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CASE REPORT

Ultrasound-guided sphenopalatine ganglion block for effective analgesia during awake fiberoptic nasotracheal intubation: A case report

Hangil Kang, Seongjae Park, Yehun Jin

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Abstract

BACKGROUND

Awake fiberoptic nasotracheal intubation (AFNI) is the preferred airway management strategy for patients with difficult airways. However, this procedure can cause significant physical and psychological distress. This case report explores the application of a sphenopalatine ganglion (SPG) block as an alternative analgesic modality to mitigate the discomfort associated with AFNI.

CASE SUMMARY

A 63-year-old female with a history of right maxillary osteosarcoma underwent craniotomy for a suspected malignant brain lesion. The patient's medical history included prior surgery, chemotherapy, and radiation therapy, resulting in significant jaw impairment and limited neck mobility. Considering the anticipated airway challenges, AFNI was planned. A SPG block was performed under real-time ultrasound guidance, providing effective analgesia during nasotracheal intubation.

CONCLUSION

The SPG block represents a promising analgesic approach in AFNI, offering potential benefits in alleviating pain involving the nasal and nasopharyngeal regions as well as improving patient cooperation.

Key Words: Sphenopalatine ganglion block; Nerve block; Regional anesthesia; Analgesia; Awake fiberoptic nasotracheal intubation; Case report

Core Tip: This is the first clinical case report of the application of a sphenopalatine ganglion (SPG) block for awake fiberoptic nasotracheal intubation (AFNI). The SPG block provided sufficient analgesia during AFNI. This case report suggests that an alternative analgesic modality for AFNI is the most reasonable option for airway management.

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INTRODUCTION

Patients with malignant oral tumors who undergo surgical intervention and chemoradiotherapy often experience progressive physiological and pathological changes at the surgical site. These changes lead to structural alterations in the upper airway, resulting in severe airway compromise during procedures requiring general anesthesia[1]. To prevent potential ventilatory challenges and hypoxia arising from difficulties in securing the airway during the induction of general anesthesia, awake fiberoptic nasotracheal intubation (AFNI) has emerged as the most reasonable option for airway management[2].

AFNI is considered a safe and effective alternative approach for patients with significant airway compromise owing to oral surgery[2]. This method enables the preservation of spontaneous breathing, thereby minimizing potential complications such as critical desaturation due to difficulties with mask ventilation[3]. However, AFNI causes considerable physical and psychological distress. In addition, reflexive movements triggered by stimulation can occur, necessitating an appropriate response. Nerve blocks aimed at alleviating pain in the vocal cords and lower airways have been developed and widely used in clinical settings[4].

Blocks of the superior and recurrent laryngeal nerves have been used to alleviate discomfort in the laryngeal region during intubation[4]. Transcricothyroid membrane blocks have been used to induce anesthesia in the subglottic region. However, challenges have arisen during AFNI, particularly regarding the associated pain and discomfort in the upper airway and nasopharyngeal regions. This case report proposes that using an ultrasound-guided sphenopalatine ganglion (SPG) block when performing AFNI is effective in alleviating pain and discomfort, particularly in the upper airway and nasopharyngeal regions.

CASE PRESENTATION

Chief complaints

A 63-year-old female (height, 153 cm; weight, 42 kg) was scheduled for craniotomy for a suspected malignant brain lesion.

History of present illness

The patient was diagnosed with right maxillary osteosarcoma 28 years ago and underwent radical orbitomaxillectomy, chemotherapy, and radiotherapy. However, disease recurrence prompted further surgical interventions, including mandibulectomy, right eye enucleation, and facial reconstruction.

History of past illness

The patient's past medical history revealed only hypertension.

Personal and family history

She denied any other medical history or family history of medical issues.

Physical examination

The patient presented with persistent complications secondary to her prior treatments, including significant jaw impairment, posterior maxillary constriction, and facial asymmetry, culminating in Mallampati classification IV and a mouth opening of < 1.5 cm. The patient also exhibited limited neck mobility associated with prior radiation therapy. On neurological examination, she exhibited an alert mental status and proper orientation, with no signs of focal neurological deficits.

Laboratory examinations

The patient's arterial blood gas analysis showed mild respiratory acidosis with CO_2 retention, as follows: pH, 7.37; PaCO_2, 47.3 mmHg; PaO_2, 87.0 mmHg; HCO_3 concentration, 25.7 mmol/L; base excess, 1.5 mmol/L; and oxygen saturation, 96.7%. Considering the patient's general condition, pulmonary function tests were not performed. The results of all other laboratory tests, including blood and urine analyses, were within acceptable ranges.

Imaging examinations

Preoperative brain computed tomography (CT) revealed osteosarcoma recurrence along the inner cortex of the right frontotemporal craniotomy site, accompanied by chronic otomastoiditis on the right side. In addition, CT findings included an asymmetrical hypoplastic mandible with erosions on the right side of the condylar head (Figure 1). Chest radiography revealed no significant abnormalities.

FINAL DIAGNOSIS

Due to restricted mouth opening and limited neck extension, difficulty in airway management or ventilation was anticipated, thus, AFNI was performed.

TREATMENT

Informed consent regarding the potential risks of anesthesia was obtained from the patient and her family. The patient was admitted to our hospital without premedication. Upon entering the operating room, routine monitoring measures, such as pulse oximetry, electrocardiography, noninvasive blood pressure measurements, bispectral index, and capnography were initiated.

The patient's vital signs measured immediately after admission were as follows: Blood pressure, 126/73 mmHg; heart rate, 73 beats/min; and oxygen saturation, 97% on room air. To prevent hypoxemia, oxygen was administered for several minutes through a high-flow nasal cannula (Optiflow, Fisher & Paykel Healthcare). An intravenous injection of 0.2 mg of glycopyrrolate was administered, as a form of premedication, to decrease saliva production. Additionally, 2 mg of midazolam were administered intravenously for conscious sedation.

Using an out-of-plane approach with a 25-gauge, 2-inch needle, a left SPG block was performed under real-time ultrasound guidance. With the patient's head inclined to the right, a linear probe was placed in the infrazygomatic region and directed upward at an angle of approximately 45°. The sonographic view was bound anteriorly by the maxilla and posteriorly by the shadow of the mandibular coronoid process, which lies over the greater wing of the sphenoid process [5,6]. The needle was introduced approximately 1 cm behind the posterior orbital rim and 1 cm above the upper edge of the zygomatic arch. The needle was angled 30° caudally and 10° anteriorly and advanced 4 cm through the pterygomaxillary fissure into the pterygopalatine fossa (PPF). We administered 6 mL of 1% lidocaine, and the spread of the local anesthetic was observed using ultrasonography (Figure 2).

Through the cricothyroid membrane puncture, we administered a 5 mL bolus of 2% lidocaine into the trachea. Oral gargling was performed with 10 mL of 4% lidocaine. Nasal intubation was performed using a 6.5 mm nasal endotracheal tube with a preloaded flexible bronchoscope. The nasotracheal tube was seamlessly inserted into the left nostril without the patient coughing or gagging. The patient did not complain of pain or discomfort as the nasotracheal tube passed through the left nostril. We verified the accurate positioning of the nasotracheal tube by observing the carina and its tips and subsequently withdrawing the bronchoscope.

Once the presence of an end-tidal carbon dioxide waveform was confirmed, anesthesia was induced using propofol and remifentanil, followed by the intravenous administration of 40 mg of rocuronium. Propofol and remifentanil-based total intravenous anesthesia with target-controlled infusion was administered to maintaingeneral anesthesia. The patient received mechanical ventilation with a fresh gas flow of 3 L/min consisting of 50% oxygen mixed with ambient air. Arterial cannulation of the right radial artery and central venouscannulation of the right internal jugular vein were performed.

OUTCOME AND FOLLOW-UP

The surgery was extended over a 6 h duration while maintaining stable vital signs. Although spontaneous breathing resumed postoperatively, nasotracheal intubation was maintained for half a day as a precaution against the anticipated airway edema. On the following day, the patient was extubated. She did not complain of nasopharyngeal pain or epistaxis.

DISCUSSION

SPG block is commonly used to alleviate pain in the nasopharyngeal region. Its effectiveness has been demonstrated in the treatment of post-dural puncture headaches, migraines, and various facial pain syndromes, as well as in the setting of endoscopic sinus surgery[5,7-9]. The application of this procedure during AFNI proved beneficial, such that the effective reduction of patient discomfort and pain in the nasal cavity and pharynx facilitated tube insertion without compromising airway integrity.

SPG, also referred to as the pterygopalatine ganglion, is located within the cranial division of the autonomic nervous system and has distinctive features[7]. It interconnects with three main neural pathways, the somatosensory, sympathetic,

Figure 1 Computed tomography revealed a rim-enhancing cystic lesion in the right mandibular ramus, which corresponded to a periosteal abscess. Computed tomography also showed the prior maxillectomy on the right side.

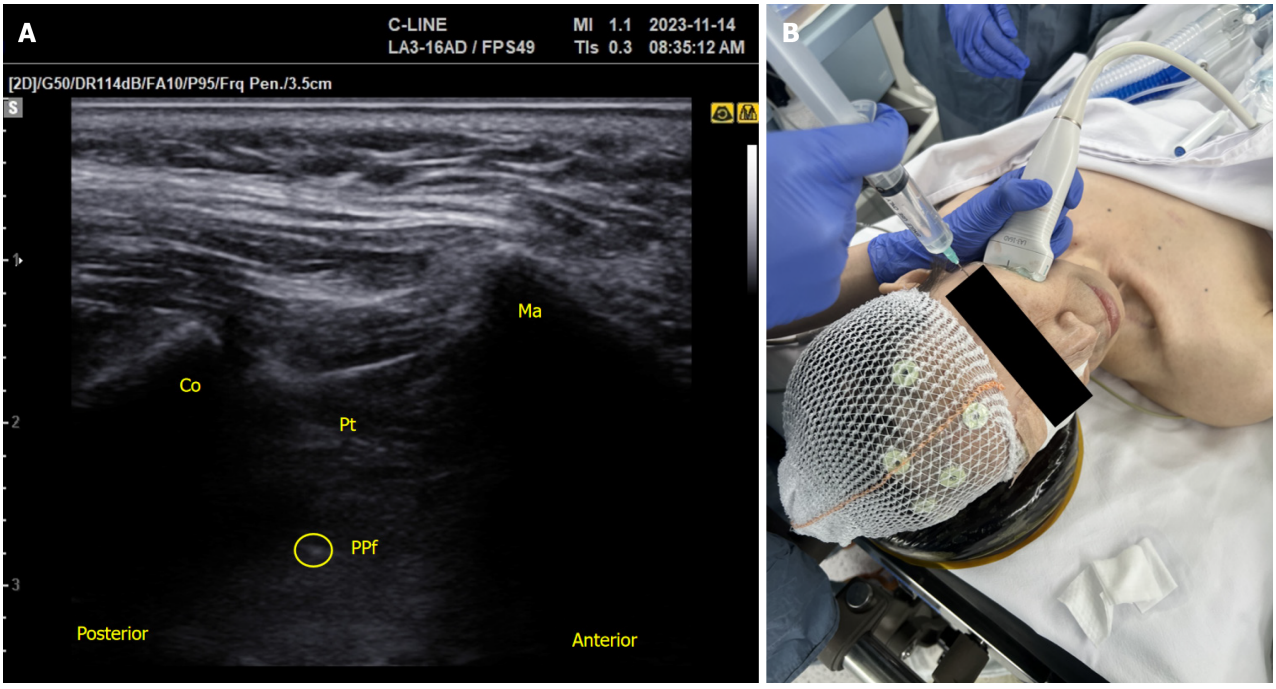

Figure 2 Sphenopalatine ganglion block guided by ultrasonography. A: Ultrasound image visualizing the surrounding anatomical structures; B: Ultrasound-guided needle placement to perform the sphenopalatine ganglion block. Co: Coronoid process of the mandible; Ma: Maxilla; Pt: Pterygoid muscles; PPf: Pterygopalatine fossa; Yellow circle: Needle tip.

and parasympathetic systems, making it well-suited for addressing various painful conditions affecting the facial and cranial regions[7].

Anatomically, the maxillary division of the trigeminal nerve courses through the foramen rotundum and proceeds anteriorly through the PPF[10]. The efferent branches of the SPG form the nasopalatine nerve, the posterior, superior, and inferior lateral nasal branches, and the pharyngeal nerves; additionally, the SPG is directly connected to the greater and

lesser palatine nerves. Sensory nerve fibers arising from the maxillary nerve traverse the SPG, facilitating the sensory innervation of the nasal mucosa, palate, and pharyngeal areas. SPG blocks modulate the transmission of pain signals by suppressing the activity of these sensory nerves.

The sympathetic pathway of the SPG originates from the superior cervical ganglion, following a trajectory through the internal carotid plexus as the deep petrosal nerve. This nerve merges with the greater petrosal nerve, forming the pterygoid canal nerve, also known as the vidian nerve[10]. Vasoconstrictive innervation of the nasal cavity, upper pharynx, and palate is supplied by the postganglionic sympathetic fibers that pass through the SPG[10]. The parasympathetic pathway originates from the superior salivatory nucleus (SSN) within the brainstem and extends towards the SPG. Efferent fibers from the SSN traverse *via* the nervus intermedius, combining to form the greater petrosal nerve, which contributes to the parasympathetic innervation of the SPG[8,10]. This pathway stimulates the secretory function of the nasal cavity, pharyngeal mucosa, and lacrimal and palatine glands[8]. Therefore, through its effects on the sympathetic and parasympathetic nervous systems, SPG block can be an effective method to facilitate the smooth execution of AFNI.

SPG block is commonly performed using transnasal and percutaneous approaches. In contrast to the transnasal approach, the percutaneous approach offers the advantage of delivering medication directly to the SPG without encountering barriers such as the nasal mucosa, sphenopalatine foramen, and fat tissue before reaching the PPF[7,11]. The transnasal method results in inconsistent coverage of the contents within the PPF, leading to fewer enduring outcomes [11].

A superior laryngeal nerve block was not performed in this case, which could be considered a limitation. The superior laryngeal nerve innervates the cricothyroid muscle, whereas the recurrent laryngeal nerve innervates the remaining muscles[12]. Although we can reduce reflective contractions by performing a translaryngeal block targeting the recurrent laryngeal nerve, this may be inadequate as the cricothyroid muscle of the larynx would remain unaffected. Overall, this was not deemed essential for awake intubation, and no disruptive reflexes were observed in our patient during the procedure.

CONCLUSION

In conclusion, when performing AFNI, the implementation of a nerve block strategy such as the SPG block improves patient cooperation and minimizes physical and mental pain without compromising airway integrity. Further clinical studies are needed to investigate the comparative outcomes and establish optimized protocols.

FOOTNOTES

Author contributions: Jin Y designed the research; Kang H, Park S and Jin Y performed the research; Kang H and Jin Y analyzed the data and wrote the paper.

Informed consent statement: All study participants have read and understand the information in this form. I have been encouraged to ask questions and all of my questions have been answered to my satisfaction. I have also been informed that I can withdraw from the study at any time. By signing this form, I voluntarily agree to participate in this study.

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