

## Pneumothorax associated with epidural anesthesia

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**Key words** Epidural anesthesia · Technique-related complication · Pneumothorax

### Introduction

Technique-related complications associated with epidural anesthesia include intravascular injection, subarachnoid injection, and neurologic injury [1]. Pneumothorax after thoracic epidural anesthesia is a rare but possible complication [2]. We report a case of pneumothorax probably associated with epidural needle insertion.

### Case report

A 17-year-old boy (height, 176 cm; weight, 56 kg) was scheduled for right bullectomy with video-assisted mini-thoracotomy, because his right pneumothorax had not improved with conservative therapy. Preoperative computed tomography revealed a multilobular bulla in the apex of the right lung, while neither obvious bulla nor bleb was observed in the left lung. He had no history of spinal anomaly. Epidural catheter insertion for postoperative analgesia was scheduled before the induction of general anesthesia.

The first insertion was attempted by a skilled resident supervised by an experienced anesthesiologist. The patient was placed in the flexed left lateral decubitus position. After his back was sterilized, the skin and subcutaneous tissue was infiltrated with 1% mepivacaine deeply enough to contact the ligamentous structure and lamina. A 17-gauge Tuohy needle was introduced 1.5 cm laterally from the midline via the left

paramedian approach at the level of the Th<sub>7</sub>–Th<sub>8</sub> interspace. After contacting the vertebral lamina, the angle of the needle was adjusted to identify the epidural space. The Tuohy needle was directed at an angle of 45° to cephalad, and, presumably, less than 15° toward the midline. A loss-of-resistance technique, using a saline-filled glass syringe, detected a likely space at a depth of 6 cm from the skin. A test aspiration was done with the syringe to confirm negative blood or cerebrospinal fluid, when air was aspirated unexpectedly. At that moment, the patient leaned slightly toward the resident. Although no symptom of pneumothorax, such as respiratory distress or decreased breath sounds, was observed, the needle was withdrawn. The other, experienced, anesthesiologist tried to insert the epidural needle via the left paramedian approach at the level of the Th<sub>8</sub>–Th<sub>9</sub> interspace after adjusting the patient's position, but without changing it to another position. The Tuohy needle was introduced 1.0 cm laterally from the midline. After contacting the lamina, "walking" on the lamina facilitated the loss-of-resistance feeling obtained at a depth of 6 cm from the skin. The angle of the needle was then about 45° to cephalad, and 15° toward the midline. A test dose of 3 ml of 2% lidocaine was injected from the epidural catheter. Bilateral Th<sub>7</sub>–Th<sub>9</sub> thermal hypesthesia was confirmed 5 min later with cold test. Subsequently, general anesthesia was induced with intravenous fentanyl, 100 µg; propofol, 90 mg; and vecuronium, 9 mg. To achieve left-sided one-lung ventilation during the right bullectomy, a single-lumen endotracheal tube with a bronchial blocker was intubated. Anesthesia during one-lung ventilation was maintained with sevoflurane, 70% oxygen in nitrogen and intravenous fentanyl, and appropriate oxygenation and carbon dioxide elimination were maintained. The anesthesia and operative procedure were then uneventful.

A routine postoperative chest radiograph, to verify proper pulmonary expansion, was taken about 4 h after the first attempt at inserting the epidural catheter, and it

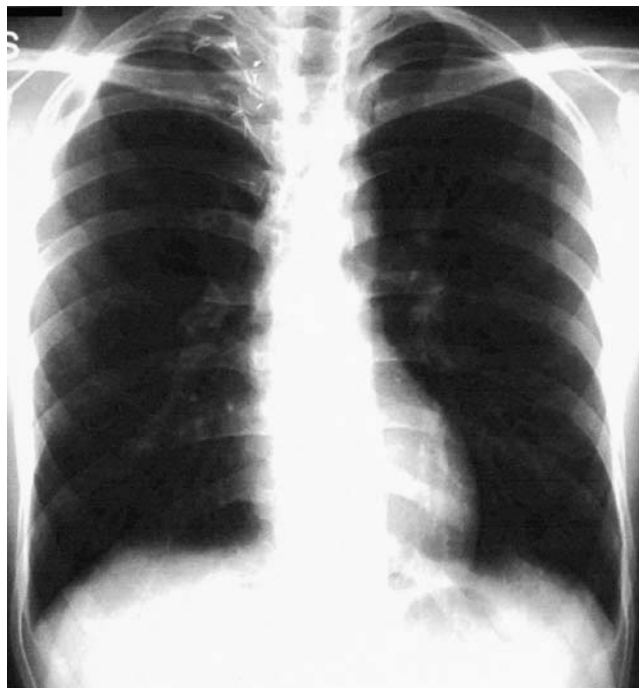


**Fig. 1.** Postoperative chest radiograph, taken about 4 h after the first attempt at inserting the epidural catheter, detected a left-sided pneumothorax

revealed a left-sided pneumothorax (Fig. 1). Although left respiratory sound was slightly weak, the patient had normal oxygenation and tidal volume without symptoms of dyspnea. The endotracheal tube was extubated, and chest drainage was not placed. The pneumothorax disappeared spontaneously within 5 days (Fig. 2), and the patient was discharged on the tenth postoperative day.

## Discussion

Pleural puncture with subsequent pneumothorax is a rare but serious complication of epidural anesthesia, and several cases have been reported. Koch and Nielsen [3], and Furuya et al. [4] have reported the intrapleural misplacement of an epidural catheter found by surgeons during open thoracotomy. Iida et al. [2] reported a patient who required chest drainage after cholecystectomy because of hemothorax and the patient's complaint of dyspnea. In these patients and ours, a "loss-of-resistance feeling" was obtained. Thus, direct entrance of the Tuohy needle into the pleural cavity through relatively tight paravertebral tissue was, possibly, the course of the pleural puncture.



**Fig. 2.** Chest radiograph on the seventh postoperative day. The pneumothorax had disappeared spontaneously

The conventional insertion point of a thoracic epidural needle is 1 to 2 cm lateral to the superior margin of the spinous process, and the needle should be advanced at angles of 45° to 55° to cephalad, and 15° to 30° toward the midline to encounter the epidural space [5]. An alternative method is to insert the needle perpendicular to the skin in all planes until the lamina is encountered. The needle is then "walked" off the superior edge of the lamina and into the epidural space [6]. As Oku and Nishimoto [7] reported, conforming to the small angle toward the midline did not prevent the advancement of the Tuohy needle toward the opposite intravertebral foramen during puncture of the ligamentum flavum. In these previous reports, misplacement of the epidural catheter occurred at the opposite side of the thoracic space [2,4,7]. In contrast, ipsilateral pleural puncture occurred in the present patient. The difference in the side of pleural puncture may be attributed to the different thickness of the subcutaneous fat tissue. In fact, the patients in the previous reports were obese, while our patient was relatively thin.

Other causes of this adverse event could include a smaller angle to compensate for the lateral insertion point, a larger distance to the midline, and inadequate positioning of the patient. The small angle toward the midline itself was not inadequate [6]. The distance to the midline during the first insertion was larger than that of the second insertion. The patient's position was, possibly, inadequate, i.e., he leaned slightly toward the

resident. Thus, the combination of the long distance to the midline and seemingly adequate angle stemming from the inadequate patient's position would have contributed to the adverse event. As for patient positioning, Brown [1] suggested that inadequate positioning of the patient negates meticulous technique.

To reduce the risk of misplacement of an epidural catheter, the insertion point should be made just beside the lateral margin of the spinous process, and the needle should be advanced with a smaller angle toward the midline than is generally accepted. Ramamurthy [5] noted that the epidural needle should be inserted from just next to the lateral margin of the cephalad edge of the spine. Minimizing the angle required to make the puncture in the ligamentum flavum will provide a safer technique without the influence of variable subcutaneous fat density, because the epidural space can be entered by "walking" off the superior margin of the lamina. The "walking" could significantly increase the safety of the technique [5].

Brismar et al. [8] reported that 4 of 21 patients who received pleural puncture, carried out to insert an intrapleural catheter for postoperative analgesia, developed minor pneumothorax. In their study, the need for great care to prevent this complication was emphasized. They recommended that patients should be instructed to hold their breath with an open airway after submaximal inspiration at the time of catheter insertion. Although there is not much necessity to pay attention to the patient's respiration during epidural catheter insertion, the relatively massive air aspiration in our patient may have been influenced by his respiration.

In summary, we encountered a case of ipsilateral pneumothorax associated with the conventional technique of thoracic epidural anesthesia. To reduce the risk of this complication, the thoracic epidural approach should be conducted with the insertion point of the needle near the midline and a small angle toward the midline, while meticulous attention is given to maintain an adequate patient position.

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