

Pneumocephalus after Epidural Anesthesia for Labor: A Case Report

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Abstract

Background: Epidural anesthesia is a commonly used technique and is considered safe, nevertheless, there are some potential side effects and complications. Pneumocephalus, defined as the collection of air in the cranial cavity, is a rare but benign condition. We hereby report a case of pneumocephalus in a primigravida after epidural anesthesia during labor. **Case Description:** A 28-year-old female, medically and surgically free, primigravida at 41 weeks of gestation, was admitted for induction of labor. On day three postpartum, the patient presented to the emergency department with insomnia, palpitation, and tachypnea, which proceeded with sudden left-sided weakness and numbness. An urgent neurological consultation was requested, and a CT brain and CT venogram were ordered, which revealed pneumocephalus. **Conclusion:** Pneumocephalus is an uncommon complication related to epidural anesthesia, and recognizing its potential occurrence and applying appropriate diagnostic and treatment strategies can lead to favorable results, as evidenced in this case.

Keywords

Epidural Anesthesia, Labor, Pneumocephalus, Postpartum, Complication

1. Introduction

An unusual neurological presentation of a newly delivered mother can lead to a wide range of differential diagnoses that will position health providers in a dilemma. Pneumocephalus, defined as the collection of air in the cranial cavity, is a rare but benign condition. Recognizing its potential occurrence and applying appropriate diagnostic and treatment strategies is vital despite its rare occurrence. On the other hand, tension pneumocephalus can be a life-threatening condition that requires immediate intervention. Pneumocephalus can also be caused by a

variety of reasons, including traumatic brain injuries, craniofacial trauma, neurosurgical procedures, anesthesia, infections involving the brain or middle ear, or positive pressure ventilation. [1] We hereby report a case of pneumocephalus in a primigravida after epidural anesthesia during labor.

Epidural anesthesia is a common procedure that is done during labor for pain relief and to ease the process of labor. It is a widely used technique and is considered safe, although there are some potential side effects and complications. During epidural injections, a loss of resistance technique can be used to identify the epidural space, which allows the air to enter the meninges. [2] Typically, the loss of resistance technique is used for locating the epidural space and employs either air or saline-filled syringes. [3] While the optimal approach is still debated, there is a growing preference for the saline technique. The clinical features of pneumocephalus can range from headaches, nausea, vomiting, altered mental status, tinnitus, and seizures. Accidental puncture of the dura during epidural anesthesia, which often presents as a headache, causes a decrease in intracranial pressure due to cerebrospinal fluid leakage. [4] The incidence of headache is six times higher in patients with loss of resistance to air technique than in patients with loss of resistance to saline. [4] [5] Despite the lack of definitive guidelines, evidence suggests that hyperbaric oxygen treatment may lead to quicker resolution of symptoms. It is important that healthcare providers are able to diagnose this condition promptly and involve other teams when necessary.

2. Case Description

A 28-year-old female, medically and surgically free, primigravida at 41 weeks of gestation, was admitted for induction of labor by Propess, a pessary that contains dinoprostone, due to postdate and decreased fetal movement. During labor, the patient requested an epidural for pain relief. The procedure was done by the anesthesiologist under an aseptic technique. During the initial attempt at epidural insertion, blood was noted. On the second attempt, cerebrospinal fluid (CSF) was observed leaking. The third attempt was successful. Loss of resistance was achieved at 5 cm at L2 - L3 level and the catheter was placed at 9 cm. There was negative aspiration, and a bolus of 8 ml from 0.1% ropivacaine was given, and an infusion was started at 10 ml/hr. Following the epidural insertion, the patient developed maternal tachycardia (reaching 140) and low-grade fever (37.6). The patient was started on acetaminophen and ampicillin, and a septic workup was ordered. The patient delivered a healthy baby with postpartum hemorrhage (PPH) due to a second-degree tear with an estimated blood loss of 500 mL. The following day, the patient was discharged as the genital, blood, and urine cultures were negative, and she was clinically and vitally stable.

On day three postpartum, the patient presented to the emergency department with insomnia, palpitation, and tachypnea, which proceeded with sudden left-sided weakness and numbness. Negative history of fever, loss of consciousness, seizures, altered level of consciousness, slurred speech, and vision changes. NIHSS:

0. Upon examination the patient was conscious, alert and oriented to time, person, and place. Obeys simple and complex commands and fluent, comprehensive speech, had no gaze preference, ptosis or nystagmus, and intact extraocular movement with bilateral reactive pupil, intact facial sensation, preserved forehead wrinkles, and no facial asymmetry. Centrally located uvula with symmetrical palatine elevation, no tongue deviation atrophy or abnormal movement with good neck power, and power was intact in all limbs with a full range of motion, preserved reflexes + 2, and normal tone, bilateral downgoing plantar reflexes. Intact fine touch, pain, and proprioceptive sensation all over including upper and lower limbs. No dysmetria, limb or truncal ataxia, adequate arm swinging, and normal gait with negative tandem gait. As the patient's presenting symptoms were concerning for a stroke as a differential diagnosis, an urgent neurological consultation was requested, and a CT brain and CT venogram were ordered.

Brain CT showed: There are multifocal air foci noted within the anterior horns of the lateral ventricles and cavernous sinus. There are concomitant air foci noted within the quadrigeminal cistern adjacent to the origin of the bilateral basal vein of Rosenthal, likely located within the deep venous system. No hydrocephalus. No acute territorial infarction or intracranial hemorrhage. No mass effect, midline shift, or brain herniation. There is a mild pacification of the paranasal sinuses. The mastoid air cells, osseous structures, and orbits are unremarkable. (**Figure 1**)



Figure 1. Multifocal air foci are noted within the anterior horns of the lateral ventricles and cavernous sinus.

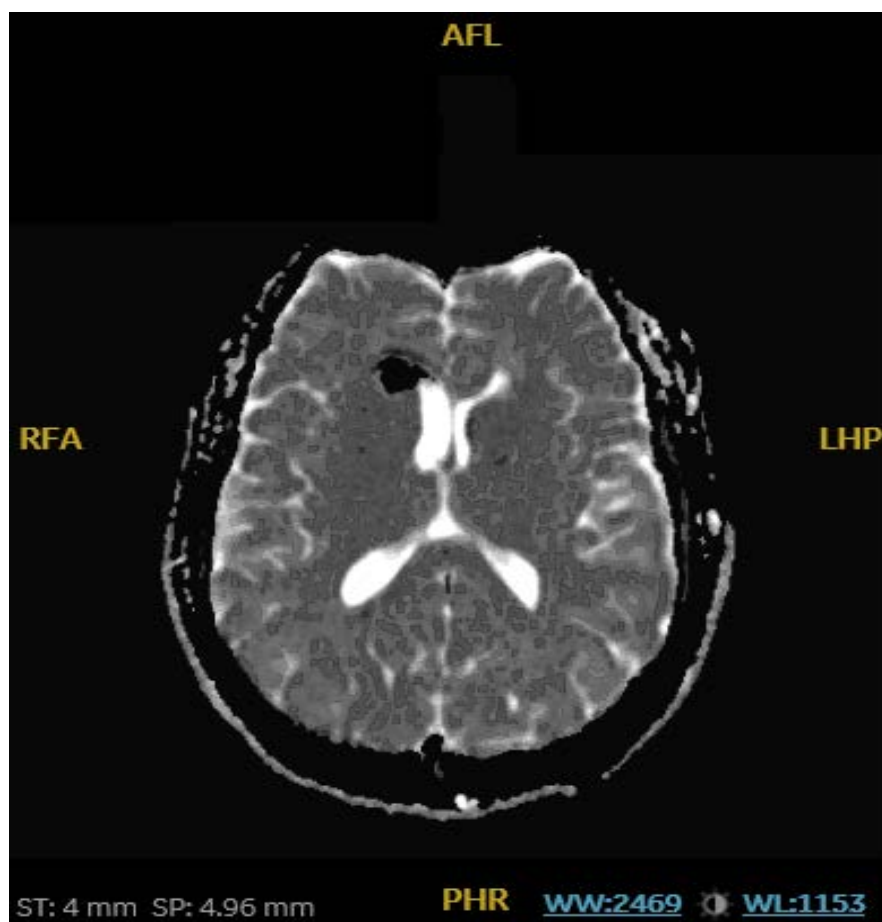


Figure 2. Pneumoventricle within the lateral ventricles is seen.

CT venogram showed: The internal jugular, sigmoid, transverse, straight vein of Galen, internal cerebral veins, and superior and inferior sagittal sinuses are patent. Hypoplastic left internal jugular, transverse, and sigmoid sinuses are noted. The final impression was intraventricular, cavernous sinus, and quadrigeminal cistern pneumocephalus with no acute territorial infarction, intracranial hemorrhage, or cerebral venous thrombosis.

MRI of the brain showed: There is a redemonstration of void signal noted at the bilateral anterior horns of the lateral ventricle, representing air. However, the sellar and quadrigeminal cistern air pockets are not well delineated. There are no diffusion restrictions to suggest an acute territorial infarct. No acute intracranial hemorrhage, brain herniation, hydrocephalus, or midline shift. Additionally, the major intracranial flow voids appear unremarkable. (Figure 2)

The patient was admitted and received 100% oxygen therapy delivered through a non-rebreather mask for 48 hours, leading to a total resolution of symptoms and a full recovery within just a few days after beginning treatment.

3. Discussion

Pneumocephalus refers to the occurrence of air in the intracranial cavity. [1] Var-

ious theories account for its formation, mainly through two processes. The first involves the inverted soda bottle phenomenon, in which a reduction in cerebrospinal fluid (CSF) volume causes air to enter. [4] [6] The second is the ball valve mechanism, in which extracranial positive pressure overpowers intracranial pressure, allowing air to enter the cranial cavity. [1] [6] The risk of developing pneumocephalus rises with numerous puncture attempts at epidural anesthesia, as the chances of air entry increase with repeated efforts or errors in identifying anatomical structures. [3] Pneumocephalus can be asymptomatic or present with symptoms of increased intracranial pressure. [4] Common manifestations include nausea, vomiting, altered mental status, and positional headaches that worsen when sitting. [1] [4] [6] Additional symptoms may involve nuchal rigidity, photophobia, and visual disturbances. [1] [6]

Computed Tomography (CT) is the preferred imaging method for diagnosing pneumocephalus due to its excellent sensitivity and specificity. [1] CT can identify as little as 0.55 ml of air in the cranial cavity, greatly surpassing the capabilities of skull X-rays, which need at least 2 ml to detect air. [4] Radiologists search for indicators that suggest the presence of pneumocephalus, such as the Mount Fuji sign, the air bubble sign, and the peaking sign. [7] In the case described, the air bubble sign was noted in the anterior horn of the lateral ventricle.

The management of pneumocephalus varies based on its severity. Generally, uncomplicated cases, regardless of their size, can often be treated conservatively, as the air usually dissipates within a few days. [1] [7] For a simple pneumocephalus, conservative treatment methods are attempted, which include maintaining a supine position, using hyperbaric oxygen therapy, and administering antiemetics and analgesics. [1] [4] [7] On the other hand, tension pneumocephalus, which is a more serious variant, is considered a medical emergency that requires immediate surgical intervention. [6] A mixed approach is recommended to effectively avoid pneumocephalus. Utilizing imaging studies preoperatively for proper assessment of spinal anatomy, decreasing the likelihood of numerous attempts when a skilled anesthesiologist excites the puncture, and postoperative observation to rule out possible complications. [3]

4. Conclusion

This case report details a rare incident of pneumocephalus that followed epidural anesthesia during labor. The patient's onset of neurological symptoms three days postpartum, despite an initially smooth discharge, highlights the necessity for careful monitoring post-procedure and educating patients about potential late complications. Moreover, this case confirms the effectiveness of CT imaging in identifying pneumocephalus, as well as the critical role of ruling out cerebral venous thrombosis via CT venography, a key differential diagnosis for postpartum patients with neurological complications. To conclude, pneumocephalus is an uncommon complication related to epidural anesthesia, and recognizing its potential occurrence and applying appropriate diagnostic and treatment strategies can

lead to favorable results, as evidenced in this case.

Consent

Informed consent was obtained in writing from the patient for the release of clinical information and related images.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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