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척추경막외병용마취를 위한 경막외마취 중 발생한 기뇌증

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Pneumocephalus Developed during Epidural Anesthesia for Combined Spinal-Epidural Anesthesia

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The superiority of air versus saline for identifying the epidural space remains unestablished. Epidural anesthesia using a loss of resistance technique (LORT) with air is associated with increasing complications of dural puncture-induced headaches and neurological and hemodynamic changes. Here, we described a case of pneumocephalus with a large amount of air that was accompanied by severe headache and nuchal and chest pain occurring after epidural block using LORT with air for combined spinal-epidural anesthesia. **(Korean J Pain 2009; 22: 163-166)**

Key Words: air, combined spinal-epidural anesthesia, headache, loss of resistance technique, pneumocephalus.

Pneumocephlaus is a well-known complication occurring shortly after an epidural block like postdural puncture headache.[1-3] Loss of resistance technique (LORT) with air has been criticized as a potential cause of pneumocephalus. Clinicians must minimize the amount of air used in LORT and be aware of the proper diagnosis and treatment of pneumocephalus caused by LORT with air.

CASE

A 51-year-old female patient, ASA physical status II, presented for elective total hip joint replacement because of recurring hip joint pain after two previous joint operations. She weighed 68 kg and was 150 cm tall (body mass index = 30.2 kg/m^2). She had no specific past history except pulmonary tuberculosis with complete resolution. Preoperative evaluation findings were within normal range. There was no contraindication to regional anesthesia. With the consent of the patient, we planned combined spinal-epidural anesthesia for anesthesia and postoperative pain control.

Preoperative baseline values of blood pressure (BP), heart rate (HR), respiratory rate (RR), and pulse oximetry (SpO_2) were 125/85 mmHg, 90 bpm, 20/min, and 100%, respectively.

In the right lateral decubitus position, her back was draped aseptically and dermal infiltration with 2% lidocaine was performed for analgesia at the L3/4 level. LORT was performed with an 18 G Tuohy needle from a CSEA kit (Espocan®, B. Broun, Germany) using air at the point

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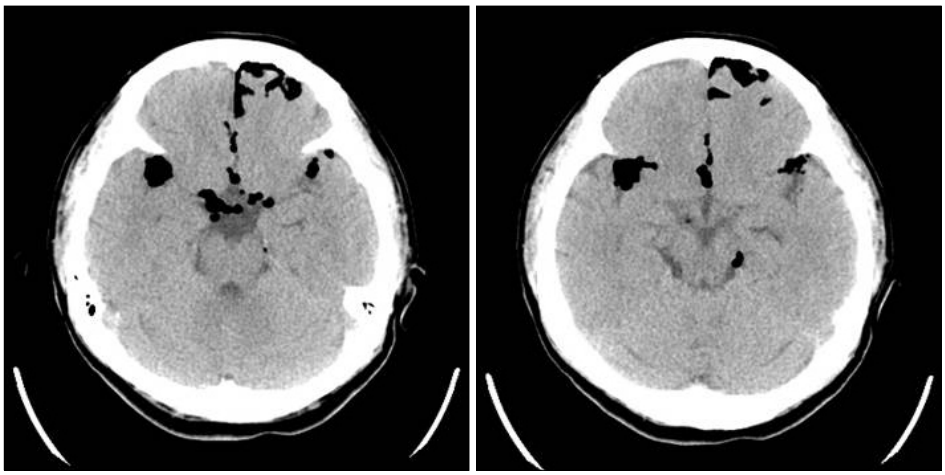

Fig. 1. Computered tomography scan of the brain taken 1 hour after headache developed. It showed large amounts of intracranial air (approximated 10 ml) in the subarachnoid space.

of 2.0 cm depth from skin to the epidural space. During a second attempt at identification of the epidural space, cerebrospinal fluid (CSF) leakage abruptly developed. Epidural anesthesia at the L2/3 level was retried using LORT with 1－2 ml of air each time trial. Immediately after identification of the epidural space in a third attempt, however, she complained of sudden severe headache and nuchal pain without abnormal neurological signs. We immediately stopped the epidural procedure and changed her to the supine position. Rapid infusion of fluid and IV NSAIDs with 100% oxygen administration via a mask was given to the patient, and her symptoms improved slightly. At that time BP, HR, RR, and SpO_2 were 125/85 mmHg, 70 bpm, 20/min and 100%, respectively. A brain computed tomography (CT) scan by a neurology consultant, taken 1 h after onset of the headache, appeared to show large amounts of intracranial air (approximated 10 ml) in the subarachnoid space (Fig. 1). Following a decrease in the patient's pain over four hours, we decided to proceed with surgery again. Both surgery and general anesthesia using sevoflurane and air were performed uneventfully. After the completion of the operation, the patient had no complaints except of operative site pain and was discharged after 17 days without any specific complaints regarding headache or neurologic sequelae.

DISCUSSION

CSE is widely utilized for regional anesthesia, particularly in the lower extremities. It provides a predictable block of rapid onset and long lasting analgesia, allows for titration of the dose to the desired effect, and generates postoperative pain control through percutaneous epidural catheter placement using LORT with air or saline.

No complications directly related to the use of saline have been reported. LORT using air, however, has been associated with pneumocephalus, nerve root compression, subcutaneous emphysema, venous air embolism, and insufficient analgesia resulting from unblocked segments caused by epidural air.[1-3] Although LORT with saline offers many benefits compared with the use of air, it can be difficult to discriminate between CSF and saline after an unintentional dural puncture. Many clinicians also still choose LORT with air because of their training and personal experience.

Although it can be asymptomatic,[4] pneumocephalus has various characteristic symptoms, including severe frontal headache without postural dependence, paresthesia, restlessness, apprehension, vegetative symptoms, or changes in blood pressure.[1-3,5] The specific symptoms depend on the intracranial distribution of the air. Our patient had a bifrontal headache and radiating pain in the nuchal area without neurologic symptoms. Specifically, the pain did not have postural dependence and the bifrontal pains were more severe on the left frontal side, probably because the procedure was done in the right lateral decubitus position instead of a sitting position. The patient's brain CT scans showed that the intracranial air was distributed to the

bifrontal area with more air on the left side.

The duration and severity of symptoms are related to the amount of air.[6] Katz et al.[7] described a case where multiple attempts were made to identify the epidural space using an estimated 20 ml air, but general anesthesia with nitrous oxide was performed after unintentional dural puncture. Delayed awakening occurred. The altered mental status was attributed to the large amounts of intracranial air, possibly made worse by the use of nitrous oxide. In this patient, we attributed the large amount air (approximated 10 ml) detected in the CT scan to the use of a two-handed grip method for LORT with air instead of the Bromage grip method with continuous pressure to a syringe. The source of the subarachnoid air could have been the air injected during the multiple attempts of LORT used to identify the epidural space at L3/4 through the unintentional dural puncture site, but we can not rule out the possibility of another source of injected air during the performance of LORT at the L2/3 level.

Utilization of saline rather than air for LORT to identify the epidural space might well reduce the incidence of pneumocephalus and dural puncture following epidural procedures.[1,2] Aida et al.[8] determined that the incidence of post-dural puncture headache was significantly greater using LORT with air, despite no difference in the incidence of dural puncture.

Conservative treatment such as supine position, aggressive hydration, caffeine, analgesics and oxygen therapy are recommended to relieve pneumocephalic symptoms, including headache.[1,2,9] It has been suggested that hypotension and cardiovascular collapse respond promptly to cardiovascular stimulants and oxygen.[6] In particular, oxygen often accelerates the absorption of the intracranial air and reduces the severity of the headache. This outcome can be best accomplished by giving the patient a high concentration of oxygen.[10] Nitrous oxide anesthesia could theoretically increase the amount of air by allowing diffusing of nitrous oxide from the blood into the pnemocephalus.[11] Accordingly, general anesthesia without nitrous oxide should be considered. The symptoms of pneumocephalus generally resolve completely within 24 hours.[7,10,12,13] In this patient, improvement of symptoms occurred after we administered 100% oxygen, changed the patient to a supine position, and provided hydration and analgesics. Complete resolution of symptoms followed within 24 hours without any other neurologic complications, and the surgery and general anesthesia without nitrous oxide was performed uneventfully.

Subarachnoid air could also potentially cause meningeal irritation with or without neurologic signs. One example is provided by a case report[14] where a CSF examination was done several days after injection of air into the arachnoid space during epidural anesthesia. The CSF analysis showed a significant inflammatory response, apparently without any associated infection. If appropriate, antibiotics should be considered for treatment in such cases.

In conclusion, this case does not expressly support the superiority of LORT with air or saline for identifying the epidural space, which is still controversial. If LORT with air is chosen for other reasons, however, the amount of air should be minimized, moreover, if an unintentional dural puncture occurs, either carefully LORT with small amount air or alternatively with saline, or genral anesthesia without N_2O could be considered.

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