

Trigeminal Neuralgia: Radiofrequency Ablation

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ABSTRACT

Trigeminal neuralgia is the commonest cause of facial pain after 50 years. If medical treatment is insufficient or has too many side effects, an invasive treatment should be carried out. There are three interventions that can be done by pain physicians to provide pain relief, which are radiofrequency (RF) ablation of the Gasserian ganglion, percutaneous glycerol rhizolysis, and percutaneous balloon decompression. Out of these, RF ablation technique is the most commonly used. These interventions are little bit technically demanding because many important structures are situated in the vicinity of Gasserian ganglion, but with better knowledge of fluoroanatomy and needling skill, one can perform this procedure safely and with great success.

Keywords: Headache, Radiofrequency ablation, Trigeminal neuralgia.

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INTRODUCTION

Trigeminal neuralgia or tic douloureux is the commonest cause of facial pain after 50 years. It is known to have worst pain in the world. Its annual incidence is 4 to 5/100,000. In around 90% of patients, the symptom starts after the age of 40 years. It is more prevalent in females than males with a ratio of 1.5:1. Its diagnosis is made mainly by obtaining clinical history and examination as suggested by the International Headache Society. Magnetic resonance imaging scan should be done to rule out specific pathologies like tumor or multiple sclerosis.

ANATOMY

Trigeminal ganglion is also known as Gasserian ganglion. It is located in Meckel's cave and contains the cell

bodies of incoming sensory nerve fibers. Trigeminal ganglion is analogous to dorsal root ganglion of the spinal cord. Trigeminal nerve is the largest cranial nerve. Its single large sensory root enters the brain stem at the level of pons. A smaller motor root emerges from the pons at the same level just adjacent to sensory root. Trigeminal nerve has two main portions namely trigeminal nucleus and trigeminal ganglion. Trigeminal nucleus extends throughout the entire brain stem. Trigeminal ganglion lies within the cranium in Meckel's cave close to the anterior surface of petrous part of temporal bone. It looks like crescentic moon in shape with its convexity directed anteriorly. The motor root runs anterior and medial to the sensory root and passes inferior to the ganglion. The motor root then comes out from the skull through foramen ovale. Just below this foramen, motor root joins the sensory root of mandibular nerve. Ganglion is bounded medially by internal carotid arteries, cavernous sinus, trochlear, and optic nerves. The posterior border is formed by dura of Meckel's cave and cerebrospinal fluid (CSF). Anteriorly, three branches emerge from the ganglion intracranially; ophthalmic (V1), maxillary (V2), and mandibular (V3). The two medial branches (ophthalmic and maxillary) are sensory, whereas the lateral most mandibular branch is partly motor. These nerves are somatotropically located in the ganglion. The ophthalmic is located most medioposteriorly, the maxillary intermediately, and the mandibular in ventrolateral position. Trigeminal ganglion links with autonomic nervous system via ciliary, sphenopalatine, otic, and submaxillary ganglia.

Foramen ovale is situated in the posterior part of the sphenoid bone, posterolateral to foramen rotundum. Mandibular nerve, accessory meningeal artery, and lesser petrosal nerve pass through this foramen. Its average max length is about 7.48 mm and width is 3.7 mm. The shape and size of foramen differ throughout its natural life.

FLUROANATOMY

Anteroposterior view (AP): we must identify left and right, mandible, maxilla, orbital bones.

Submental view: we have to see mentonian arch of the targeted side and look for foramen ovale in between maxilla and mandible. Generally, the foramen ovale is close to the medial side of mandible at the level of the maxilla (second molar tooth).

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In lateral view, we have to identify sella turcica (pituitary fossa), anterior and posterior clinoid process, petrous part of temporal bone, external auditory meatus, and mandible.

TECHNIQUE

Preparation and planning are very important before performing RF ablation.

During RF ablation, patients need to be awake during stimulation, so we have to use sedation and analgesia accordingly. Intravenous fentanyl with propofol and/or midazolam can be used during procedure.

Patients should be on empty stomach around 6 hours in view of sedation and analgesia used. Patient should be in supine position with neck slightly extended. His/her head should be fixed and stable. Intravenous access should be secured.

All instructions regarding stimulations should be explained to maintain proper communication during intervention. All vital parameters should be monitored throughout procedure. Oxygen should be supplemented with nasal cannula. We should prepare the needle entry zone with all aseptic precautions.

First we should take PA view with C arm for confirmation of target and orientation. Then we should obtain submental view by tilting C arm caudally. We have to visualize foramen ovale by rotating the C arm obliquely till it became clearly visible. It will be seen near to medial side of mandible at the level of maxilla. Mark the entry point at the skin by visualizing foramen ovale. Infiltrate the skin with 1% lignocaine and wait for a minute. A 22 G, 10 cm RF cannula with 2 mm active tip electrode is inserted with one finger inside the mouth under tunnel view approach with C arm targeting foramen ovale (Fig. 1).

Advance the needle in parallel axis of C arm in submental view in the direction of foramen ovale. Target

the lateral border of foramen for mandibular, middle for maxillary, and medial for ophthalmic division. In lateral view, the needle should be in the direction toward angle produced by clivus and petrous part of temporal bone. We should not go too deep to avoid needling in cerebral cortex and brain stem area. Once position is confirmed, aspirate for blood/CSF.

Sensory stimulation is done at 50 Hz at 0.1 to 1.5 V setting. Patient should feel paresthesia at desired dermatomes at less than 0.5 V setting. Motor testing can be done with 2 Hz, 0.1 to 1.5 V setting. Mandibular branch has motor fibers, so we can see the contraction of mandible. After successful stimulation and negative aspiration, we can go for RF lesioning.

Before lesioning, sedate the patient or you can inject 0.5 mL of 1% lignocaine also to provide comfort for the patient:

- Lesion 1: 60° for 60 seconds
- Lesion 2: 65° for 60 seconds
- Lesion 3: 70° for 60 seconds

If ophthalmic division is affected, lesioning should be done at 60° or below to preserve corneal reflex:

Evaluate the corneal reflex after each lesioning

Apply sterile dressings

Shift to postprocedure/recovery room

Observe the patient for at least 2 hours with monitoring of all vital parameters.

TROUBLESHOOTING/TIPS

If more than one branch is affected, then perform several lesions by repositioning the electrode. If blood comes out of the cannula, change the position of cannula slightly and aspirate again. If blood comes again, terminate the procedure.

If CSF comes during aspiration, no drug should be given (either local anesthetic before RF or neurolytic solution in neurolysis). It can spread to the brain stem. If patient has artificial dental prosthesis, keep them *in situ*. In edentulous patients, entry point becomes more posterior and the needle trajectory becomes more acute.

Before entry through the foramen, always feel the bony edge of foramen. Then turn the C arm into lateral position to view the entry and have a check on going much deeper. The tip of the cannula must not exceed 2 mm in distance from the plane of clivus. A finger should be placed inside the mouth. This helps to guide the needle and prevents penetration of oral mucosa. There are chances of meningitis in case of oral mucosa penetration.

Impedance monitoring is also very important during RF lesioning. Impedance is generally between 300 and

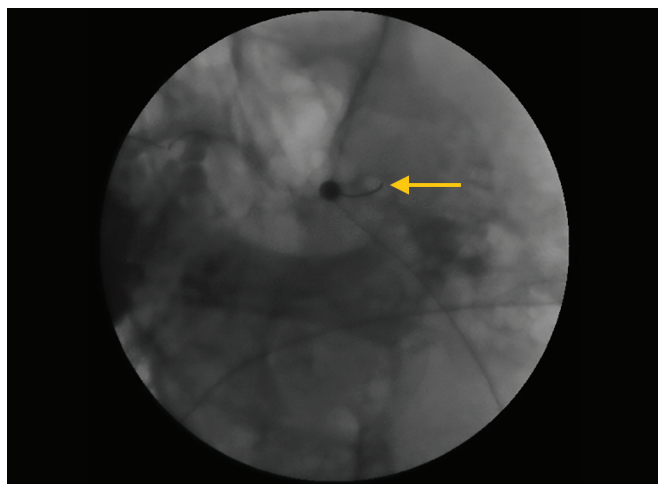


Fig. 1: Needle tip at the foramen ovale (yellow arrow)

450 O if the needle is in the nerve. It is 1,000 O when it is in non-neural tissue. To prevent cheek hematoma, ice compression after withdrawal of the needle should be done in every case.

SUGGESTED READING

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