DOI: 10.7860/JCDR/2023/65537.18675

Case Report

Radiology Section

Computed Tomography Findings in Traumatic Pneumorachis: A Case Report

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ABSTRACT

The phenomenon of air entering the spinal canal is rare and termed pneumorachis. Due to its rarity, the evaluation and management of pneumorachis have not been well understood. Here, the authors describe a case of pneumorachis associated with pneumothorax, pneumomediastinum, subcutaneous emphysema, and traumatic pulmonary injuries in a 21-year-old male patient following blunt chest trauma after a motor vehicle accident. The patient presented with chest pain and difficulty breathing immediately after the vehicle accident, along with a deformed left arm. A bedside Focused Assessment with Sonography in Trauma (FAST) scan was performed, followed by a non-contrast CT of the thorax, which revealed intraspinal air and multiple fractures. The patient recovered without any adverse outcomes with conservative management of the intraspinal air. Pneumorachis is usually secondary to trauma and typically follows a benign course with spontaneous resolution after conservative management. It is important to be aware of this condition to identify it early and prevent complications.

Keywords: Intraspinal air, Pneumothorax, Pneumomediastinum, Subcutaneous emphysema, Trauma

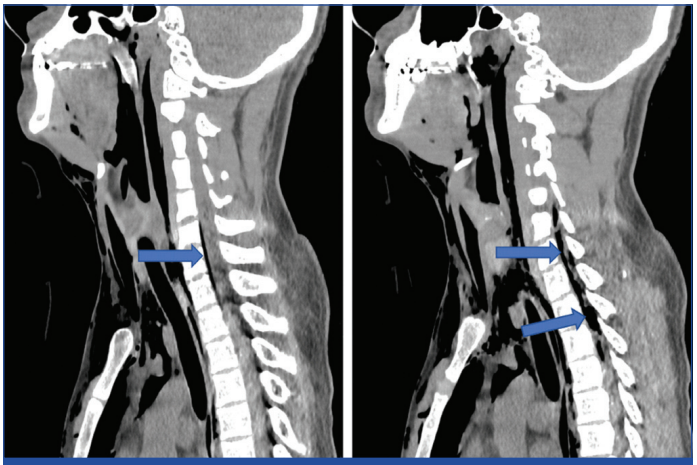
CASE REPORT

A 21-year-old male patient was brought to the Emergency Department by an ambulance with a suspected history of a motor vehicle injury within the past two hours. He complained of pain and restricted movement in his left upper limb immediately after the trauma. The pain started suddenly, gradually worsened, had a sharp character, increased with movement, and improved with rest. He also experienced diffuse chest pain and difficulty breathing. Upon arrival at the Emergency Department, the patient had a blood pressure of 110/80 mmHg, a respiratory rate of 22 cycles per minute, a pulse rate of 124 beats per minute, and an oxygen saturation level of 92% on room air. His Glasgow Coma Scale score was 11 out of 15, indicating that he was conscious and oriented to time, place, and person.

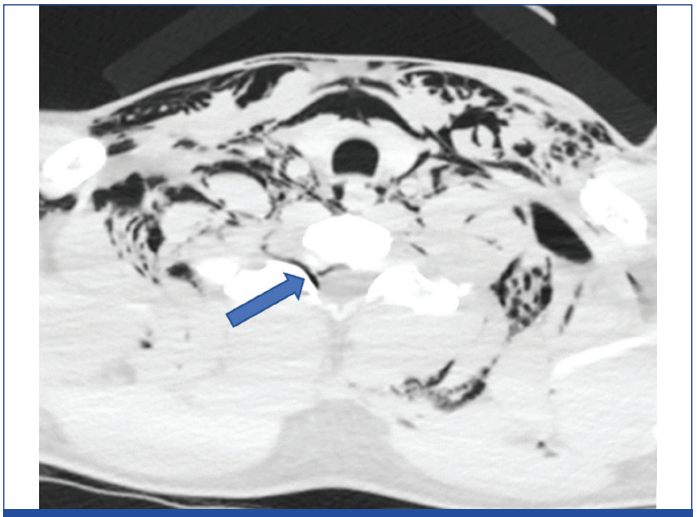
During the clinical examination, chest compression was found to be positive, and there was deformity in the proximal arm of the left side with painful restricted movement of the left shoulder. Tenderness was observed in the deltoid and supraclavicular region on the left side upon palpation. A bedside FAST scan was performed to rule out any intra-abdominal solid organ injury. The patient was advised to undergo a chest radiograph, followed by a non-contrast Computed Tomography (CT) scan of the thorax for further evaluation. Once the patient was stabilised, a non-contrast CT scan of the head and thorax was performed using a GE Revolution 128 Slice machine, with a slice thickness of 5 mm and post-processing 1.25 mm multiplanar reformats.

The CT head study showed no bone or parenchymal injuries. However, the CT thorax study revealed air densities within the spinal space, extending from the C5 to T4 level [Table/Fig-1]. The intraspinal air was observed to communicate with the subcutaneous emphysema through the right neural foramina [Table/Fig-2]. Pneumomediastinum was also noted [Table/Fig-3]. Multiple air densities were observed in the subcutaneous and intermuscular planes, affecting the neck and bilateral anterior, posterior, and lateral chest walls, which were suggestive of subcutaneous emphysema [Table/Fig-3,4]. Mild pneumothorax was present bilaterally, with the right-side being more affected than the left [Table/Fig-5].

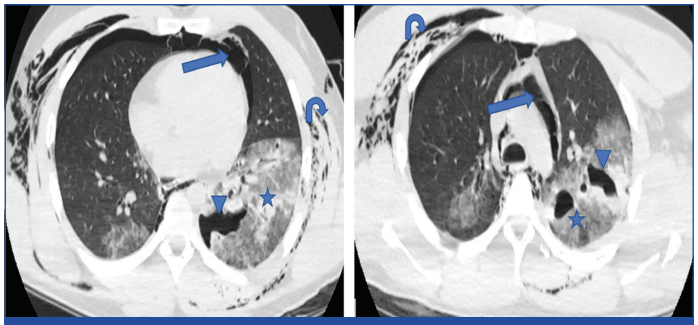
Diffuse confluent areas of ground glass attenuation [Table/Fig-3] were observed, affecting the apical and posterior segments of the right upper lobe, as well as the superior, postero-basal, and medial basal segments of the right lower lobe. Similar findings were



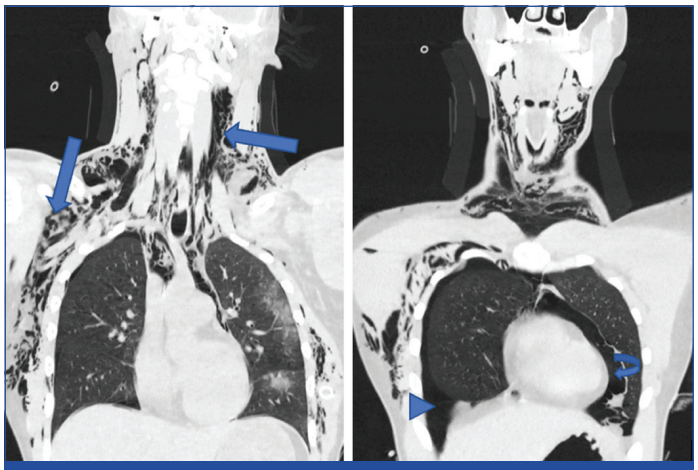
[Table/Fig-1]: Midsaggital and right paramedian saggital view; non-contrast Computed Tomography (CT) of cervical spine showing presence of pneumorachis (arrow) in relation to the body of fifth cervical vertebrae extending to fourth thoracic vertebral body. (Images from left to right)



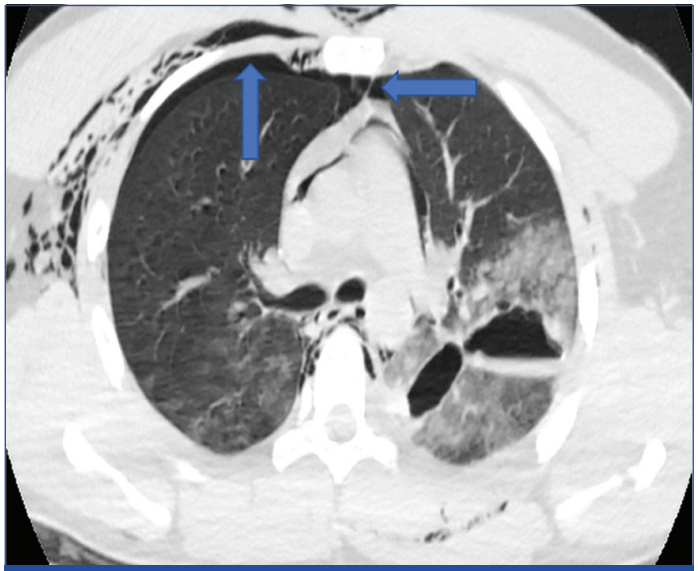
[Table/Fig-2]: Axial non-contrast Computed Tomography(CT) image at the level of 6th cervical vertebra shows intraspinal free air communicating with subcutaneous on the right-side (arrow).



[Table/Fig-3]: Axial view; non-contrast Computed Tomography (CT) at different levels of thorax shows pneumomediastinum (arrow), multiple centrally located intraparenchymal lacerations with pneumatocele (arrowhead) with surrounding ground-glass attenuation, reflecting contusions (*). Note surgical emphysema along the thoracic walls (curved arrow).



[Table/Fig-4]: Coronal view; non-contrast Computed Tomography (CT) of the thorax showing extensive subcutaneous emphysema along the chest walls extending to the neck bilaterally (arrow), pneumomediastinum (curved arrow) and pneumothorax (arrowhead).



[Table/Fig-5]: Axial view; non-contrast Computed Tomography (CT) of the thorax depicting mild pneumothorax bilaterally (arrow).

noted in the apico-posterior segment of the left upper lobe and all segments of the left lower lobe. Multiple air-filled cavities were seen in the left upper and lower lobes, indicating pneumatoceles [Table/Fig-3] resulting from traumatic lacerations. Some of these cavities exhibited air-fluid levels.

Multiple fractures were identified, involving the body of the left scapula, the mid-shaft of the left clavicle, the right 1st rib, and several ribs on the left-side. The fractures were managed conservatively. A follow-up non-contrast CT study of the thorax [Table/Fig-6], performed one week later, revealed complete spontaneous resolution of pneumorachis. The patient's symptoms improved, and he was discharged 10 days after admission.

[Table/Fig-6]: Sagittal view; non-contrast Computed Tomography (CT) of cervical and upper thoracic spine showing resolution of pneumorachis after one week.

DISCUSSION

The presence of free intraspinal air is referred to as pneumorachis. This phenomenon was first described in 1977 by Gordon IJ and Hardman DR, while the term pneumorachis was first coined by Newbold RG et al., in 1987 [1,2]. Since its initial description, multiple terms have been used to describe pneumorachis, including intraspinal pneumocele, aerorachia, traumatic pneumomyelogram, or pneumosaccus [3]. It is a rare condition with associated injuries that are poorly described in the literature. Typically, pneumorachis is asymptomatic and underdiagnosed. However, with the development of modern imaging methods like multidetector CT, such cases are now easier to detect.

The majority of pneumorachis cases are caused by secondary traumatic injury to the respiratory system. Additionally, pneumorachis may develop in association with pneumothorax, pneumomediastinum, pneumocephalus, subcutaneous emphysema, or bowel perforation [4]. Conditions that cause increased intrathoracic pressure and barotrauma may also act as predisposing factors [4].

Pneumorachis can be classified as internal or external, depending on the presence of free air inside or outside the dura mater [5]. Internal or intradural pneumorachis can occur within the subdural or subarachnoid space, while external or extradural pneumorachis is seen in the epidural or extradural space. Internal traumatic PR is frequently associated with major trauma and is considered a sign of serious injury [6]. Pneumocephalus following trauma can result in the air travelling to the subarachnoid space in the cervical spinal canal or even distally [7].

A one-way air valve mechanism may cause air to become trapped and dissect between the paraspinal soft tissues and epidural space via the neural foramina, which traverse along the nerve roots, thereby producing pneumorachis. In certain cases, pneumorachis can be accidental findings, and the conditions causing pneumorachis may remain undetected [8]. Non-contrast computed tomographic evaluation remains the diagnostic tool of choice for prompt and reliable detection [9]. However, distinguishing between intradural and extradural pneumorachis may be difficult on CT. X-ray examinations may be helpful in the initial evaluation of patients with larger amounts of intraspinal air. They depict linear lucency along the spinal canal on lateral chest or dorso-lumbar spine radiographs [10].

There has been one rare case reported in the literature of concomitant pneumocephalus and pneumorachis without skull base injury [11]. However, authors did not find the presence of pneumocephalus in the present case. Pneumorachis in the cervical region has been found to be an extension of pneumocephalus following craniofacial injury or fracture of the skull base or paranasal sinuses [12]. Pneumorachis typically tends to be asymptomatic, non-migratory, and has a greater tendency to reabsorb completely and spontaneously [13]. However, the extent of free intraspinal air and its causes must be evaluated to prevent the entry of air as a one-way valve mechanism, as it may cause tension pneumorachis. Such cases may require decompressive neurosurgery. Incidentally detected pneumorachis typically has a benign course. However, its early detection is important, especially in cases where the patient presents with symptoms of spinal cord compression.

CONCLUSION(S)

Intraspinal air is a radiographic finding and not a clinical diagnosis. Pneumorachis can have varied aetiology but is most commonly caused by traumatic injury to the thorax. It typically follows a benign course and often resolves spontaneously with conservative management. Rarely, it may cause symptoms due to cord compression, necessitating decompressive surgery. Therefore, prompt identification of this condition is important and should alert the treating physicians to a probable underlying injury.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: May 23, 2023
- Manual Googling: Jul 29, 2023
- iThenticate Software: Aug 22, 2023 (9%)

ETYMOLOGY: Author Origin

EMENDATIONS: 5

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **May 22, 2023**
Date of Peer Review: **Jul 26, 2023**
Date of Acceptance: **Aug 24, 2023**
Date of Publishing: **Nov 01, 2023**