Efficacy of Microvascular Decompression in the Treatment of Trigeminal Neuralgia: A Retrospective Study of 24 Cases Outcome in a Single Center

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ABSTRACT:

BACKGROUND:

Vascular compression of the trigeminal nerve at its entrance into the pons is the common etiological factor in trigeminal neuralgia. Jannetta developed an operation to move the offending vessel(s) away from the nerve. This procedure is referred to as microvascular decompression because it involves an operating microscope and microsurgical technique. The area is exposed through a lateral posterior fossa craniectomy (retromastoid craniectomy), and after the vessel or vessels are separated from the nerve, a material such as a synthetic sponge or Teflon felt is inserted to maintain the separation.

AIM OF THE STUDY:

Searching for efficacy and complications of microvascular decompression surgery in treatment of trigeminal neuralgia.

METHODS:

The study included retrospective study on twenty-four patients with trigeminal neuralgia over a period from January 2016 to September 2018 at Neuroscience Hospital, Baghdad, Iraq. Preoperative evaluation with magnetic resonance imaging was applied to all patients. Pain was evaluated preoperatively and postoperatively using the Barrow Neurological Institute scale, visual analog scale and BPI-Facial scoring systems. Microscope-assisted microvascular decompression was performed using retrosigmoid craniotomy approach. The postoperative follow-up period was 6 months.

RESULTS:

Initial assessment to MVD patients reveals significant pain complaining with unknown etiology of TGN and normal brain MRI. They are mainly presented with significant right sided predominance and significant female gender predominance MVD patients shows significant improvement in 6 months follow-up compared with the preoperative.

CONCLUSION:

MVD can be offered as a line of surgical treatment for patients with TN. They are very effective method for patients with TN with immediate, better pain relief of TN.

KEYWORDS: microvascular decompression, trigeminal neuralgia

INTRODUCTION:

Trigeminal neuralgia (TN): also known as tic douloureux, is a disorder characterized by recurrent unilateral brief, electric, shock-like pains, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve, often triggered by innocuous trigeminal tactile stimuli. It may develop without apparent cause (classic or typical TN) or may be a result of another diagnosed disorder

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(secondary or symptomatic TN) like due to SCA compression or CPA tumor or MS or infarction.[1-2-4]

In the majority of patients with classic TN, the pain is generated because of compression of the trigeminal nerve at the root entry zone (point in the proximal nerve root central oligodendrocyte myelin persists and has not yet given way to peripheral Schwann cell myelin). The plaques of demyelination that occur lead to hyperexcitability of exposed and potentially injured afferents, which results after discharges large enough to cause a nonnociceptive signal being perceived as pain.[2-8-9]

Currently, the most widely accepted theory to explain TN is the one proposed by Devor—the ignition theory. It is likely that both central nervous system and nerve root changes occur over time, which would account for why not all patients get permanent relief after relief of vascular compression of the nerve root**.**

The major risk factor for TN is MS [3-10]. Despite this risk factor, less than 5% of patients with unilateral TN will be found to have MS Hypertension is a risk factor in women, but the evidence is less clear for men.

A history of TN in a first-degree relative is also a minor risk factor.

TN is a characteristic pain in the distribution of one or more branches of the fifth cranial nerve. In the majority of cases, the pain begins in the second or third divisions of the trigeminal nerve (V2 and V3, respectively). With time, it can spread to other divisions including the first division (V1). However, TN involves V1 in isolation in only 5% of cases. Isolated V1 involvement should lead to careful consideration of differential diagnoses.[9]

The classification scheme used in study for following up patients is: **the Barrow Neurological Institute** has become widely used and is the prototypical composite scale.

I. No pain, no medications
II. Occasional pain, no medications required
III. Some pain, adequately controlled with medications
IV. Some pain, not adequately controlled with medications
V. Some pain, not adequately controlled with medications

BPI scale was implemented as a simple, carefully validated, and widely used questionnaire in the field of chronic pain **(Pain intensity) (Interference in general activities) (interference with activity).**

PGIC… (Patient Global Impression of Change)**. By dividing to 5 groups according to improvement after intervention.**

Medical treatment

Carbamazepine ,Oxcarbazepine ,Gabapentin, Baclofen ,Lamotrigine and Phenytoin.

<u>Surgical treatment:</u>

*Microvascular decompression[1-5]

Other lines (Gasserian gangliolysis, Trigeminal rhizotomy, Gamma Knife radiosurgery, Trigeminal tractotomy, Balloon compression rhizotomy). [1-2-5]

Vascular compression of the trigeminal nerve at its entrance into the pons is the common etiological factor in trigeminal neuralgia. Jannetta developed an operation to move the offending vessel(s) away from the nerve.

This procedure is referred to as microvascular decompression because it involves an operating microscope and microsurgical technique. The area is exposed through a lateral posterior fossa craniectomy (retromastoid craniectomy), and after the vessel or vessels are separated from the nerve, a material such as

a synthetic sponge or Teflon felt is inserted to maintain the separation.[1-2-3]

The trigeminal nerve must be carefully and circumferentially inspected along its entire intracranial course from the root entry zone to its entrance laterally into Meckel's cave. This procedure ordinarily provides pain relief without any facial sensory loss and has a greater potential for producing long-lasting pain relief. It is interesting to note that the tic pain does not always stop immediately following a microvascular decompression, but instead may take several days. Furthermore, nerve manipulation without moving the artery will transiently stop the tic pain although it will soon recur thereafter.

MATERIALS AND METHODS:

The study represents a retrospective included twenty-four patients with trigeminal neuralgia (and follow up them before operation and post operation first month and 3 months and 6 months) by BPI and PGIC and Barrow neurological institute score. Over a period from January 2016, to September 2018 at Neuroscience Hospital, Baghdad, Iraq. Preoperative evaluation with magnetic resonance imaging was applied to all patients. Pain was evaluated preoperatively and postoperatively using the Barrow Neurological Institute scale, visual analog scale and BPI-Facial scoring systems after one month, 3months and 6 months.

To exclude the presence of intracranial lesions (such as neoplasm), preoperative MRI was performed in all the patients. MRI was also done to evaluate and confirm the neurovascular relationships if it was apparent. Microscope-assisted microvascular decompression was performed using retrosigmoid craniotomy approach. The postoperative follow-up period was 6 months.

RESULTS:

Initial assessment to MVD patients reveals significant pain complaining with unknown etiology of TGN and normal brain MRI. They are mainly presented with significant right sided predominance (79.2%) and significant female gender predominance (71%). MVD patients shows significant decrease in Barrow Neurological Institute scores and visual analog scale scores in the postoperative 6 months follow-up compared with the preoperative scores with *P* value <0.01. There is some post operation complications that's treated conservatively.

Table1:Characteristics of 24 patients with TN in this study.

		MVD	%
Gender	male	7	29
	female	17	71
Age (years) ± STDev		59±19	
<40		2	8.3
40-50		10	41.7
50-60		4	16.6
60-70		6	25
≥70		2	8.3

Abbreviations: TN, trigeminal neuralgia;
MVD, microvascular decompression; STDev.,standard

Distribution of pain

Our research showed no involvement of V1 branch of the trigeminal nerve but showed the highest involvement with the combined V2 and V3 branches of the trigeminal nerve (54.1% in MVD). Patients with (V1-2-3) involvement (25%). Patient with only V3 involvement (12,5). Most of the patients were complaining from right sided pain (79.2%). Facial numbness was presented in (25%). No bilateral TGN patients.

Table 2: Distribution of pain during Examination.

	MVD	%
V1	0	0
V2	2	8.3
V3	3	12.5
V1-2	0	0
V2-3	13	54.1
V1-2-3	6	25
Right	19	79.2
Left	5	20.8
Bilateral	0	0
Associated facial numbness	6	25

Drug history (pre-Operation)

In our study, 100% of the MVD group was taking Carbamazepine to control their pain symptoms. Patients taking pregabaline are 12.5% and patients taking gabapentine only one patient and only one patient taking baclofen.

Table 3: Drug history.

Drug of choice	MVD	Dose Per day	%
Carbamazipine	24	1000mg	100
Pregabaline	3	150mg	12.5
Gabapentine	1	900mg	4.1
Baclofene	1	0mg	4.1

Abbreviations: TN, trigeminal neuralgia; MVD, Microvascular decompression; STDev., standard deviation

Previous intervention

Our research included 12 patients (50%) who underwent previous intervention for TN while the previous surgical interventional group contains 4 patients had received GKR (16.6%). 6 patients received local glycerol injection (25%) and 2 patients had gasserian rhizotomy.

Table 4: Previous intervention.

Previous Intervention	MVD	%
GKR	4	16.6
Local injection	6	25
Rhizotomy	2	8.3
Total	12	50

Abbreviations: TN, trigeminal neuralgia; MVD, Micro vascular decompression

Vessel involved in the MVD group

During the MVD procedure, we found that in 16 patients (67%) the trigeminal nerve was compressed by SCA,while 3 patients (12.5%) the trigeminal nerve was compressed by both SCA and AICA. In 3 patients were compressed by AICA (12.5%). Venous compression by the superior petrosal vein (Dandy's vein) was found in two patients (8 %).

In the study we depend on interoperation diagnosis of cause of compression of TN.

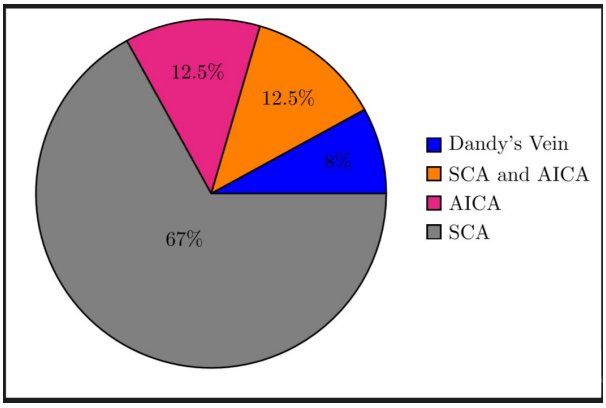

Figure 1: Vessels involved in TGN cause

Preoperative and postoperative pain assessment with BNI and VAS scores BNI (Brief Pain Intensity – Facial scale) score distribution preoperatively was 5 in 15 of patients and come down to one. VAS score (Visual Analogue Score scale) distribution was 9 and come down to 0 or 1 in all of cases. The detailed distribution of both preoperative BNI and VAS scores,

Table 5: Post operation assessment.

	MVD	%
BNI IV	9	37.9
BNI V	15	62.5
VAS mean	9	
STDev+-	1.198	

Postoperatively, patients that do surgery by MVD showed significant improvement in BNI scores compared with their respective preoperative BNI scores (P<0.01). After six months of follow-up while the total number of patients with TN who do MVD and attained pain relief was 23 out of 24 (95.8%), there was only one case did not get benefit with BNI III

Table 6: Pre and post operation assessment.

	BNI I (n)	BNI II (n)	BNI III (n)	BNI IV (n)	BNI V (n)	P value
Pre-MVD	0	0	0	9	15	< 0.01 *
Post-MVD	1	0	1	0	0	
Comparison of BNI treated by MVD after 6 months of follow-up.						
Comparison of BNI of MVD before and after treatment.						
MVD						
VAS mean	1.11			0.01*		
STDev. ±	0.45			<0.01**		
Comparison of VAS treated by MVD after 6 months of follow-up.						
** Comparison of VAS of MVD before and after treatment.						

The postoperative VAS scores mean for MVD were significantly decreased compared with their respective preoperative VAS scores (P value <0.01).

However, MVD group shows good improvement in pain (all P values are =<0.01

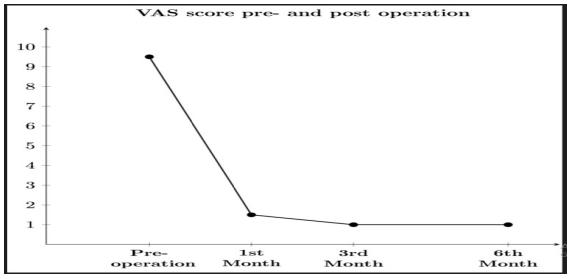

Figure 2:VAS score pre and post operation.

Pre and postoperative pain assessment with BPI-Facial and PGIC scores

The research shows significant decrease in all three categories of the BPI- Facial scale with the highest noticed decrease in the Interference with facial specific activities category (from mean ± standard deviation = 6.08 ± 1.5 to 0.57 ± 0.5 in the MVD group). However, there was a significant difference in all categories of the BPI-Facial score favoring MVD over other modalities of treatment

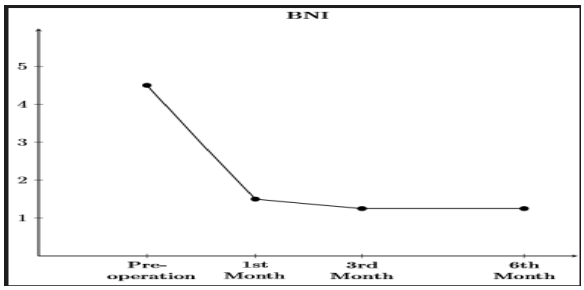

Figure 3: Pre and post operation BNI score.

We calculated the Patient Global Impression of Change (PGIC) after 6 months of post-surgical procedure follow-up. The highest results in our research was " very Much improved" reaching to 75 % while about 16% of patients described a PGIC of "Much improved" and about 19 % of patients described a PGIC of "Minimally improvement.

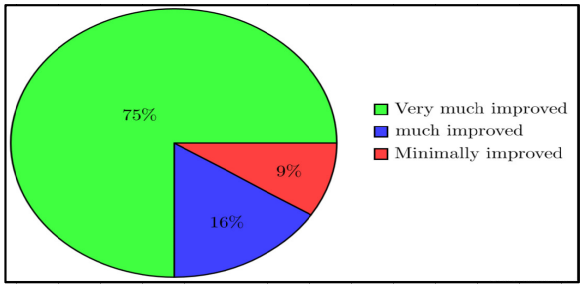

Figure 4: Post operation improvement.

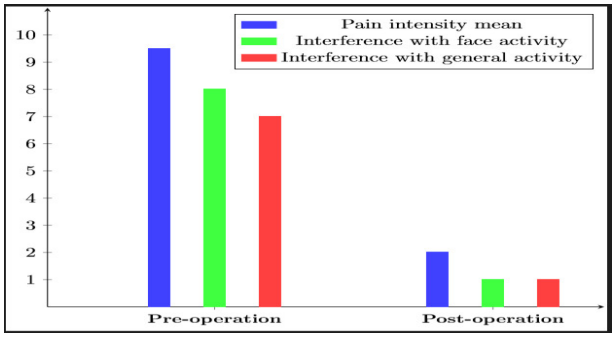

Figure 5 : Pre and post operation pain intensity

We found that the raw change score (subtracting the follow-up score from baseline score in each category of the BPI-Facial score) and the percentage change was more in patients who described their PGIC (Patient Global Impression of Change) of "Very much improved" in MVD groups.

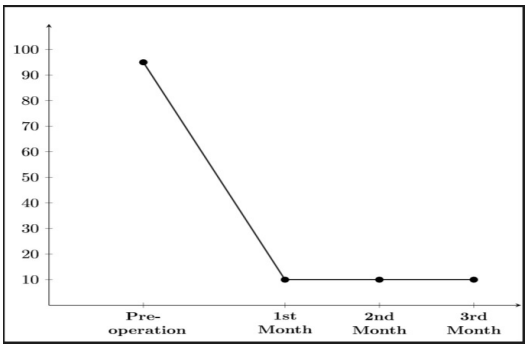

Figure 6: Post operation pain intensity follow up.

Postoperative pain remission rate

The research shows pain relief immediately after operation. There is only one patient with moderate change and one patient without obvious improvement. (P<0.01).

The pain relapse rate equal in our follow up for one case of MVD group within 6 months (4.16%). And the case with moderate improvement was stable without increasing in severity of pain.

This shows us that the remission rates were significantly different in our patients.

Postoperative complications and hospital stay

The postoperative hospital stay for MVD patients was one week+-2 days.

Our patients' preparation for operation needs 7 days in average with full investigations and anesthetic consultation with co morbidity disease controlling.

There was no corneal numbness, eye problem, diplopia nor hearing problem our patients. One patient symptoms and signs of anesthesia dolorosa. There was one case with bacterial meningitis with otitis media history who treated by antibiotics, but there was a local wound

skin infection in three patients (12.5%) which was treated by simple conservative measurement by dressing changing and oral antibiotics and NSAID. We found 3 cases with csf leak (12.5%) treated conservatively and stopped after 3 weeks (one case csf otorrhia remain for more than month), we have one case of cerebellar ataxia and one case of facial palsy grade 5.

Table 7 : Post operation complications.

		MVD	(%)
Cerebellar signs	1		4.16
Paresthesia within the 5th Cranial nerve divisions.	1		4.16
Anesthesia dolorosa	1		4.16
Meningitis	1	4.16	
Csf leak	3	12.5	
Wound infection	3	12.5	
7th C.N palsy	1	4.16	

DISCUSSION:

In our retrospective study - which was carried out in a single center- our finding shows that microvascular decompression procedures are effective and can be recommended as a line surgical treatment for patients with trigeminal neuralgia and can be recommended as an adjunctive line of treatment as well.

About 83% of patients with TGN have been reported to have vascular compromise of the trigeminal nerve (fifth cranial nerve), with 63.8% − 80% of such vessels found to be superior cerebellar arteries and 9% − 35% being veins. Approximately 92% of patients in our study who underwent MVD showed that the trigeminal nerve was compressed by cerebellar arteries we found that in 16 (67%) patients the trigeminal nerve was compressed by SCA while 3 patients (12.5%) the trigeminal nerve was compressed by both SCA and AICA. In 3 patients were compressed by AICA (12.5%). and about 8% of patients showed that the compression of the trigeminal nerve was by veins.[1-2-12-13]

Two studies showed that patients with TN who were treated by MVD expressed excellent results with up to 98% of patients reporting immediate pain relief and more than 85% and 80% of patients pain-free without medication at the 5 and 9 years' follow-up, respectively. [1-2-12-13]

.Other previous studies showed that the success rate of MVD for the treatment of trigeminal neuralgia ranged from 75% to 100%.

In our study, patients showed spectacular results with more than 95.4% success rate within six months of follow-up. Theoretically, patients should express immediate pain relief following MVD. We believe that this delayed response in two patients was due to the long-term vascular compression, which might result in demyelination of the trigeminal nerve. It is possible that a longer disease course with a higher VAS score of patient before

the treatment results in a more resistant/refractory patient to this form of treatment, or may be due to wrong diagnosis of TGN.

Only one out of 24 patients by MVD (about 4.16%) experienced no pain improvement within six months of follow-up. Dia Zi-Feng and colleagues supported our study showing that 6.9% of patients showed pain recurrence (no improvement) within 6 months following surgery. Other studies suggested that the pain recurrence rate in patients with trigeminal neuralgia treated by MVD was from 1% to 19.4%.

CONCLUSION:

Patients with trigeminal neuralgia with failure to respond to medical management may be considered as good candidates for surgical treatments. The selection of surgical treatment should be based on the patient's health and age, and the preference and experience of the surgeon. In this retrospective study, the MVD are effective first line and adjunctive surgical treatment for patients with trigeminal neuralgia. However, patients treated with MVD had superior pain relief rate reaching to 95.4% and lesser pain recurrence. However, the most important determinant of outcome and morbidity is carful patient selection. Morbidity and mortality are very rare complications when the procedure is performed by an experienced surgeon

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