

CASE REPORTS

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Pneumocephalus after Spinal Anesthesia

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Pneumocephalus is relatively frequent in neurosurgery¹ and neuroradiology (pneumoencephalography,² pneumomyelography³). It can also be caused by trauma⁴ or infection.^{5,6} It is known to occur, albeit rarely, with epidural blocks, particularly when the "loss of resistance to air" technique⁷⁻⁹ is used. Conversely, the occurrence of pneumocephalus after spinal anesthesia is extraordinarily rare. Only one case has been described, in which a small quantity of air was injected to clear the spinal needle.¹⁰ We present a case of pneumocephalus after spinal anesthesia in which no air was injected at any time.

Case Report

A 71-year-old, 65-kg, 168-cm, ASA physical status 3 man was referred for surgical treatment of a right inguinal hernia. He had a history of dilated cardiomyopathy, with an ejection fraction of 0.3, chronic obstructive pulmonary disease, atrial fibrillation, and who was receiving digoxin, dicoumarol, captopril, and furosemide. Dicoumarol administration was stopped, and just before surgery, he had an international normalized ratio of 1.1 and an activated partial thromboplastin time of 28 s (control = 30 s).

After beginning rapid infusion of crystalloid solutions and catheterization of the left radial artery for continuous monitoring of arterial pressure, the patient was turned to the right decubitus position. A 22-gauge Quincke spinal needle was inserted into the subarachnoid space *via* the L3-L4 intervertebral space. Cerebrospinal fluid dripped slowly from the needle, and 12.5 mg hyperbaric 0.5% bupivacaine

was immediately injected. Previously, the syringe that contained bupivacaine had been purged completely. The needle was removed after its correct subarachnoid insertion had been checked. During the procedure, however, the patient had a short series of coughs with vigorous inspiratory efforts, which provoked the abrupt egress of a small quantity of CSF, followed by striking oscillations in the CSF level observed in the hub of the needle that coincided with the patient's deep respiratory movements.

The level of the subarachnoid block was T₆.

Surgery was completed without further incident, and the patient was stable, conscious, and aware throughout the operation. After surgery, the patient was moved to the postanesthetic care unit, where electrocardiogram, arterial pressure, and oxygen saturation by pulse oximeter were recorded. Thirty minutes later, the patient began to suffer disorientation, dysarthria, and a striking deterioration in consciousness. Neither hypotension nor desaturation were recorded. The patient's clinical history led us to consider the possibility of a seizure, and an urgent computed tomography (CT) of the brain was done. The only findings of the CT study were two intracranial bubbles that contained 2-4 ml air (figs. 1 and 2). An hour later, the patient began to steadily recover full consciousness and his normal powers of articulation. A new CT scan performed a week later was normal, without any evidence of air. He has remained asymptomatic neurologically as of this writing.

Discussion

This case has some unusual characteristics: (1) air was not administered by syringe, as occurred in all other cases described to date, whether involving epidural⁷⁻⁹ or spinal¹⁰ procedures; (2) the volume of air found seems too small to explain the clinical picture; and (3) the symptoms did not include headache, which is the most common condition associated with the appearance of pneumocephalus.

Most of the cases of pneumocephalus related to regional blocks have been described in epidural anesthesia using the loss of resistance to air technique. Vasdev and Chantigian¹¹ report an incidence of dural puncture of 1-2% with the epidural block. It is easy to understand that, in these cases, the air injected can enter the subdural or subarachnoid space directly, causing pneumocephalus. However, Roderick *et al.*¹⁰ report a case of intracranial air during spinal anaesthesia after air injection through the needle meant to clear it.

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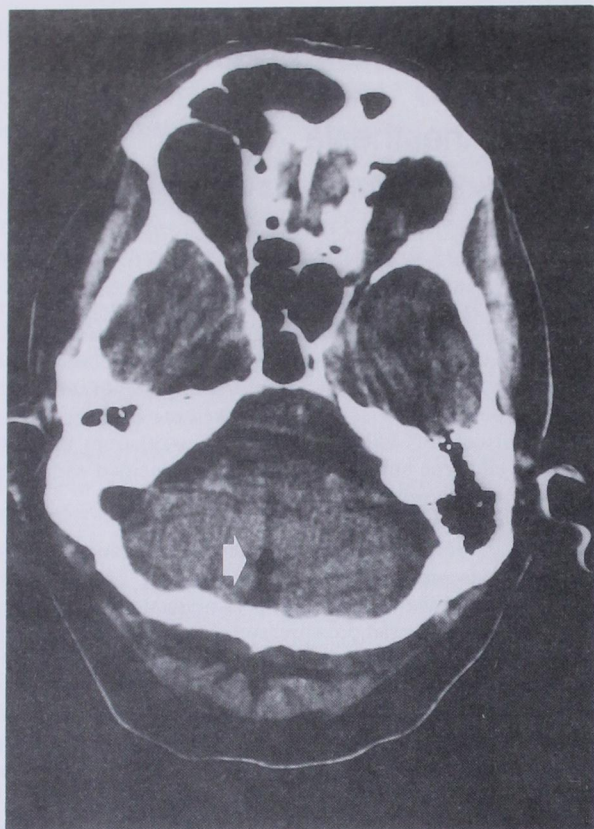


Fig. 1. Larger intracranial air bubble found on the computed tomogram. It is located in the supracerebellar cistern.

In our case, we impute the entry of air to the deep inspiratory movements of the patient (chronic obstructive pulmonary disease) after his short series of coughs. Coombs and Hooper¹² registered subarachnoid pressures in the lateral decubitus position of 2.27 ± 0.79 cmH₂O. During a deep inspiration, the negative intrathoracic pressure could decrease the subarachnoid pressure below atmospheric level, allowing a small quantity of air to enter.

It could be argued that the syringe or the hub of the spinal needle could have been unpurged, but this possibility was fully discounted by two observers.

During the performance of a pneumomyelography, with the patient in the lateral decubitus position, an air injection of at least 40 ml into the subarachnoid space is necessary for the air to reach the head and to

produce symptoms.¹³ Hogan and Haddox¹⁴ presented a case of intracranial air with headache after an epidural injection of 2–4 ml, with the patient in the lateral decubitus position; they explained it as the result of a possible injection into the subdural space, because air there is more painful than in the subarachnoid space and spreads quickly to the head despite the patient being in the lateral position, because of its characteristics of low pressure and decreased capacitance.¹⁵ In addition, in the case described by Roderick *et al.*,¹⁰ 2 ml air injected into the subarachnoid space was enough to provoke a symptomatic pneumocephalus.

In the case we present, air must penetrate the subarachnoid space, because both at the beginning and at the end, the CSF dripped from the needle, which was held absolutely steady.

Our patient's clinical picture appeared approximately 90 min after the completion of spinal anaesthesia. He suffered profound disorientation and dysar-

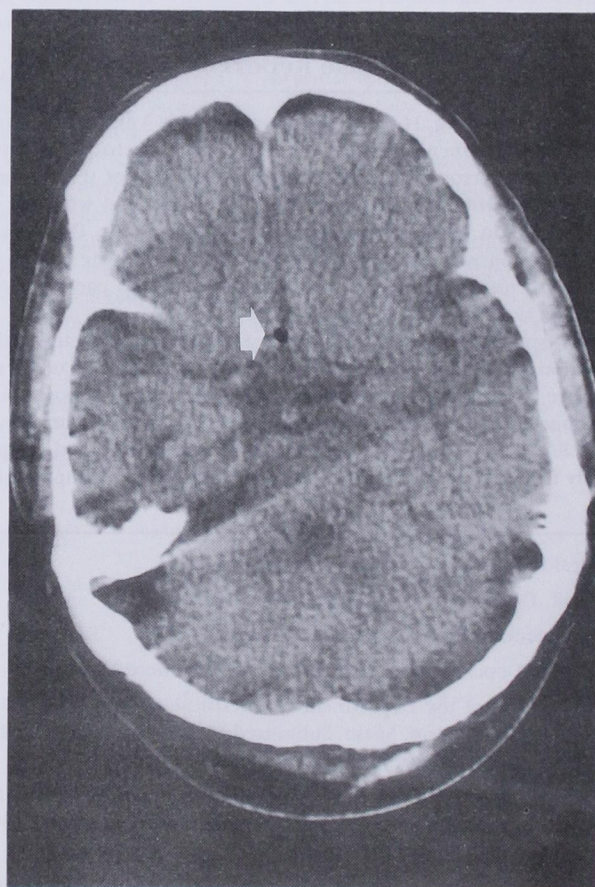


Fig. 2. The second and smaller air bubble was found in the suprasellar cistern.

|| Lemere F, Barnacle C: Encephalography: A review of eight hundred encephalograms with special reference to subdural air. *Archives of Neurology and Psychiatry* 1936; 35:990–1001.

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thria, without hemodynamic repercussions, for an hour. Most clinical cases consist of sudden severe frontotemporal cephalgia.^{7,8,10} Nevertheless, the appearance of other symptoms, such as lethargy, confusion, slow arousal, and different motor signs, has been described.¹⁶

Our patient had concurrent cardiac and respiratory problems, besides a high risk of embolism, all of which might have provided partial explanations for his neurologic deterioration. However, continuous recordings of arterial pressure, electrocardiogram, and oxygen saturation by pulse oximeter allowed us to exclude them. In addition, two brain CTs made a week apart showed neither signs of an infarction nor hemorrhage. However, it is conceivable that the neurologic deterioration might have been due to a transient ischemic attack. In this case, serial CT scans may not manifest any evidence of neurologic injury.

In conclusion, we present an extremely rare case of pneumocephalus after spinal anesthesia, without the injection of air *via* a syringe. The possible entry of small quantities of air through the spinal needle when the stylet had been withdrawn would make us reconsider our technique. The appearance of neurologic symptoms in patients undergoing epidural or spinal anesthesia suggests the possibility of pneumocephalus and other, more common, explanations, such as a transient ischemic attack, as a cause for the symptoms.

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