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Thermogangliolysis of the Gasserian ganglion under computed tomography fluoroscopy

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Abstract
Gasserian ganglion block is an established treatment for trigeminal neuralgia. A landmark approach assisted by X-ray fluoroscopy is the most common method; however, visualization of the foramen ovale is difficult in some cases. Here we report two cases in which a novel technique using modern computed tomography (CT) fluoroscopy was employed. A 63-year-old woman suffering pain in the maxillary nerve area was treated by thermogangliolysis under CT fluoroscopy. The patient was positioned on a CT stage with the head in an overhanging position. The CT gantry was set at an oblique angle to obtain a coronal view of the foramen ovale. The safest and shortest route to the foramen was designed using the CT image and a 22-gauge insulated needle was advanced following the designed route under CT fluoroscopy. The effect of the nerve block was estimated by injection of a test dose of mepivacaine, after which the ganglion was thermally coagulated at 90°C. Satisfactory analgesia was obtained in this case without any complications. Another patient (65 years old) was also treated by the same technique, and satisfactory pain relief was obtained. In conclusion, CT fluoroscopy-guided Gasserian ganglion thermolysis is considered a safe, quick, and effective treatment for trigeminal neuralgia.

Key words CT fluoroscopy · Trigeminal neuralgia · Thermogangliolysis · Gasserian ganglion

Introduction

Idiopathic trigeminal neuralgia is the most common facial pain syndrome; Gasserian ganglion block is an established treatment of this disorder. For this block, many textbooks and review articles recommend the use of X-ray fluorography or sequential film radiology when advancing the nerve-block needle into the foramen ovale [1]. This is because the Gasserian ganglion is located on the floor of the middle cranial fossa, which is surrounded by cranial nerves. Malpositioning of the needle can result in serious neurological complications. The location of the foramen can be found on lateral X-ray radiography by referring to the junction of the clivus and petrous bone. However, the precise location of the foramen ovale is difficult to find using uniplanar fluoroscopy. Also, soft tissues cannot be visualized by these methods. In some patients, the foramen cannot be clearly visualized by fluoroscopy or X-ray radiography because of atypical skeletal configurations [2]. Hakanson reported that the first attempt to puncture and visualize the trigeminal cistern radiographically was unsuccessful in 15% of patients [3]. In contrast, the configuration of bones and soft tissues are clearly visualized by CT imaging. Furthermore, recent advances in CT technology have enabled physicians to manipulate a biopsy needle under CT guidance in a real-time manner (CT fluoroscopy). In this case report, we describe CT fluoroscopy-guided Gasserian ganglion thermogangliolysis in which a frontal slice of the foramen ovale was visualized and an insulated nerve block needle was guided by CT fluoroscopy.

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Case report

Case 1

A 63-year-old woman had episodic pain in the left maxillary and mandibular nerve area. Her pain was resistant to medications including carbamazepine, and peripheral nerve blocks were not effective for the pain. Gasserian ganglion block under X-ray fluoroscopy had been scheduled previously, however, the foramen ovale could not be visualized on the diseased side. The patient was positioned on the CT stage with her head in an overhanging position. Marking devices made of thin metal wires were attached to her ipsilateral cheek. The

Fig. 1. The patient's neck (Case 1) is extended and the angle of the computed tomography (CT) gantry is set vertically to the cranial base on the scout view. The *arrow* points to the *white bar* that indicates the inclination of the CT gantry

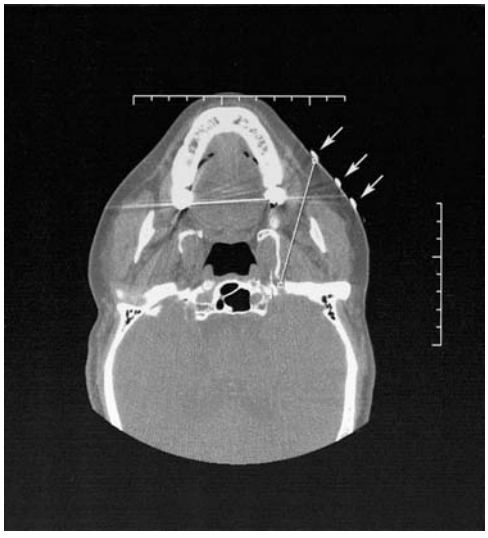

Fig. 2. The safe and shortest route to the foramen was designed on the CT image (Case 1). The *arrows* show the marking devices

first marking device was located 3 cm lateral to the angulus oris. The CT gantry (Hispeed Advantage SG; GE Medical System, Milwaukee, WI, USA) was set at an oblique angle to obtain a coronal view of the foramen ovale. In this position the angle of the gantry is vertically to the cranial base on the scout view (Fig. 1). The safest and shortest route to the foramen was designed on the CT image (Fig. 2), and the distance between the insertion point and the foramen ovale was measured. The insertion point was marked using a marking device. Following sterilization of 0.05% chlorhexidine gluconate and application of subcutaneous anesthesia with 0.5% lidocaine, a 22-gauge insulated needle was inserted from the marked point. The insertion angle of the needle was adjusted using a red guiding laser transmitted from the CT gantry. The needle was then advanced following the designed route under CT fluoroscopy (Fig. 3). When the needle tip was located at the entrance of the foramen, electrical impulses (2 Hz, 0.1–0.2 V; RFG-3CF, Radionics, Burlington, MA, USA) were applied to the needle and contraction of the masseter muscle was confirmed. The needle tip was further advanced by 0.5 mm beyond the outer border of the foramen. Again, electrical current (50 Hz, 0.1–0.2 V) was applied to the needle tip and paresthesia in the diseased area was confirmed. Once again, the location of needle tip and the effect of the nerve block were estimated by a test dose injection (2% mepivacaine 0.2 ml). After confirming the loss of sensation in the diseased area and the lack of side effects, the ganglion was thermally coagulated at 90°C for 120 s. Satisfactory analgesia was obtained in the mandibular area without any complications. Slight pain remained in the maxillary area. On the following day, the visual analogue pain score was reduced from 10/10 to 2/10 in the mandibular area and from 9/10 to 3/10 in the maxillary area.

Fig. 3. The needle was advanced following the predesigned route under CT fluoroscopy (Case 1)

Case 2

A 65-year-old woman had medication-resistant pain in the left maxillary and mandibular area. Although contact between the trigeminal nerve and the vasculature was suspected on the magnetic resonance image, she

declined any surgical intervention and preferred percutaneous nerve block. The same procedure as in case 1 was applied in this case and complete analgesia was obtained both in the mandibular and maxillary area without any complications. On the following day, the visual analogue pain score was reduced from 9/10 to 0/10 in the mandibular area and from 9/10 to 0/10 in the maxillary area.

Discussion

Several recent reports describe the use of CT images for needle guidance when the visualization of the foramen ovale in the anteroposterior view was difficult using X-ray fluoroscopy. Krol and Arbit and Okuda et al. independently described CT-guided trigeminal nerve block at the peripheral branch [4,5]. More recently, Gusmao et al. reported CT-guided Gasserian thermogangliolysis in which the axial view was obtained intermittently to confirm the location of the needle tip [6]; however, there has been no report describing visualization of the coronal view of the foramen ovale during Gasserian block.

The foramen ovale is on the greater wing of the sphenoid bone and the size of the foramen is approximately 4×7 mm [2]. In some patients, bilateral foramina are asymmetrical and the skeletal configuration does not permit visualization by X-ray imaging [2]. In the first case in this report, the left foramen had a funnel shape and was overridden by an adjacent bone protrusion (Fig. 4). Because of this anatomical configuration, we could not visualize the foramen ovale in this patient using X-ray fluoroscopy. However, CT imaging technology provided a coronal view of the foramen. By setting the CT gantry at an oblique angle, it was not necessary for the patient to maintain a hyperlordotic neck position. By monitoring the location of the needle tip in a real-time manner, the operator could easily avoid dural puncture.

The amount of radiation energy exposure may be a concern in CT-guided procedures; however, Gusmao et al. reported that the level of radiation energy exposure for the patient and medical staff was smaller in the CT-guided technique than in a conventional X-ray fluoroscopy-guided technique [6]. This is because CT guidance allows physicians quick and accurate needle advancement. Teeuwisse et al. reported that the level of radiation exposure in CT fluoroscopy was acceptable [7]. The CT equipment used in our two cases radiated 0.176 mGy/s (10 mA, 120 kV, per 3-mm slice). The total

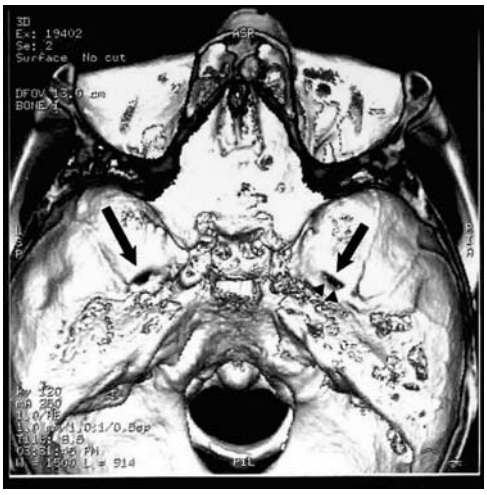

Fig. 4. The left foramen has a funnel shape and is overridden by an adjacent bone protrusion (Case 1). The *arrows* show the foramina ovale and the *arrowheads* show an adjacent bone protrusion

duration of radiation exposure in cases 1 and 2 was 187 s and 273 s, respectively. By reducing insertion time, exposure to radiation energy can be further reduced. In addition to minimal radiation exposure, this quick and easy technique decreases the need for sedatives and the risk of complications such as subcutaneous bleeding and infection.

In conclusion, Gasserian thermogangliolysis under CT fluoroscopy guidance was considered a safe, quick, and effective method for patients with trigeminal neuralgia.

References

1. Cousins JM. Neuroral blockade in clinical anesthesia and management of pain.
2. Newton TH, Potts PG. Radiology of the skull and brain. THE SKULL. 1971, Volume one book 1, pp 297–315
3. Hakanson S (1981) Trigeminal neuralgia treated by the injection of glycerol into the trigeminal cistern. Neurosurgery 9:638–646
4. Krol G, Arbit E (1988) Percutaneous electrocoagration of the trigeminal nerve using CT guidance. J Neurosurg 68: 972–973
5. Okuda Y, Okuda K, Shinohara M, Kitajima T (2000) Use of computed tomography for maxillary nerve block in the treatment of trigeminal neuralgia. Regional Anesthesia and Pain Medicine 25:417–419
6. Gusmao S, Oliveira M, Tazinaffo U, Honey CR (2003) Percutaneous trigeminal nerve radiofrequency rhizotomy guided by computerized tomography fluoroscopy. J Neurosurg 99:785–786
7. Teeuwisse WM, Geleijns J, Broerse JJ, Obermann WR, Van Meerten Van Persijn EL (2001) Patient and staff dose during CT guided biopsy, drainage and coagulation. Br J Radiol 74:720–726