A Lesson Learned

It was called to my attention by a reader that the article by Nielsen et al.1 that was published in January 2005 issue of ANESTHESIOLOGY was very similar in design and conclusions to another article, published by the same authors in the October 2004 issue of the Canadian Journal of Anesthesia.2 The authors’ comments follow.

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In Reply—Thank you for giving us this opportunity to respond. We wish to apologize to the editorial staff and readership of ANESTHESIOLOGY and the Canadian Journal of Anesthesia.

In October 2004, we published a study in the Canadian Journal of Anesthesia,1 and in January 2005, we published another article in ANESTHESIOLOGY.2 At the time of the ANESTHESIOLOGY submission, we failed to notify the journal of the existence of the previous article, which used the same data set and had similar methodology. Although the article in ANESTHESIOLOGY expanded on the findings reported in the Canadian Journal of Anesthesia, this is inconsistent with our acknowledgment of the Instructions for Authors, which states, “Submitted manuscripts must not have been published elsewhere, in whole or in part.” We realize that journals must take this issue seriously. It is necessary to maintain integrity and provide the peer review process the complete information to thoroughly evaluate a manuscript and arrive at the optimal decision. Although not intended to hide the existence of another manuscript, our actions did not allow this process to occur. We take the issue of academic integrity seriously, and we are sincerely sorry for causing this situation.

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This is unfortunate and unnecessary. Editors are fully aware that it is often impossible to summarize the results of large, complex studies in a single manuscript. If I had been aware of the overlap, the authors would have been given the opportunity to explain the differences in the two manuscripts, and by working with the editorial offices, they could easily have produced a second manuscript addressing a distinctly different (or complementary) aspect of their study. This is something that we do on a regular basis; all it requires is that the authors be forthcoming about their other work. The result would have benefited the authors, the Journal, and our readers.

This situation should serve as a lesson to all authors. Editors take their Instructions to Authors very seriously, and so should authors. Editors are also more flexible than some might believe. There is no reason to conceal other manuscripts from us. Like authors, we want to publish the results of high-quality science. In most cases, we are happy to work with authors toward achieving a mutually beneficial result. We simply ask that authors honor their signed statements and comply fully with the well-accepted rules established by all journals.

Michael M. Todd, M.D., Editor-in-Chief
To the Editor:— At our institution, we use the Human Patient Simulator (HPS), model D, developed by Medical Education Technology, Inc. (METI, Sarasota, FL). Although this model is a high-fidelity simulator, one of its disadvantages is that there is not a module to simulate and train the procedure of arterial cannulation. The arterial pulses are created by means of pneumatic bladders that can be palpated, but vessel cannulation is not possible. Another disadvantage of the HPS pulses is that although the rate of the pulses correlates with that of the programmed simulation, the intensity is invariable, so hemodynamic changes are not reflected in changes in pulse intensity.

We have developed a device that, when attached to the Trauma Disaster Casualty Kit (TDCK) of the HPS, allows the trainee to palpate the radial and femoral pulses as well as cannulate the simulated vessels using commercially available cannulation devices. The TDCK is an adjunct to the HPS that is used for trauma training. This kit simulates arterial or venous hemorrhage using simulated blood when adjunctive devices that mimic lacerated body parts are attached to the HPS. Because the TDCK communicates with the HPS, the programmed cardiac rate of the HPS correlates with that of the TDCK arterial pulses.

Our device is easily constructed with readily available commercial tubing and intravenous stopcocks (fig. 1). It is comprised of inflow channels that separate the “blood flow” to either the radial or the femoral sites, as well as other anatomical sites the operator chooses, and outflow channels that drain the fluid. Resistance in the system can be varied by limiting outflow with the stopcocks. Increased flow is regulated by increasing the flow into the system using the METI TDCK software. When our device is attached to the TDCK and placed within the HPS, palpable radial and femoral pulses are created by the flow of simulated blood through our device (fig. 2). When the “vessels” are cannulated, a pulsatile flash is observed that correlates with the pulse of the HPS. A transducer can then be attached, and a simulated waveform generated by the simulator software is then displayed on the monitor. In addition, when the hemodynamics of the “patient” change (e.g., increased cardiac output, vasoconstriction), by regulating the flow into the “vessels” or controlling the resistance to outflow, the intensity of the pulse can be varied to match that of the situation. We believe that this device further increases the fidelity of any training scenario involving arterial cannulation and adds another procedure that can be taught using a simulator. Moreover, because we can change the intensity of the pulses, this device can be used to teach inexperienced clinicians the importance of evaluating the arterial pulses as a qualitative clinical sign and to demonstrate basic clinical cardiovascular physiology. For example, we can demonstrate the changes in pulse intensity with changes in cardiac output or systemic resistance by having students palpate the pulse when either flow or outflow resistance are varied.

For those institutions that have an HPS, we believe this device is a very useful adjunct to anesthesiology training. Trainees can learn to perform an arterial cannulation within the context of a simulated clinical situation in real time in a nonthreatening learning environment. Although our device is designed to work with the METI HPS/TDCK, it can also be easily adapted to any other configuration (e.g., artificial limb, HPS without a TDCK) to produce a low-cost arterial cannulation simulator (albeit without the benefit of a synchronized pulse) when attached to either a powered or a manual pumping device. Detailed assembly instructions, illustrations, and a video on how to construct this device can be found on the ANESTHESIOLOGY Web site.

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Additional material related to this article can be found on the ANESTHESIOLOGY Web site. Go to http://www.anesthesiology.org, click on Enhancements Index, and then scroll down to find the appropriate article and link. Supplementary material can also be accessed on the Web by clicking on the “ArticlePlus” link either in the Table of Contents or at the top of the Abstract or HTML version of the article.

Support was provided solely from institutional and/or departmental sources.
To the Editor—We present a case of inadvertent injection of a mixture of rocuronium and morphine into the caudal epidural space in an awake patient.

A 53-yr-old, 80-kg, otherwise healthy man was scheduled to undergo emergency surgery during general anesthesia because of a rectal abscess. For postoperative analgesia, caudal injection was planned before general anesthesia with 13 ml of a mixture of 100 mg lidocaine and 3 mg morphine. After premedication with 3 mg midazolam and 0.5 mg atropine intramuscularly and standard anesthetic monitoring, with the patient in the prone position, the caudal space was easily identified with a 25-gauge needle. After a negative aspiration test result for blood or cerebrospinal fluid, the prepared solution was injected in three divided doses. The patient reported pain and a burning feeling during every injection. The needle was withdrawn 5 mm, and the injection was continued. Nevertheless, he still reported the burning feeling during every injection. Fifteen seconds after the injection was completed, he reported difficulty in breathing and consequently in speaking. First, total spinal anesthesia was considered, and the patient was immediately turned to the supine position. His spontaneous breathing was very weak, and his eyelids were lowered. Assisted ventilation was started via facemask with 100% oxygen, and 100 mg propofol was administered for possible awareness. At this point, the patient’s blood pressure and heart rate were very stable. It was then realized that a mixture of 100 mg rocuronium and 3 mg morphine had been administered into caudal space because of a preparation error. Five minutes after caudal injection, the patient was intubated easily with an additional 100 mg propofol, and anesthesia was maintained with 1.5% sevoflurane in nitrous oxide and oxygen. The patient’s wife and surgeons were fully informed; it was decided to perform the surgery because it was an emergency case. After obtaining written informed consent from his wife, the patient was placed in the lithotomic position, and surgery was started. After the first 20 min, he had pinpoint pupils. There was nothing else to note preoperatively. The surgery was completed 45 min after caudal injection, and neuromuscular blockade was reversed with 2.5 mg neostigmine and 1 mg atropine intravenously. Two minutes after the reversal, the patient was maintaining an adequate breathing rate and depth, and the endotracheal tube was removed. After an additional 5 min, his sustained head lift was longer than 5 s, and he could obey verbal commands. Ten minutes after reversal, he was completely awake and oriented. His neurologic findings were normal except for pinpoint pupils. There was no motor or sensory block, and he was completely pain free. He could vomit easily 5 h later. On the second day, neurologic examination was normal except that his pupil size was still 2 mm. Thirty hours after injection, his pupil size had completely recovered, and he was still pain free. Three days later, he was discharged from the hospital without any complaints. Thereafter, we followed up with the patient by telephone for 1 month. He never experienced any problems.

No data about inadvertent injection of rocuronium or other nondepolarizing neuromuscular blockers (NDNMBs) into the caudal epidural space in awake patients have been documented in the literature. Vecuronium and cisatracurium were reported without any neurologic or cardiovascular side effects or other symptoms of local or systemic toxicity. However, because both drugs were administered through a catheter into the lumbar epidural space during general anesthesia, the patients were unable to report problems, and some symptoms were not observed.

Drugs administered inadvertently into the epidural space have resulted in serious morbidity and mortality due to a direct drug or drug-additive neurotoxic, pH, or osmolality effect. Rocuronium, a steroid NDNMB, has a rapid onset and an intermediate duration. It is an isonic solution, and its isonicitony is obtained using sodium chloride; a pH of 4 is achieved by adding acetic acid, sodium hydroxide, or both. Its metabolite, 17-desacetyl-rocuronium, has been observed rarely in the plasma or urine of humans.

It has been demonstrated that NDNMBs introduced into central nervous system are pharmacologically active, and they cause an increase in intracellular calcium concentrations and activation of either nicotinic acetylcholine receptors or glutamate receptors in rat brain, resulting in autonomic dysfunction, weakness, prolonged neuromuscular blockade, neuronal injury and death, and seizures.

The only side effect of the current inadvertent injection was nonreactive pinpoint pupils perioperatively and postoperatively. A possible explanation of the miosis may be the migration of rocuronium and morphine solution from the epidural space into the cerebrospinal fluid, then to the basal cisternae, and thence through brain tissue around the fourth ventricle. The patient’s lithotomic position might have magnified intracranial spread of drugs. In humans, morphine has a miotic effect, which is generally explained by direct stimulation of preganglionic parasympathetic fibers in the Edinger-Westphal nucleus. Prolonged time of the miosis (e.g., 30 h) is appropriate with the analgesic time of the morphine applied neuroaxially.

As mentioned above, contrary to what was seen in the neuromuscular receptors, NDNMBs may activate, rather than inhibit, particular subtypes of nicotinic acetylcholine receptors in the central nervous system. Therefore, activation of brain acetylcholine receptors by NDNMBs might participate in miosis mechanism. That may be another answer to the question, Why were other side effects of opioids, such as respiratory depression, sedation, and mental status changes, not observed with miosis? It can be postulated that activation of brain acetylcholine receptors prevented these side effects.

The caudal epidural space is rich in venous plexuses. Although the rate of absorption of rocuronium from the caudal space is unknown, the onset time may be estimated to be between that of an intravenous and an intramuscular bolus. Intravenous injection of 1.2 mg/kg rocuronium (approximately the dose of the current injection) provides good intubating conditions in most patients in less than 2 min, and this dose may be expected to provide 67 (38–160) min of clinical relaxation. It has been demonstrated that the absorption half-life is approximately 6.6 min, plasma concentrations peak at 15 min, and less than 4% of the drug remains to be absorbed from the intramuscular depot 30 min after rocuronium is administered into the deltoid muscle in children. In our patient, constitution of excellent intubation condition 30 min after rocuronium is administered into the deltoid muscle is appropriate with the analgesic time of the morphine applied neuroaxially.

In this case, pain during injection should have warned us about the wrong drug administration. However, sometimes caudal injection may also be painful because of subperiosteal injection. In addition, par aesthesia or a feeling of fullness is common during injection, and some anxious patients may feel and report this as pain.

When an inadvertent epidural injection has occurred, some practitioners attempt to dilute the concentration of the drug in the epidural space by flushing with distilled water or saline. Others have used epidural or intravenous corticosteroids to reduce the inflammatory response. But these attempts were speculative, and they could potentially worsen the situation because of upward spread of drugs. There-
Bifocal Tuberculosis Highlighted by Obstetric Combined Spinal-Epidural Analgesia

To the Editor—Spinal1 tuberculosis highlighted by epidural anesthesia has been scarcely reported in the literature, and in most cases, only the anterior wall of the spine was involved.1,2 Here, we report a case of unknown tuberculosis involving the posterior spinal process with epidural abscess drained by obstetric combined spinal–epidural anesthesia.

A 35-yr-old Cambodian woman, gravida 2, was admitted during labor at 39 weeks’ gestation, at term of a normal pregnancy. Her medical history revealed a postpartum hemorrhage during her first delivery, which had necessitated blood transfusion with inactive hepatitis C as a sequela. At 5 cm of cervical dilatation, she benefitted from combined spinal–epidural analgesia with strict aseptic conditions. The spinal injection included 2.5 mg bupivacaine and 5 μg sufentanil. After a test dose, an epidural continuous infusion of 0.1% ropivacaine was started through a filter. The patient did not experience motor block, decrease in blood pressure, fetal bradycardia, or pruritus. The onset of analgesia was rapid, and maternal satisfaction was high. Thirty minutes later, she delivered a healthy boy without complications. The epidural catheter was removed 2 h after delivery, and the epidural tip did not show any abnormality. Before discharge from the hospital, the patient reported a small tumefaction on her back, without fever or pain. The site of the epidural puncture was slightly swollen but without signs of inflammation or neurotoxicity.

Fifteen days later, the patient was treated for a back skin abscess with surgical incision and oral antibiotics in view of the increase of the tumefaction. The results of bacteriologic investigations were negative. The patient did not experience any pain or fever. The results of clinical and neurologic examinations were unremarkable. Biologic samples were within the reference ranges, except for the inflammation test result. Two months after her delivery, the patient was referred to the hospital because the wound had still not healed, despite her good health. Magnetic resonance imaging (fig. 1) and computed tomography were performed and revealed a displacement of the nerve roots by an expansive mass in the posterior extradural space, which took up more than 50% of the spinal canal. This mass began at the L2–L3 level with an L2 neural arch lysis and continued down to L4–L5. Inflammatory infiltrate extended in both psoas and sacroiliac joints. Soft tissues were involved with collections in both paraspinal muscles. An emergency neurosurgical procedure was performed with laminectomy at L2 and L3, and a solid abscess, adherent to the dura mater, was removed from the epidural space. No pus was found in the spinal canal. The soft tissues and paravertebral muscles were dissected. The patient made an uneventful recovery. All of the surgical bacteriologic samples were sterile. No alcohol-fast bacilli were identified in the surgical specimen. However, pathologic examination of the abscess showed granulomatous inflammation with epithelioid and gigantocellular cells and necrosis, which was poorly compatible with classic epidural abscess. A skin tuberculin test result was strongly positive, and a chest radiograph showed a right mediastinal mass. Empirically, double therapy was started with antibiotics and antituberculous treatment (rifampin, isoniazid, and pyrazinamide). Six weeks later, the diagnosis of tuberculosis was confirmed when Mycobacterium tuberculosis was cultured from intraoperative specimens of bone fragments and necrotic soft tissues. Moreover, a thoracic computed tomography image showed a voluminous tissue mass in the lower right laterotracehal area and pleural nodules in the upper and lower right lung. The final diagnosis was tuberculosis of the pulmonary area, mediastinal and lumboaortic lymph nodes, and vertebral areas resulting in lysis of the L2 spinal process. Epidural puncture led to revealing the disease. The outcome of the patient was good, without any sequelae, and antituberculous treatment is being continued for 18 months.

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References

To the Editor.—Nasogastric tube insertion during anesthesia is often difficult. Many techniques have been proposed to aid insertion, including forward displacement of the larynx, use of a split endotracheal tube, and various kinds of forceps. 1-3 The most common sites for impaction of the nasogastric tube are pyriform sinuses and the arytenoid cartilage. 4 Maneuvers to keep the nasogastric tube along the lateral or posterior pharyngeal wall encourages the smooth passage into the esophagus. 5,6 Our experience of using a gloved finger to steer the nasogastric tube along the posterior pharyngeal wall supports this premise. 7

Our current effort was intended to determine whether neck flexion would facilitate nasogastric tube passage. We recruited 60 consecutive patients with normal airways and neck movements who required intubation and nasogastric tube insertion as a part of their surgery. After obtaining informed consent from the patients, general anesthesia and muscle relaxation was achieved. The patients were then randomized to either the neck flexion or the neutral group using a sealed-envelope method. After tracheal intubation, both nares were vasoconstricted with 0.05% oxymetazoline. A well-lubricated 16-French gastric tube was inserted via one nostril for a length of 8–9 cm in females and 9–11 cm in males. The onset of vertebral injury probably began with venous pool increase is combined with vena cava syndrome. The onset of vertebral injury probably began with the L2 spinal process and then extended to the paravertebral muscles and the epidural space. The epidural puncture drained the epidural abscess and might have, as a mild trauma, exacerbated the tuberculous spinal lesion. 8

In summary, we recommend that, however mild the symptoms are, abnormal recovery after an epidural puncture should lead to rapid and effective imaging. Tuberculosis is a latent illness, which is still a topical illness, especially in the nonnative and immunocompromised population.

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References


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Table 1. Summary of Study Results

<table>
<thead>
<tr>
<th>Position of the Neck for Insertion of Nasogastric Tube</th>
<th>Flexion</th>
<th>Neutral</th>
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<tr>
<td>No. of patients with success in first passage in intended position</td>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td>No. of patients with success in second passage in intended position</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>No. of patients with success with alternate method</td>
<td>3</td>
<td>9</td>
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