Paraplegia After Delayed Detection of Inadvertent Spinal Cord Injury During Thoracic Epidural Catheterization in an Anesthetized Elderly Patient

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We report a case of permanent paraplegia in an 81-yr-old patient who had thoracic epidural catheterization performed under general anesthesia for abdominal surgery. The epidural needle was introduced at the T9-10 interspace, and 3 passes were made to locate the epidural space with the loss-of-resistance-to-air technique. During the postoperative epidural pump infusion, the patient was unaware of the progressive motor and sensory impairment. Sensory loss below T11 and paraplegia with no movement of either lower extremity were identified 8 h after surgery. Magnetic resonance imaging demonstrated an intramedullary split-like lesion extending from T4 to T12 and an intramedullary air bubble at T9. Spinal cord injury caused by an intracord catheterization with subsequent local anesthetic injection was diagnosed. Little improvement was noted after large-dose IV methylprednisolone for initial treatment and subsequent rehabilitation for 6 mo. The possible causes of the delayed detection of the neurologic deficits and the timing of performing epidural anesthesia are discussed.

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Permanent paraplegia after epidural anesthesia is extremely rare; the incidence is <0.02% (1–4). The causes are diverse, including epidural hematoma, epidural abscess, direct cord trauma, spinal infarction, and neurotoxicity by accidental subarachnoid injection or chemical contamination (1,4). Bromage and Benumo (5) reported a case related to epidural catheterization under general anesthesia followed by significant hypotensive episodes in a 62-yr-old woman undergoing total knee replacement. On the fifth overall attempt with the loss-of-resistance-to-air technique, the catheter was inserted above the upper end of a previous lumbar laminectomy scar, which was thought to be the T12-L1 interspace. The patient awoke paraplegic, and magnetic resonance imaging (MRI) demonstrated an intracord air bubble at T10 and an ischemic change at the level of T4-5. Kasai et al. (6) described a case of cord edema after a single-shot thoracic epidural in an anesthetized 9-yr-old child undergoing appendectomy. The first attempt of needle insertion through the T10-11 interspace by using the hanging-drop technique was complicated by dural puncture. It was accomplished with a second attempt by using the techniques of hanging drop and loss of resistance at the same level. The child experienced temporary neurologic symptoms after surgery, and MRI revealed abnormal signals at T10-12. Subarachnoid immigration of epidural bupivacaine containing a preservative was considered the cause. Here we report a case of complete paraplegia noted 8 h after surgery in an elderly patient who underwent thoracic epidural anesthesia under general anesthesia. The serial imaging findings demonstrated an extensive myelopathy after an intracord catheterization with subsequent local anesthetic injection. The possible causes resulting in the delayed detection of the neurologic deficits and the timing of performing epidural anesthesia are discussed.

Case Report

An 81-yr-old man (height, 170 cm; weight, 75 kg) with acute cholecystitis and common bile duct stones underwent open cholecystectomy and cholecodocholithotomy. He had a history of hypertension, and the baseline arterial blood pressure was 166/67 mm Hg. He was mentally competent, and the use of a thoracic epidural for postoperative pain relief was...
suggested before surgery. However, the elderly patient could not comprehend the procedure and feared having the epidural inserted while he was awake. Thinking that he might not be cooperative, we discussed the possibility with him and his family and decided that the procedure would be done after the induction of general anesthesia. The possible risks, including potential cord injury, were explained.

General anesthesia was induced with fentanyl 150 μg and thiamyl sodium 450 mg IV, and tracheal intubation was facilitated by rocuronium 50 mg IV. Anesthesia was maintained with isoflurane in oxygen. The patient was turned to the left lateral position, and, with aseptic technique, a 17-gauge Tuohy needle (Arrow, Reading, PA) was introduced at the T9-10 interspace. Three needle passes were made to locate the epidural space by using the loss-of-resistance-to-air technique. A 19-gauge single-end port catheter (FlexTip Plus®) was inserted 3.5 cm cephalad. There was some resistance to catheterization through the needle. Catheter aspiration was negative. Lidocaine 2% 2 mL with 1:200,000 epinephrine was injected as a test dose. The arterial blood pressure slightly decreased from 130/64 to 110/52 mm Hg 5 min later. Ten minutes after the test dose injection, an epidural bolus of 0.2% bupivacaine 8 mL with morphine 1 mg was given. Arterial blood pressure gradually decreased to 70/40 mm Hg within the next 10 min but returned to 110/60 mm Hg after epinephrine 16 mg and lactated Ringer’s solution 500 mL IV were administered. The operation lasted for 2.5 h and was uneventful. The patient was sent to the postanesthesia care unit after resumption of spontaneous breathing. The endotracheal tube was removed after he was alert and able to follow complex commands 1 h later. He was pain free and did not complain of motor or sensory impairment. Physical examination showed freely movable extremities but relative weakness in the lower extremities, with muscle strength of 4/5 and poor response to pain and sensory stimulus. Negative catheter aspiration was confirmed again to exclude intrathecal placement. A patient-controlled analgesia pump was then programmed to deliver 0.1% bupivacaine with fentanyl 1 μg/mL at a basal rate of 4 mL/h, with a demand dose of 2 mL and a lockout interval of 20 min. The systolic blood pressure was 100–130 mm Hg in the postanesthesia care unit, and he was returned to the ward 1 h later without significant further decreases in muscle strength. It was late in the evening and beyond the regular follow-up period by our acute pain team members.

The patient first complained of numbness and weakness of the lower extremities 8 h after surgery, early the next morning. Neurologic assessment revealed sensory loss below T11 and paraplegia, with no movement of either lower extremity. The epidural pump infusion was discontinued. Little residual fluid and no blood were aspirated from the catheter, which was removed. Including the initial bolus dose during surgery, a total volume of 44 mL of bupivacaine with opioid was given. The periodic systolic blood pressure in the ward was approximately 100 mm Hg. Neurologic reassessment remained unchanged 4 h after discontinuation of the pump infusion. An emergent computed tomography scan was performed, and it showed an intramedullary 2.4-mm-diameter air bubble at T9. MRI was performed, and it revealed extensive intramedullary abnormally high signals on T2-weighted images (T2W) from dorsal T12 extending upward to ventral T4 (Fig. 1). The intramedullary air bubble at T9 was noted on MRI (Fig. 2). The lesions did not show evidence of contrast enhancement. A methylprednisolone 30 mg/kg IV bolus over 15 min, followed by a 5.4 mg·kg⁻¹·h⁻¹ IV infusion for the next 23 h, was given in accordance with the consulting neurologist’s suggestion. The neurologic deficits were evaluated daily. Summarized neurologic deficits on postoperative Day 3 revealed bowel and bladder incontinence, flaccid paraplegia with areflexia, loss of pain and temperature perception, and preservation of touch and position sensations of both legs. MRI was followed by...
Discussion

Acute paraplegia after epidural anesthesia can result from spinal cord compression, spinal cord infarction, and cord trauma. Epidural hematoma, spinal stenosis, or metastatic lesions resulting in cord compression are the most common causes, but they were excluded by the imaging studies in this case. In addition, the MRI that demonstrated intramedullary high signals on T2W extending from dorsal T12 upward to ventral T4 did not support the possibility of a territorial spinal infarct from a vascular insult (7,8). Cord trauma due to intracord injection of chemicals is reported to have demarcated paracentral splitting lesions and hydromyelia on the MRI (9). In this case, the intramedullary air bubble and the long segmental and slitlike lesion on the MRI suggested an intracord catheterization with subsequent injection of local anesthetic. Such an extensive and serious myelopathy caused by an unrecognized intracord catheterization with subsequent injection of local anesthetic has not been reported.

In reviewing the image studies, we found that the patient had a severely spondylotic spine, which may have complicated the catheter placement. We believe that the air injected into the spinal cord split the cord and thus facilitated the following catheterization. The hypotension after the initial epidural bolus dose during surgery and the relative postoperative hypotension were attributed to the intramedullary bupivacaine and opioids. The pump infusion may have increased the intracord pressure and compromised cord perfusion, which may have exaggerated the aberrant hemodynamics, resulting in a vicious cycle of cord injury. Retrospectively, the nurses on the ward described that the patient was asleep but could be awakened to talk during visits. He did not complain of pain or abnormal bodily change through the night. In addition to the residual anesthetic effects, the intramedullary bupivacaine and opioids should have masked the patient’s discomfort during the continuing cord trauma with the continuous pump infusion. The delayed response of this elderly patient and lack of regular neurologic checkups by our acute pain team members at night also served as obstacles to early recognition.

The optimal time for performing regional anesthesia during combined epidural and general anesthesia has been debated (10–12). Performing regional blockade during general anesthesia has become an established and accepted practice in pediatric anesthesia. The risks of anesthetized children undergoing regional blockade have been well evaluated in some large studies (13–15), but relevant studies are lacking in adults, especially in elderly patients. Horlocker et al. (16) reported that there was no direct neurologic complication related to lumbar epidural catheterizations in 4298 anesthetized patents. Although there are insufficient data to support the assumption of increased risks of thoracic epidural catheterization under general anesthesia for adults, we believe that thoracic epidural catheterization is best performed in awake patients, because needle insertion into the cord is heralded by local or radiating pain, paresthesia, or movement (9,17). Nevertheless, in conscious patients undergoing epidural catheterizations, cases have been reported of direct cord trauma by the local anesthetic infiltration needle due to the patient’s bodily movement and painless intracord catheterization, resulting in fluid collection within the spinal cord (18,19). Procedures have the potential to cause cord injury when performed in either awake or unconscious patients. In our department, thoracic epidurals are routinely performed in awake and unpremedicated patients. Few anesthesiologists in our department would favor performing thoracic epidurals in anesthetized patients when the patient is extremely nervous or uncooperative before or during the procedures or in complicated intraoperative situations where the surgeons strongly request the advantage of thoracic epidurals. In such situations, letters of consent from those patients or their families have been a prerequisite. Because this practice in unconscious patients is limited, we lacked formal data to calculate the frequency of adverse events. However, this catastrophe underscores the danger of the technique. Until formal studies are done demonstrating no increased risk from performing thoracic epidurals in anesthetized patients, this technique is forbidden in our department. Neurologic monitoring in patients receiving regional blocks has also been increased. The medicolegal problem of this case was settled by the coordination committee in our institute, and the society of anesthesiologists in our country will collect such cases of serious anesthesia-related complications annually.

In conclusion, we report a case of permanent paraplegia with correlated imaging findings of intracord catheter placement after thoracic epidural catheterization in an anesthetized elderly patient. This case underscores the potential for cord injury with this technique. We suggest that thoracic epidurals be performed only in conscious patients. This will not eliminate the risks of cord injuries but will help to identify them earlier. Epidural catheterization in an anesthetized patient should be reserved only for circumstances in which performing the technique in the awake patient is truly not feasible.
In this situation, a lumbar epidural should be considered the method of choice. In addition, follow-up of the adverse effect during epidural analgesia of elderly patients requires extra vigilance.

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References