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# A Case of Altered Mental Status and Severe Frontal Headaches in Patient with Imaging Confirmed Pneumocephalus and a Review of Previous Cases

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**ABSTRACT**

Neuraxial anesthetic technique is a common and safe method of providing labor analgesia and anesthesia for cesarean section (CS). Pneumocephalus (PC) is a known rare complication from neuraxial anesthesia. Here we present a case of a high risk parturient for planned CS via spinal anesthesia with catheter technique who experienced altered mental status (AMS) and severe headaches due to PC confirmed by head computed tomography (CT). Additionally, we review and discuss the body of literature of pneumocephalus resulting from neuraxial technique.

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**Abbreviations:** Pneumocephalus (PC), computed tomography (CT), LORA = Loss of resistance to air, LORS = Loss of resistance to saline,

## Introduction

Cesarean section (CS) via spinal anesthesia is a common and safe technique. Pneumocephalus (PC) is a rare, but well documented complication of spinal or combined spinal/epidural anesthesia for obstetric cases [1]. The most common clinical symptoms of PC are intense bilateral headache (usually immediate onset and not alleviated by lying down), nausea, vomiting, dizziness, hemiparesis, and cranial nerve deficits [1]. Our case presentation furthers existing literature of PC induced during loss of resistance to air (LORA) neuraxial technique, while illustrating a rare presentation that should be concerning for future practitioners that PC may be present.

## Case Report

A 28 year-old undomiciled parturient gravida 4 para 2 presented to labor and delivery in preterm labor at 34 weeks and 1 day with history significant for asthma, bipolar disorder, attention deficit hyperactivity disorder (ADHD), morbid obesity (136kg, BMI 53.1), and status post gastric bypass complicated by abdominal adhesions and chronic abdominal pain. The patient was also known to have a difficult airway requiring awake fiberoptic intubation in the past. Given the patient's morbid obesity and history of difficult airway, a combined spinal-epidural (CSE) technique was the preferred anesthetic to ensure a dense, bilateral block and provide continued anesthesia via epidural catheter. However, a spinal needle compatible with epidural length was unavailable and therefore an intentional dural puncture with a 17G Tuohy needle and intrathecal catheter placement was planned. Ultrasound was used to assess depth and location of midline was identified by the spinous processes. Loss of resistance to air (LORA) occurred at 11cm and dural puncture was performed at L3-L4 interspace. The catheter was inserted to 15cm. Intrathecal catheter placement was confirmed with cerebral spinal fluid (CSF) aspiration and an injection of 10.5mg of hyperbaric bupivacaine, 15mcg of fentanyl, and 0.25mg of preservative morphine was performed. A few minutes later the patient became unresponsive and non-verbal. A stroke code was called and the decision was made to continue Cesarean Section (CS) as the vital signs were stable and the patient was spontaneously breathing. A head CT without contrast performed immediately following CS showed moderate volume gas in the basal cisterns, frontal horns, and 3rd and 4th ventricles, and partial imaging of extradural gas in the upper cervical spinal canal (See Figure 1). The neurology and psychiatry services were consulted. It was noted that the patient had similar incidences of unresponsiveness to stressful stimuli in the past, and within 4 hours was back to her baseline. No neurological intervention was undertaken from the timeframe of the stroke code and the patient proceeded to the postpartum unit safely. The Neurology and Psychiatry services concluded that given the rapid resolution of symptoms and prior history, conversion disorder was a likely diagnosis. The following morning the patient developed delayed severe bilateral frontal headaches not related to positioning. The headaches improved with oxygen supplementation via nasal cannula. She was discharged on post-operative day 4 without any further complications.

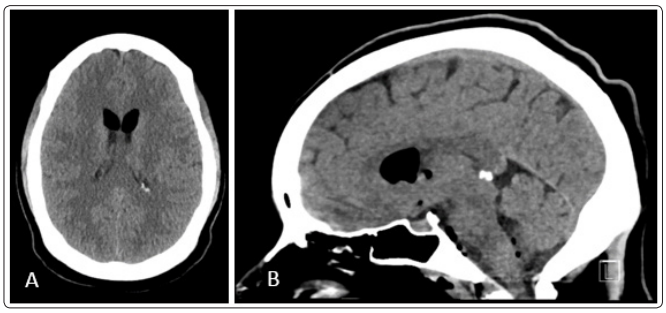


**Figure 1 A** and **B** showing transverse and sagittal head CT with moderate volume gas in the basal cisterns, frontal horns, and 3rd and 4th ventricles and partial imaging of extradural gas in the upper cervical spinal canal.

**Discussion**

In our patient, entrainment of air into the intrathecal space may have occurred during LORA technique, dural puncture with a larger gauge Tuohy needle instead of a spinal needle, or placement of the intrathecal catheter. The most convincing body of literature suggests that the most likely culprit was our technique utilized to localize the epidural space. The two most common techniques for epidural localization are LORA and loss of resistance to saline (LORS). Saline provides the advantage of immediate tactile feedback and extradural expansion aiding catheter placement; however, may delay dural puncture detection and dilute out anesthetics. Air does provide more reliability in detecting dural puncture; however, this comes with the risk of air emboli, subcutaneous emphysema, and pneumocephalus [2]. To the knowledge of the authors, there are currently no known cases of pneumocephalus with loss of resistance to saline described across our extensive literature review (see Table 1). Aida et al. (1998) investigated post meningeal puncture headache (PMPH) in patients undergoing epidural block with either LORA and LORS [9]. Meningeal perforation was observed in 2.6% of the air group and 2.7% of the saline group (n not significant). Of the 48 patients with meningeal perforation, 32 (66.7%) went on to develop PMPH with 30 of 32 (94%) demonstrating PC on CT. Conversely, there was no PC observed on CT in any of the patients with meningeal perforation in the saline group (n = 51). PMPH in the saline group (5/51 or 10%) was attributed to CSF leakage.

**Table 1: Cases of symptomatic PC were identified in the literature. Most PC cases were from a labor epidural, but three cases were identified in patients in the chronic pain setting**

| Case report (author name et.al and year) | Setting (Labor and delivery vs chronic pain procedure) | Primary presentation | Tuohy or spinal needle and gauge | Loss of resistance (air, saline, or unknown) | Imaging guidance or assistance during neuraxial placement? |
|---|---|---|---|---|---|
| Ash et al. (1991)13 | Labor epidural | bilateral cephalea and emesis | 16g Tuohy needle | LORA (5ml) | No imaging guidance |
| Chung et al. (2014)5 | Labor epidural | Loss of consciousness, convulsions, bilateral ptosis, and respiratory failure | Epidural needle (case 1), spinal needle (case 2) | NA | No Imaging guidance |
| Figueiera et al. (2017)14 | Chronic pain epidural | AMS (lethargy, apathy, hypophonia) | 18g Tuohy needle | LORA | No imaging guidance |
| Gomez Rios et al. (2013)15 | Labor epidural | Bilateral cephalea | Gauge NA | LORA (3ml) | No image guidance |
| Jagia et al. (2016)16 | Preoperatively (procedural) | Bilateral cephalea, HTN emergency, and nausea | 16g Tuohy needle | LORA | No imaging guidance |
| Ince et al (2019) | Chronic pain epidural | Cephalea | 18g Tuohy needle | LORA | No imaging guidance |
| Katz et al. (1990)7 | Labor epidural | Unilateral cephalea, Altered mental status | 16 g Tuohy needle | LORA (20ml of air) | No imaging guidance |
| Kuczkowski et al. (2003)17 | Labor epidural | Occipital cephalea | 18g Tuohy needle | LORA (4ml of air) | No image guidance |
| Laviola et al. (1999)18 | Labor epidural | Bilateral cephalea, respiratory distress, hypotension, unilateral dilated pupil | 18g Tuohy needle | LORA (5ml) | No imaging guidance |
| Lin et al. (1997)6 | Labor epidural | Respiratory depression and stuporous consciousness | Gauge NA | LORA | No image guidance |
| Mohensi et al. (2019)19 | Preoperatively (procedural) | Loss of consciousness, cephalea, hypotension | 17g needle | LORA (5ml of air) | No imaging guidance |

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|---|---|---|---|---|---|
| Nafiu et al. (2005)20 | Labor epidural | Bilateral cephalea, nausea, photophobia and phonophobia | Gauge NA | LORA | No image guidance |
| Nistal-Nuno et al. (2014)21 | Labor epidural | Bilateral cephalea, tinnitus, nausea | 18g Tuohy | LORA (3ml of air) | No image guidance |
| Ohri et al. (2016)22 | Labor epidural | Bilateral cephalea | NA | LORA | No imaging guidance during placement |
| Roderick et al. (1985)23 | Preoperatively (procedural) | Bilateral cephalea | 26g spinal needle | LORA (2ml of air) | No imaging guidance during placement |
| Rodrigo et al. (1997)8 | Labor epidural | Convulsions and loss of consciousness | Gauge NA | LORA | No image guidance |
| Shin et al (2018)24 | Labor epidural | Anoxic brain injury, cephalea, and Cardiac arrest | Case 1 epidural (gauge NA), Case 2 epidural (gauge NA) | LORA | No image guidance |
| Sherer et al. (1999)4 | Labor epidural | Loss of consciousness, dilated and non-reactive pupils | Gauge NA | LORA | No imaging guidance |
| Wankar et al. (2016)25 | Chronic pain | Delirium and bilateral ptosis | 20g quincke needle | LORA | No imaging guidance |

Although the patient's history is notable for a similar episode of altered mental status (AMS) concerning for conversion disorder, it would be prudent to also consider iatrogenic causes such as high spinal or PC in this patient, particularly with a head CT demonstrating presence of PC with symptoms the following morning. While intense rapid onset bilateral headache is the most common symptom of PC, central nervous system symptomatology has been documented, albeit limited studies, in the literature. Sherer et al. previously described an episode of AMS with focal neurological findings requiring intubation for airway protection following epidural anesthesia for elective repeat CS in a previously healthy G2P1 female [4]. Following epidural placement utilizing LORA the patient underwent an uneventful delivery; however, after delivery the patient lost consciousness and was found to have dilated nonreactive pupils. Within one hour, the patient regained consciousness and was successfully extubated. A head CT demonstrated PC.

Chung et al. presented a very similar case of spinal anesthesia for an elective CS that resulted in loss of consciousness, respiratory failure, generalized convulsions, and bilaterally dilated non responsive pupils with emergent MRI showing large volume of air in the cisterns [5]. This case study importantly highlighted that PC can occur with spinal needle puncture in additional to larger gauge Tuohy needles. Lin et al. described an episode of respiratory depression with altered mental status following accidental dura puncture with LORA causing PC [6]. Katz et al. similarly presented a case of an otherwise healthy primigravida undergoing epidural for CS with LORA (20ml of air injected) who developed respiratory failure and cardiovascular instability with CT showing PC [7]. Rodrigo et al. illustrated a case of accidental dural puncture with LORA technique leading to generalized convulsions and loss of consciousness that resolved spontaneously [8].

Three cases of epidural placement in the chronic pain setting resulting in symptomatic PC were identified in our review (see Table 1). Interestingly, none of these cases used imaging guidance such as fluoroscopy which is the current standard of practice for epidural steroid injection. Lack of imaging guidance may cause multiple attempts increasing the potential for entrainment of air into the intrathecal space. Identification of PC in the literature has been based on imaging ordered due to patient neurological changes. However, the literature has described the presence of PC in asymptomatic patients [9]. The size and location of the PC may play a role in patient symptomatology.

Our report and review of the literature further illustrates that PC may cause not only headache but potentially an explanation to AMS after neuraxial anesthesia. To reduce such risks, numerous studies have suggested a switch to LORS only. With the incidence of dural puncture ranging from 1 to 2% and as little as 2cc of air being enough to elicit symptomatic PC [10-12]. The issue, however, arises when the spinal tip only partially penetrates the dura, and in which cases saline and not true CSF may be incorrectly aspirated. For this, some authors have proposed that LORA with minimal volume (1-1.5cc) and intermittent pressure may be the best alternative [13,14]. Nonetheless, our case study further provides yet another precautionary tale against the use of LORA for spinal or combined spinal/epidural anesthesia, and suggests that LORS may be a safer technique.

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