself works as a negative contrast to delineate vertebrae [1,5]. Conventional PA view of chest roentgenograms provide a quick survey of severity of injury, associated injury and complications such as pneumomediastinum and pneumothorax with subcutaneous emphysema [1,4]. The gold standard diagnostic tool for PR is CT, which distinguishes between internal or external types and also helps to delineate the extent of air in the body cavity and damage to other organs; thus, its application is much wider in PR because it is a marker of severe injury [1,3–5]. MRI is rarely used for diagnosis, but is indicated for determining coexisting etiologies of PR and differential diagnostically examinations [1].

PR should be differentiated from free intraspinal gas collection secondary to malignant, inflammatory, degenerative and infectious diseases by gas-forming organisms by gas chromatographically [1,2]. PR is uncommon but not exceptional, as there is not exact established incidence rate of PR, although recently published data suggest a 9.5% incidence rate [1,2]. PR needs to be treated on an individual basis depending on its etiology; PR in itself usually is asymptomatic,

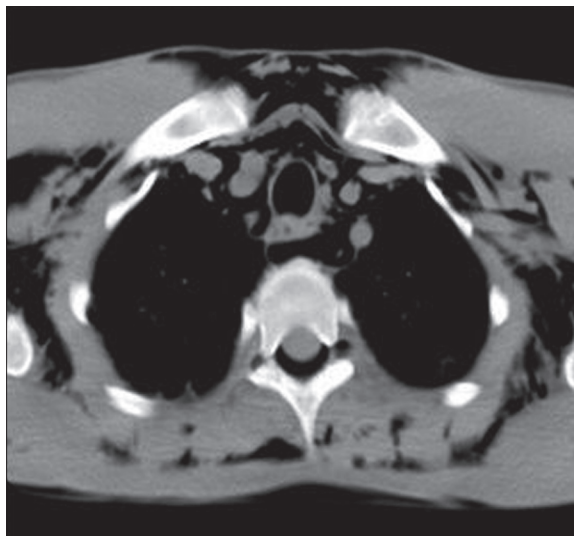


Figure 2. Axial computed tomographic (Soft tissue window) view demonstrating extradural air collection in upper dorsal spine.

does not tend to migrate and reabsorbs spontaneously and completely, with air being passed directly into the blood in several days without recurrences [1,3]. Patients with PR are managed conservatively and treatment must be decided on an individual basis, frequently requiring an internal multidisciplinary regime. Entrapped air occupies space in the cerebrospinal compartment, leading to intracranial and intraspinal hypertension, as well as hypotension secondary to increased and decreased pressure, respectively. PR *per se* is very rarely symptomatic and associated with discomfort or pain or even neurological deficits [1]. Thus PR should be treated based on etiology and severity of symptoms, surgery, antibiotics, foreign body removal from the trachea, bronchodilators in chronic bronchitis and depressurization of oropharyngeal and nasal cavity will be employed in individual cases [2]. The present report indicates that in a patient with spontaneous pneumomediastinum and pneumothorax, PR is mildly symptomatic and self-remittent, and may be managed conservatively.

As our patient had mild headache and his chief complaint was breathlessness due to pneumothorax, we proceed with intercostal drain insertion and high-flow oxygen therapy. Documented treatments of symptomatic PR include intravenous dexamethasone, decompression of the epidural space by percutaneous insertion of Tuohy needle with air aspiration, and high concentration of inspired oxygen or hyperbaric oxygen therapy with promoting re-absorption of air (Nitrogen washout) [1,2,5]. Most recent surveys suggest that patients with pneumorrhachis associated with spontaneous pneumothorax and pneumomediastinum with asymptomatic neurological status are self-limited in 98% of cases. Our patient was observed for recurrence of pneumothorax and worsening of pneumomediastinum and subcutaneous emphysema. He stayed at rest and his symptoms improved within a few days. His intercostal drain was removed on the 4th day. Seven days later, the intraspinal air and pneumomediastinum had resolved spontaneously on follow-up chest CT. Obstructive airway disease was ruled out, as spirometry revealed normal lung function.

CONCLUSIONS

Pneumorrhachis can have a multitude of causes, and evaluation of etiology is very crucial in its management. The diagnosis of PR is often accidental, and discovering its cause can be challenging. PR *per se* is self-limiting, and without any active intervention it will reabsorbed automatically. Asymptomatic patients and those with minimal neurological symptoms due to PR associated with pneumomediastinum or pneumothorax are efficiently managed conservatively with high-flow oxygen inhalation therapy, which enhances its re-absorption by nitrogen washout and further helps in symptomatic improvement in high pressure PR where air under pressure has entered into the epidural space. Spontaneous pneumomediastinum, pneumothorax and PR secondary to violent cough in flu or the common cold is a self-limiting and benign condition that should not be over-investigated or over-treated.

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