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

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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 neuropathy[6] and an acute compression syndrome of the femoral nerve caused by a subfascial hematoma.[7]

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 1,38/80 mmHg, and her heart rate was 64 beats/min. Atrial fibrillation with a slow ventricular response rate was detected by electrocardiography.

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 mg propofol, and 100 mg succinylcholine. The trachea was intubated without difficulty with an 8 mm-ID cuffed orotracheal tube, and controlled ventilation was started. Pulmonary auscultation and capnography were normal. Anesthesia was maintained with sufentanil infused at a rate of 0.005 $\mu g \cdot kg^{-1} \cdot min^{-1}$ 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, Saarbrucken, Germany) was inserted just lateral to the artery. The femoral nerve was accurately located with a peripheral nerve stimulator (Anaestim MK III, Meda, Belgium). The needle was removed 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

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infusion (Haemaccel 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 μg/ml fentanyl and 1 μg/ml clonidine at 10 ml/h 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 blockade was noted in both legs, and bilateral thermoanalgesia was present from S5 to T7 when assessed with an ether-soaked swab. Epidural blockade was suspected and was 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.

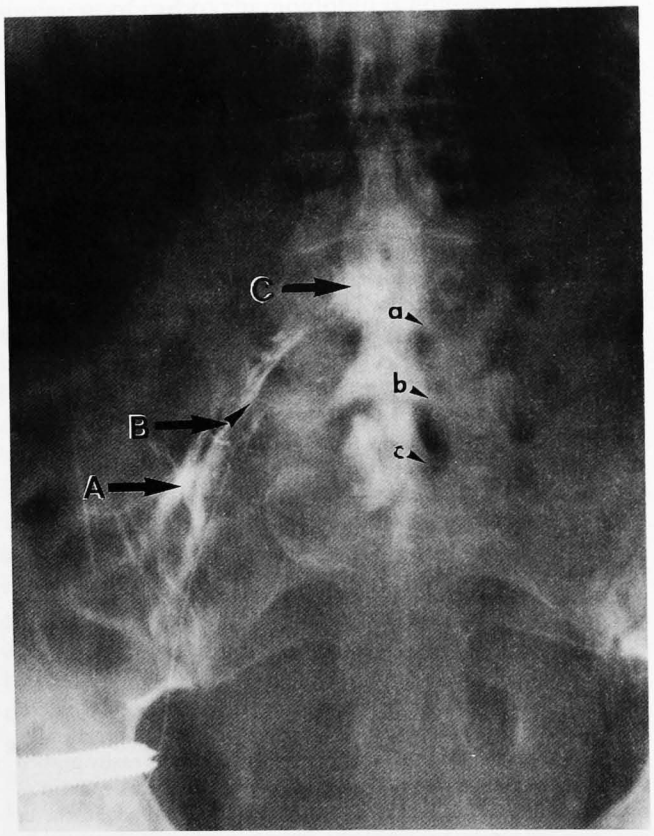

Fig. 1. Radiograph (anterior view) taken after injection of 15 ml radio-opaque contrast medium (Iohexol—Omnipaque, Nyscomed Imaging, Oslo, Norway) into the 3-in-1 catheter. It spreads firstly distally into the psoas compartment (*A*) and then cephalad into the epidural space (*C*). The tip of the catheter 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.

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 right 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 12.

Discussion

One anterior and at least two posterior approaches to the lumbar plexus have been described. Winnie[8] described the inguinal paravascular technique (3-in-1 blockade). Chayen[9] and Winnie[10] 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[11] have reported a case of (probable) epidural spread of local anesthetics after lumbar plexus blockade at the L4–L5 level. Dalens *et al.*[12] found a high incidence of epidural blockade (22 of 25 patients) in children when using a modified Chayen (L4–L5) approach. Farny *et al.*[13] reported that, when using Winnie's landmarks for posterior approach of the lumbar plexus blockade, 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.*,[14] 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[15] 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[6] and an acute compression syndrome of the femoral nerve caused by a subfascial hematoma.[7] 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,

along spinal nerves.[15,16] 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 anesthetic 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 firstly opacified 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 relation between the length of introduction of 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,[8] more than 20 ml of local anesthetic are required to obtain a complete 3-in-1 blockade, and blockade of the higher elements of the lumbar plexus (genitofemoral, ilioinguinal, and iliohypogastric 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

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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 63-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 dexchlorpheniramine (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 allergic 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 epinephrine (a total dose of 3.5 mg), as well as volume expansion using crystalloids were used to restore the hemodynamic status. Blood and urinary 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 performed to determine the possible responsible agents included human basophil degranulation test in presence of midazolam, lidocaine, iodine, 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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