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Epidural Anesthesia Complicating Continuous 3-in-1 Lumbar Plexus Blockade

F. J. Singelyn, M.D.,* V. Contreras, M.D.,† J. M. Gouverneur, M.D.*

CONTINUOUS 3-in-1 lumbar plexus blockade is a safe and reliable technique for providing postoperative analgesia after open knee,1,2 femoral shaft,3 or hip surgery.4,5 Serious complications have been described in only two cases: a severe postoperative femoral neuropathy6 and an acute compression syndrome of the femoral nerve caused by a subfascial hematoma7 We report a case of epidural anesthesia complicating a continuous 3-in-1 blockade performed to provide postoperative analgesia after elective total hip replacement.

Case Report

A 65-yr-old, 174-cm, 80-kg woman, ASA physical status 2, was admitted for elective right total hip replacement. She was taking propranolol for chronic atrial fibrillation and doxepin for psychotic depression. At the time of surgery, her physical examination and preoperative laboratory investigation results were normal. Her blood pressure was 138/80 mmHg, and her heart rate was 64 beats/min. Atrial fibrillation with a slow ventricular response rate was detected by electrocardiography.

* Staff Anesthesiologist.
† Resident in Anesthesiology.

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Address reprint requests to Dr. Singelyn, Department of Anesthesiology, Université Catholique De Louvain School of Medicine, St. Luc Hospital, Hippocrate Avenue 10/1821, 1200 Brussels, Belgium.

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The patient was premedicated with 2 mg lormetazepam orally and 0.5 mg atropine intramuscularly. After administration of oxygen by mask and insertion of a 16-G intravenous catheter, a pulse oximeter, a radial arterial catheter, and an electrocardiogram monitor were applied. Anesthesia was induced intravenously with 15 µg sufentanil, 160 µg propofol, and 100 µg succinylcholine. The trachea was intubated without difficulty with an 8 mm-ID cuffed orotracheal tube, and controlled ventilation was normal. Pulmonary auscultation and capnography were normal at a rate of 0.005 µL/kg·min-1 and a mixture of nitrous oxide (66%) and isoflurane (0.3-0.5%) in oxygen.

Before surgery but under general anesthesia, a continuous 3-in-1 blockade was performed to provide postoperative analgesia. With the patient’s verbal informed consent, she was included in a study assessing the relationship between the length of introduction of the 3-in-1 catheter into the psoas compartment and the success rate of the technique. She was the first patient of the group,“as cephalad as possible.”

Continuous 3-in-1 blockade was performed following Winnie’s landmarks.8 The femoral artery was located just below the inguinal ligament, and an 18-G short bevelled cannula (Alphaplex set, Sterimed, Scharbrucken, Germany) was inserted just lateral to the artery. The femoral nerve was accurately located with a peripheral nerve stimulator (Anatech MK III, Meda, Belgium). The needle was retracted from the cannula, and a semi-rigid wire composed of a metallic core covered by an external, longer plastic sheath was easily pushed through the cannula into the psoas compartment as far cephalad as possible. The cannula was removed, and a 20-G end-hole catheter was threaded on the wire into the psoas compartment at the same depth (24 cm) using a Seldinger technique. After a negative aspiration test for blood and cerebrospinal fluid and a negative test dose of 3 mL 0.25% bupivacaine with 1/200,000 epinephrine, 37 mL of the same solution were injected. The patient was positioned on her left side, and surgery was started. During the procedure, moderate hypotension (systolic/diastolic blood pressure 80-100/45-55 mmHg) and bradycardia (heart rate 50-65 beats/min) were observed. A total dose of 10 mg ephedrine and 0.25 mg atropine and moderate fluid
infusion (Hacmeccel 1 L, autologous blood 490 ml) were required to maintain this cardiovascular status. Emergence from anesthesia was quick, smooth, and quiet.

In the recovery room, the patient did not complain of pain and was quiet but remained moderately hypotensive (systolic/diastolic blood pressure 80-100/45-55 mmHg). A continuous infusion of 0.125% bupivacaine with 1 mg/ml fentanyl and 1 mg/ml clonidine at 10 ml/hr through the 3-in-1 catheter was begun. Two hours later and before leaving the recovery room, the efficacy of the catheter was assessed by the resident in charge of the patient (V.C.). Complete motor block was noted in both legs. and bilateral thomoualgesia was present from S5 to T1 when assessed with an eter-sealed swab. Epidural blockade was suspected and confirmed by the injection of 15 ml of radio-opaque contrast medium (Iohexol—Omnipaque, Nycomed Imaging, Oslo, Norway) in the catheter (Fig. 1). The lateral view of the spinal column appeared to exclude intradural spread. However, considering the degree of motor blockade and the extent of bilateral sensory anesthesia obtained after the injection of 0.25% bupivacaine, a partial subdural or subarachnoid spread of the local anesthetic may not be definitively excluded.

The 3-in-1 catheter was removed, and the patient remained in the recovery room until disappearance of motor blockade and regression of anesthesia to below the T12 level. Eleven hours after the initial 3-in-1 bolus injection, the patient returned to the ward. A high residual lumbar plexus blockade (femoral, lateral cutaneous, and obturator nerves) was noted.

On day 1, motor and sensory function were normal. No delayed complication was noted, and the patient was discharged on day 2.

**Discussion**

One anterior and at least two posterior approaches to the lumbar plexus have been described. Winnie described the inguinal paravascular technique (3-in-1 blockade). Chayen and Winnie described a posterior approach with the placement of the needle tip into the fascial compartment between the psoas and the quadratus lumborum muscles at approximately the level of the L4-L5 interspace. Both posterior approaches can result in epidural blockade. Muravchick and Owens have reported a case of probable epidural spread of local anesthetics after lumbar plexus blockade. Dalens et al. found a high incidence of epidural blockade (22 of 25 patients) in children when using a modified Chayen (L4-L5) approach. Farny et al. reported that, when using Winnie’s landmarks for posterior approach of the lumbar plexus, 4 of 45 patients displayed a contralateral extension of analgesia, suggesting an epidural distribution of the local anesthetic. In the study by Parkinson et al., epidural anesthesia developed in 4 of 25 patients with Chayen’s technique, whereas with Winnie’s technique, this was seen once.

For all these cases, the apparent mechanism is spread of local anesthetic proximally into the paravertebral space rather than needle placement directly into the epidural space. This is supported by all patients having residual lumbar plexus blockade when the epidural analgesia wore off. To our knowledge, our patient is the first described of epidural blockade complicating a continuous anterior approach of the lumbar plexus (continuous 3-in-1 blockade). Until now, only two serious complications of this technique have been reported: a severe postoperative femoral neuropathy and an acute compression syndrome of the femoral nerve caused by a subfascial hematoma. To explain our complication, two different mechanisms of action may be postulated. It has been reported that the epidural space may extend far beyond intervertebral foramina.

**Fig. 1. Radiograph (anterior view) taken after injection of 15 ml radio-opaque contrast medium (Iohexol—Omnipaque, Nycomed Imaging, Oslo, Norway) into the 3-in-1 catheter. It spreads first distally into the psoas compartment (A) and then cephalad into the epidural space (C). The tip of the catheter is indicated by an arrow (B). Small arrows identify the dural root sheaths filled with contrast at L3-L4 (A), L4-L5 (B), and L5-S1 (C) levels. A lateral view excluded an intradural spread of the contrast medium.**

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...along spinal nerves. We used a semirigid wire and advanced it into the perineural compartment as cephalad as possible. It may be presumed that this wire could have entered such an epidural extension and that the local anesthetic was injected directly into the epidural space or even into the subdural or subarachnoid space. Nevertheless, the wire was easily pushed into the psoas compartment (no pop was felt, progression was stopped immediately when a resistance was perceived) and its plastic sheath (longer than its metallic core) virtually abolished the sharpness of its tip. The second hypothesis is analogous to that described above for the posterior approach of the lumbar plexus, i.e., an epidural spread of local anesthetics proximally through the paravertebral space. This second mechanism of action is supported by the fact that, when injected into the catheter, radio-opaque contrast medium filled the psoas compartment and then the epidural space. Moreover, the patient presented a residual lumbar plexus blockade when the epidural analgesia dissipated.

In our department, continuous 3-in-1 blockade is used routinely as postoperative treatment of pain after hip, femoral shaft, or knee surgery. Except in this particular case (this patient was included in a study on the relationship between the length of injection into the catheter into the psoas compartment and the success rate of the technique), 3-in-1 catheter is introduced less than 15 cm into the psoas compartment. As demonstrated by Winnie, more than 20 ml of local anesthetic is required to obtain a complete 3-in-1 block, and blockade of the higher elements of the lumbar plexus (genitofemoral, llioinguinal, and lliohypogastric nerves) may result if the volume of local anesthetic injected is increased as high as 40–60 ml. In our experience, a bolus dose of 30 ml (height < 170 cm) to 40 ml (height > 170 cm) ml of 0.25% bupivacaine with epinephrine 1/200,000 provided more complete 3-in-1 blockade. That’s why our patient received 40 ml of local anesthetic as bolus dose. During the last 3 yr, more than 900 patients have been treated with this technique. High success rates have been noted with no major complications.

However, as demonstrated by this study (which was stopped, and the protocol was modified to reduce the likelihood of such complication) and although the mechanism of this complication has not been definitely established, the fact remains that some degree of epidural, subdural, or even subarachnoid anesthesia may result if the catheter is advanced too far.

Thus, when performing continuous 3-in-1 blockade, we recommend that preservative-free solution be used, that the catheter not be pushed into the psoas compartment as cephalad as possible without verification of its position with radio-opaque contrast medium (<15 cm in the sheath probably would be safe in the absence of control), that aspiration test for blood and cerebrospinal fluid be systematically performed, and that the patient be fully monitored and observed for evidence of epidural, subdural, or even subarachnoid blockade.

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Pulmonary Artery Catheter Balloon: An Unusual Cause of Severe Anaphylactic Reaction

Marilyn Gosgnach, M.D.,* Lise Marie Bourel, M.D.,* Anne Ducart, M.D.,† Eric Barre, M.D.,* Pierre Viars, M.D.‡

SINCE 1989, latex (gloves, syringes) has become an important agent responsible for intraoperative allergic reactions. This case report focuses on the balloon of a pulmonary artery catheter as the source of latex involved in a severe anaphylactic reaction.

Case Report

A 65-yr-old obese patient (102 kg) was admitted for resection of an 11 mm abdominal aortic aneurysm. The patient had undergone no previous surgical procedures or general anesthesia. He had only reported an allergic reaction to shellfish. The preoperative electrocardiogram revealed inverted T-waves in the V3–V6 leads. A catheter was placed in the radial artery, and a pulmonary artery catheter was inserted via the internal jugular vein after disinfection of the skin and topical lidocaine anesthesia. Immediately after positioning the pulmonary artery catheter, a skin rash developed, and systolic arterial blood pressure decreased from 120 to 70 mmHg. Plasma volume expansion using gelatins and intravenous administration of dextroamphetamine (5 mg), methylprednisolone (120 mg), and epinephrine (total dose 1 mg by 0.1 mg intravenous bolus) succeeded in restoring the hemodynamic status. The suspected diagnosis was an anaphylactic reaction, and the different elements in contact with the patient before the occurrence of the first signs were noted: iodine, lidocaine, and heparin in the arterial catheter and the pulmonary artery catheter. Surgery was cancelled, and the pulmonary artery catheter was removed. In view of the delay, coronary angiography and aortography were performed to complete the preoperative assessment. We suspected iodine as the responsible agent, but angiography was performed with no adverse reaction. The following day, the patient was rescheduled for resection of the abdominal aortic aneurysm. After insertion of a peripheral intravenous catheter, 2 mg midazolam and 50 µg fentanyl were injected. Then a radial artery catheter and a pulmonary artery catheter were inserted. Just after positioning the pulmonary artery catheter, the patient complained of dyspnea, and the hemoglobin oxygen saturation decreased from 93% to 79%. Pulmonary auscultation revealed bronchospasm. At the same time, the systolic arterial pressure had decreased from 110 to 50 mmHg, and a skin rash was noted. Tracheal intubation was performed, and phenylephrine, then ephedrine (a total dose of 55 mg), as well as volume expansion using crystalloids were used to restore the hemodynamic status. Blood and urine samples were obtained, and the surgical procedure was cancelled again. The trachea was successfully extubated 2 h later, and the pulmonary artery catheter was removed at that time.

Tests to determine the possible responsible agents included human basophil degranulation test in presence of midazolam, lidocaine, fentanyl, and latex. Radioallergosorbent tests were performed to detect immunoglobulin E compared with the same agents. Radioimmunoassay was used to detect immunoglobulin E against the quaternary ammonium ions of muscle relaxants. The results of these examinations were received 10 days later, and the conclusion was an allergy to latex. In this context, the only source of latex, compatible with the chronology of the clinical events, was the balloon of the pulmonary artery catheter.

Carefully avoiding further latex exposure, the surgical procedure was performed uneventfully.

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* Staff Anesthesiologist
† Resident in Anesthesiology
‡ Professor of Anesthesiology, Chairman

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Address correspondence to Dr. Gosgnach: Département d’Anesthésie Réanimation, Hôpital Pitié Salpêtrière, 47-83 boulevard de l’Hôpital, F-75015 Paris Cedex 13, France.

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