Pneumocephalus following Lumbar Spine Surgery: A Rare Cause of Delayed Emergence from Anesthesia

Ritesh Lamsal1  Rajeeb K. Mishra1  Niraj Kumar1

1Department of Neuroanesthesiology and Critical Care, All India Institute of Medical Sciences, New Delhi, India

Address for correspondence Niraj Kumar, MD, Department of Neuroanesthesiology and Critical Care, Room No. 709, Neuroscience Centre, All India Institute of Medical Sciences, New Delhi 110 029, India (e-mail: drnirajaiims@gmail.com).

Abstract

Pneumocephalus is an unusual presentation after lumbar spine surgery. We report the case of a young healthy patient, who had delayed emergence from anesthesia after undergoing an uncomplicated lumbar spine surgery. After shifting to the Intensive Care Unit, the patient had an episode of generalized tonic—clonic seizure. Computed tomography scan revealed the presence of pneumocephalus. The patient was managed conservatively, extubated the following day and discharged with no neurological deficits.

Keywords
- delayed emergence
- lumbar spine
- pneumocephalus

Introduction

Delayed recovery from anesthesia always poses a diagnostic challenge for the anesthesiologist because multiple factors need to be considered. This is particularly true in short surgeries using newer anesthetic agents where delayed recovery is not anticipated. Some of its causes are easy to identify and temporary, whereas others may have serious long-term effects.

Lumbar spine surgeries are routinely performed in most neurosurgical set-ups around the world, and most of these patients are extubated in the operating room. Pneumocephalus has a high incidence after craniotomies and cervical spine surgeries, but its occurrence is rare in uncomplicated lumbar spine surgeries.1,2

Case Report

A 2-year-old male child, weighing 10 kg, with no known co-morbid illness was scheduled to undergo lumbar laminectomy (L2–L3) and excision of an intramedullary spinal cord tumor. The child was brought by the parents to the hospital with a brief history of difficulty in walking. Preoperative evaluation was unremarkable, and all laboratory parameters were within normal limits.

Anesthesia was induced with fentanyl 20 μg and propofol 20 mg. Tracheal intubation was facilitated with rocuronium 10 mg, and a standard-sized micro-cuffed endotracheal tube was inserted. Intraoperative monitoring was done with pulse oximetry, noninvasive blood pressure, electrocardiogram, nasopharyngeal temperature, end-tidal gases and CO₂. Forced warm-air blanket was used to maintain normothermia. Anesthesia was maintained with oxygen with nitrous oxide (40:60), sevoflurane (1%–1.5%) and boluses of rocuronium and fentanyl as required. After laminectomy and tumor excision, the dura was repaired and its adequacy was confirmed by valsalva manoeuvre. The total duration of surgery was 3 h. At the end of the surgery, the child did not regain consciousness even after 1 h of discontinuing sevoflurane and adequate neuromuscular reversal. Hemodynamic parameters, as well as body temperature were normal. The pupils were bilaterally constricted, equal and reacting to light; ventilatory efforts were adequate. The child was not extubated and shifted to the Intensive Care Unit (ICU) for further investigations. Immediately after reaching the ICU, the child had a sudden episode of generalized tonic-clonic seizure lasting for around 10 s with spontaneous cessation. Loading dose of 150 mg (15 mg/kg) phenytoin was administered to the patient. Post-seizure investigations including arterial blood gases, serum electrolytes and glucose were normal. A computed tomography (CT) scan revealed the presence of pneumocephalus in the pre-pontine cistern (►Fig. 1). The patient had full recovery of consciousness and followed commands after 3 h in the ICU. The trachea was extubated 12 h later. Further course in the ICU was uneventful, and he was discharged from the ward on the seventh postoperative day without any neurological deficit.

ISSN 2348-0548.
after lumbar spine surgery. Akyüz et al described a case of forming epidural analgesia and epidural steroid injections. Spinal anesthesia and accidental dural puncture whilst per

Pneumocephalus has been reported after traumatic injuries, neuronal membrane excitability because of the air pocket. The mechanism of seizure in this case is difficult to ascertain, possible generalised tonic–clonic seizure. Although the exact mechanism of seizure in this case is difficult to ascertain, possible causes include hypothermia, electrolyte disturbances, hypercarbia, acidosis, hypoglycemia, obesity and advanced age. In most instances, the etiology is readily identifiable and is promptly reversible. More serious and unexpected causes after general anesthesia include cerebral hypoxia, seizure, central anticholinergic syndrome, cerebral hemorrhage, embolism or thrombosis. Pneumocephalus is a rare cause that is not encountered too often outside neurological manifestations are present that is not explained by any other usual cause. A head CT-scan is warranted in such cases.

Discussion

Delayed emergence from anesthesia is multifactorial and warrants close attention. The most common cause of delayed emergence from anesthesia is pharmacological – drugs that are used in the perioperative period – their overdose, interactions or residual effects. Other common causes include hypothermia, electrolyte disturbances, hypercarbia, acidosis, hypoglycemia, obesity and advanced age. In most instances, the etiology is readily identifiable and is promptly reversible. More serious and unexpected causes after general anesthesia include cerebral hypoxia, seizure, central anticholinergic syndrome, cerebral hemorrhage, embolism or thrombosis. Pneumocephalus is a rare cause that is not encountered too often outside neurological operating rooms. Pneumocephalus is formed once cerebrospinal fluid flows out of a surgical or traumatic defect in the dura and air takes its place to equilibrate the pressure differential.

The incidence of pneumocephalus is extremely high following craniotomies. Most of these cases are benign and resolve spontaneously. Sometimes, it may manifest as tension pneumocephalus with severe headache, altered sensorium, seizure or focal neurological deficit. In our patient, pneumocephalus close to the prepontine cistern manifested in delayed emergence from anesthesia, failure of extubation and neurological sequelae. It is a neurosurgical emergency that needs to be promptly diagnosed and decompressed with interventions such as craniotomy, burr hole evacuation, needle aspiration or ventriculostomy placement. High FiO2 may be helpful in treating pneumocephalus. When high concentration of oxygen is used, it reduces blood and brain nitrogen concentrations, increasing the nitrogen concentration gradient across the pneumocephalus-containing cavity, promoting its absorption.

Continuous positive airway pressure ventilation has also been implicated in the development of pneumocephalus by increasing positive pressure in the upper airway and causing a slow entry of air into the intracranial space. Similarly, coughing, sneezing, Valsalva, forceful blowing and even positive pressure during bag-mask ventilation can enlarge the size of pneumocephalus.

The treatment of pneumocephalus is mostly supportive with gradual resorption of the air over several days. However, tension pneumocephalus, caused by large volume of air, can result in sudden mass effect with major neurological sequelae. It is a neurosurgical emergency that needs to be promptly diagnosed and decompressed with interventions such as craniotomy, burr hole evacuation, needle aspiration or ventriculostomy placement. High FiO2 may be helpful in treating pneumocephalus. When high concentration of oxygen is used, it reduces blood and brain nitrogen concentrations, increasing the nitrogen concentration gradient across the pneumocephalus-containing cavity, promoting its absorption.

To conclude, pneumocephalus is a rare presentation after uncomplicated lumbar spine surgery and may not be suspected by many anesthesiologists. Pneumocephalus should be a differential diagnosis following any spinal surgery when unanticipated complications such as delayed recovery from anesthesia, failure of extubation and neurological manifestations are present that is not explained by any other usual cause. A head CT-scan is warranted in such cases.

Funding

None.

Conflict of interest

None.

Fig. 1 A noncontrast computed tomography scan showing pneumocephalus in the prepontine cistern.
References


