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Microvascular Decompression for Trigeminal Neuralgia: Our Experiences at Bir Hospital

Trigeminal neuralgia (TGN) is a very peculiar disease, mostly characterized by unilateral paroxysmal facial pain, often described by patient as 'one of the worst pain in my life'. This condition is also known as 'Tic Douloureus'. The annual incidence of TN is about 4.7/100000 population, male and female are equally affected. The diagnosis is usually made by history, clinical findings and cranial imaging is required to rule out compressing vascular loop, organic lesions and Multiple Sclerosis (MS) at Trigeminal nerve (TN). Treatment of TGN ranged from medical to surgical intervention.

Between September 2007 and April 2015, 20 patients underwent micro vascular decompression (MVD) of TN for TGN who were refractory to medical treatment at department of Neurosurgery, Bir Hospital. All decompressions were performed using operating microscope. Follow up period ranged from 22 months to 8 years.

There were 9 males and 11 females and age ranged from 30-70 years. The neuralgic pain was localized on right side in 13 patients and left on 7 patients. Pain distribution was on V3 (mandibular branch) dermatome in 11, V2(Maxillary branch) in 4, V2-3 in 2 and V1-2-3 in 3 patients respectively. On intraoperative findings TN was compressed by superior cerebellar artery (SCA) in 8, tumors in 4, unidentified vessels in 3, veins in 2, anterior inferior cerebellar artery (AICA) in 1 and no cause was found in 2 patients. 7 patients suffered postoperative complications which included hyposthesia in 3, pseudomeningocele in 3 and meningitis in 1. There was no mortality in this series. 20 patients felt pain relief immediately after procedure and 1 patients came after 3 years with recurrent pain requiring second surgery.

In conclusion, MVD for TGN in younger patients who are refractory to medical treatment is one of the best treatment options which is safe and long term pain relief is achieved in majority of cases.

Key Words: microvascular decompression, recurrence, surgical results, trigeminal nerve, trigeminal neuralgia

Trigeminal neuralgia (TGN) is a clinical condition characterized by sudden sharp, shooting, lancinating pain lasting several seconds to minutes and localized to one, two or three branches of trigeminal nerves (TN). The pain is usually unilateral, however, bilateral facial pain have been reported in the literature. The attack of pain usually starts by stimulation of so called trigger zones like teeth brushing, eating, chewing, drinking, washing face etc. Annual incidence of TGN is 4.7/100,000 population per year. [9]

Most cases of TGN are still referred to as idiopathic, although many are associated with vascular compression of the trigeminal nerve. In minority of cases pain might be due to multiple sclerosis (MS) or nerve compression by tumors.[16] TGN due to compression by tumors is about 4% and most common tumors are trigeminal schwannomas, acoustic neuromas, dermoid and epidermoids. Two percent (2%) of patients with MS have TGN, where as 18% of patients with bilateral TGN have MS.[13]

Diagnosis is usually made by classical history, however, cranial imaging like CT Scan /MRI is indicated to exclude other pathology such as tumors, vascular malformation, MS and other abnormalities of brain Stem.

First line treatment of TN is always drug therapy and carbamazepine is the first choice of drug. Other drugs which are being used alone or in combination of carbamazepine are amitryptilline, gabapentine, pregabapentin and baclofen.[16]

If medical treatment fails or is not tolerated surgical interventions are available. Surgical interventions ranged from ablative therapy like percutaneous rhizotomy to MVD.[2,9] After the popularization of MVD by Peter Jannetta in 1970s , MVD became one of the best and widely used treatment option for TGN.[8] Non invasive treatment like Gamma Knife/Cyber Knife has been shown effective treatment to relieve neuralgic pain in some patients, however, long term results are not available. [4,10]

In this study 20 patients suffering from TGN and underwent MVD were retrospectively analyzed and results were discussed with review of pertinent literature.

Materials and Methods

This is a retrospective study of case series of TGN who were not responding to medical treatment and underwent MVD after clinical and radiological evaluation. Details of cases were retrieved from admission charts, OT register, discharge summary files and follow up records. Between September 2007 and April 2015, 20 patients underwent MVD at department of Neurosurgery, Bir Hospital. All MVDs were performed using operating microscope. We do not use intraoperative brainstem auditory evoked potentials monitoring. Follow up period ranged from 22 months to 8 years.

Surgical Technique of MVD

After general anaesthesia patient is kept in supine obligue or lateral decubitus or park bench position with head fixed to Mayfield's three pins after head is mildly flexed, rotated up to 10^0 and making the head parallel to floor providing maximum exposure of postauricular retromastoid area. About 4-6cm mildly curvilinear or straight skin incision is made just 1.5 – 2cm behind or medial to the mastoid groove or notch. The extension of incision should be 1/3 above and 2/3 below the transverse sinus which should coincide with an imaginary transverse line drawn from tragus. Retromastoid suboocipital bone is exposed after deattachment of muscles and pericranium. A standard 2-3cm diameter suboccipital craniectomy or craniotomy is performed at the junction of transverse and sigmoid sinuses and exposing the edges of transverse sinus above and sigmoid sinus anteriorly. The curvilinear dural opening is made and reflecting dural edges toward sigmoid and transverse sinuses. The cerebellar hemisphere is gradually retracted medially and CSF is drain and in many occasion cervicomedullary cistern needs to be punctured to drain CSF adequately to lax brain. At this point operating microscope is brought to the operating field. Now inside the CP angle area we can see petrosal vein, 7^{th}& 8^{th} nerves and lower cranial nerves from above to downward. Arachnoid membrane covering the petrosal vein to 7 and 8 cranial nerves are opened up by sharp dissection. If petrosal vein is under tension or started bleeding, it is diathermized and divided. After opening arachnoid layer 5^{th} nerve is visualized which is located anterior to petrosal vein and anteriosuperior to 7^{th} and 8^{th}nerves.In majority of cases the offending vessel compressing dorsal REZ of TN is found. Occasionally , more than one vessel may be identified. The vascular loop is well recognized and displaced with sharp dissecton and a Teflon or muscle piece is placed in between TN and vascular loop to avoid contact. After proper hemostasis dura is closed in water tight fashion. The wound closed in anatomical layers after replacing and repositioning bone flap if free bone flap has been raised previously.

Results

Twenty patients underwent MVD for TGN who were refractory to medical treatment. There were 9 male and 11 female and age ranged from 30- 70 years. Pain was localized to right face in 13 patients and to the left in 7 patients. Branches involved were V3 (11), V2 (4), V2 &

V3 (2) and V1 V2 & V3 (3) respectively **(Table 1)**. All 20 patients undergone MVD had intractable facial pain despite multi drugs therapy treatment. Prior to surgery, all patients were advocated for cranial MRI. 16 patients had normal cranial imaging and 4 patients had cerebellopontine angle masses. All patients underwent standard unilateral suboccipital retromastoid craniectomy and MVD of TGN in park bench position under general anaesthesia. MVD was performed using operating microscope in all cases.TN were compressed by SCA in 8, tumors in 4, unidentified vessels in 3, veins in 2, AICA in 1 and no cause was found in 2 **(Table 2)**. 7 patients suffered postoperative complications which included hyposthesia in 3, pseudomeningocele in 3 and meningitis in 1 patient **(Table 3)**. There was no surgery related mortality in our series. Pain was relieved immediately after MVD in all cases. All patients were discharged from hospital within 7 to 10 days after postoperative cranial imaging. There was one patient who came after 3 years of MVD with recurrence of pain and underwent second decompression **(Table 4)**.

Trigeminal nerve branches	No of cases (%)
V2	4 (20%)
V3	11 (55%)
V2 & V3	2 (10%)
All	3 (15%)

Table 1: Pain distribution

Causes of compression	No of patients (%)
Superior cerebellar artery (SCA)	8 (40%)
Anterior inferior cerebellar artery (AICA)	1 (5%)
Veins	2 (10%)
Unidentified vessels	3 (15%)
CP angle mass	4 (20%)
No cause	2 (10%)

Table 2: Etiology of trigeminal neuralgia

Complications	No of cases (%)
Facial hyposthesia	3 (15%)
Pseudomeningocele	3 (15%)
Meningitis	1 (5%)

Table 3: Post operative complication of MVD

Outcome	No. of cases	Percentage (%)
Immediate pain relief	20	100
Long term pain free	19	95
Recurrence	1	5
Morbidity	7	35
Mortality	0	0

Table 4: Outcome of MVD

Discussions

If a patient does not obtain relief from neuralgic pain with medical treatment, then some form of interventions may be advocated. It is estimated that up to 50% of the patients suffering from TGN will sooner or later be in that situation [4]. Among invasive procedures, there are mainly two, one is ablative and other one is non destructive procedure. Ablative procedures are lesioning nerve fibers or ganglion cells such as peripheral nerve section, ganglionectomy, rhizotomy etc. Percutaneous procedures like Chemical rhizotomy(Glycerol), Thermal coagulation, balloon compression of Gasserian ganglion are commonly practiced ablative procedures which are comparatively safe and less invasive.[12]

More recently Gamma Knife therapy has been used to make a lesion in the trigeminal dorsal REZ by means of a stereotactic technique, however, its efficacy and long term results are not available.[4,10]

The non destructive procedure is MVD, which is widely accepted main surgical option for TGN these days.

Walter Dandy used to do open trigeminal nerve sensory fibers section for TGN and in many occasions during surgery he found vascular loops compressing the trigeminal nerve. Then in 1932, he proposed that trigeminal neuralgia could be due to a mechanical compression or irritation of the nerve root.[4] In 1959, James Gardener tried to perform MVD but he could not succeed due to lack of proper instruments.[7] On this basis, Peter Jannetta, in 1967, performed first successful MVD using operating microscope and microinstruments and later on he popularized it.[8] Now a days, MVD became a widely applied procedure for TGN.

Patients who are refractory to medical treatment and/or who developed drug intolerance like allergic reaction, are the ideal candidates for MVD. Predicting outcome of MVD for individual patients is difficult, however, previous experiences have shown that if the patient is male, has immediate postoperative pain relief, if there is no cause of venous compression, if shorter duration of disease and no previous surgery, respond better to MVD and offers best

long term cure rates.[1,5,11,13,15] Outcome also varies with the case load of the operating surgeons.

MVD is a non destructive procedure and curative in more than 85% of cases, however, it is a major surgical undertaking and should be performed under general anaesthesia, so best avoided in old age with comorbidity. Though rare, lethal complication like meningitis can occur which may kills patient if not diagnosed and treated in time. [5,11] The general morbidity such as hearing loss and sensory disorders in trigeminal distribution varies between 0.2 and 4.5%. [13,15] The aim of operation is to remove the suspected compression of the nerve by a loop of an artery or sometimes a vein near brainstem at dorsal REZ. Gold standard procedure is microscope assisted MVD which has been practicing widely by neurosurgeons, however, since last few years endoscope assisted MVD is gradually emerging procedure but its long term results are not available.[3]

Most common compressing structures found during MVD are SCA, AICA, arteries, veins and tumors. In Jannetta's series of 163 cases, common compressing structures were SCA (82), AICA (9), veins (19), arteries and veins (22), tumors (13), multiple sclerosis (4), atrophic nerve (2).[11] In Oseman series of 156 patients, TN was compressed by SCA in 66% , 14% by arterial and venous compression, 9% by only veins, 3% by tumors and in 6% there was no compression.[13] In Bohman and et al's series of 47 patients, SCA was the most common cause of TN compression in 89% of patients.[3] Similarly in our present series Compression of TN was caused by SCA in 8 patients, tumors in 4, unidentified vessels in 3, veins in 2, AICA in 1 and no cause was found in 2.

One of the most common complication after MVD is hyposthesia over the trigeminal dermatome and 3 patients in our series had developed hyposthesia which was transient. 11 out of 362 patients in a series of Marc Sindou, had developed postoperative hyposthesia, paresthesia and most of them were permanent deficit [15]. In Oesman's series of 156 cases, 13% patients had suffered hyperpathia and hyposthesia. Other cranial nerve deficits like 7, 8, 9, 10 and 11 were rare.[13] Transient complications like dizziness, nausea or headache are other common complications.[1,2,9,11,13] MVD seems to be a safe procedure, however, occasionally CSF leak and meningitis can occur.[13,15] In our series one patient had developed meningitis after CSF leakage from the wound which required wound repair, lumbar drain for one week and IV antibiotics for two weeks.

Surgery related death is remote in MVD for TN. There was no mortality in Oesman's series of 156 cases.[13] There was no surgery related mortality in Marc Sindou's series of 362 cases as well.[15] In Peter Jannetta's series of 1185 cases there was 0.2% mortality.[11] In our series there was no surgery related death.

As mentioned earlier long term pain relief after MVD rely on etiology, type of TGN, age of the patients and duration of symptoms before surgical intervention. [1,5,8,11,13,15] Long term cure of neuralgia can be achieved in more than 80% of cases.[5,13,11,15] In Marc Sindou's series immediate pain relief was achieved in 85% and long term pain relief was in 73.38%.[15] In Oesman's series 88% reported immediate pain relief and 82% had long term pain relief.[13] We have similar experienes of having 100% immediate pain relief and 95% in 22 months to 7 years followed up period.

Recurrence of pain after MVD is one of the common clinical scenario. Recurrence is about 20-30% in most of the published series of MVD.[1,2,13,14] In Barker and Jannetta's series of 1185 cases recurrence rate was 30% in 20 years followed up period and most of the recurrence occurred within first two years after surgery.[1] Burchiel et al reported 6% recurrence at 60 months and 42% in 100 months.[5] In our series, there was 5% recurrence in 3 years' period which required second procedure.

Conclusion: MVD for TN in younger patients who are refractory to medical treatment is one of the best treatment options which is safe and long term pain relief is achieved in majority of cases.

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