

A Rare Case of Pneumocephalus in a Postpartum Patient

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ABSTRACT

Pneumocephalus is commonly caused by traumatic events or surgery. We describe it as a collection of air within the intracranial space that can be diagnosed with computed tomography (CT) scan of the head. Parturient patients are oftentimes offered epidural anesthesia to help manage associated labor pains resulting in them being a common obstetrical procedure. Pneumocephalus is a rare complication of epidural anesthesia and as such, many cases have not been discussed in the literature. Our case report describes a 35-year-old G2P0010 female patient who presented for an induction of labor (IOL) for a category II fetal heart tracing (FHT) with minimal variability. She received neuraxial/ epidural anesthesia resulting in fetal heart decelerations leading to an emergent cesarean section delivery. Patient complaints included a delayed onset headache which carried into her postpartum period until discharge. Complaints of a postural headache that was exacerbated by movement, relieved when supine, and only mildly managed with fioricet encompassed her postpartum course.

Keywords

Pneumocephalus, Pneumatocele, Intracranial arocele, Epidural injections, Obstetrical pain management, Procedural complications, Headache, Neuraxial anesthesia, Epidural anesthesia, Iatrogenic.

Introduction

Pneumocephalus has been described as a collection of air within the epidural, subdural or subarachnoid space, a condition that was first noted to be described in 1741 [1]. Etiologies are congenital malformations, trauma, infection, neoplasm, spontaneous formations and iatrogenic causes. Special focus should be centered on the obstetric population as these patients who request epidural anesthesia are said to have a risk of unintentional dural puncture. Pneumocephalus, albeit a rare pathology, is a complication of unintentional dural puncture. This can be from repeated attempts when establishing neuraxial anesthesia with the loss of resistance to air (LORA) technique. This occurs when a small amount of air is inadvertently injected into the subarachnoid space producing clinically relevant symptoms such as: headaches, nausea, vomiting, irritability, dizziness and seizures. Repeated attempts at this procedure not only increases the risk of inadvertent dural puncture, but it concomitantly increases the risk for post dural

puncture headache (PDPH). The pathophysiology surrounding pneumocephalus follows two schools of thought. The first being the Ball Valve Theory which encompasses the one directional entry of air into the cranial cavity or dural space [2]. The second being the inverted soda bottle effect, where a slow leak of cerebrospinal fluid (CSF) can lead to a negative pressure gradient causing air to be taken in from other existing defects or spaces [3]. A majority of pneumocephalus cases occur in the trauma setting; however, in our case we had the unique opportunity to follow the clinical course of an obstetric patient who developed pneumocephalus status-post epidural anesthesia. By combining our comprehensive patient history and computed tomography (CT) scans of the head we were able to discover this rare event affecting our patient. Our objective is to present a case of pneumocephalus in an obstetrics patient that originally presented for an induction of labor (IOL) at 38 weeks' gestation.

Case Report

This is a case report of a 35-year-old female G2P0010 with an intrauterine pregnancy at 38 weeks and 4 days' gestation, estimated due date (EDD) of 02/27/2020, dated by first trimester sonogram, who was admitted to our labor and delivery unit for induction of

labor (IOL) due to a category II fetal heart tracing due to minimal variability. Our patient had no significant past medical or surgical history and reported a history of one spontaneous abortion five years prior. Her prenatal course was uncomplicated and all prenatal labs were unremarkable.

At 36 weeks' gestation, the fetus had a non-reactive stress test due to minimal variability. She was admitted to the labor and delivery unit for fetal monitoring and a course of betamethasone. The patient was counseled on induction of labor but refused and signed out of the hospital against medical advice.

The patient returned to the hospital two weeks later at which point she was in agreement to an induction of labor for a category II fetal heart tracing. Upon admission to the labor and delivery unit, bedside sonogram revealed a fetal cephalic position, 14cm of amniotic fluid, and an estimated fetal weight of 2950 grams.

Her induction of labor was started with misoprostol followed by pitocin (oxytocin). The fetus had an intermittent category II fetal heart tracing for minimal variability with a fetal heart rate baseline of 140 beats per minute. Maternal resuscitative measures were in place including oxygen administration with the patient in the left lateral decubitus position. Artificial rupture of membranes was performed and clear fluid was noted. As the contractions increased in intensity and frequency, the patient was counseled on pain management options and decided on neuraxial anesthesia with an epidural. Epidural was successful after 3 attempts using the loss of resistance to air technique, with the patient in an upright seated position. After epidural administration, the fetus was noted to have fetal bradycardia at 60 beats per minute that did not resolve with resuscitative efforts. Her cervical exam at that time was 4cm dilated, 60% effaced, with the fetus in the -3 position. The patient was counseled on the need for a primary low transverse cesarean section due to a category III FHT to which she was in agreement. The neonate was delivered with APGARS 9 and 9 at 1 and 5 minutes respectively.

Her postoperative course was carried out in routine fashion, however, on postpartum day one, she developed an occipital headache associated with posterior neck pain that was alleviated only by lying flat. The pain was described as severe and constant and she was unable to ambulate due to the pain. There was no motor or sensory deficit noted. Postdural puncture headache was suspected and the patient opted for conservative management. Intravenous fluid hydration as well as oral Fioricet was prescribed to the patient with no relief. Anesthesia was consulted and recommended a blood patch. The procedure was performed on postoperative day one with the patient in the left lateral decubitus position. She reported no improvement in symptoms. CT of the lumbar spine with and without contrast as well as MRI and CT of the head with and without contrast were performed revealing air in the epidural space as well as the thecal sac at the level of T11-L1 (Figure 1 and 2). There was also a small air bubble noted in the anterior horn of the left cerebral ventricle (Figure 3 and Figure 4).



Figure 1: Lateral view of the thoraco-lumbar spine showing air in the epidural space and thecal sac at the level of T11-L1.



Figure 2: Lateral view of the thoraco-lumbar spine showing air in the epidural space and thecal sac at the level of T11-L1.



Figure 3: Transverse view of air bubble in the anterior horn of the left cerebral ventricle.



Figure 4: Sagittal view of air bubble in the anterior horn of the left cerebral ventricle.

Due to the unremitting headache, anesthesia and neurology were consulted and recommended another blood patch procedure as well as was intravenous toradol 30mg and magnesium sulfate 1g. The blood patch procedure was performed by a different anesthesiologist in a seated upright position at bedside. The patient began to have improvement of symptoms and was discharged home on day 13.

Discussion

The occurrence of pneumocephalus is a rare sequela of epidural anesthesia and it is a pathology that as clinicians we should be aware of. Commonly due to iatrogenic intervention within the obstetric population, it is explained as the entry of air into subdural and potentially subarachnoid space. The introduced air (via the LORA technique) allows migration in a cranial fashion that causes dural irritation leading to the patient outcomes discussed above. As little as 2 ml of air injected into the subarachnoid space by inadvertent puncture has been sufficient to lead to clinical symptoms [4]. From the limited information provided in literature, what is agreed upon is that headache is the most frequently reported symptom and is almost instantaneous [5]. Our patient did not report an acute headache, in fact she developed a postpartum headache in which pathology severity was exacerbated by standing and motion, and partially relieved when supine.

In the realm of obstetric headaches, pneumocephalus and PDPH should be considered in the differential. Although PDPH has a delayed onset, commonly 24-48hrs after the initial dural puncture, the symptoms are indistinguishable from the pneumocephalic presentation. Thus, radiologic evidence is needed to support the diagnoses.

CT scan and adequate patient course of events are indispensable in narrowing the differential for the constellation of symptoms that patients may present status post epidural anesthesia. Meaning, diagnosis can be accomplished through clinical history in conjunction with radiological imaging. Although magnetic resonance imaging (MRI) can be used, gold standard evaluation is accomplished by CT scan of the head which may show the presence of an air bubble or bubbles [2]. In Figure 3 we appreciate it from a transverse view, and in Figure 4 we appreciate the air bubble via a sagittal approach suggesting that the air bubble is trapped within the anterior horn of the left lateral ventricle. Both images were obtained via gold standard CT.

Accidental dural puncture may not always present with a clear case as above. Our patient was at increased risk due to 3 repeated attempts for epidural placement and 2 blood patch procedures in an attempt to remedy her symptoms. Although literature is limited on pneumocephalus post neuraxial anesthesia, it has been described that there is a 0.6% incidence of dural puncture when epidural anesthesia is attempted prior to repeated attempts [5]. In addition, some cases may not be as clear as ours. However, our findings uncovered the possibility that the initial PDPH interwoven with the inverted bottle cap or ball valve theory may have been the initial manifestation in the development of our patients pneumocephalus.

Treatment of a pneumocephalus is supportive/conservative. In most cases, resorption occurs prior to the onset of advanced clinical symptoms such as seizure or meningismus [6]. Resolution commonly ranges within 3-5 days from symptom onset; however our patient was noted to have complete symptomatic resolution by

hospital day 13, in which she was then discharged home. Eighty five percent of cases have shown spontaneous resorption, as was the case in our patient⁷ with symptom duration lasting from 1-3 weeks [8]. Implementing strict bed rest and placing the patient in the fowler position (semi-seated position) is suggested along with the use of analgesics and antipyretics with avoidance of measures that may increase intrathoracic pressure such as the Valsalva maneuver [2]. Research suggests that the use of high flow oxygen (5L/ min for at least 5 days) via face tent or 100% non-re-breather mask which will allow the pneumocephalus to alter its composition to primarily oxygen (instead of nitrogen) and promote its resorption by altering the concentration gradient should be implored [2]. Although our patient attempted to gain relief by repeated blood patch procedures, we noted that the blood patch had no immediate effect on treating our patients pneumocephalus and perhaps could have exacerbated the already formed pneumocephalus. Aida et al. noted that epidural infusion or blood patch had no effects on the outcomes of treating pneumocephalus. The blood patch may also be considered an iatrogenic cause of pneumocephalus as well, exacerbating the already formed pneumocephalus [9,10].

Prevention of this phenomenon can be tailored to employ a Loss of Resistance to Saline (LORS) approach and prevent repeated attempts at access with the LORA technique, which is unfortunately the suspected mechanism in our patient. Some clinicians believe that if a repeated epidural attempt is warranted, that the LORS technique should be considered over the LORA technique to appreciate the epidural space [5]. Should the LORA technique be preferred, clinicians are urged to consider using less than 2 ml of air in their glass loss of resistance syringe [11].

As we are commonly part of a multifaceted team, diligent and accurate observation by the nursing team regarding patient position and detailed instruction for the patient can help reduce unfavorable outcomes. Pneumocephalus occurs due to decisions surrounding the offering of epidural anesthesia to patients in need in the obstetric setting. It is clear that a multidimensional approach

should be taken by the anesthesiologist and obstetrician to improve patient outcomes because pneumocephalus is an uncommon outcome that results from a common procedure.

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