Failed spinal anesthesia after a psoas compartment block

[L'échec de la rachianesthésie après le bloc de la loge du psoas]

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Purpose: To report the case of a patient who experienced failed spinal anesthesia following a psoas compartment block (PCB) and discuss its implications.

Clinical features: A 70-yr-old male was scheduled for a right total hip arthroplasty. He agreed to a PCB for postoperative analgesia and a spinal anesthetic. The spinal anesthetic was performed after completion of the PCB. Free flow of clear fluid was demonstrated at the beginning and at the end of the presumed intrathecal injection. General anesthesia had to be induced because of failure of the spinal anesthetic. The patient awoke from his general anesthetic with a functional PCB and no evidence of residual neuraxial anesthesia. The possibility of epidural spread of local anesthetic from the PCB impairing the ability to perform spinal anesthesia is discussed and reviewed. We hypothesize that local anesthetic in the epidural space may have falsely reassured the anesthesiologist that the needle was properly placed.

Conclusion: We describe a case of failed spinal anesthesia following a PCB and discuss its implications.

Objectif: Présenter le cas d'un patient chez qui la rachianesthésie a échoué à la suite d'un bloc de la loge du psoas (BLP) et discuter des implications.

Éléments cliniques: Un homme de 70 ans devait subir une arthroplastie totale de la hanche droite. Il avait accepté une analgésie postopératoire avec BLP et une rachianesthésie. La rachianesthésie a été réalisée après l'exécution du BLP. L'écoulement libre d'un liquide clair a été démontré au début et à la fin de l'injection intrathécale présumée. La rachianesthésie ayant échoué, une anesthésie générale a été induite. Au réveil de l'anesthésie générale, le patient présentait un BLP fonctionnel et aucune évidence d'anesthésie neuraxiale résiduelle. La possibilité d'une diffusion péri-durale de l'anesthésique local du BLP affectant la capacité à réaliser une rachianesthésie est discutée et

revue. La présence d'anesthésique local dans l'espace péri-dural a pu faussement rassurer l'anesthésiologiste que l'aiguille avait été correctement placée.

Conclusion : Nous décrivons un cas d'échec de la rachianesthésie à la suite d'un BLP et discutons de ses implications.

THE primary causes of failed spinal anesthesia remain elusive.¹⁻³ Factors suggested to favour failure of spinal anesthesia include failure to demonstrate free flow of cerebrospinal fluid (CSF), the choice of local anesthetic and adjuvant, technical factors related to a patient's body morphology (e.g., kyphoscoliosis), the judgement and experience of the anesthesiologist and variable CSF volume.¹ Reported failure rates are definition-dependent and vary from 0.8% to 17%.^{2,4}

The traditional end-point for confirmation of proper placement of a needle during the performance of a spinal anesthetic is free flow of clear fluid from the needle hub. In normal circumstances, when this end-point is obtained it is unusual for spinal anesthesia to fail.² However, assuming that the clear fluid that flows from a needle tip is CSF may lead to failure of spinal anesthesia.⁵ We report a case of failed spinal anesthesia following a psoas compartment block (PCB) and hypothesize that local anesthetic in the epidural space may have falsely reassured the anesthesiologist that the needle was properly placed.

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Case report

A 70-yr-old male (weight 98.8 kg, height 175 cm) was scheduled for a right total hip arthroplasty. After a full discussion of his anesthetic and analgesic options, the patient chose to have a spinal anesthetic supplemented with a single-shot PCB. After the application of supplemental oxygen (3 L·min⁻¹ via nasal prongs) and monitors (electrocardiography, automated blood pressure, pulse oximetry) and the establishment of *iv* access, the patient was given *iv* sedation (ketamine 15 mg, sufentanil 0.01 mg, and midazolam 1 mg). He was positioned in the left lateral decubitus position with his hip and knee joints flexed.

The PCB was performed first. Surface landmarks described by Capdevila *et al.* were used to guide needle placement.⁶ The skin was cleaned with 2% chlorhexidine and a sterile plastic drape was applied to the back. A 100-mm Stimuplex needle (Stimuplex; Braun, Melsungen, Germany) was attached to a Braun nerve stimulator (Stimuplex; Braun: 100 μ sec pulse width, 2 Hz) and the output set to 2 mA. Both an assistant and the patient were asked to report the occurrence of any movement (or sensation) to the anesthesiologist immediately. The needle was advanced until bone was contacted, this was assumed to be the transverse process of L4–5. The needle was then moved caudally off the transverse process and advanced until a motor response was obtained. Approximately 2 cm beyond the bone the final end-point obtained was a quadriceps motor response at a minimal current of 0.25 mA. The patient felt no paresthesia. After a negative aspiration test, 20 mL of 0.75% bupivacaine with 1:200,000 epinephrine were injected in 1 to 5 mL aliquots. No blood or fluid of any nature was aspirated throughout the injection.

Immediately after the PCB was completed, a spinal anesthetic was performed. Tuffier's line was used to estimate the needle entry point.⁷ A 25-gauge Whitacre spinal needle was advanced in the midline at the L3–4 interspace. No distinct loss of resistance was experienced. When the needle had been advanced about 70 mm the stylet was removed and clear fluid immediately flowed from the needle hub. A syringe with 12.5 mg 0.5 % isobaric bupivacaine, 5 μ g sufentanil, and 200 μ g morphine (total volume 2.5 mL) was attached to the Whitacre needle. Approximately 1 mL of clear fluid was easily aspirated from the needle via the syringe. Unexpected resistance was met when the injection was initiated. Therefore, aspiration was attempted again. Clear fluid was again easily aspirated from the needle. Subsequently, the drug mixture was injected slowly over approximately 30 sec. The patient did not complain of paresthesia or discomfort. The patient was then turned supine and prepared for surgery.

After approximately 25 min, it was clear that the spinal anesthetic had failed. The patient had a dense sensory block to pin prick and a motor block in the distribution of the right lumbar plexus only. There was a marked differential conduction block outside the territory of the right lumbar plexus on both sides extending from about T10–L5 (diminished sensation to pin prick but unaltered sensation to touch and pressure) with a patchy bilateral motor block. The block was felt to be insufficient for the surgery to proceed. The situation was discussed with the patient after which general anesthesia was induced with propofol 200 mg. Muscle relaxation was provided with rocuronium 50 mg. Anesthesia was maintained with desflurane end-tidal concentrations of 5 to 6% in air and oxygen. Cefazolin 1 g was given *iv*. The surgery proceeded uneventfully. Residual muscle paralysis was reversed at the end of the case with neostigmine (4 mg) and glycopyrrolate (0.4 mg) and the patient's trachea was extubated when he was awake and following instructions.

The patient was reassessed in the recovery room about 3.5 hr after the initial blocks were performed. A dense right PCB was present but there was no evidence of conduction blockade anywhere else. He required 6 mg of *iv* morphine in the recovery room for postoperative pain control.

The patient was transferred to the general surgical ward. He experienced no nausea or pruritus. He used 24 mg of morphine over the ensuing 48 hr via an *iv* patient-controlled analgesia device (Lifecare® 4100 PCA Plus Infusor; Abbott Laboratories, North Chicago, IL, USA). The *iv* patient-controlled analgesia machine was discontinued on the second postoperative day and he was started on oral analgesia (oxycodone SR 10 mg *po* bid). He experienced no headache postoperatively. He was ambulating the day after surgery and discharged home on the fifth postoperative day. Follow-up three months later did not reveal any sequelae from his anesthetic or surgery.

Discussion

We report a case of failed spinal anesthesia likely due to incorrectly identifying local anesthetic as CSF, subsequent to a PCB. Failed spinal anesthesia as a result of maldistribution of the intrathecal injection or incorrectly identifying other fluids as CSF has been reported.^{2,8} However, to our knowledge, it has not been reported immediately following a PCB. Our case presents critical issues regarding technique.

The traditional end-point for needle placement when performing spinal anesthesia is return of clear fluid into and from the needle hub. It is assumed that the fluid returning is CSF. In some instances failure of

anesthesia has occurred despite the return of clear fluid from the spinal needle.⁵ The explanation that has been offered is that the fluid was not CSF but other fluid in the epidural space or *sc* tissue.

The incidence of epidural spread with unilateral and/or bilateral anesthesia after posterior lumbar plexus block varies from 1.8 to 16%.⁹ However, the extent and contributing factors of epidural spread after lumbar plexus block are variable and undefined.¹⁰ Since the paravertebral space is contiguous with the epidural space, it is possible for local anesthetic to spread centrally from the paravertebral space to the epidural space depending on the position and direction of the injecting needle.⁹⁻¹² In the case described, the central spread of local anesthetic after the performance of the PCB may explain the events experienced by the patient (Figure). We speculate that the clear fluid obtained with removal of the stylet was likely local anesthetic, not CSF. This speculation is supported by the fact the patient experienced an initial, bilateral, markedly segmental and restricted, differential conduction block that dissipated before the patient awoke from general anesthesia. Other explanations regarding the identity and origin of the solution are possible (i.e., from the *sc* tissue or a subarachnoid cyst),⁸ however, they seem extremely unlikely. Thus, this case reminds anesthesiologists to be aware of this rare but potentially easily misdiagnosed end-point from the effect of performing two regional blocks in proximity.

Although intrathecal morphine has recently been shown to provide effective postoperative analgesia for total hip arthroplasty,¹³ it is the experience of the principal author that spinal analgesia cannot reliably be extended beyond 12 to 18 hr with intrathecal morphine without undesirable side effects. On the other hand, a single-shot PCB in addition to intrathecal analgesia, generally allows the patient to ambulate the next day, control pain with oral analgesia and is associated with fewer side effects. In addition, a PCB was selected over a three-in-one femoral or fascia iliaca compartment approach because it provides a more consistent block of the obturator nerve than either of the latter approaches.¹⁴ In this case, the PCB was performed before the spinal block because of concerns of masking events that may warn of impending nerve injury (e.g., paresthesia).¹⁵⁻¹⁷ An increased awareness of permanent spinal cord injury following spinal anesthesia has recently occurred.^{18,19} Risk may be related to variability in the termination of the conus medullaris, performing procedures in heavily sedated or anesthetized patients, the increasing popularity of combined spinal-epidural anesthesia, and to the inaccuracy of surface landmarks used to guide needle

FIGURE The assumed flow of fluids. The "O" represents the puncture site of the psoas compartment block. The arrow indicates the assumed flow of the injected local anesthetic.

insertion.^{7,15-19} This case reminds us of the dilemma created if anesthesiologists decide to perform two regional blocks in one area. Should the spinal anesthetic be performed first? If local anesthetic spreads to the epidural space during the performance of a PCB, will that increase the risk of nerve or spinal cord damage during the performance of the spinal technique by masking paresthesia? Similarly, what is the risk to the patient of performing a PCB following the spinal administration of local anesthetic? Clearly, there is insufficient information to make a recommendation. Anesthesiologists must continually consider the impact of any changing conditions under which they operate. This case underlies the importance of considering the implications of a previous procedure. If we had considered the previous PCB, we should have been able to confirm the source of fluid from the spinal needle rather than assuming it was CSF.

In this unusual set of circumstances, aspiration mislead the practitioner. The combination of a lack of a distinct loss of resistance with needle advancement and unusual resistance to injection following aspiration of fluid should prompt anesthesiologists to consider the possibility that the needle is improperly placed.

The presence or absence of CSF may be reliably confirmed by using a bedside assessment of glucose or protein content of aspirated fluid.²⁰ The absence of a positive test for glucose or protein suggests the fluid is not CSF.²⁰ Alternatively, a modification of the Tsui test may be used to facilitate correct spinal needle

placement by providing objective information, in addition to the return of CSF via the needle.²¹ In previous studies, a different dose-response relationship has been shown in electrical stimulation for the epidural and the intrathecal space.^{22–24} When it is not clear that returning fluid is CSF, confirmation of placement may be obtained by passing an electrical current through an insulated spinal needle.^{19,25} The obvious limitation of this technique is the need for an insulated needle. Finally, as suggested by this case report, unexpected resistance upon the initiation of injection should prompt the anesthesiologist to consider that the needle may be misplaced.

This case supports, potentially, previous reports of epidural spread from PCB. In addition, it reminds anesthesiologists to keep this clinical scenario in mind as the extent and causes of epidural spread resulting in bilateral symmetrical or unilateral anesthesia after lumbar plexus block are still undefined. Finally, the importance of weighing the risks and benefits of performing two regional blocks in one area and the importance of considering changing patient conditions due to previous procedures performed on the patient are highlighted in this case.

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References

- 1 *Carpenter RL, Hogan QH, Liu SS, Crane B, Moore J.* Lumbosacral cerebrospinal fluid volume is the primary determinant of sensory block extent and duration during spinal anesthesia. *Anesthesiology* 1998; 89: 24–9.
- 2 *Levy JH, Islas JA, Ghia JN, Turnbull C.* A retrospective study of the incidence and causes of failed spinal anesthetics in a university hospital. *Anesth Analg* 1985; 64: 705–10.
- 3 *Liu SS, McDonald SB.* Current issues in spinal anesthesia. *Anesthesiology* 2001; 94: 888–906.
- 4 *Pittoni G, Toffoletto F, Calcarella G, Zanette G, Giron GP.* Spinal anesthesia in outpatient knee surgery: 22-gauge versus 25-gauge Sprotte needle. *Anesth Analg* 1995; 81: 73–9.
- 5 *Portnoy D, Vadhera RB.* Mechanisms and management of an incomplete epidural block for cesarean section. *Anesthesiol Clin North America* 2003; 21: 39–57.
- 6 *Capdevila X, Macaire P, Dadure C, et al.* Continuous psoas compartment block for postoperative analgesia after total hip arthroplasty: new landmarks, technical guidelines, and clinical evaluation. *Anesth Analg* 2002; 94: 1606–13.
- 7 *Kim JT, Babk JH, Sung J.* Influence of age and sex on the position of the conus medullaris and Tuffier's line in adults. *Anesthesiology* 2003; 99: 1359–63.
- 8 *Kelly D, Gudin JA, Brull SJ.* Subcutaneous cysts: another cause of "failed" spinal anesthesia? *J Clin Anesth* 1996; 8: 603–4.
- 9 *Mannion S.* Epidural spread depends on the approach used for posterior lumbar plexus block (Letter). *Can J Anesth* 2004; 51: 516–7.
- 10 *Karmakar MK, Ho AM.* Epidural spread depends on the approach used for posterior lumbar plexus block (Reply). *Can J Anesth* 2004; 51: 517.
- 11 *Naja Z, Lonnqvist PA.* Somatic paravertebral nerve blockade. Incidence of failed block and complications. *Anaesthesia* 2001; 56: 1184–8.
- 12 *Purcell-Jones G, Pither CE, Justins DM.* Paravertebral somatic nerve block: a clinical, radiographic, and computed tomographic study in chronic pain patients. *Anesth Analg* 1989; 68: 32–9.
- 13 *Souron V, Delaunay L, Schiffrine P.* Intrathecal morphine provides better postoperative analgesia than psoas compartment block after primary hip arthroplasty. *Can J Anesth* 2003; 50: 574–9.
- 14 *Liu SS, Salinas FV.* Continuous plexus and peripheral nerve blocks for postoperative analgesia. *Anesth Analg* 2003; 96: 263–72.
- 15 *Benumof JL.* Permanent loss of cervical spinal cord function associated with interscalene block performed under general anesthesia. *Anesthesiology* 2000; 93: 1541–4.
- 16 *Bromage PR, Benumof JL.* Paraplegia following intracord injection during attempted epidural anesthesia under general anesthesia. *Reg Anesth Pain Med* 1998; 23: 104–7.
- 17 *Rosenquist RW, Birnbach DJ.* Epidural insertion in anesthetized adults: will your patients thank you? *Anesth Analg* 2003; 96: 1545–6.
- 18 *Hamandi K, Mottershead J, Lewis T, Ormerod IC, Ferguson IT.* Irreversible damage to the spinal cord following spinal anesthesia. *Neurology* 2002; 59: 624–6.
- 19 *Reynolds F.* Logic in the safe practice of spinal anaesthesia (Editorial). *Anaesthesia* 2000; 55: 1045–6.
- 20 *el-Behegy BA, James D, Koh KF, Hirsch N, Yentis SM.* Distinguishing cerebrospinal fluid from saline used to identify the extradural space. *Br J Anaesth* 1996; 77: 784–5.
- 21 *Tsui BC, Wagner A, Finucane B.* The threshold current in the intrathecal space to elicit motor response is lower and does not overlap that in the epidural space: a porcine model. *Can J Anesth* 2004; 51: 690–5.
- 22 *Tsui BC, Gupta S, Finucane B.* Detection of subarachnoid and intravascular epidural catheter placement. *Can J Anesth* 1999; 46: 675–8.

- 23 Tsui BC, Gupta S, Emery D, Finucane B. Detection of subdural placement of epidural catheter using nerve stimulation. *Can J Anesth* 2000; 47: 471-3.
- 24 Tsui BC, Guenther C, Emery D, Finucane B. Determining epidural catheter location using nerve stimulation with radiological confirmation. *Reg Anesth Pain Med* 2000; 25: 306-9.
- 25 Tsui BC, Gupta S, Finucane B. Loss of resistance to saline -- does the dripping bother you? (Letter). *Can J Anesth* 1999; 46: 615-6.

In Memoriam

Jack Rolf Vanderburgh MD FRCP(C)

Dr. Jack Vanderburgh died on November 2, 2002, after a lengthy career in anesthesia at Scarborough General Hospital. When neurosurgeons, Drs. Elgie and Hugenholtz came to Scarborough General, Jack was one of the mainstays of neurosurgical anesthesia, spending countless hours in the operating room. With the departure of the neurosurgeons in 1976, Jack developed an interest in thoracic and vascular procedures. Again many hours were spent without mishap, until Jack retired in 2002.

My first meeting with Jack was on July 1, 1966; I was a new resident at St. Michael's Hospital, who had never given an anesthetic; Jack was saddled with teaching me. This he did with skill and patience. His teaching and accompanying works of wisdom to me continued when I joined the staff of Scarborough General in 1969.

At Scarborough General, where I still work, hardly a week goes by without Jack's name being mentioned. He is certainly missed by our staff.

As well as his love of medicine, Jack was a dedicated husband, father, and grandfather, speaking often of his family and their achievements. Jack leaves his wife Beverly, a daughter Leslie, and a son Gregory and many pleasant memories with his friends and colleagues.

Robert W. Lamont
Toronto, Ontario