

Pneumocephalus in thoracoabdominal aortic aneurysm repair after lumbar drain removal and blood patch

Jack Bontekoe, MD, and Kyla Bennett, MD, *Madison, Wis*

ABSTRACT

Lumbar spinal drain use during thoracic and thoracoabdominal aortic aneurysm repair has reduced the incidence of ischemic spinal cord injury with relatively low risk. We report a case of pneumocephalus in a 55-year-old woman who had undergone open repair of a 6.7-cm type IV thoracoabdominal aortic aneurysm. After lumbar spinal drain removal, she developed a postdural headache, which was subsequently treated with blood patch placement. After discharge, she had presented with transient headaches, perioral numbness, and left-hand weakness. Computed tomography revealed intraventricular gas within the lateral ventricles. Pneumocephalus is an exceedingly rare and potentially dangerous complication of lumbar spinal drains and blood patch placement. (*J Vasc Surg Cases and Innovative Techniques* 2021;7:478-80.)

Keywords: Abdominal aortic aneurysm; Cerebrospinal fluid pressure; Postdural puncture headache; Postoperative complication; Pneumocephalus; Thoracic aortic aneurysm

Pneumocephalus (PNC) is defined as the presence of air within any intracranial compartment.¹ The introduction of intracranial air is inevitable with craniotomy but can also be encountered in the setting of head and facial trauma, skull base tumor resection, and other neurosurgical and otorhinolaryngologic procedures.¹⁻³ To a lesser extent, PNC can occur after other less invasive procedures, such as lumbar puncture and spinal and epidural anesthesia.⁴ Typically, small amounts of residual air will be spontaneously reabsorbed and will be incidental findings on subsequent imaging studies. Although rarely symptomatic, the clinical presentation includes headaches, nausea, vomiting, seizures, and neurologic deficits owing to the elevated intracranial pressure.^{1,5} We have described a rare case of symptomatic PNC in a patient who had undergone open type IV thoracoabdominal aortic aneurysm (TAAA) repair with surgical lumbar spinal drain use and an epidural blood patch. The patient had provided written informed consent for the report of her case and imaging studies.

CASE REPORT

A 55-year-old, otherwise healthy, woman was referred to our institution for an incidental 6.7-cm type IV TAAA found on computed tomography (CT) during evaluation

of a palpable abdominal mass. The patient's medical history was uncomplicated, pertinent only for controlled hypertension, occasional headaches, and mild tobacco use. Her family history was negative for aneurysms, except for a sister who had died of speculated intracerebral aneurysm rupture. Our patient was evaluated in the vascular surgery clinic and elected open repair instead of the endovascular option. Owing to the need to clamp the descending thoracic aorta, a spinal drain was used and was successfully placed via a single attempt with a Tuohy 14-gauge needle with fluoroscopic guidance at the L2–L3 intervertebral space before performance of open type IV TAAA repair. A 20-mm Dacron tube graft was used with beveling to the visceral segments and reimplantation of the left renal artery. Additional components of the institutional spinal protection protocol included an intraoperative cerebrospinal fluid (CSF) pressure goal of <8 mm Hg, hypothermia to 33°C, and administration of naloxone, mannitol, and steroids. No immediate complications had occurred from the surgery or spinal drain placement, and no adverse electrophysiologic events were identified by continuous intraoperative electroencephalographic monitoring.

Postoperatively, the patient was kept intubated and remained in the intensive care unit for 2 days. After surgery, the spinal fluid pressure was controlled at 6 to 8 mm Hg until the patient was awake and able to perform leg lifts. After 48 hours, the lumbar drain was removed, and she was transferred to a general ward. The next day, CSF leakage was noted from the drain site, in which two stitches were placed without further evidence of leakage. The patient was asymptomatic. On postoperative day 6 (4 days after drain removal), she had begun experiencing occipital head pain, consistent with postdural puncture headaches (PDPHs). After receiving 2 U of platelets for thrombocytopenia of 57 K/ μ L with an appropriate increase to 136 K/ μ L, a 20-mL

From the Division of Vascular Surgery, Department of Surgery, University of Wisconsin School of Medicine and Public Health.

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Correspondence: Jack Bontekoe, MD, Division of Vascular Surgery, Department of Surgery, University of Wisconsin School of Medicine and Public Health, 600 Highland Ave, Madison, WI 53792 (e-mail: jbontekoe@uwhealth.org).

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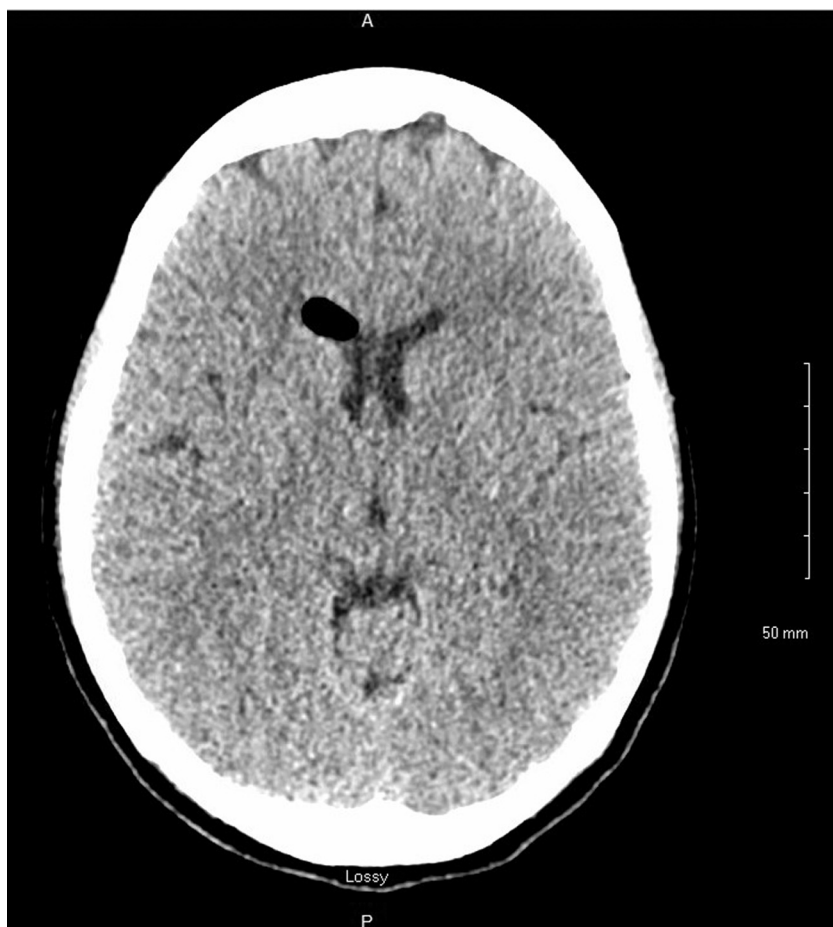


Fig. Noncontrast-enhanced computed tomography scan of the head demonstrating the presence of intraventricular gas within the anterior horn of the right lateral ventricles.

blood patch was placed after three attempts. Both loss of resistance to air (LORA) and loss of resistance to saline (LORS) techniques were used for epidural space identification. The patient's headaches had fully resolved after the procedure. She was discharged home on hospital day 8 after an otherwise uneventful postoperative course.

However, 3 days after discharge, she began experiencing transient episodes of frontal headaches, perioral numbness, and paresthesia and weakness in her left hand. Concerned for stroke, she presented to her local emergency department. Neuroimaging with noncontrast-enhanced CT scan of the head demonstrated the presence of intraventricular gas within the nondependent portions of the anterior horns of the lateral ventricles, with the right greater than the left (Fig). Because of these findings, she was transferred to our facility for further evaluation. On arrival, her neurologic examination findings were unremarkable and her vital signs stable. The neurology stroke and neurosurgery services were consulted, with the conclusion that her symptoms were likely secondary to PNC. Because her headache and focal neurologic symptoms had since entirely resolved, no intervention was recommended.

The patient was discharged home in good condition. Two weeks later at clinic visit, she reported no recurrence of symptoms.

DISCUSSION

We encountered a unique case of PNC after an open type IV TAAA repair. After 48 hours, the lumbar spinal drain was removed, and the patient developed a presumed PDPH, which was treated with a blood patch. At 72 hours after the TAAA repair, she had presented again with headache and focal neurologic deficits with neuroimaging demonstrating PNC.

The use of perioperative lumbar spinal drains is common practice in thoracic aortic aneurysm and TAAA repair for prophylaxis of ischemic spinal cord injury and reduction of paraplegia risk.⁶ Although complications of lumbar drains have been described for otolaryngologic and neurosurgical procedures, few studies have analyzed complications with lumbar drains after thoracic aortic aneurysm and TAAA repair.⁷⁻¹⁰ A review analyzing the outcomes of lumbar drains in 486 patients undergoing TAAA repair revealed relatively low drain-associated

complications, including PDPH treated with an epidural blood patch (2.8%), intracranial bleeding (3.5%), neurologic deficits (1%; one death from brain herniation, one permanent hemiparesis, one transient ataxia), and mortality from spinal drain complications (0.6%).⁷ In that study, the patients who had experienced neurologic deficits or bloody drain output had undergone spinal and head CT; however, no cases of PNC were encountered.⁷

To the best of our knowledge, the present case is the first reported case of PNC seen in a TAAA patient with a perioperative lumbar spinal drain and a blood patch. PNC is an infrequent complication of lumbar anesthesia and exceedingly rare with an epidural blood patch procedure.¹¹ Symptomatic PNC cases have been described after unintentional dural puncture during spinal and epidural anesthesia, mostly within the field of obstetrics. In a retrospective review of 182 patients in the antepartum, peripartum, or postpartum setting referred for headache who had received lumbar anesthesia, only 3 patients were found to have PNC (1.6%).⁴

Although the procedural risk factors overlap, the clinical features of PNC and PDPH can differ. PDPH is usually attributed to CSF leakage through the dural defect, which leads to low CSF pressure and classically presents as a postural headache within 48 hours.^{12,13} Treatment for PDPH includes caffeine, analgesics, intravenous fluids, and an epidural blood patch.^{4,12} In contrast, the headaches associated with PNC are attributed to the cephalad migration of air causing irritation of the intracranial meninges and are often rapid in onset and nonpositional.⁴ Intracranial air behaves like space-occupying lesions and can cause nausea, vomiting, cranial nerve palsies, lethargy, and, as demonstrated in our patient, hemiparesis and focal neurologic deficits.^{4,13} A potentially fatal form of PNC, known as tension PNC, occurs when greater amounts of air lead to a significant mass effect causing intracranial hypertension and cardiovascular instability.^{3,11} Treatment of symptomatic PNC ranges from supplemental oxygen to surgical decompression of tension PNC.³

Two methods for localizing the epidural space used during blood patch placement and epidural anesthesia include the LORA and LORS techniques.¹³ It has been postulated that the LORA technique might allow for the introduction of air through an existing dural defect, leading to potential PNC, a complication avoided by the use of LORS.^{11,14} The case reports of PNC associated

with epidural blood patch placement via the LORA technique have advocated for the use of LORS.^{15,16}

CONCLUSIONS

In our patient, it was possible that PNC had developed from the introduction of air during initial lumbar drain placement and/or drain removal; however, PNC had most likely occurred from the use of the LORA technique for the blood patch. The present case highlights a rare complication of lumbar drain use within TAAA repair and argues against the use of the LORA technique for blood patch placement.

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