—Case Reports—

Subarachnoid Block-Induced Deafferentation Pain Successfully Treated with Pentazocine

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Deafferentation pain induced by subarachnoid block (SAB) is rare, but it can appear in the form of recurrent phantom lower limb pain, new acute-onset stump pain in amputees, lower limb pain in patients with tabes dorsalis, and neuropathic pain. We have previously reported that thiopental is an effective treatment for deafferentation pain induced by therapeutic SAB applied to treat neuropathic pain of central origin. Here, we report the case of an amputee who developed new stump pain in his lower limb immediately after subarachnoid tetracaine was administered prior to appendectomy. A 51-year-old man who had previously undergone right below-knee amputation for acute arterial thrombosis, and who had not previously experienced chronic phantom limb or stump pain, was scheduled for emergency open appendectomy. For anesthesia, we induced SAB with a hyperbaric tetracaine solution. No paresthesia occurred during administration. However, the patient immediately complained of severe, lightning-bolt pain in the right lower limb stump after the SAB was established. He was given intravenous pentazocine, which promptly resolved the pain. Appendectomy was then performed under sedation using intravenous midazolam. The patient did not experience further deafferentation pain during his hospital stay and has reported no stump pain since discharge from the hospital. This case report suggests that SAB induces deafferentation pain in some patients and that this unusual pain can be treated with pentazocine. (J Nippon Med Sch 2017; 84: 183–185)

Key words: deafferentation pain, subarachnoid block, pentazocine

Introduction

It is rare for subarachnoid block (SAB) to induce deafferentation pain. Several cases have been reported, however, in which SAB applied in patients with previous lower limb amputation[1–8], tabes dorsalis[9], or neuropathic pain of central origin[10] has induced recurrent phantom limb pain, new stump pain, or severe lightning-bolt pain in a lower limb. Various interventions have been attempted to relieve this unusual pain[1–10]. We previously reported that an intravenous sub-anesthetic dose of thiopental was effective for alleviating severe lightning-bolt pain induced by therapeutic SAB in a patient with neuropathic pain of central origin[10]. Here, we present a case in which intravenous administration of pentazocine successfully relieved new, acute-onset stump pain in the lower limb of an amputee immediately after SAB that had been performed to facilitate an appendectomy.

Case Report

A 51-year-old man was admitted with acute appendicitis and was scheduled for an emergency open appendectomy. He had no concurrent diseases and was not taking any drugs. A serological test for syphilis (Wassermann) and a hemagglutination assay for *Treponema pallidum*

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were negative. One year prior to this admission, he had undergone two surgical procedures: amputation below the right knee for acute arterial thrombosis and pancreatectomy for a choledochal cyst. Both were performed under combined general and epidural anesthesia. Although he experienced right phantom limb pain once postoperatively after the amputation, he had no stump pain, and the phantom limb pain resolved spontaneously.

Standard monitoring was performed in the operating room. With the patient in the right lateral position, the SAB was established using a 23 G needle at the L2–3 intervertebral space. After verifying that the cerebrospinal fluid was clear and free-flowing, 16 mg of hyperbaric tetracaine solution was administered. The patient reported no paresthesia during puncture of the thecal membrane or during drug administration. That is, the procedure was uneventful. Immediately after the patient was returned to the supine position, however, he complained of severe, lightning bolt-type pain in the lower limb stump, which he had never experienced before. We administered 15 mg of pentazocine intravenously, and the pain resolved within 5 min. At that point in time, the SAB-induced upper level of analgesia (identified by a pinprick using a blunt 22 G needle) was T10 on both sides. We subsequently administered 5 mg of midazolam intravenously for sedation. Surgery was completed within 20 min, after which the patient awoke spontaneously. Before transfer to the general ward, the upper level of the SAB-induced analgesia (again determined by a pinprick) was T6 on both sides. The patient reported that the pain had not recurred.

It took approximately 3 h for the SAB to wear off. Although the patient reported postoperative wound pain, he had no further stump pain. Regular diclofenac, 50 mg, per rectum, three times daily, and intermittent intravenous pentazocine, 30 mg, and hydroxyzine, 50 mg, were administered to reduce postoperative visceral and wound pain. There were no SAB-related neurological complications.

The patient began to walk with a cane on the first postoperative day. During recovery, low-grade pyrexia raised suspicion of an intra-abdominal abscess, for which the patient was treated with a 4-day course of intravenous antibiotics. The fever disappeared, and he could practice walking with his prosthetic limb. He reported lower back pain. An orthopedic surgeon diagnosed sciatic neuralgia, which was treated conservatively with heat compression. The patient was discharged home 2 weeks after surgery with no sciatica and no pain in the lower limb stump. He has reported no stump pain since being discharged.

Discussion

We report a case in which intravenous administration of pentazocine successfully relieved new, acute-onset, lightning bolt-type stump pain in the lower limb of an amputee. It had been provoked by SAB, which had been established to facilitate appendectomy.

Although the precise mechanism of new stump pain induced by SAB remains unclear, it may due to deafferentation brought about by the SAB. Deafferentation pain occurs following the loss of afferent impulses to the dorsal horn of the spinal cord, thereby reducing the inhibitory impulses from brainstem reticular areas, increasing autonomous neural activity in the dorsal horn[2,11]. Pain then arises due to the absence of inhibitory control of spontaneous abnormal firing in the dorsal horn[12]. Thus, we believe that facilitation of inhibitory impulses and depression of autonomous neural activity in the dorsal horn is the key to treating this type of deafferentation pain.

In this case, we treated the SAB-provoked severe lightning-bolt stump pain with intravenous administration of 15 mg of pentazocine. The pain resolved within 5 min. Pentazocine has been widely used for pain management. Its analgesic effect is mediated by stimulation of the κ-opioid receptor. Berkowitz reported that, after intravenous administration of pentazocine (20–25 mg/70 kg), peak analgesia occurred within 15 min, and moderate to good analgesia lasted 1 h[13]. A recent study reported that pentazocine suppressed the uptake of norepinephrine by cultured bovine adrenal medullary cells, thus inhibiting norepinephrine transporter function through a κ-opioid receptor-independent pathway[14]. Pentazocine may, therefore, act on deafferentation pain by reducing autonomous neural activity in the dorsal horn via the κ-opioid receptor and activating descending norepinephrine-ergic pain modulatory pathways.

Although the sensory level of the SAB was sufficient for surgery to proceed, we elected to administer midazolam as a sedative because intravenous midazolam has been reported also to alleviate deafferentation pain after SAB[6,8,10]. The analgesic effect of midazolam may be due to its action at the γ-aminobutyric acid type A ($GABA_A$) receptor in the spinal cord[15,16]. The benzodiazepine-$GABA_A$ receptor complex enhances the inhibitory effect of GABA on autonomous neural activity and eliminates abnormal firing in the dorsal horn. Su et al. noted that intravenous

administration of midazolam, 5 mg, relieved recurrent SAB-induced phantom pain of an amputated limb for around 2 h[8]. In our case, despite exceeding the reported duration of the pentazocine-induced analgesic effect, the added administration of midazolam could free the patient from severe pain until the SAB wore off. Hence, we believe that in our patient, midazolam may have acted synergistically with pentazocine, resulting in a longer duration of analgesia after appendectomy.

Although we had previously concluded that intravenous thiopental provided relief of SAB-induced deafferentation pain[10], we chose to administer pentazocine in this case. During lower abdominal surgery, under SAB, patients may complain of nausea or discomfort due to upper displacement of the intestines or traction of the viscera, so additional doses of analgesics or light general anesthesia may be required. In this case, we had already prepared syringes of pentazocine and midazolam to administer as an analgesic and a sedative, respectively, before establishing the SAB, allowing us to administer both agents promptly once the deafferentation pain had appeared.

It has been suggested that SAB is contraindicated in patients who have previously undergone lower limb amputation as it may induce recurrent phantom pain[2,3]. In our opinion, SAB is an option in such patients because deafferentation pain is rare, SAB is preferable to general anesthesia in some circumstances, and drugs can be prepared for immediate administration should pain arise.

In conclusion, we present a case in which SAB caused new, acute-onset pain in the lower limb stump of an amputee undergoing appendectomy. Intravenous administration of pentazocine successfully alleviated the lightning bolt-type pain. Physicians should be aware that SAB may induce deafferentation pain in patients with a damaged spinal dorsal horn or who have central pain. Thus, drugs to relieve such pain should be prepared and ready to use if necessary. Further studies are needed to identify the most effective drug for managing SAB-induced deafferentation pain.

Acknowledgements: The authors thank the late Dr. Ryo Ogawa and the late Dr. Tetsuo Inoue, both formerly Professors Emeritus, Department of Anesthesiology, Nippon Medical School, for their assistance with the reporting of this case.

Conflict of Interest: None of the authors has a conflict of interest regarding publication of this paper.

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(Received, November 19, 2016)
(Accepted, March 23, 2017)