

Pneumocephalus : Radiological Presentation of Intra-cranial Hypotension after Spinal Anaesthesia

Abstract:

Pneumocephalus is a commonly encountered entity in patients of head trauma and post-op cases of neurosurgery, however it is rarely observed after spinal anaesthesia.

It commonly presents orthostatic hypotension associated with severe headache, nausea and vomiting. We report a case of pneumocephalus following spinal anaesthesia administered for open hernia repair.

The proposed mechanisms of pneumocephalus secondary to spinal tapping are the ball-valve mechanism (1) and the inverted soda-bottle effect. (2)

Keywords: Pneumocephalus , Intracranial Hypotension, Thunderclap Headache, Post-operative, Spinal Anaesthesia, Complication

Introduction

“Pneumocephalus is defined as the presence of air within the intracranial cavity. Air can be present in the epidural, subdural, subarachnoid, intraventricular, or intraparenchymal compartments. The main cause of pneumocephalus is trauma resulting in fractures of air sinuses or skull base with a breach of the dura mater” [1,2]. “Nontraumatic pneumocephalus is uncommon and can result from neurosurgical interventions, infection or tumors. In a minority of cases it can be due to barotrauma or frequent sneezing. Very rarely, pneumocephalus can be secondary to a cerebrospinal fluid (CSF) fistula with leakage of CSF, classified as spontaneous pneumocephalus. A CSF fistula is an egress of CSF from the intracranial cavity through a defect or weak point in the skull. Most commonly they occur in the ethmoid roof, sphenoid sinus, and temporal bone” [3,4].

Case Report:

A 56-year-old man underwent hernia repair under spinal anaesthesia in JNMCH, Aligarh. Due to the difficulty in getting subarachnoid block, multiple punctures were performed.

Postoperatively, he had an uneventful recovery and he was subsequently discharged.

Four days following the surgery, the patient developed ‘thunderclap’ headache which was associated with nausea. On CNS examination there was no evidence to suggest any focal neurological deficits or any signs of meningeal irritation.

CT head showed evidence of extraxial pneumocephalus overlying B/L cerebral hemispheres, in B/L sylvian fissures and along cerebral convexities (Figure 1)

A diagnosis of intracranial hypotension was made secondary to spinal anaesthesia

Imaging:

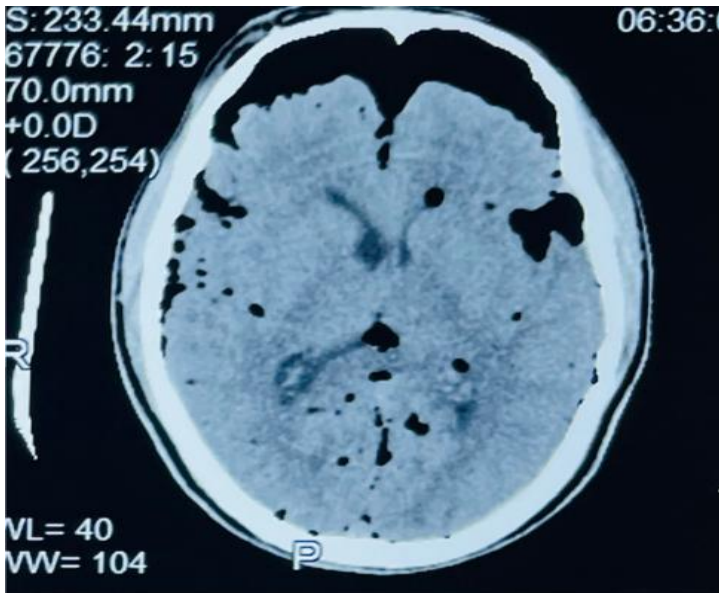


Figure 1: NCCT Head Axial cut section at the level of Sylvian fissure reveals presence of extra-axial pneumocephalus overlying B/L cerebral convexities, along falx and in the subarachnoid spaces.

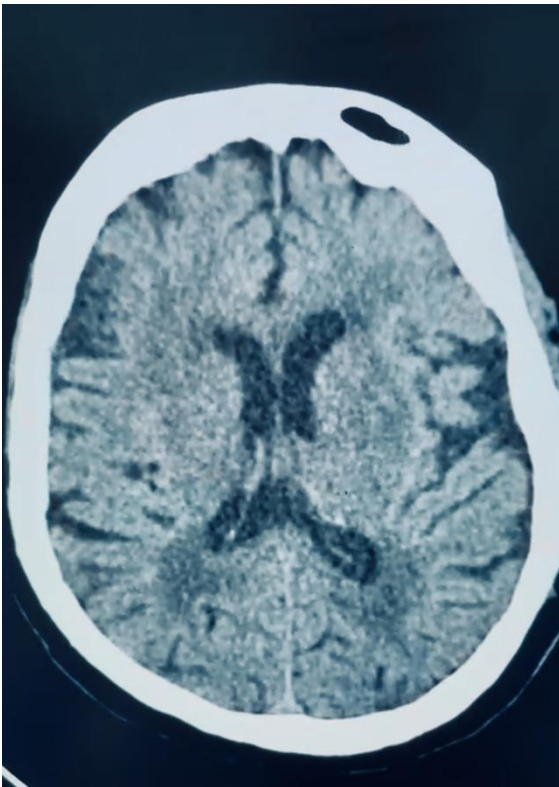


Figure 2: Follow up CT scan after 5 days following treatment initiation shows resolution of the pneumocephalus.

DISCUSSION:

“Spinal anaesthesia is an effective alternative to general anaesthesia for lumbar spine surgery and has a reduced rate of minor complications”.[3] In our facility, it is standard procedure to perform surgery under spinal anaesthesia in co-operative patients

“The headache after spinal anaesthesia is usually ascribed to unintentional dural puncture with consequent CSF leakage through the hole in the dura resulting in low CSF pressure” [4]. This headache is generally mild to moderate in intensity and resolves spontaneously

„Pneumocephalus is rare consequence of evident or unnoticed accidental dural puncture and develops from injection of air into the subarachnoid or subdural space and cranial migration. It is not often followed by symptoms, but, when present, severe headache is the most frequent. The development of pneumocephalus after spinal anaesthesia is exceptionally rare” [5,6].

“After a dural–arachnoid tear from spinal tapping, air leaks into the subarachnoid space through the puncture site causing air trapping from the ball-valve effect. The air then travels through the subarachnoid space and cisterns to the uppermost part of the brain due to relatively lower pressure”.(7)

The most typical symptom of pneumocephalus is a thunderclap headache that begins suddenly and progressively gets better over the course of 4-5 days as the accumulated air is slowly and gradually reabsorbed.

“The headache is caused by fast brain motion resulting from air injection and meningeal irritation. It is exacerbated by motion and may not be alleviated by lying down” [8].

“There may be appearance of more severe symptoms of neurological impairment such as focal neurological deficit including cranial nerve palsies or diverse motor signs, depending on the spread and extent of intracranial air”. [8]

“The other complications are uncommon and include haemorrhage, CSF leak, PDPH and infection. The treatment of pneumocephalus is usually conservative but it depends upon the severity of the condition”. [8]

PATIENT COURSE

Our patient was treated with bed rest, 30-degree Fowler position. He was administered oxygen therapy, and analgesics. His symptoms gradually resolved. Repeat CT scan of the head 5 days later showed resolution of pneumocephalus

CONCLUSION:

Pneumocephalus is a rare radiological manifestation in patients with intracranial hypotension following spinal anaesthesia. Doctors should be aware of it as a potential but rare complication following spinal or epidural anaesthesia. CT head should be prioritised with a reasonable index of suspicion.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Ethical Approval

The study was approved by the University Ethical Committee.

REFERENCES:

1. Dandy WE. Pneumocephalus (intracranial Penumatocele or aereocele). *Arch Surg* 1926;12:949–82. doi:10.1001/archsurg.1926.01130050003001
2. Horowitz M. Intracranial PNEUMOCOELE. An unusual complication following mastoid surgery. *J Laryngol Otol* 1964;78:128–34
3. Tetzlaff JE, Dilger JA, Kodsy M, al-Bataineh J, Yoon HJ, Bell GR. Spinal anesthesia for elective lumbar spine surgery. *J Clin Anesth.* 1998;10:666–9.
4. Han CS, Yu JS, Kim IH, Kim YJ, Kim CS, et al. Headache and pneumocephalus after lumbar epidural block: A case report. *J Korean Pain Soc.* 1996; 9: 251-255.
5. 12. Spence D, Nations R, Rivera O, Bowdoin S, Hazen B, et al. Evidence-based anesthesia: The use of preprocedural ultrasonography during labor to facilitate placement of an epidural catheter. *AANA J.* 2012; 80: 223-230.
6. 13. Avellanal M, Olmedilla L, Ojea R, Rueda ML, Navia J. Pneumocephalus after spinal anesthesia. *Anesthesiology.* 1996; 85: 423-425.
7. Thongtan T, Julayanont P, Test V Pneumocephalus: a radiological presentation of intracranial hypotension secondary to spinal anaesthesia *BMJ Case Reports CP* 2021;14:e239750.
8. Nafiu OO, Urquhart JC. Pneumocephalus with headache complicating labour analgesia: should we still be using air? *Int J Obstet Anesth.* 2006; 15: 237-239.