Pneumorrhachis

General information

AKA pneumatorrhachis, intraspinal pneumocele, spinal pneumatosis and spinal emphysema.

Definition

Air within the spinal canal (intracranial air is called pneumocephalus). Classified as external pneumorrhachis (epidural) or internal pneumorrhachis (subdural or subarachnoid).

A rare condition most commonly seen in association with trauma (including surgery or certain invasive diagnostic testing) or with primary diseases of the respiratory tract.

Classification

PR is commonly classified as spontaneous (nontraumatic), traumatic, or iatrogenic, and iatrogenic PR is the most common and often occurs secondary to invasive procedures such as epidural anesthesia, lumbar puncture, or spinal surgery.

Etiologies

1. trauma (penetrating - usually associated with external pneumorrhachis, or blunt - usually inter- nal pneumorrhachis associated with pneumocephalus)

a) spine fracture

b) pneumocephalus:spinal air from this is usually in the subarachnoid space and is more common with skull base fractures

c) pneumothorax

d) pneumomediastinum

e) iatrogenic

● following thoracic spine surgery

● epidural anesthesia

● after LP (e.g. diagnostic LP, or LP for myelography…)

● following lumbar discectomy

● intentional injection of air: historically used diagnostically (so-called air myelogram)

2. non-traumatic

a) pneumomediastinum:5.8% have associated pneumorrhachis,(more common when all mediastinal compartments are involved)

b) elevated intrathoracic pressure: e.g.acute exacerbation of coughing in bronchial asthma, emesis in diabetic ketoacidosis, CPR, and in foreign body aspiration causing airway obstruction

c) regional necrotizing fasciitis (rare)

d) bronchial-subarachnoid fistula (AKAthoraco arachnoid fistula)

e) emphysematous pyelonephritis

f) opportunistic pneumonia in immunocompromised patients

Clinical Features

Many cases are asymptomatic, especially external pneumorrhachis. Reported findings have included:

1. new-onset radicular pain (cervical or lumbar)

2. cauda equina syndrome

3. positional headache

4. transient unilateral lower extremity paresis

5. unilateral distal upper extremity hypesthesia

Evaluation

Non-contrast CT scan is probably the most sensitive test for detecting pneumorrhachis as well as air in other body compartments, but cannot reliably distinguish external from internal pneumorrhachis. Air shows up as dense black.

MRI is superior at delineating the anatomic boundaries of intraspinal air.

Plain X-rays may detect large collections of air.

Treatment

Air associated with asymptomatic pneumorrhachis in an otherwise stable patient will undergo spontaneous reabsorption over the course of a few days (particularly with external pneumorrhachis), possibly expedited by the delivery of hyperbaric oxygen.

Antibiotics are not indicated in the absence of spinal infection (meningitis) or extraspinal indications.
Surgical indications:

1. intracranial hypo-/hypertension refractory to medical management

2. significant or persistent Cerebrospinal fluid fistula.

3. evidence of unidirectional ball valve (termed tension pneumorrhachis) near at-risk nervous tissue

4. herniation or serious injury of adjacent structures (e.g. lung) into the spinal cord

Surgical considerations:

1. surgical intervention is often directed at the underlying etiology, and may require a multidisciplinary approach

2. inhalational nitrous oxide diffuses into air-filled spaces, causing expansion of existing cavitary air, and further raising the CSF pressure which can worsen coexistent pneumocephalus

3. techniques that add pressure to the nasopharynx or oropharynx are contraindicated for similar reasons

4. intermittent positive-pressure ventilation with hyperbaric oxygen therapy has been recommended.

Outcome

While pneumorrhachis may be associated with an increased morbidity and mortality risk (particulary internal pneumorrhachis in the setting of severe trauma), the appropriate evaluation and management of this often self-limiting condition results in reversal of symptomatology and no permanent deficit in most cases.

Case reports

Han et al. reported a rare case of intramedullary cervical PR following a cervical epidural steroid injection (ESI) and include pertinent discussion [1)].

1)
Han HJ, Wook KJ, Ho JJ. Intramedullary pneumorrhachis following a cervical epidural steroid injection. Neurochirurgie. 2020 Oct 10:S0028-3770(20)30403-3. doi: 10.1016/j.neuchi.2020.08.002. Epub ahead of print. PMID: 33049286.