Gamma Knife Radiosurgery and Maxillary Nerve Block with Alcohol in the Trigeminal Neuralgia Involving V1 and V2 Divisions

Young Bok Lee[1,*], Chang Ik Choi[2] and Su Jin Kim[3]

[1] Department Yonsei University Wonju College of Medicine, 20 Ilsan-ro, Wonju, Korea, Republic of, 26426

[2] Department Yonsei University Wonju College of Medicine, 20 Ilsan-ro, Wonju, Korea, Republic of, 26426

[3] Department Yonsei University Wonju College of Medicine, 20 Ilsan-ro, Wonju, Korea, Republic of, 26426

[*] *Corresponding author's email: yblee [AT] yonsei.ac.kr*

ABSTRACT— ***The first line treatment for trigeminal neuralgia (TN) is medical therapy. However, if medical treatments are ineffective or produce intolerable side effects, invasive or ablative treatment modalities are performed. These modalities include ablative procedures such as alcohol neurolysis, percutaneous balloon compression, radiofrequency thermocoagulation, gamma knife radiosurgery (GKRS) and non-ablative microvascular decompression (MVD). The patient presented in this case had been TN involving maxillary division and treated with infraorbital nerve block. And then a new intractable TN occurred in ophthalmic division. We performed GKRS and were able to control the pain involving the ophthalmic division without sensory change. After three months, the TN involving maxillary division became severe, additional maxillary nerve block using alcohol was conducted. We present this case as the pain caused by trigeminal neuralgia involving different divisions were controlled applying GKRS and maxillary nerve block.***

Keywords— gamma knife radiosurgery, maxillary nerve block, ophthalmic division, trigeminal neuralgia

1. INTRODUCTION

Medical treatment with anticonvulsants is a first-line treatment for trigeminal neuralgia (TN) [1]. However, if medical treatments are ineffective or cause intolerable side effects, other invasive treatments or ablative modalities are used. These treatment modalities include ablative procedures such as alcohol neurolysis, percutaneous balloon compression, radiofrequency thermocoagulation, gamma knife radiosurgery (GKRS), and non-ablative microvascular decompression (MVD) [1-4]. GKRS is used to treat patients with TN by irradiating the root entry zone of the trigeminal nerve. However, this procedure is less effective, as only a minimum radiosurgical dose is used in order to prevent trigeminal sensory disturbance [5-7]. The patient in this case report had previously presented TN involving the maxillary division and the condition had been treated with alcohol neurolysis of the infraorbital nerve combined with medications. A new TN then appeared in the patient's ophthalmic division, and none of the treatments for it - including medications and nerve block - were effective. We performed GKRS and were able to control the pain involving the ophthalmic division without sensory disturbance. Three months after the GKRS, the TN involving the maxillary division became severe, and an additional maxillary nerve block with alcohol was performed. We report this case of pain caused by trigeminal neuralgia in different divisions that was controlled with GKRS and a maxillary nerve block.

2. CASE REPORT

A 45-year-old female patient with trigeminal neuralgia was treated with an infraorbital nerve block and GKRS after visiting our pain clinic for intractable left facial pain. Four years prior, she had been diagnosed with TN by another clinic, as she had presented with agonizing pain in her left face, upper lip and gum. The brain MRI performed at the time had revealed no significant abnormalities, and she had been treated with carbamazepine and gabapentin. However, the pain had not relieved by increased medication dose. Therefore, she visited our pain clinic one and a half year ago. She had undergone a donor nephrectomy procedure three years prior, and was otherwise in good health with no notable past

medical events. She complained that the facial pain persisted even when she took 600 mg of carbamazepine and 900 mg of gabapentin per day. The pain score was 9-10/10 on the numeric rating scale (NRS). She had difficulty speaking due to her severe pain and was not able to carry out daily activities because of the severe dizziness caused by the medications. We explained the possibility of an infraorbital nerve block with alcohol to her, and performed the nerve block after obtaining her consent. We first performed a test block in which we identified the left infraorbital foramen in the supine position with an ultrasound (Sonosite, Bothell, WA, USA) and by advancing a 22G, 5-cm block needle into the infraorbital foramen and injecting 0.4 ml of 2% mepivacaine [8,9]. After the procedure, the facial pain was alleviated, and there was numbness; however, the pain caused by the first molar area of the maxilla remained. As the pain was less severe, we carefully injected 0.4 ml of alcohol. After the infraorbital nerve block, the patient no longer suffered pain when she took 200 mg of carbamazepine per day.

After a year, an electric shock-like new pain emerged in her left forehead. The pain did not respond to carbamazepine, and its intensity increased. Even under a gentle touch, the degree of pain was 9-10/10 on the NRS. We diagnosed a new TN involving the ophthalmic division. A test block was performed on the supraorbital and supratrochlear nerves with 2 ml of 2% mepivacaine. Even after the procedure, the electric shock-like pain did not fade despite the skin's numbness. We informed the patient that a supraorbital and supratrochlear nerve block was no longer effective to relieve the pain and suggested GKRS, one of the treatment procedures for TN. She was then transferred to the neurosurgery department, was admitted to the neurosurgery, and underwent GKRS (Leksell Gamma Knife, Eleckta AB, Sweden) (1/Lt. trigeminal nerve root entry zone/20.08cm³/marginal dose 41 Gy/maximum dose 82 Gy) (Fig. 1). She was discharged after two days. Two weeks after the surgery, the pain in her left forehead had been alleviated, and no abnormal sensory response was detected. However, as the pain in her maxilla was still 3-4/10 on the NRS, she was medicated with 200 mg of carbamazepine per day. After three months, she revisited the neurosurgery department for uncontrolled severe pain in her left face. She was prescribed a nerve block, and consequently revisited our pain clinic. In the physical examination, the sense of touch in her left face was reduced to 5-6/10 compared to that in her right face. Her facial pain affected the maxillary nerve distribution area, and the pain expanded. However, the pain did not recur in her forehead (which had been treated with GKRS). After informing the patient, a maxillary nerve block was performed using fluoroscopy. The procedure involved a lateral approach in the supine position using a 23G, 8-cm block needle. When the tip of the needle was positioned within the sphenopalatine fossa and was advanced halfway between the foramen rotundum and the inferior orbital fissure on the fluoroscopic image, the patient complained of paresthesia in areas associated with the maxillary nerve (Fig. 2). After it was confirmed that no blood was aspirated, 0.5 ml of 2% mepivacaine was injected. When it was confirmed that the maxillary nerve was blocked and the pain had dissipated, 0.5 ml of dehydrated alcohol was slowly injected. Three months after the maxillary nerve block, the pain had subsided and the patient was doing fine without medication.

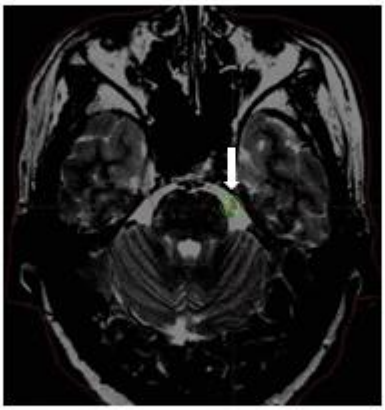

Figure 1: The root entry zone of the trigeminal nerve with a single 4-mm isocenter.

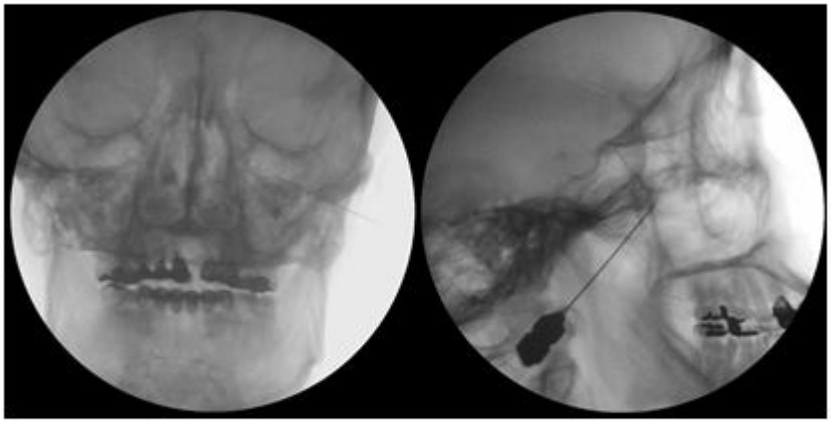

Figure 2: Fluoroscopic imaging of needle position, anteroposterior and lateral view.

3. DISCUSSION

Among the secondary procedures used to treat TN, radiofrequency thermocoagulation and nerve blocks using alcohol are performed at the trigeminal ganglion or at selective divisions of the trigeminal nerve and distal nerves [9-12]. The disadvantage of ablative procedures is that they cause sensory loss around the relevant nerve. Therefore, although they are the most effective treatment modality, they must be performed in a way limits the area of sensory disturbance as much as possible.

The patient visited our pain clinic because a high dose of drugs was not effective to control her pain. In an attempt to minimize the area of numbness, an infraorbital nerve block with alcohol was performed instead of a maxillary nerve block. After the infraorbital nerve block, minor discomfort was left around the first molar area. This discomfort was controlled with an additional 200 mg of carbamazepine per day.

The patient was doing well until new pain emerged in her left forehead. She was diagnosed with a new intractable TN in her left ophthalmic division. Under our recommendation, the patient was transferred to the neurosurgical department to undergo GKRS. GKRS is an ablative procedure that is conducted at the entry zone of the trigeminal nerve root. To prevent trigeminal sensory disturbance resulting from the destruction of the trigeminal nerve, maximal radiation doses between 70-90 Gy are used in the procedure [6]. However, due to the limited radiosurgical dosage, GKRS is not sufficient to alleviate pain. Lee et al. reported that 72.8% of patients treated with maximal doses between 65.2-83.6 Gy suffered uncontrollable agony or lasting pain even with medications [6]. Conversely, a high probability of remaining pain-free without medication after GKRS has also been reported [7]. In previous reports, facial sensory loss was observed in up to 10% of patients who received a mean maximal dose around 80 Gy [13,14]. Our patient was treated with the maximum radiation dose of 82 Gy. She was discharged from the hospital after the procedure without any pain or loss of sensations around her forehead.

After three months, the patient revisited the hospital for severe pain in the left side of her face that could not be controlled even with a high dose of carbamazepine. As the pain spread around her maxillary nerve, we performed a maxillary nerve block with alcohol. Although the patient lost sensations around the area associated with the maxillary nerve, she is otherwise doing well without a need for medications or side effects.

When an intractable TN is associated with the maxillary or mandibular division, we perform a distal nerve block such as an infraorbital or mental nerve block first. A maxillary or mandibular nerve block is performed for the treatment of a wider TN in each division. A supraorbital and supratrochlear nerve block is performed for intractable TN involving the ophthalmic division. However, pain control may be difficult if the agony persists after a distal nerve block. In these cases, another option may be GKRS with a low radiation dose. The patient in this case report showed a positive response, as her ophthalmic TN was regulated without sensory disturbance. In conclusion, we need to avoid neurolysis to treat TN involving the ophthalmic division, as there is a risk of sensory loss. As GKRS uses low-dose radiation, it is limited for

the treatment of TN involving the maxillary or mandibular nerve. If the effects of GKRS for TN involving the ophthalmic division and the maxillary or mandibular divisions are insufficient, neuroablation can be chosen for the treatment.

4. REFERENCES

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