Contralateral local anesthetic spread from an outpatient interscalene catheter

Diffusion contralatérale d'anesthésique local provenant d'un cathéter interscalénique posé en ambulatoire

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Abstract

Purpose Ambulatory continuous infusions have been associated with improved analgesia and few serious complications. This report describes an unusual case of a patient with a continuous interscalene nerve block who developed a contralateral upper extremity sensory block. The complication did not occur until postoperative day two while the patient was at home.

Clinical features A 56-yr-old woman had a continuous interscalene catheter placed for arthroscopic lysis of adhesions of her shoulder. The insertion needle was initially injected with 0.5% ropivacaine 25 mL (1:400,000 epinephrine), producing a unilateral interscalene block. Postoperatively, the patient was started on a continuous interscalene infusion of 0.2% ropivacaine at 8 mL·hr⁻¹ via a disposable infusion pump. The next day, the patient had a unilateral brachial plexus block and an associated Horner's syndrome and was discharged home with the infusion. On the morning of the second postoperative day, the patient developed ipsilateral and contralateral Horner's syndrome with associated numbness in both shoulders. The catheter was removed and symptoms resolved four hours later.

Conclusions Ambulatory continuous infusions are typically associated with few serious complications and a favourable safety profile. This case demonstrates that unexpected complications can still occur even after days of normal operation. Based on our previous experience, we believe this to be a rare but potentially serious event that

requires awareness by those discharging patients with continuous infusions of local anesthetics.

Résumé

Objectif Les perfusions continues en ambulatoire ont été associées à une meilleure analgésie et à peu de complications graves. Ce compte-rendu décrit le cas inhabituel d'une patiente chez qui un bloc nerveux interscalénique continu a été réalisé et qui a manifesté un bloc sensitif contralatéral des membres supérieurs. La complication ne s'est manifestée qu'au jour postopératoire deux, alors que la patiente était rentrée chez elle.

Éléments cliniques Un cathéter interscalénique continu a été installé chez une femme de 56 ans pour une lyse arthroscopique des adhérences au niveau de son épaule. L'aiguille d'insertion a d'abord servi pour l'injection de 25 mL de ropivacaïne 0,5 % (épinéphrine 1:400 000), induisant un bloc interscalénique unilatéral. En période postopératoire, une perfusion interscalénique continue de ropivacaïne 0,2 % à 8 mL·h⁻¹ a été amorcée chez la patiente avec une pompe à perfusion jetable. Le jour suivant, la patiente a eu un bloc du plexus brachial unilatéral et a subi un syndrome de Horner associé au bloc, puis on lui a donné son congé avec la perfusion. Le matin du deuxième jour postopératoire, la patiente a manifesté un syndrome de Horner ipsilatéral et contralatéral auquel s'est ajouté un engourdissement des deux épaules. Le cathéter a été retiré et les symptômes ont disparu quatre heures plus tard.

Conclusion Les perfusions continues en ambulatoire sont traditionnellement associées à un nombre restreint de complications graves et présentent un bon profil d'innocuité. Ce cas démontre que des complications imprévues peuvent toutefois survenir et ce, même après plusieurs jours de fonctionnement normal. Sur la base de

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nos expériences passées, nous pensons que cet événement, quoique rare, est potentiellement grave et nécessite que les personnes qui donnent le congé à des patients avec perfusion continue d'anesthésiques locaux en soient conscientes.

Ambulatory continuous interscalene nerve blocks have been shown to improve analgesia, decrease opioid consumption, and facilitate discharge after major shoulder surgery.¹ To achieve these results in trials and clinical practice, effort has been made to mitigate complications. This involves careful patient selection, patient education on care of the catheter and limb, identification of local anesthetic toxicity, and daily telephone calls to identify complications.² This approach has led to a favourable safety profile, with complications typically related to catheter dislodgement, need for supplemental analgesics, motor block, and superficial infections.³ Bilateral upper extremity blockade is a very rare complication usually attributed to epidural spread that occurs with initial bolus injections or shortly after starting an infusion in hospitalized patients.^{4–10} This report describes an unusual case of a patient with a continuous interscalene nerve block who developed a contralateral upper extremity sensory block that did not occur until postoperative day two while the patient was at home. The patient gave written consent for publication of this report.

Case

A 56-yr-old 85-kg woman with adhesive capsulitis of the right shoulder was scheduled for arthroscopic lysis of adhesions. Her medical history was significant for a previous rotator cuff repair four months prior, performed with a continuous interscalene nerve block with a home infusion of local anesthetic. The same anesthetic was planned to facilitate this surgery and postoperative rehabilitation. Standard monitoring was placed and the patient was sedated with intravenous fentanyl 100 µg and midazolam 2 mg. After sterile prep, the brachial plexus at the interscalene level was located with ultrasound guidance (L38x 10 MHz linear transducer, S-Nerve, Sono Site Corp, Bothell, WA, USA). Using an out-of-plane approach and a modified lateral insertion technique, an 18-gauge 5-cm Tuohy needle was advanced ~1.5 cm, and 0.5% ropivacaine (1:400,000 epinephrine) 25 mL was injected.¹¹ Next, a 20-gauge multi-orifice continuous catheter (Contiplex, B.Braun Medical, Bethlehem, PA, USA) was inserted 4 cm past the tip of the needle. Placement of the catheter near the

brachial plexus was confirmed with ultrasound visualization by injecting local anesthetic and 1 mL of air, each of which spread around the neural structures. The catheter was secured with medical adhesive and a sterile dressing. Good unilateral sensory and motor blockade was achieved and the surgery proceeded without complications. After an uneventful recovery, the patient was transferred to a 23-hr observation unit postoperatively, and she was started on a continuous interscalene infusion of 0.2% ropivacaine at 8 mL·hr⁻¹ via a disposable infusion pump (On-Q Pain Buster, IFlow Corp, Lake Forest, CA, USA). The patient had no pain overnight. In the morning, she was unable to flex her arm at the elbow but could move all of her fingers. Her fourth and fifth fingers were insensate and she had tingling and slight return of feeling to touch on her first, second, and third fingers with an associated ipsilateral Horner's syndrome. Clinical exam at this time revealed a lack of contralateral sensorimotor blockade. She was discharged the day after surgery with the same continuous infusion of ropivacaine.

The ipsilateral Horner's syndrome persisted throughout the first postoperative day. The patient reported sleeping on her left side for the entire night of the first postoperative day. On the morning of the second postoperative day, the patient noted that she now had both ipsilateral and contralateral Horner's syndrome. The patient continued to have good pain control of her right shoulder with associated numbness in her fourth and fifth fingers. However, now she also experienced numbness not previously present that affected her left shoulder and arm and extended to her elbow. She had no motor weakness of the contralateral limb. The patient was concerned about this new finding and decided to remove the nerve catheter since the infusion pump was almost empty. Two hours following removal of the nerve catheter, the patient noted that she had normal sensation and motor function in both upper extremities and that her ipsilateral Horner's syndrome had resolved. The contralateral Horner's syndrome did not resolve until four hours after removal of the nerve catheter. Although the patient was an excellent historian, it is worth noting that there was no physician clinical examination to confirm these findings.

Discussion

This case demonstrates bilateral spread of local anesthetic from a continuous interscalene catheter. The fact that symptoms were not detected until postoperative day two is very unusual and suggests that this complication occurred from gradual spread of local anesthetic or migration of the catheter from its initial position. Despite numerous provisions designed to ensure safe management of local

anesthetic infusions at home, this case highlights a previously unreported risk of an ambulatory continuous interscalene catheter. Furthermore, had the spread of local anesthetic been greater or undetected or had it occurred in a medically compromised patient, hemodynamic and respiratory compromise could have occurred in an outpatient setting.

Previous reports of bilateral spread after interscalene block and catheters have typically been associated with symptoms of cervical epidural blockade, such as sensory and motor weakness, difficulty breathing, bradycardia, and hypotension.³ An example of this was described by Cook *et al.*⁷ when they described a patient who developed bilateral shoulder numbness associated with postural hypotension after the initial local anesthetic was bolused through an interscalene catheter. The catheter passed 12 cm beyond the tip of the needle and was subsequently located near the intervertebral foramina. In another case, Faust *et al.*¹⁰ demonstrated the potential for an unusual and variable clinical presentation if the catheter is misplaced. In their case, 20 mL of ropivacaine was injected through the needle; a catheter was advanced 5 cm, and an infusion of 0.2% ropivacaine was infused at 5 mL·hr⁻¹. Six hours later, the patient described partial sensory and motor deficits of the ipsilateral lower extremities despite the fact that it was a continuous interscalene catheter. Since this patient was in the hospital, the hospital staff were able to obtain a detailed physical exam and a cervical computed tomography, which again showed the tip of the catheter close to the intervertebral foramen at the C7-T1 level and several intravertebral paramedullar air bubbles.

Anatomically, the mechanism of bilateral local anesthetic spread may be attributed to more than one etiology. Kumar *et al.*,⁴ who described two early cases of bilateral cervical and thoracic blockade following interscalene block, postulated that it occurred because of a direct epidural injection due to a deep caudal needle insertion. Alternatively, bilateral spread may occur from an indirect etiology. An example of this is local anesthetic diffusion from the paravertebral space into the epidural space due to close proximity of the needle to the dural cuff or the intervertebral foramen.¹² Another hypothesis for contralateral spread was developed by Lombard and Couper⁵ from cadaveric dissections. They described a potential route via a midline connective tissue septum behind the prevertebral fascia.

In this case, the absence of symptoms with initial block injection and their presentation nearly 48 hr after insertion suggests that initial epidural injection and placement was unlikely. Since the initial local anesthetic was placed through the needle rather than via the catheter, the possibility of aberrant catheter location cannot be excluded. However, given the gradual onset of symptoms, it seems

more likely that there was diffusion of local anesthetic along adjacent tissue planes due to either total accumulation of local anesthetic or migration of the original catheter position. Additionally, previous rotator cuff repair with an interscalene catheter could have caused brachial plexus and other tissue scarring, providing an alternate route for local anesthetic spread. In addition, the contralateral sensory block with the associated bilateral Horner's syndrome could be explained by paravertebral spread via either the prevertebral fascia^{13,14} or the epidural route.¹⁵ Unfortunately, the removal of the catheter precluded any imaging studies that might have led to a definitive etiology. Another patient factor to consider as a risk for contralateral spread should include cervical disk disease, specifically patients who have undergone cervical spine interventions that could lead to disruption of midline tissue.

In addition to direct anatomical etiologies, overadministration of local anesthetic could theoretically contribute to contralateral spread. The device that was utilized in this case employs an elastomeric infusion reservoir connected by tubing to a flow restrictor that determines the infusion rate. Malfunction of the restrictor or higher than usual pressures delivered by the elastomeric system from either internally or externally applied pressure could have increased local anesthetic delivery.

Whether inserted with ultrasound or nerve stimulator guidance, catheters are typically test-dosed with a local anesthetic solution containing epinephrine to help identify undesirable placement, as in this case. To further minimize complications and enhance safety, candidates for home infusions are carefully selected and receive verbal and written discharge instructions focusing on care of the catheter, infection, local anesthetic toxicity, and limb and fall protection. While these topics may seem like the most common areas of conceivable risk, this case demonstrates that unexpected complications can still occur even after days of normal operation. Based on our previous experience, we believe this to be a rare but potentially serious event that requires awareness by hospital staff discharging patients with continuous infusions of local anesthetics.

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Conflicts of interest None declared.

References

1. Ilfeld BM, Morey TE, Wright TW, Chidgey LK, Enneking FK. Continuous interscalene brachial plexus block for postoperative pain control at home: a randomized, double-blinded, placebo-controlled study. *Anesth Analg* 2003; 96: 1089-95.
2. Ilfeld BM, Enneking FK. Continuous peripheral nerve blocks at home: a review. *Anesth Analg* 2005; 100: 1822-33.

3. Hadzic A, *New York School of Regional Anesthesia*. Textbook of regional anesthesia and acute pain management. New York: McGraw-Hill, Medical Pub. Division; 2007.
4. Kumar A, Battit GE, Froese AB, Long MC. Bilateral cervical and thoracic epidural blockade complicating interscalene brachial plexus block: report of two cases. *Anesthesiology* 1971; 35: 650-2.
5. Lombard TP, Couper JL. Bilateral spread of analgesia following interscalene brachial plexus block. *Anesthesiology* 1983; 58: 472-3.
6. Huang KC, FitzGerald MR, Tsueda K. Bilateral block of cervical and brachial plexuses following interscalene block. *Anaesth Intensive Care* 1986; 14: 87-8.
7. Cook LB. Unsuspected extradural catheterization in an interscalene block. *Br J Anaesth* 1991; 67: 473-5.
8. Gologorsky E, Leanza RF. Contralateral anesthesia following interscalene block. *Anesth Analg* 1992; 75: 311-2.
9. Mahoudeau G, Gaertner E, Launoy A, Ocquidant P, Loewenthal A. Interscalenic block: accidental catheterization of the epidural space (French). *Ann Fr Anesth Reanim* 1995; 14: 438-41.
10. Faust A, Fournier R, Hagon O, Hoffmeyer P, Gamulin Z. Partial sensory and motor deficit of ipsilateral lower limb after continuous interscalene brachial plexus block. *Anesth Analg* 2006; 102: 288-90.
11. Borgeat A, Dullenkopf A, Ekatodramis G, Nagy L. Evaluation of the lateral modified approach for continuous interscalene block after shoulder surgery. *Anesthesiology* 2003; 99: 436-42.
12. Karmakar MK. Thoracic paravertebral block. *Anesthesiology* 2001; 95: 771-80.
13. 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.
14. Karmakar MK, Kwok WH, Kew J. Thoracic paravertebral block: radiological evidence of contralateral spread anterior to the vertebral bodies. *Br J Anaesth* 2000; 84: 263-5.
15. Macintosh R, Mushin W. Observations on the epidural space. *Anaesthesia* 1947; 2: 100-4.