Traumatic air myelogram

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Abstract

We present the case of a 60-year-old male patient admitted to our intensive care unit after a high-velocity car accident. On-site clinical examination revealed normal consciousness with no focal deficits. Chest X–Ray was suggestive of right pneumothorax with pneumomediastinum and extensive subcutaneous emphysema. CT scan revealed right pneumothorax, pneumomediastinum, extensive subcutaneous emphysema and extradural pneumorachis. A right tube thoracostomy was done and the patient was placed on High flow nasal cannula at 40 lpm and 100% FiO_2. There was a gradual resolution of pneumothorax and all the extra-alveolar air including pneumorachis by the 7th day. The patient was discharged in a clinically stable condition.

Keywords: Pneumothorax, Pneumomediastinum, Pneumorachis

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Case

We present the case of a 60-year-old male patient admitted to our intensive care unit after a high-velocity car accident. On-site clinical examination revealed normal consciousness with no focal deficits. Chest X–Ray was suggestive of right pneumothorax with pneumomediastinum and extensive subcutaneous emphysema (Figure 1). CT scan revealed right pneumothorax, pneumomediastinum, extensive subcutaneous emphysema and extradural pneumorachis (Figure 2). A right tube thoracostomy was done and the patient was placed on High flow nasal cannula at 40 lpm and 100% FiO_2. There was a gradual resolution of pneumothorax and all the extra-alveolar air including pneumorachis by the 7th day. The patient was discharged in a clinically stable condition.

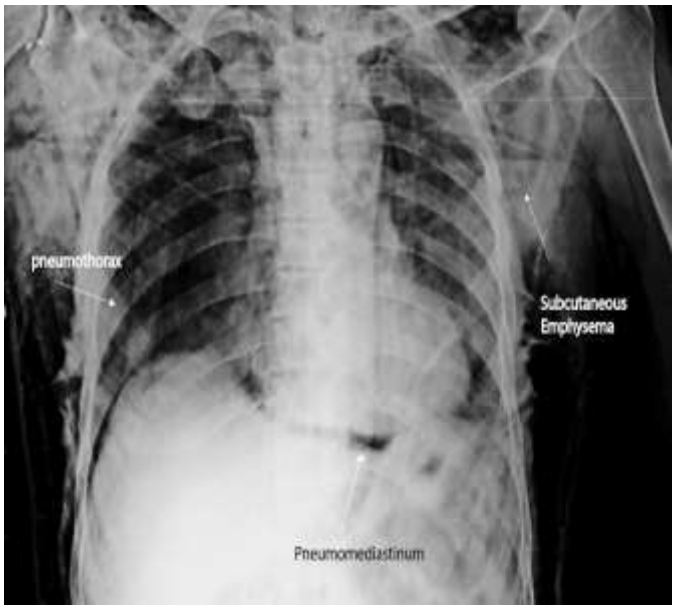

Figure 1: Chest X-ray showing Pneumothorax, Subcutaneous Emphysema, and Pneumomediastinum (white arrows)

Figure 2: Axial CT scan of chest view showing 1) Pneumothorax 2) Pneumomediastinum, 3) Pneumorachis, 4) Subcutaneous-Emphysema

Discussion

Traumatic air myelogram or pneumorachis refers to the presence of air in the spinal canal and is mainly an iatrogenic complication whose traumatic origin is even rarer. [1] Even more rarely seen in blunt chest trauma. [2] The etiologies of pneumorachis are classified broadly into iatrogenic, nontraumatic, and traumatic. [3] Three possible mechanisms have been proposed for the mechanism of air entrainment into the spinal canal; however, the mechanism has not yet been clarified. There is no fascia between the posterior mediastinal space and the dural space; therefore, air generated by pneumothorax or pneumomediastinum can enter the nerve roots through the neural foramen due to pressure as a result of the macklin effect. [4] Another possible pathway for pneumorachis is the embolization of air into the mediastinum veins and vertebral vein plexus from the air entrapped in the mediastinum. [3] Another mechanism is the migration of air within the subcutaneous emphysema and a pleural hernia into the spinal canal. [5] Spontaneous pneumorachis can occur because of respiratory conditions and complications that incite barotrauma. [6]

The location and distribution of air within the spinal canal are probably dependent on the site of air dissection into the spinal canal, rate of air entry and volume of intraspinal air with large volumes spreading widely, capacity of intraspinal space and positioning of the patient. In cases of external pneumorachis, because of the lower resistance from the loose connective tissue, as compared with the rich vascular network that is present anteriorly, the epidural air usually collects in the posterior epidural space.

The diagnostic tool of choice for reliable and prompt detection of pneumorachis is CT. An MRI is not

required unless signs of cord compression are present and other etiologies such as contusion, hematoma, herniation, or compressing bone fragments need to be ruled out.

Pneumorachis does not tend to migrate and reabsorbs spontaneously and completely with the air being passed directly into the blood in several days without recurrence. [7] As the entrapped air occupies parts of the cerebrospinal compartment, thus may cause syndromes of both intracranial and intraspinal hypertension as well as hypotension secondary to either an increase or decrease in intracranial and intraspinal pressure.

Pneumorachis is asymptomatic in most cases but can cause neurologic symptoms, including spinal cord compression in about 10% of patients. [8] As pneumorachis by itself rarely causes spinal cord compression, we should search for alternative explanations such as epidural hematomas, abscesses, herniation etc. if neurological symptoms are present. [9-11]

Rarely, Pneumorachis per se is symptomatic and associated with discomfort and pain or even neurological deficits. Gonzales et al. reported a case of reversible spinal cord and lower cervical root dysfunction caused by air dissection through a bronchopleural-epidural-cutaneous fistula likely due to tumour erosion and post-radiation changes. [12] The patient underwent surgical exploration of the chest with improvement of symptoms postoperatively. Treatment for pneumorachis post epidural anaesthesia consisted primarily of removal of the spinal catheter, bed rest and medication for pain relief, without permanent sequelae in most cases. [13]

Other treatment modalities included intravenous dexamethasone,[14] decompression of the epidural space by percutaneous insertion of a Tuohy needle with air aspiration, administration of high concentrations of inspired oxygen with the idea of promoting reabsorption of air from the subdural space or even trials of hyperbaric oxygen therapy. [15,16]

Because of the rareness and the different pathogenesis and aetiologies, no empiric guidelines for the treatment of pneumorachis and standards of care exist. Pneumorachis associated with decreased intraspinal pressure secondary to cerebrospinal fluid leakage usually has a more benign character, whereas entrapped intraspinal air under pressure entering the cranio-spinal compartment usually in combination with a one-way air valve mechanism might cause tension pneumorachis and pneumocephalus with nervous tissue compression requiring intervention.

Because of the higher risk of possible meningitis, demonstrable cerebrospinal fluid leaks, if significant or persistent, may have to be repaired neurosurgically or treated by a temporary lumbar spinal catheter. Furthermore, in some cases, the underlying pathologies causing pneumorachis such as fistulous tracts between intrathoracic structures and the subarachnoid space (thoracoarachnoid fistulas), traumatic lung injury or lung herniation into the spinal canal may require surgical intervention.

If general anaesthesia is required in a patient with pneumorachis, because of the presumptive diagnosis of a perforation of the dura mater and additional pneumocephalus, the involved anaesthetist should not use inhalational nitrous oxide, because it may cause expansion of intracavitary air and result in an increase in CSF pressure, as nitrous oxide diffuses into the air-filled space. In addition, pressurisation of the oro- and nasopharynx should be avoided, and alternative anaesthetic techniques such as intermitted positive pressure ventilation with transient high-concentration oxygen should be used, thus preventing an increase in the volume of any intraspinal and intracranial air and promote faster reabsorption of air. [16]

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