

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.

Michael M. Todd, M.D., Editor-in-Chief, ANESTHESIOLOGY, The University of Iowa, Iowa City, Iowa. anesthesiology@uiowa.edu

Anesthesiology 2005; 103:442

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.

The first paragraph of the cover letter signed by authors submitting their work to ANESTHESIOLOGY states, "On behalf of my coauthors, I am submitting the enclosed material for possible publication in ANESTHESIOLOGY. It has not been submitted for publication nor has it been published in whole or in part elsewhere. . . . I acknowledge that both I and the other authors have read the Instructions for Authors and agree with its contents." Those instructions, in turn, state that "submitted manuscripts must not have been published elsewhere, in whole or in part, on paper or electronically. . . . The Editor-in-Chief must be notified if another manuscript derived from the same experiment has been published previously, or has been submitted to another journal." Nearly identical statements and requirements can be found in the author instructions of most journals, including the *Canadian Journal of Anesthesia*.

Although the authors signed cover letters, first to the *Canadian Journal of Anesthesia* and then to ANESTHESIOLOGY, attesting to their compliance with these conditions, they did not, in fact, comply—which resulted in the publication of two very similar articles. This has now resulted in embarrassment to both Journals and to the authors. Although the articles are not identical, the overlap is substantial, and if either Donald R. Miller, M.D. (Editor-in-Chief, *Canadian Journal of Anesthesia*), or I had been aware of the other submission, the editorial and review process would have been entirely different.

References

1. Nielsen KC, Guller U, Steele SM, Klein SM, Greengrass RA, Pietrobon R: Influence of obesity on surgical regional anesthesia in the ambulatory setting: An analysis of 9,038 blocks. ANESTHESIOLOGY 2005; 102:181-7
2. Cotter JT, Nielsen KC, Guller U, Steele SM, Klein SM, Greengrass RA, Pietrobon R: Increased body mass index and ASA physical status IV are risk factors for block failure in ambulatory surgery: An analysis of 9,342 blocks. Can J Anesth 2004; 51:810-6

© 2005 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.

Karen C. Nielsen, M.D., *Ulrich Guller, M.D., M.H.S., Susan M. Steele, M.D., Stephen M. Klein, M.D., Roy A. Greengrass, M.D., F.R.C.P. M.D., F.R.C.P., Ricardo Pietrobon, M.D., Ph.D. *Duke University Medical Center, Durham, North Carolina. niels006@mc.duke.edu

References

1. Cotter JT, Nielsen KC, Guller U, Steele SM, Klein SM, Greengrass RA, Pietrobon R: Increased body mass index and ASA physical status IV are risk factors for block failure in ambulatory surgery: An analysis of 9,342 blocks. Can J Anesth 2004; 51:810-6
2. Nielsen KC, Guller U, Steele SM, Klein SM, Greengrass RA, Pietrobon R: Influence of obesity on surgical regional anesthesia in the ambulatory setting: An analysis of 9,038 blocks. ANESTHESIOLOGY 2005; 102:181-7

(Accepted for publication April 15, 2005.)

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

A System to Simulate Arterial Blood Flow for Cannulation in the Human Patient Simulator

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

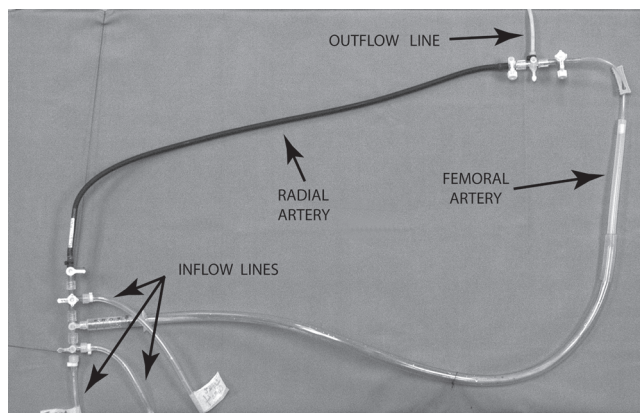


Fig. 1. Assembled device connected to inflow and outflow manifolds.

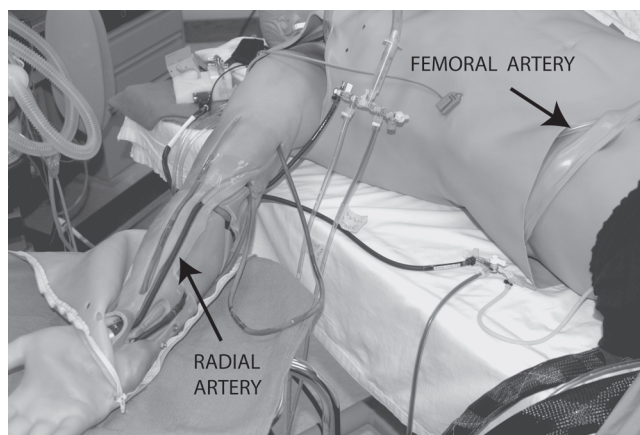


Fig. 2. Device installed in model D of Human Patient Simulator (Medical Education Technology, Inc.) at right radial and femoral locations. The arm skin has been removed for visualization. The inflow tubing (shown here exposed) is usually hidden under drapes.

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.

Martin P. Eason, M.D., J.D., * M. David Linville, M.D., Charles Stanton, M.S. * Quillen College of Medicine, East Tennessee State University, Johnson City, Tennessee. eason@etsu.edu

The authors thank Phillip Bagnell, M.D. (Executive Associate Dean, Department of Academic Affairs, Quillen College of Medicine, East Tennessee University, Johnson City, Tennessee), for his support in this project.

(Accepted for publication February 28, 2005.)

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.

Accidental Caudal Injection of Rocuronium in an Awake Patient

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 lithotonic 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 sensorial block, and he was completely pain free. He could void 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. Vecuronium¹ and cisatracurium² 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.³ Rocuronium, a steroid NDNMB, has a rapid onset and an intermediate duration. It is an isotonic solution, and its isotonicity 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.^{4,5}

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 lithotonic 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.⁶ 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.⁵ Therefore, activation of brain acetylcholine receptors by NDNMBs might participate in miosis mechanism. That may be an 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.⁸ It has been demonstrated that the absorption half-life is approximately 6.6 min, plasma concentrations peak at 13 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.⁷ In our patient, constitution of excellent intubation condition was slower (5 *vs.* < 2 min) but duration of action was not longer as compared with clinical duration after intravenous administration (50 *vs.* 67 [38–160] min).

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, paresthesia 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.³ But these attempts were speculative, and they could potentially worsen the situation because of upward spread of drugs. There-

Support was provided solely from institutional and/or departmental sources.
*www.fda.gov/medwatch/SAFETY/2003/03Jun_PI/Zemuron_PI.pdf. Accessed March 3, 2005.

fore, we decided only to observe the patient and provided symptomatic and supportive treatment as required.

Mehmet Cesur, M.D., † Haci A. Alici, M.D., Ali F. Erdem, M.D., Ibrahim Boga, M.D. † Ataturk University, Erzurum, Turkey. mcesur@atauni.edu.tr

References

1. Kostopaniotou G, Mylona M, Massoura L, Siafaka I: Accidental epidural injection of vecuronium. *Anesth Analg* 2000; 91:1550-1
2. Vassilakos D, Tsakiliotis S, Veroniki F, Zachariadou G, Giala M: Inadvertent epidural administration of cisatracurium. *Eur J Anaesthesiol* 2004; 21:663-72

3. Hew CM, Cyna AM, Simmons SW: Avoiding inadvertent epidural injection of drugs intended for non-epidural use. *Anaesth Intensive Care* 2003; 31:44-9
4. Szenohradszky J, Trevor AJ, Bickler P, Caldwell JE, Sharma ML, Rampil JJ, Miller RD: Central nervous system effects of intrathecal muscle relaxants in rats. *Anesth Analg* 1993; 76:1304-9
5. Cardone C, Szenohradszky J, Yost S, Bickler PE: Activation of brain acetylcholine receptors by neuromuscular blocking drugs: A possible mechanism of neurotoxicity. *ANESTHESIOLOGY* 1994; 80:1155-61
6. Murray RB, Adler MW, Korczyn AD: The pupillary effects of opioids. *Life Sci* 1983; 33:495-509
7. Reynolds LM, Lau M, Brown R, Luks A, Sharma M, Fisher DM: Bioavailability of intramuscular rocuronium in infants and children. *ANESTHESIOLOGY* 1997; 87:1096-105

(Accepted for publication March 1, 2005.)

Anesthesiology 2005; 103:445-6

© 2005 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.

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 neurologic abnormality. She was discharged with local antiseptic care.

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 granuloma-

tous 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 laterotracheal area and pleural nodules in the upper and lower right lung. The final diagnosis was tuberculosis of the pulmonary area, mediastinal and lumbo-aortic 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.

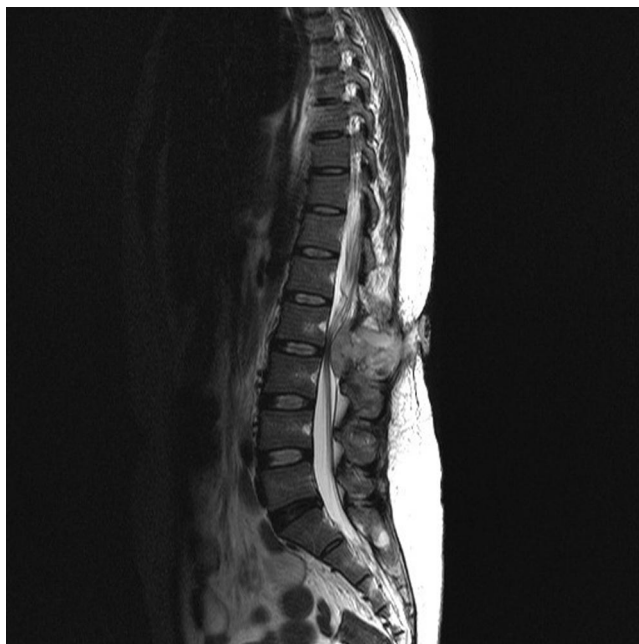


Fig. 1. T2-weighted sagittal magnetic resonance image of the lumbar spine. There is destruction of the L2 spinal process with epidural abscess. This abscess reduced the spinal canal more than 50%. There is a continuity with the paraspinal muscles and skin.

Support was provided solely from institutional and/or departmental sources.

Spinal tuberculosis highlighted by epidural anesthesia has been reported twice in the literature.^{1,2} However, this is the first report of involvement of the posterior wall of the lumbar spine. Tuberculosis of posterior bony elements is an uncommon entity.³ Spinal tuberculosis usually involves the anterior wall of the spine with osteomyelitis or discitis. The location of the posterior elements of the lumbar spine (both bone and epidural space) and the preceding history of epidural catheterization led us to suspect septic complications of anesthetic management in this case. Such catheter-related epidural abscesses are well described in the obstetric population.⁴ In these cases, *Staphylococcus aureus* is the most common infecting organism. Patients generally present with fever, leucocytosis, and neurologic symptoms in addition to backaches, and diagnosis is fast because of the symptoms. On the contrary, tuberculosis is known to be a latent illness. It can be well advanced before any symptoms are sufficient for warning the medical staff. In our case, the patient was poorly symptomatic, but the extent of the lesion was very important, as shown in figure 1. The clinical presentation did not argue against usual germ epidural abscess, and the diagnosis was delayed. Nevertheless, the positive inflammation test result, in addition to a cutaneous wound that did not heal with antibiotics, in an immigrant parturient should have led to the diagnosis of tuberculosis. Immigrants coming from endemic regions frequently develop bone and joint tuberculosis as a reactivation of endogenous tuberculosis.⁵ Furthermore, southeast Asia has the highest prevalence of tuberculosis infection, with nearly 50% of all reported cases of tuberculosis.⁶

Despite the decrease in immunity status during pregnancy, pregnancy does not seem to worsen tuberculosis.⁷ Nevertheless, the vertebral hematogenous dissemination might have been supported by the increase in pregnancy blood volume, especially the epidural and vertebral blood volume, where 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.

Estelle L. Morau, M.D., * Anne A. Lotthe, M.D., Didier Y. Morau, M.D., Mathieu Parneix, M.D., Anne-Françoise Hocquet, M.D., Pascal H. Colson, M.D., Ph.D. *Hôpital Arnaud de Villeneuve, Centre Hospitalier Universitaire Montpellier, Montpellier, France. e-morau@chu-montpellier.fr

References

1. Raj V, Foy J: Paraspinal abscess associated with epidural in labour. *Anaesth Intensive Care* 1998; 26:424-6
2. Lee BB, Kee WD, Griffith JF: Vertebral osteomyelitis and psoas abscess occurring after obstetric epidural anesthesia. *Reg Anesth Pain Med* 2002; 27: 220-4
3. Turgut M: Spinal tuberculosis (Pott's disease): Its clinical presentation, surgical management, and outcome. A survey study on 694 patients. *Neurosurg Rev* 2001; 24:8-13
4. Loo CC, Dahlgren G, Irestedt L: Neurological complications in obstetric regional anaesthesia. *Int J Obstet Anesth* 2000; 9:99-124
5. Halsey JP, Reeback JS, Barnes CG: A decade of skeletal tuberculosis. *Ann Rheum Dis* 1982; 41:7-10
6. Breslin AB: Tuberculosis: The threat re-emerges. *Anaesth Intensive Care* 1996; 24:176-9
7. Tripathy SN: Tuberculosis and pregnancy. *Int J Gynaecol Obstet* 2003; 80:247-53
8. Dubrow EL, Landis FB: Reactivation of pulmonary tuberculosis due to trauma. *Chest* 1975; 68:596-8

(Accepted for publication May 16, 2005.)

Role of Neck Flexion in Facilitating Nasogastric Tube Insertion

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 for females and 9-11 cm for males, with concave side hugging the floor of nasal passage. We selected this arbitrary length on the basis of distance of the upper cervical vertebrae from the anterior

nares, which is 8-9 cm in females and 9-11 cm in males. We determined these distances manually during our digital method to facilitate insertion of the nasogastric tube.⁷ In the neutral group, the gastric tube was then further passed with the patient's head in the neutral position. In the flexion group, the patient's neck was flexed as far forward as possible, and the gastric tube was then advanced. After two unsuccessful attempts in the assigned position, the anesthesiologist was allowed to perform any additional maneuvers desired to aid the successful passage of the tube. The number of attempts required for successful insertion was recorded for each patient.

Thirty patients were allocated to the neutral group, and 30 were allocated to the flexion group. Passage of the nasogastric tube was successful during the first attempt in 24 patients (80%) in the flexion group *versus* 15 (50%) in the neutral position (table 1). Three patients (10%) in the flexion group required additional maneuvers depending on the preference of the anesthesiologist to pass the tube. In contrast, 9 patients (30%) in the neutral group required additional maneuvers to pass the nasogastric tube.

These results support the observation that passage of the nasogastric tube with neck flexion is associated with a higher success rate than with the neutral position. We believe that neck flexion, in combination with the curve of the nasogastric tube, tends to keep the tube in close proximity to the posterior pharyngeal wall, facilitating its smooth passage into the esophagus. This is a simple but a useful technique and has proved useful in both the intensive care unit and the operating room.

Support was provided solely from institutional and/or departmental sources.

Table 1. Summary of Study Results

	Position of the Neck for Insertion of Nasogastric Tube	
	Flexion	Neutral
No. of patients with success in first passage in intended position	24	15
No. of patients with success in second passage in intended position	3	6
No. of patients with success with alternate method	3	9

Rajesh Mahajan, M.D.,* Rahul Gupta, M.B.B.S., Anju Sharma, M.B.B.S. * Acharya Shri Chander College of Medical Sciences (Ascoms), Jammu (J&K), India. drmahajan@rediffmail.com or drmahajan@yahoo.com

References

1. Flegar N, Ball A: Easier nasogastric tube insertion (letter). *Anaesthesia* 2004; 59:197
2. Sprague DH, Carter SR: An alternative method for nasogastric tube insertion (letter). *ANESTHESIOLOGY* 1980; 53:436
3. Campbell B: A novel method of nasogastric tube insertion (letter). *Anaesthesia* 1997; 52:1234
4. Parris WC: Reverse Sellick maneuver (letter). *Anesth Analg* 1989; 68:423B
5. Ozer S, Benumof J: Oro and nasogastric tube passage in intubated patients: Fiber optic description of where they go at the laryngeal level and how to make them enter the esophagus. *ANESTHESIOLOGY* 1999; 91:137-43
6. Bong LC, Macachar JD, Hwang NC: Insertion of the nasogastric tube made easy (letter). *ANESTHESIOLOGY* 2004; 101:266
7. Mahajan R, Gupta R: Another method to assist nasogastric tube insertion. *Can J Anesth* 2005; 52:652-3

(Accepted for publication April 27, 2005.)