Annals of
Clinical and Medical Case Reports

ISSN: 2639-8109

Case Report

Mental State Alterations and Transient Bradypnea Resulting from Pneumocephalus After the Application of Epidural Anesthesia: A Case Report

Radecic M[1], Glazar T[2], Wolfand A[2], Finka N[3],Grubjesic I[2] and Sotosek V[2,4*]

[1]Department of Anesthesiology, Resuscitation and Intensive Care Medicine, General Hospital Šibenik, Šibenik, Croatia

[2]Department of Anesthesiology, Resuscitation and Intensive Care Medicine, Clinical Hospital Centre Rijeka, Rijeka, Croatia

[3]Department of Anesthesiology, Resuscitation and Intensive Care Medicine, General Hospital Zadar, Zadar, Croatia

[4]Faculty of Medicine, Faculty of Health Science, University of Rijeka, Rijeka, Croatia

Volume 2 Issue 3- 2019
Received Date: 28 Sep 2019
Accepted Date: 22 Oct 2019
Published Date: 26 Oct 2019

2. Keywords

Bradypnea; Dural Puncture; Epidural Anesthesia; Pneumocephalus

1. Abstract

Pneumocephalus is a very rare complication after the application of epidural anesthesia. Pneumocephalus can cause headache, convulsions, altered state of consciousness, and hemodynamic instability or cardiac arrest. This case report presents a rare case of pneumocephalus as a complication of epidural anesthesia for abdominal surgery. A 67-year-old woman with a malignant cecal neoplasm was scheduled for elective right hemicolectomy. Before surgery, an epidural catheter was placed in the Th11/Th12 space by using the loss of resistance technique. After the patient received a bolus drug mixture via epidural catheter after the surgery, motor and sensory blockade of lower extremities occurred. The epidural catheter was immediately removed, and no visible cerebrospinal fluid leakage was reported. The patient was hemodynamically and respiratory stable and her Bromage score and Aldrete score were normal. Therefore, she was dismissed to the abdominal surgery ward. Four hours later, the patient became unconscious and bradypneic. An emergency computed tomography scan of the brain was conducted and showed bilateral air inclusions in the subarachnoid area and surrounding the lateral ventricles. The patient was admitted to the intensive care unit, and fully recovered within 24 hours.

3. Introduction

Epidural anesthesia is one of the most widely used anesthesia and analgesia techniques in surgery. It is used for pain control during surgery and for postoperative and chronic pain management.

Two widely used techniques allow the identification of the epidural space: the "Loss of Resistance" ("LOR") technique and the "hanging drop" technique. The LOR technique can be further divided into two subtypes, based on the medium filling the syringe: the "Loss of Resistance to Air" ("LORA") technique and the "Loss of Resistance to Saline" ("LORS") technique. The former uses 2 mL of air whereas the latter uses 2 mL of saline in a syringe that is connected to the epidural needle [1, 2]. Possible complications after the use of epidural anesthesia are unilateral analgesia, prolonged motor and/or sensory blockade, postpunctural headache, subcutaneous emphysema, venous air embolism, epidural and/or subdural hematoma, spinal cord and spinal nerve roots compression, puncture site infection, and accidental intravenous drug application [3]. Pneumocephalus after the application of epidural anesthesia is a very rare complication and has been described in a very limited number of cases across the globe [3]. Despite its being very rare, pneumocephalus is a very serious condition because it can cause headache, convulsions, altered state of consciousness, and hemodynamic instability or cardiac arrest [4]. In this report, we describe a rare case of pneumocephalus as a complication after dural puncture occurred during the application of epidural anesthesia using the LORA technique in a patient who presented with an altered state of consciousness and

***Corresponding Author (s):** Vlatka Sotosek, Department of Anesthesiology, Reanimatology, Emergency and Intensive Medicine, University of Rijeka, Brace Branchetta 20, 51000 Rijeka, Croatia, Tel: +385-51-407-400, Fax: +385-51-218-407, Email address: vlatkast@medri.uniri.hr*

Citation: Sotosek V, Mental State Alterations and Transient Bradypnea Resulting from Pneumocephalus After the Application of Epidural Anesthesia: A Case Report. Annals of Clinical and Medical Case Reports. 2019; 2(4): 1-4.

transient bradypnea.

4. Case Report

A 67-year-old woman required a right hemicolectomy because of a malignant cecal neoplasm. The procedure was preformed at the Clinical Hospital Centre Rijeka (Rijeka, Croatia). The patient had a history of arterial hypertension, chronic kidney disease, and sideropenic anemia, and was overweight. In 1998, she had undergone a cholecystectomy. She also had undergone knee joint endoprosthesis implant surgery on both of her knees. She reported no previous complications after anesthesia.

Before surgery, the patient was brought to the preoperative holding area where an intravenous line was placed. Five hundred milliliters of a crystalloid (Plasma Lyte; Baxter US, Deerfield, IL, USA) was administered.

An anesthesiologist explained the epidural analgesia technique and its complications to the patient; thereafter, the patient gave written consent for treatment.

An attempt to insert an epidural catheter (B. Braun, Melsungen, Germany) at the Th10/Th11 space was initially unsuccessful. After three attempts, the catheter was successfully placed at the Th11/Th12 space by using the LORA technique. No spinal fluid leakage occurred during the insertion of the epidural catheter. A test dose (60 mg) of 2% lidocaine (60 mg; Belupo, Zagreb, Croatia) was applied. No motor and/or sensory blockade subsequently occurred. The patient was then transferred to the operating room where general anesthesia was induced with 25 μg of sufentanil (Hameln Pharma Plus GmbH, Hameln, Germany), 150 mg of propofol (Fresenius Kabi, Bad Homburg, Germany), and 50 mg of rocuronium (MSD, Kenilworth, NJ, USA); she was afterwards orotracheally intubated and placed on mechanical ventilation. General anesthesia was maintained with sevoflurane (AbbVie North, Chicago, IL, USA) (minimum alveolar concentration, 0.8) combined with continuous epidural analgesia (a mixture of 50 mg of 0.5% levobupivacaine [Fresenius Kabi], 50 μg sufentanil and 30 mL of saline [B. Braun, Melsungen]) set at 4-6 mL/h. During the surgery the patient remained hemodynamically stable.

After the surgery (i.e., medial laparotomy and right hemicolectomy), the patient slowly recovered from anesthesia in the post-anesthesia care unit (PACU). After the patient was awake for 2 hours, a bolus drug mixture (15 mg of 0.5% levobupivacaine, 3 mg of morphine [Alkaloid, Skopje, Macedonia], and 4 mL of saline solution) was administered via epidural catheter. Motor and sensory blockade of the lower extremities occurred. The epidural catheter was then immediately removed. No visible cerebrospinal fluid (CSF) leakage was noted. The patient remained in the PACU for another hour. She was later dismissed to the abdominal surgery ward because she was hemodynamically and respiratory stable, and her Bromage score and Aldrete score were normal.

Four hours after being dismissed from the PACU, the abdominal surgery ward personnel noticed that the patient's state of consciousness was altered and that she was not breathing properly. Therefore, an anesthesiologist was called. On the arrival of the anesthesiologist, the patient was unconscious (i.e., the Glasgow Coma Score was 3) and her pupils were miotic and unresponsive to light. The vital signs were as follows: respiratory rate, 5–6 breaths/min; blood pressure, 105/60 mmHg; heart rate, 85 beats/min; sinus rhythm; capillary refill time, >2 seconds; and blood glucose level, 16.1 g/L. The peripheral saturation of oxygen could not be measured. Assisted ventilation was commenced using a bag valve mask (fraction of inspired oxygen, 100%; flow rate, 15 L/min). The patient shortly thereafter began breathing spontaneously with a peripheral oxygen saturation of 100% and began to respond to painful stimuli by opening her eyes.

An emergency computed tomography scan of the brain showed bilateral air inclusions in the subarachnoid area and surrounding the lateral ventricles, and a possible secondary infratentorial lesion on the right (**Figure 1**). The patient was then assessed by a neurologist. At the time of the examination the patient was conscious, her pupils were isochoric and reactive to light stimuli, and her verbal and motor responses were slow and showed no signs of meningism. The patient was admitted to the intensive care unit (ICU) where she remained awake and in full contact, and breathed spontaneously during the whole stay.

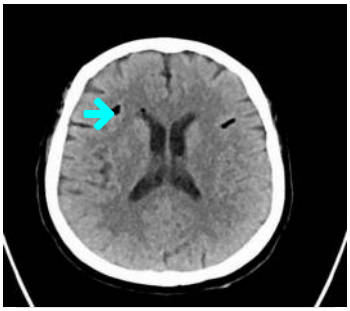

Figure 1: Computed tomography scan of patient's brain. The arrow indicate the air inclusion.

The acid–base status on her admission to the ICU showed severe acidosis and carbon dioxide (CO2) retention (pH, 7.05; partial pressure of carbon dioxide [PaCO2], 10.2-10.6 KPa), maintaining a normal partial pressure of oxygen. Therefore, noninvasive ventilation was applied during the night. The next morning the acid–base status had improved significantly (pH, 7.27; PaCO2, 6.5 KPa).

A control magnetic resonance imaging scan showed no signs of pneumocephalus or lesions of the brain structures. The patient

Copyright ©2019 Sotosek V et al This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and build upon your work non-commercially.

was awake, had a stable respiratory and hemodynamic status. She showed no sign of neurological alterations; therefore, she was dismissed to the abdominal surgery ward after a 24-hour stay in the ICU.

5. Discussion

This case study is the first to demonstrate mental state alterations and transient bradypnea as a consequence of pneumocephalus. During anesthesia administration, the dura membrane was most likely damaged, which was confirmed by the presence of a motor block on administering a bolus dose of anesthetic drugs using the epidural catheter. The air entered the subarachnoid space by passing through the previously damaged dura membrane.

Complications after administering epidural anesthesia are rare. Pneumocephalus is a possible complication that occurs after the puncture of the dura membrane, usually after the LORA technique [5].

Okell and Springe [6] reported that the incidence of dural puncture is as high as 0.6% when attempting to administer epidural anesthesia. The incidence of pneumocephalus after dural puncture is higher for the LORA technique than for the LORS technique [6].

Several minutes after pneumocephalus develops, it usually causes symptoms. Pneumocephalus is probably caused by the "ball-valve" effect in which positive pressure (created while sneezing, coughing, during the Valsalva maneuver, etc.) "presses" the air through the lesioned dura membrane. It can also develop after a large amount of CSF has leaked out of the spinal space, thereby creating a negative pressure in the spinal canal and sucking air into the cranial cavity [7].

Even a volume as low as 2 mL of air instilled in the subarachnoid space can cause symptoms of pneumocephalus. However, the minimal volume of air that can be safely administered to the epidural space without causing pneumocephalus symptoms remains undetermined [8].

Cardiac arrest in patients who develop pneumocephalus after undergoing epidural anesthesia has been described (4). Air trapped inside the neurospinal space can cause tension pneumocephalus that compresses the neural structures, and subsequently results in cardiac arrest [4].

Sorber et al. [9] reported a case of pneumocephalus with altered mental status, convulsions, and focal neurological deficit. Pneumocephalus occurred in a patient who had previously been injected with steroids in the epidural space in an attempt to cure or alleviate chronic pain of the lumbar spine. Computed tomography scans revealed air inclusions in the right lateral ventricle that regressed during the ICU stay.

The incidence of postpunctional headache after epidural anesthesia is higher with the LORA technique than with the LORS technique [10]. In most instances, mild symptoms will spontaneously retreat if a patient is maintained in a supine position [3]. When pneumocephalus occurs, the air is typically reabsorbed in 3–5 days and the patient fully recovers without any residual neurological deficits.

Treatment for pneumocephalus consists of administering oxygen (fraction of inspired oxygen, 40%–100%) with the patient supine, which allows for the reabsorption of air bubbles by increasing the nitrogen diffusion concentration gradient between the air bubbles and the surrounding brain tissue. Using nitrous oxide is contraindicated if pneumocephalus may have occurred because nitrous oxide causes air bubble expansion [5, 11].

Hsieh et al. [12] reported a rare case of pneumocephalus and pneumorrhachis after the administration of epidural anesthesia. Pneumocephalus should always be considered if alterations in a patient's mental state occur after the administration of epidural anesthesia.

Kasai and Osawa [13] reported a rare case of pneumocephalus during continuous epidural infusion in which an epidural catheter was placed in the subdural space. Air leakage through the epidural catheter subsequently caused pneumocephalus.

Katz et al. [14] reported their experience with a 25-year-old parturient undergoing epidural anesthesia for cesarean delivery. Multiple attempts to identify the epidural space were performed by using an estimated 20 mL of air. The patient's catheter was subsequently dosed with 16 cc of 0.5% bupivacaine. She became apneic, and required endotracheal intubation, mechanical ventilation, and vasopressor support as a treatment for a "high spinal." Even after spontaneous respiration and movement resumed, the patient continued to be "drowsy and stuporous." The patient's continued altered mental state was attributed to the large (approximately 25 mL) air-filled cavity in the parietofrontal cerebral cortex, which was revealed on the computed tomography (CT) scan. The following day, the patient's neurological status returned to baseline and a repeat CT scan was negative for residual air.

No cases of pneumocephalus after epidural anesthesia administered by using the LORS technique have been recorded. Many reports highlight the LORS technique as superior to the LORA technique, and further highly advise that, if LORA is used, a small air volume in the syringe (1-2 mL) should be used [10,15]. The LORA technique should be abandoned if a possible dural puncture may occur when administering epidural anesthesia [15].

In this patient in this report, an accidental dural puncture and using the LORA technique to administer epidural anesthesia

caused pneumocephalus. The symptoms developed a few hours after TH edura was damaged. The patient presented with an altered mental state, which was most likely caused by brain tissue compression induced by the air inclusions in the subdural space. Bradypnea was most likely a consequence of the altered mental state and CO2 retention. Assisting the ventilation of the patient using 100% oxygen concentrations while supine caused the absorption of air bubbles, which was later confirmed with a magnetic resonance scan of the brain. The patient later fully recovered and has not presented with any neurological deficits after being dismissed from the ICU .

6. Conclusion

The case confirms the possibility that a pneumocephalus can occur after using the LORA technique to administer epidural anesthesia. When a patient presents with symptoms indicative of pneumocephalus, then imaging diagnostic procedures such as a CT scan need to be conducted.

7. Conflicts of interest: Authors have none to declare

References

1. Kleinman, W., Mikhail, M. Spinal, epidural and caudal blocks. Morgan and Mikhail's Clinical Anesthesiology. New York, NY: McGraw-Hill Companies. 2013.

2. Barash PG, Cullen BF, Stoelting RK, Cahalan MK, Stock MC, Ortega R. Clinical Anesthesia: Eighth Edition. Alphen aan den Rijn, Netherlands: Wolters Kluwer Health. 2013.

3. Braga AFA, Braga FSS, Potério GMB, Cremonesi E, David LH, Schmidtt R. Pneumocenefalo apos anestesia peridural: relato de caso. Revista Brasileira de Anestesiologia. 2001; 51(4): 325-330.

4. Shin H, Choi HJ, Kim C, Lee I, Oh J, Ko BS. Cardiac arrest associated with pneumorrhachis and pneumocephalus after epidural analgesia: two case reports. J Med Case Rep. 2018; 12(1): 387.

5. Nistal-Nuño B, Gomez-Rios MA, Case report: m pneumocephalus after labor epidural anesthesia. F1000Reserch. 2014; 3: 166.

6. Okell RW, Sprigge JS. Unintentional dural puncture: a survey of recognition and management. Anaesthesia, 1987; 42(10): 1100-1111.

7. Reddi S, Honchar V, Robbins MS. Pneumocephalus associated with epidural and spinal anesthesia for labor. Neurol Clin Pract. 2015; 5(5): 376-382.

8. Roderick L, Moore DC, Artru AA. Pneumocephalus with headache during spinal anesthesia. Anesthesiology. 1985; 62(5): 690-692.

9. Sorber J, Levy D, Schwarz A. Pneumocephalus and seizures following epidural steroid injection. Am J Emerg Med. 2017; 35(12): 1987e1-1987e2.

10. Aida S, Taga K, Yamakura T. Headache after attempted epidural block: the role of intrathecal air. Anesthesiology. 1998; 88(1): 76-81.

11. Gomez-Rios MA, Fernandez-Goti MC. Pneumocephalus after inadvertent dural puncture during epidural anesthesia. Anesthesiology. 2013; 118(2): 444.

12. Hsieh XX, Hsieh SW, Lu CH, Wu ZF, Ju DJ, Huh B, et al. A rare case of pneumocephalus and pneumorrhachis after epidural anesthesia. Acta Anaesthesiologica T ca. 2015; 53(1): 47-49.

13. Kasai K, Osawa M. Pneumocephalus during continuous epidural block. J Anesth. 2007; 21: 59-61.

14. Katz Y, Markovits R, Rosenberg B. Pneumocephalus after inadvertent intratecal air injection during epidural block. Anaesthesiology. 1990; 73(6): 1277-1279.

15. Jagia M, Kapoor MC, Panjiar P. Pneumocephalus after epidural analgesia: should loss of resistance with air be blown out? J A siolo Clin Pharmacol. 2016; 32(2): 272-273.