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# ENDOSCOPIC MICROVASCULAR DECOMPRESSION IN TRIGEMINAL NEURALGIA – ADVANTAGES OF FREE HAND TECHNIQUE

Neurosurgery

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## ABSTRACT

**INTRODUCTION:** Trigeminal neuralgia is one of the most painful diseases known to man. Classical trigeminal neuralgia is characterized by stereotyped attacks of intense pain, of sharp or stabbing quality and can be provoked by trigger factors or trigger areas. It is widely accepted that a neurovascular contact in the cisternal segment of the trigeminal nerve is the primary cause of classical trigeminal neuralgia. Microvascular decompression (MVD) of the trigeminal nerve is a recognised treatment for trigeminal neuralgia, due to vascular compression. The neuroendoscope is not only a complementary tool but can totally replace operating microscope in microvascular decompression. Especially with the use of free hand technique, endoscopes can be taken in further to look behind the trigeminal nerve and also above and below. This amplifies the chance of identifying all the NVCs in a patient and hence reduces the recurrence rate.
**OBJECTIVES:** To establish the usefulness of neuroendoscopes in CP angle surgery with special focus on microvascular decompression for trigeminal neuralgias using free hand technique.
**MATERIALS AND METHODS:** This study deals with a purely endoscopic MVD of the trigeminal nerve using free hand technique through the retrosigmoid route in 50 patients who presented with trigeminal neuralgia from Jan 2015 to April 2019.
**RESULTS :** Out of a total of 50 patients studied who underwent E-MVD , 48 had identifiable NVCs of which 3 had veins only ,2 had multiple arteries and veins and the rest had only arterial NVCs. Amongst the arterial alone group , 4 were due to AICA ,3 were due to AICA and branches of SCA, rest 36 were due to SCA or its branches.
**CONCLUSION:** Use of neuroendoscopes allows one to identify all neurovascular conflicts effectively, even more so when one employs the free hand technique. Hence MVD can be accomplished in all the cases with less chance for recurrence , at the same time with very minimal morbidity and no mortalities

## KEYWORDS

endoscopic microvascular decompression ,neurovascular conflicts , neuroendoscope, root entry zone, trigeminal neuralgia.

## INTRODUCTION

Trigeminal Neuralgia is a relatively common disorder, which, in its classic description, fulfils several clinical criteria.(1) The pain is localized to one or more branches of the trigeminal nerve. It has a sharp, shooting, lancinating, “electric shock”-like character. The pain occurs as a brief episode or attack, lasting several seconds, with pain-free intervals between attacks initiated by stimulation of so-called “trigger zones” or may start spontaneously without obvious provocation. Dandy proposed the neurovascular compression theory accounting for TN in 1934.(2) Gardner and Miklos are credited for being first to decompress a trigeminal nerve as a treatment for TN.(3) It was Jannetta who further explored and popularized MVD as an effective treatment .(4)

Patients were diagnosed based on Burchiel Classification. According to the diagnostic criteria there should be no sensory abnormalities in classical trigeminal neuralgia. Based on ignition hypothesis, a neurovascular contact damages the myelin sheath in the trigeminal nerve which makes the sensory afferents hyperexcitable by means of ectopic pacemaker sites and ephaptic cross-talk and crossed after discharges between axons. It was confirmed by anatomical studies that the root entry zone or transition zone of the trigeminal nerve, where the myelination changes from peripheral Schwann cell myelination to central oligodendrocyte myelination is a site of dysmyelination in patients with classical trigeminal neuralgia with a neurovascular contact.

Since Dandy postulated that vascular compression of the trigeminal nerve is responsible for TN, microvascular decompression (MVD) has been widely used with good outcomes.(2,5). Many neurosurgeons use endoscopy in combination with the microscope (endoscope-assisted MVD) (6-8) whereas very few neurosurgeons across the world do fully endoscopic MVD (E-MVD).

## OBJECTIVES

To establish the usefulness of neuroendoscopes in CP angle surgery with special focus on microvascular decompression for trigeminal neuralgias using free hand technique.

## MATERIALS AND METHODS

We included 50 patients with the diagnosis of unilateral classical trigeminal neuralgia who underwent E-MVD using free hand technique during the period from Jan 2015 to April 2019 . Atypical facial pain syndromes ,Bilateral classical trigeminal neuralgia, prior microvascular decompression were excluded from the study. Tumors, vascular malformation and multiple sclerosis were also excluded from the study.

When patients were not responding to medical treatment ,endoscopic surgeries were carried out. Neurological deficits were ruled out preoperatively in all patients. Magnetic resonance imaging (MRI) scans were performed preoperatively especially to detect any NVC. Other secondary causes of TN can also be ruled out by imaging studies. E-MVD was performed in all patients without any assistance of microscope. Cerebrospinal fluid leak, cranial nerve deficit, infection and recurrence of pain, were assessed postoperatively. Patients were followed up on an average from 3 months to 3 years .

## SURGICAL TECHNIQUE

Patient was positioned in supine with head turned to opposite side with a towel roll under the ipsilateral shoulder. A linear 4-5 cm incision was marked behind the ear from the asterion caudally. 2.5 cm keyhole retrosigmoid craniotomy posterior to the junction of sigmoid and transverse sinus was made. A 25 degree 2.7 mm Karl Storz scope was used for the E-MVD. Dura was opened in a C shaped fashion with base to sigmoid sinus. Arachnoidal dissection was done meticulously starting with the opening of cisterna magna by directing the endoscope caudally to laxen the brain. While introducing the instrument one has to initially guide it visually and then with tactile feel of the instrument gliding past the endoscope into the field of vision. This way we can prevent cerebellar/neurovascular injury. Inspection of all neurovascular bundles was done in a sweeping fashion from cranial to caudal. Arachnoidal dissection of trigeminal nerve with both sharp and blunt technique. The offending vessels were identified and mobilised away from the nerve very meticulously. Since we employ a free hand technique and use a smaller diameter endoscope we routinely use the scope to look in every nook and corner, including the ones that are medial to the nerve and those that hide near the meatus. If we rely on larger diameter scopes mounted on an endoscope holder and a preop MRI to identify NVC's it wouldn't be possible to identify all NVC's and provide complete relief to the patient. Only Teflon was used for interpositioning. If no NVC's could be identified a thick arachnoid jacket is dissected to free the nerve and internal neurolysis of nerve was done by dissecting all nerve rootlets from the meatus to the root entry zone. No veins were cauterised at any point of time. No brain retractors were used. Dura was closed primarily with a burr hole titanium mesh.

## RESULTS

Our study group comprises of 50 patients; 38 were females and 12 were males. Age of patients at surgery ranged from 37 to 82 years(average 61.5 years). Left sided trigeminal neuralgia was more prevalent in our study than right( left n=40 , right n=10). Preoperative duration of trigeminal neuralgia ranged from 6 months to 15 years. Three trigeminal nerve branches were involved in 8 patients, two branches in 25 patients, and single branch in 17 patients . Intraoperatively 2 patients had no identifiable NVC's. There was only a thick veil of arachnoid like a jacket . Venous compression was identified as the sole cause in 3 patients with a venous aneurysm in 1. In 2 patients there were 4 NVC involving both SCA branches above , AICA from below and a vein from the medial aspect .In the rest 43 patients only arterial NVC were identified. Trigeminal nerve was identifiably deformed / stretched and flattened significantly in 32 cases. Dynamic compression /deformation/stretching was made out in 10 cases. Amongst the arterial alone group , 4 were due to AICA ,3 were due to AICA and branches of SCA, rest 36 were due to SCA or its branches. No procedure was abandoned or converted into microscopic assisted MVD.

Surgery time ranged from 90 minutes to 180 minutes. As one gets used to the procedure surgery time becomes less and less .In recent days the average duration of the procedure has come down to 110 minutes. No patient received blood transfusion in our study.Average blood loss is estimated to be less than 100 ml.

Postoperatively 3 patients had House Brackman's grade 3 facial palsy with complete recovery within 6 months. 1 patient had CSF leak , no postoperative wound infection , no mortality occurred in our case series. So far recurrence occurred in 1 patient 2.5 years after surgery which was transient following a suspected Hand Foot Mouth disease. 1 patient did not derive complete pain relief postoperatively with persisting neuralgic pain in one division and at the same time the character of the pain has also changed from a lancinating intractable pain to intermittent dull aching pain. 1 octogenerian required post operative ventilation since post anaesthesia recovery was delayed.

## DISCUSSION

Although surgeries alone offers permanent pain relief , medications such as carbamazepine , phenytoin , gabapentin are used routinely. Many patients eventually opt for surgery in view of failing pain relief or due to side effects of drugs.

Other modalities of surgery include alcohol block, radiofrequency gangliolysis, glycerol rhizotomy. Drawbacks of these procedures include facial anesthesia or keratitis. Pure endoscopy or endoscope-assisted microvascular decompression has been found to give better results than using a microscope (9,10). Though most of the procedure is done with a microscope in M-EVD, the endoscope is introduced to see NVC and to know if proper decompression has been done. This time wastage in changing from the microscope to the endoscope and back to the microscope can be avoided if the entire procedure can be performed using endoscopy. We were able to complete surgery with the endoscope alone, including release of CSF from the cisterna magna by directing the scope inferiorly towards the cistern. The nerve from pons to ganglion could be visualised with entirety without any brain retraction. Similar observations have been made by other authors (11,12)which also included visualization of vascular conflict on the ventral aspect of the nerve .

New NVC which could be missed by microscope in 7.5-33% patients (as reported in other studies) can be identified by endoscope.(11,13). The endoscopic approach is also helpful in patients in whom the petrosal veins may block the access to the REZ without additional fissure opening or sacrifice of vein.(14). In certain studies, decompression was not found sufficient at the end of procedure using the microscope alone and follow up endoscopy revealed the need for additional decompression procedures .Hence Endoscopy helps in better identification of completeness of decompression after surgery in TN . (15)

Advantages of Endoscopic technique includes a smaller skin incision, smaller bony opening, minimal dura incision, no brain retraction, less need for manipulation of the nerve, without any need to split cerebellar fissures, and no drilling of the bony prominence to get access to the full course of the nerve and all conflicts, even in patients with prominent tubercle. Similar observations were made in other case studies using an endoscopic technique or E -MVD.(16) Brain retraction was not required in our case series.

The CSF leak rate in our study was 2.0% which was temporary and relieved within 3 months with conservative measures. According to Yadav et al. (17), Balansard et al. (18), Miyazaki et al. (19), and El-Garem et al. the rate of CSF leak was 1, 2.4, 3.6, 10% respectively. Muscle pieces interpositioned between the dura mater, use of artificial dura mater, cranioplasty, and sealing of mastoid sinus by bone wax and muscle can be effective techniques for the prevention of CSF leak. Delayed removal of stiches and meticulous repair of the dura could be responsible for the lower incidence of CSF leak in our series.

Pain recurrence was 2% in our study. In other studies with long term follow up, recurrence rates from 18 to 34% have been reported .(20) Re-displacement of the vascular loop, missing the NVC at the time of surgery, granuloma formation, and adhesion between the trigeminal root and fibrin glue or prosthesis can be the causative factors for recurrence. TN can also occur due to re-growth of new vein and artery. Missing the NVCs at the time of surgery is the major cause of recurrence. This can be mitigated by employing free hand technique.

## CONCLUSIONS

Though Endoscopic MVD has a very steep learning curve , when one learns and practices it with due diligence, patients benefit the maximum. Free hand technique helps in identifying all neurovascular conflicts without fail. Also the added advantage of not requiring brain retractors leads to reduced postoperative morbities.

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