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Intraoperative sensitization in trigeminal region caused by postherpetic neuralgia: a case report

Gangwen Guo[1], Dan Li[2], Hongyan Li[3], Rong Hu[1*] and Haocheng Zhou[1,4,5*]

Abstract

Background Interventional therapy of trigeminal neuropathic pain has been well documented; however, intraoperative monitoring and management of pain hypersensitivity remains barely reported, which may pose a great challenge for pain physicians as well as anesthesiologists.

Case presentation A 77-year-old Han Chinese male, who suffered from severe craniofacial postherpetic neuralgia, underwent pulsed radiofrequency of trigeminal ganglion in the authors' department twice. The authors successfully placed a radiofrequency needle through the foramen ovale during the first procedure with local anesthesia and intravenous sedation (dexmedetomidine). The patient reported about 50% pain reduction postoperatively, and the second procedure was performed 1 week later. However, the intraoperative administration of sedative agents was suspended owing to hemodynamic instability during the second session. As a result, the patient displayed hypersensitivity to the percutaneous operation under local anesthesia and the authors failed to place the needle inside the Meckel's cave for uncontrollable breakthrough pain. The patient still needed to take oral medication for pain control, oxycodone (10–20 mg, every 12 hours) and pregabalin (75 mg, two times a day) in the last follow-up at 1.5 years after discharge.

Conclusion The authors report a failure case of percutaneous puncturing operation with trigeminal neuropathic pain, potentially caused by intraoperative sensitization. It is essential to monitor and prevent hypersensitivity to both innoxious and noxious stimuli in patients with neuropathic pain syndrome, especially at surgical sites close to the area of nerve injury.

Keywords Intraoperative, Sensitization, Allodynia, Hyperalgesia, Trigeminal postherpetic neuralgia, Case report

*Correspondence:
Rong Hu
16902407@qq.com
Haocheng Zhou
Haocheng.Zhou@csu.edu.cn
[1] Department of Pain, The Third Xiangya Hospital and Institute of Pain Medicine, Central South University, Changsha, China
[2] Department of Anesthesiology, The Third Xiangya Hospital, Central South University, Changsha 410013, China
[3] School of Information Engineering, Changsha Medical University, Changsha, China
[4] Hunan Key Laboratory of Brain Homeostasis, Central South University, Changsha, China
[5] Brain Research Center, Central South University, Changsha, China

Introduction

Sensory sensitization is a core symptom in patients with neuropathic pain, characterized by overactive responses to nociception (hyperalgesia) and hypersensitivity to innoxious stimuli (allodynia). Postherpetic neuralgia (PHN) may result in a typical phenotype of neuropathic pain, with moderate to severe pain lasting for months or even years. Invasive procedures may be considered when conventional medication therapy fails to provide satisfactory control of pain. The authors routinely performed neuromodulation therapy for those with trigeminal PHN in their center by applying pulsed radiofrequency,

combined with or without peripheral nerve stimulation [1, 2]. The analgesic mechanism of neuromodulation is to restore the neural hyperexcitability in neuropathic pain condition [3]. Although patients undertake minimally invasive procedures, it remains essential to conduct intraoperative pain management. Surgeons need to perform the percutaneous operation in the orofacial region, which is anatomically close to the painful dermatomes and can worsen the severity of pain experienced during interventional procedures. Here, the authors report a case of intraoperative sensitization caused by craniofacial PHN during percutaneous pulsed radiofrequency treatment.

Case presentation

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request. A 77-year-old Han Chinese male presented with unilateral severe craniofacial pain at the authors pain clinics in September 2023. A review of systems revealed chronic obstructive pulmonary disease, rheumatoid arthritis, a history of hip replacement surgery, a weight of 52 kg, and an American Society of Anesthesiologists (ASA) classification of category III. A typical herpetic lesion had been found in the ophthalmic branch of trigeminal nerve about 1 month prior. Antiviral treatment was applied at the initial phase of herpetic infection; however, this patient still suffered from severe, spontaneous, stabbing, and burning pain in the craniofacial region, with a numerical rating scale (NRS) of pain severity ranging between 8 and 10 (NRS, 0 = totally pain free; 10 = worst imaginable pain). In addition, classical sensory impairment of neuropathic pain, including hyperalgesia, allodynia, and numbness was reported by this patient in the left orofacial regions associated with the distributions of cranial nerves V1, V2, and V3. No other neurological deficiencies of cranial nerve injury were reported by this patient. Barely any relief of pain was achieved with a combination of oral pregabalin (150 mg, twice a day), celecoxib (200 mg, daily), and oxycodone (30 mg, every 12 hours) preoperatively. The patient reported no related family or psychosocial history.

To control pain, the authors recommended that this patient to undergo a minimally invasive neuromodulation procedure of the trigeminal ganglion using pulsed radiofrequency treatment. During the first operation, the patient presented in an awake state with mild to moderate orofacial pain, a heart rate of 65 bpm, and blood pressure of 151/89 mmHg. A total of 40 μg dexmedetomidine was applied intravenously. Alfentanil 0.3 mg was administrated at the beginning of percutaneous puncturing, and the radiofrequency needle approached the foramen ovale. The authors administered local anesthesia with 0.05% lidocaine during the percutaneous procedure. The tip of the radiofrequency needle was successfully targeted at the trigeminal ganglion, as confirmed by the lateral view of fluoroscopy (Fig. 1a). The patient was maintained in a satisfactory state of sedation, which could be interrupted by verbal calls intraoperatively. The patient was stable, with a heart rate of 57–66 bpm and a slight drop of blood pressure to 126/79 mmHg. No discomfort or pain was reported intraoperatively. About 50% relief of pain was obtained after neuromodulation therapy.

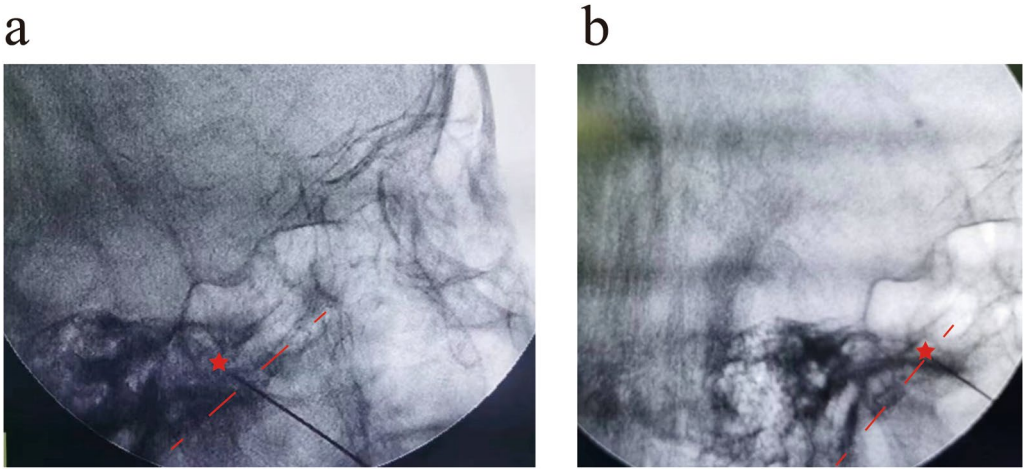

Fig. 1 Distinct placement of radiofrequency needle targeting trigeminal ganglion. **a** Tip of radiofrequency needle (star symbol) placed slightly beyond the foramen ovale in the first procedure; **b** failure of cannulation into the foramen ovale in the second procedure, confirmed by a lateral view of fluoroscopy. The dashed line indicates the basal skull border

In the following week, the patient reported partial pain relief compared with baseline; however, he still needed to take oxycodone (10–20 mg, every 12 hours) for pain control. The second neuromodulation was then scheduled. In the authors' center, the choice of anesthetic agents is variable and preferentially determined by distinct physicians. During the second procedure, dexmedetomidine was replaced by propofol for intravenous sedation. The propofol was infused at a speed of 180 mg per hour and discontinued after 10 minutes, owing to a significant drop of blood pressure from 120/79 to 86/52 mmHg. The patient fell asleep, but with brisk response to light glabellar tap. Oxygen saturation (SpO_2) was maintained above 97% with nasal catheter oxygen supply. The authors assume that a decrease of body fluid caused by preoperative fasting may contribute to the hypotension. In addition to the acceleration of fluid infusion, ephedrine (2 mg) was delivered three times to increase the patient's blood pressure to 155/96 mmHg. Electrocardiogram (ECG) monitoring indicated frequent premature ventricular contractions before the onset of percutaneous operation. Several factors may have contributed to arrhythmia, including hypoperfusion and cardiac dysfunction caused by chronic obstructive pulmonary disease. Given the potential risk of hemodynamic instability, the authors decided not to use additional anesthetic drugs. Combination of local lidocaine and intravenous oxycodone was administrated. Unfortunately, the patient continued complaining about craniofacial pain induced by the surgical procedure, even with rescue of oxycodone. Moreover, breakthrough and persistent episodes of pain were presented when the cannula was close to the entry of foramen ovale, which led to the patient's refusal to undergo further attempts at cannulation. As a result, the authors failed to place the needle into the Meckel's cave (Fig. 1b). The authors injected 1.0 ml ropivacaine (0.3%) and 5 mg dexamethasone into the radiofrequency needle at the end of surgery. The patient reported less than 50% postoperative pain relief, and he continued to take oxycodone (10 mg, every 12 hours) 2 months after discharge. Unfortunately, this patient still reported intolerant pain (NRS 5–7) and required ongoing medication for pain control at 6-month, 12-month, and 18-month outpatient visits. To control the craniofacial pain, oral oxycodone (10–20 mg, every 12 hours) and pregabalin (75 mg, once a day) was administrated. The patient declined hospitalization for additional therapy for pain relief, considering the aggressive condition of chronic obstructive pulmonary disease, which resulted in a half-month stay in the intensive care unit during the previous year.

Discussion and conclusion

The authors report a case of intraoperative sensitization caused by trigeminal PHN during a minimally invasive procedure of pulsed radiofrequency. Essential sedation is required when performing percutaneous procedures to reduce anxiety and discomfort. In general, patients will not suffer significant pain with local anesthesia owing to the minimally invasive site. In this case, characteristic sensory impairment included both mechanical allodynia and hyperalgesia. For instance, noxious stimuli can be triggered by light touch or skin disinfection. Additionally, the enhancement of the nociceptive response to the percutaneous puncturing operation, which was consistent with the neuropathic phenotype of hyperalgesia, hindered the correct placement of the radiofrequency needle into the Meckel's cave.

In addition, the insufficient analgesic effect of opioids in this case also supported the clinical feature of neuropathic pain. It remains a great challenge to effectively treat neuropathic pain. Preclinical evidence has revealed a potential role of dexmedetomidine in treatment of neuropathic pain, by alleviating both sensory allodynia and depressive symptoms [4]. It may partially explain the superior clinical outcome during the initial neuromodulation treatment under administration of dexmedetomidine. Given its functions of sedation, analgesia, and anti-anxiety, dexmedetomidine has been increasingly applied as a conjunct agent for peripheral nerve block [5]. Likewise, previous reports supported the usage of dexmedetomidine in the management of neuropathic pain caused by cancer, complex regional pain syndrome, surgical injury, and opioid-induced hyperalgesia [6–9]. The authors successfully accomplished the surgery with a combination of intravenous dexmedetomidine and local lidocaine infusion. In contrast, when solely local nerve block was performed, the authors assume that the irritation of the mandibular branch of the trigeminal nerve may have contributed to the intraoperative breakthrough pain, leading to failure of the radiofrequency needle placement in the second procedure. Consistent with previous cases [6–11], the authors' experience revealed a potential role for dexmedetomidine in attenuating the neuropathic component of pain, when combined with other drugs, as an alternative option. Possible mechanisms underlying the analgesic effects of dexmedetomidine include antisympathetic function, the inhibitory effect on apoptosis, oxidative stress, and the inflammatory response [10].

One major limitation is that the authors cannot conclude that the incidence of intraoperative sensitization during the second procedure in this case was dependently associated with the application of dexmedetomidine. A well-designed, prospective, comparative study

with a considerable number of participants may be of help to determine the role of dexmedetomidine in the prevention of intraoperative hypersensitivity. Additionally, it remains unclear what the appropriate dosage of dexmedetomidine is in perioperative management of neuropathic pain, which involves initiating a bolus dose of 0.5–1 μg/kg, followed by a continuous infusion of 0.5–2 μg/kg per hour [12]. Despite the pharmaceutic effect, potential factors underlying intraoperative sensitization included anesthetic techniques, procedural details, and the patient's psychological state.

Apart from dexmedetomidine and opioids, an alternative option for perioperative pain management may be further considered to prevent the incidence of intraoperative breakthrough pain, including nonsteroidal anti-inflammatory drugs (NSAIDs), paracetamol, tramadol, and other nonopioid analgesics and their combinations [13].

In conclusion, the authors report a case of intraoperative sensitization caused by trigeminal PHN during a neuromodulation procedure. Although a minimally invasive procedure was conducted, it is essential to monitor and prevent this hypersensitivity to innoxious or noxious stimuli in patients with neuropathic pain syndrome, especially for surgical sites close to the distribution of nerve injury.

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Author contributions
GG, RH, and HZ contributed to all aspects of the manuscript, including acquiring patient consent, literature review, drafting the original manuscript, and editing and revising the final version of the manuscript; DL contributed to intraoperative management and monitoring; HL contributed to language editing and drafting of the original manuscript. The final version of this manuscript has been written, read, and approved by all authors. The material has not been published, either whole or in part, and is not under consideration for publication elsewhere.

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Availability of data and materials
All data related to this case report are contained within the manuscript.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
The authors declare no competing interests in this paper.

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