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Different modalities of treatment of trigeminal neuralgia

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Abstract---Background; Trigeminal Neuralgia: It is a syndrome characterised by recurrent sudden & usually unilateral severe brief stabbing. One & more branches of 5th cranial nerve are causing pain. It is painful, brief experience. Pain can occur spontaneously & be triggered by innocuous stimuli like yawning, chewing, light touch, & other transmitted stimuli. & divided by different lengths of pain-free intervals, Aim and objectives; to assess effectiveness of Different Modalities in studied cases with trigeminal neuralgia, Subjects & methods; This research Was showed on group of 20 patients having trigeminal neuralgia managed by different modalities, percutaneous radiofrequency, microvascular decompression, peripherical neurectomy and nerve block. This study was conducted on patients with variant ages at the time of diagnosis, presenting with trigeminal neuralgia, admitted and managed at neurosurgery- Functional unit -Faculty of medicine Al-Azhar University From 2017 To 2021, Result; The description of radiological findings by MRI FIESTA. The major finding was no loop compassing (50%) in patients followed by Arterial loop compassing trigeminal nerve (35%). Most of the patients had V1, V2, V3 affected in 70% of the patients, and 20% of the patients had V2, V3 affected, The major surgery done was Radiofrequency (40%) followed by MVD (30%), Conclusion; females were more frequently impacted by TN than males. All of studied procedures particularly MVD and RF were safe & influence in cure of TN.

Keywords---modalities, Neuralgia, cure, Trigeminal

Introduction

Trigeminal Neuralgia: It is a syndrome characterised by sudden & usually unilateral severe brief stabbing recurrent pain in one & more branches of 5th cranial nerve. It is painful, brief experience. Pain may be unexpected & triggered by gentle, innocuous stimuli like yawning, chewing, light touch, & other transmitted stimuli, with pain-free intervals of differing duration.¹ The occurrence of TGN is nearly 4050 cases per million, with overall incidence of 100200 per million population.² TGN differs with years old, less than five per million in younger than eighteen years, & 800 per million in old age.³ The pain descriptions related to TGN available since prehistoric times. The disorder was first described by Roman and Greek physicians such as Galen & Aretaeus. Johannes, German physician who struggled from TGN, made one of earliest notes on disease in 1671.⁴

Few years later, physician & philosopher John Locke gave thorough explanation of disease, such as cure. Pain is so severe that it is referred to as "suicide disease." Some texts refer to it as prosopalgia, which is derived from Greek words prosopon (face) & algos (pain). Severe TGN causes repetitive facial muscle spasms that mimic facial tics, prompting Nicolas André to coin term tic Douloureux in 1756.⁴ According to earliest studies, TGN has a very poor response to therapy. To cure disease, some people recommend sleeping in dark room, taking hot baths, & drinking wine.⁵ Until nineteenth century, only mode of cure was medication. Quinine, mercury, camphor, opium, arsenic, & ether were among drugs used in cure. Reaction to these drugs was negative. Schloesser performed first percutaneous alcohol injections in peripheral trigeminal nerve in 1904.⁶

Substances injected into gasserian ganglion, as phenol and other types of alcohol. Pollock & Potter proposed using x-rays to verify position of injecting needle in order to reduce difficulties.⁴ Stereotactic electrocoagulation of Gasserian ganglion through foramen ovale was performed in 1931 using head-frame. Seven Sweet & Wepsic conducted first RF thermal lesioning of trigeminal nerve in 1974.⁸ Early surgery date back to 1750s, in 1858: The earliest surgery by Carcochan. Selective sectioning of dorsal trigeminal root fibers known as Spiller-Frazier technique presented in 1920s & widely experienced.⁹ More than decade ago, fully endoscopic microvascular decompression of trigeminal nerve was characterised.¹⁰ The need of endoscope as alternative to microscope in transsphenoidal pituitary surgery to enable resection of inaccessible microscopic assessed transsphenoidal surgery has revolutionised anterior skull base surgery.¹¹ Purpose of this research was to assess efficacy of various modalities in studied cases suffering from trigeminal neuralgia.

Subjects and Techniques

Research Was conducted on group of 20 patients having trigeminal neuralgia managed by different modalities, percutaneous radiofrequency, microvascular decompression, peripheral neurectomy and nerve block. This study was conducted on patients with variant ages at the time of diagnosis, presenting with trigeminal neuralgia, admitted and managed at neurosurgery- Functional unit - Faculty of medicine Al-Azhar University from 2017 to 2021.

Inclusion criteria

Patients with trigeminal neuralgia, patient's loss response to medical treatment and different ages and Comorbidities but type of treatment Differs.

Exclusion criteria

Other types of facial pain.

Techniques

All research participants were exposed to following:

Taking thorough history: Complete medical history, complaint: the chief complaint uses the patient's own words evaluation in other words, history of present illness: Severe pain in sharing of trigeminal nerve or one of its branches, Proper analysis of pain regarding site, character, severity (according to visual analogue scale "VAS"), interval in between attacks, duration, and response to any medication given before **N.B.** Each symptom was analyzed regarding the onset, course, duration, associations, exacerbating factors, relieving factors and associated symptoms: Complete general examination, neuralgical examination, visual analogue score, past history of previous interventions and medical & past history

Neurological examination

Mental Status

Cranial Nerves Examination

- **With special attention to: Trigeminal nerve** (Cranial nerve V) – This nerve is evaluated by having studied case clench their jaw & testing for sensation of ophthalmic, maxillary, & mandibular branches. In comatose studied cases, corneal reflex is usually conducted to measure brainstem function. Lack in awake studied case could indicate localised lesion impacting trigeminal nerve, facial nerve, or both.
- **3-visual analogue scale (VAS):** We assess pain for patients group as a baseline by (VAS) which is valid and reliable extent of chronic pain intensity, as well as acute pain measurement using a ruler. Studied cases provide pain intensity score ranging from zero to ten cm, with score of zero-four cm indicating mild pain. Five - seven cm of moderate pain & eight-ten cm of severe pain

Radiological assessment through

- **FIESTA “fast imaging employing steady state acquisition” MRI:** 3D FIESTA method was used to image pons in TN region.
- **Investigations: Complete blood picture:** Hemoglobin concentration, red blood cells, white blood cells, & platelet count are all measurements, **renal function examination:** serum creatinine, blood urea & urine analysis, **liver Test Profile:** Serum aspartate & alanine aminotransferases, serum albumin, serum bilirubin, prothrombin time & international normalized

ratio, **coagulation profile** (INR, APTT, platelets and fibrinogen) and **ECG and ECHO when needed**

- **Consent for surgery:** All participants who agree to share in this study signed an informed consent form after being fully informed about the technique and its circumstances prior to the operation of full EVD.

Operative procedures

- **Skin incision & soft tissue dissection:** small (5×5-cm) area behind ear is shaved. Before making skin incision, anatomical surface landmarks must be identified. The TS is recognised & characterised along line that connectsinion with zygomatic arch at level of supramastoid crest & passes through asterion. Tip & body of mastoid are then depicted by second line. Small vertical elliptical craniectomy (3×2 cm) is conducted just caudally to asterion using high-speed 5-7-mm cutting drill. Opening is elliptical in shape, with posterior margin of SS & inferior margin of TS forming anterior & superior borders, & sinuses junction forming upper anterior extremity of ellipse.
- **Exposure of CPA & nerve decompression:** microscope is presented at this point in process. Dura mater is opened curvilinearly, with its base toward SS, revealing both tentorium & posterior surface of petrous ridge & generating direct supralateral cerebellar corridor beneath superior petrosal sinus. Trigeminal nerve is investigated along its entire length from its origin at brainstem to its exit through porus trigemini once it has been recognised as running just behind & medially deep to SPV complex.

Postoperative assessment

- Postoperative clinical assessment through: Neurological examination including conscious level and cranial nerves examination and symptoms of increased intracranial pressure
- Postoperative radiological assessment through: Computed tomography (CT) scan of the brain

Percutaneous radiofrequency trigeminal (retrogasserian) rhizotomy

These procedures were performed under fluoroscopic guidance with IV sedation. RF ablation is the most commonly performed procedure A 22 gauge, 10 cm RF cannula was introduced at point two-three cm lateral to, & one cm inferior to, commissura labialis. It was pointed at pupil three cm anterior to external auditory meatus.

Neurectomy: Supraorbital Neurectomy

It is contacted extraorally into incision in upper brow; nerve is recognised & avulsed by reeling on hemostat. Nerve fragments were cauterised. Double-layered closure was suggested.

Infraorbital Neurectomy

maxillary vestibular approach was used to reach infraorbital nerve. Infraorbital foramen was recognised, as well as infraorbital nerve & its peripheral branches.

Nerve was then avulsed from soft tissues & infraorbital canal using hemostat & reeling. Deep in foramen, nerve remnants were cauterised.

Inferior Alveolar Neurectomy

Incision was made lingually & buccally along anterior border of elevated ramus, followed by blunt dissection to deepen its medial aspect.

Outcome

We assessed clinical outcome of the patient by Visual Analog Scale for Pain (VAS Pain) to measurement of pain intensity Befor and after the operation. Ethical consideration: All participants provided informed consent after being notified about research's goals & process, & any applicable objectives. Research procedures had no bad impacts on participants & service provided.

Data management & Statistical Analysis

SPSS version twenty was used for data entry, handling, & statistical analysis. Following examination of significance were used: Kruskal-Wallis, Wilcoxon, Chi square, logistic regression analysis, & Spearman's correlation. Data were expressed, & appropriate analysis was performed based on type of data obtained for each variable. P-values of less than 0.05 were deemed clinically meaningful.

Results

This work was carried out on 20 patients who were admitted and operated for Trigeminal neuralgia from 2017 to 2022 at Al-Azhar university hospitals.

Table 1
Demographic data of 2 tested categories

Variable		Studied cases (n=20)
Years old		
Mean $\pm$ SD		48.65 $\pm$ 11.84
Range		23 – 70
Sex	Male	12 (60%)
	Female	8 (40%)
BMI (kg/m ²)		
Mean $\pm$ SD		24.82 $\pm$ 5.77
Follow up (months)		
Mean $\pm$ SD		16.2 $\pm$ 9.24

The description of demographic data in all studied patients as regard age, that mean age was 48.65 $\pm$ 11.84 years with mean BMI of 24.82 $\pm$ 5.77 kg/m².As

regard Sex 60% of the patients were males. Mean follow up duration was 16.2 ± 9.24 months.

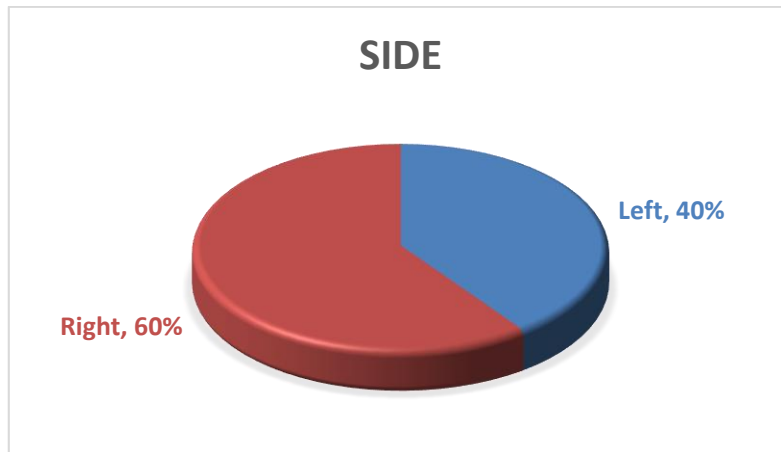


Figure 1. Description of Side distribution among the studied patients

The patient who who complain of trigeminal neuralgia show that the left side was affected in 40% of the patients and right was in (60%)

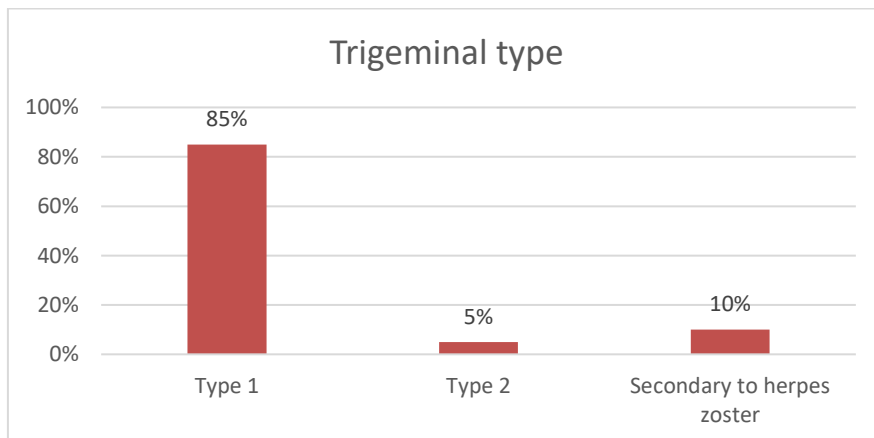


Figure 2. Description of Trigeminal type distribution among the studied patients

Most of the patients were type 1 (85%), secondary to herpes zoster was 10% and only one patient was type 2.

Table 5
Radiology findings distribution among the studied patients

	Patients (n=20)
Arterial loop compassing trigeminal nerve	7 (35%)
No loop compassing	10 (50%)
Teflon graft (previous surgery)	1 (5%)
Venous loop compassing trigeminal nerve	1 (5%)

Venous loop touching trigeminal nerve	1 (5%)
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The description of of radiologiucal findings by MRI FIESTA..The major finding was no loop compassing (50%) in patients followed by Arterial loop compassing trigeminal nerve (35%).

Table 7
Roots affected distribution among the studied patients

	Patients (n=20)
V1	1 (5%)
V2	1 (5%)
V1, V2, V3	14 (70%)
V2, V3	4 (20%)

Most of the patients had V1, V2, V3 affected in 70% of the patients, and 20% of the patients had V2, V3 affected

Table 8
Surgery distribution among the studied patients

	Patients (n=20)
MVD	6 (30%)
MVD (internal neurolythesis)	2 (10%)
Nerve block for V1, V2, V3	1 (5%)
Nerve block for V2	1 (5%)
Neurectomy of V1	1 (5%)
Neurectomy of V2, V3	1 (5%)
Radiofrequency	8 (40%)

The 20 patients who admittd to our hospital that the major surgery done was Radiofrequency (40%) followed by MVD (30%).

Table 9
Complications distribution among the studied patients

	Patients (n=20)
No	12 (60%)
Delayed healing and infection wound	1 (5%)
Dizziness and ataxia	3 (15%)
Dysesthesia on V1,2,3	1 (5%)
Fascial palsy	1 (5%)
Parotid edema	1 (5%)
TMG osteoarthritis	1 (5%)

The major complication was Dizziness and ataxia (15%) which 2 of them were improved and one patient with facial palsy and partially improved on treatment.

Table 11
Preoperative and postoperative VAS according to Surgery distribution between studied cases

	VAS Mean $\pm$ SD		pt	p
	Preoperative	Postoperative		
MVD	9.5 $\pm$ 0.548	1.00 $\pm$ 0.00	38.1	<0.001
MVD (internal neurolythesis)	8.5 $\pm$ 0.707	1.00 $\pm$ 0.00	15	.042
Nerve block for V1, V2, V3	9	1	--	--
Nerve block for V2	9	1	--	--
Neurectomy of V1	9	1	--	--
Neurectomy of V2, V3	9	1	--	--
Radiofrequency	9.38 $\pm$ 0.744	1.25 $\pm$ 0.463	27.5	<0.001

There is important reduce in VAS from preoperative to postoperative in all treatment modalities.

Case (1)

Clinical data

Female pt. 58 y not DM or HTN presented with typical trigeminal neuralgia she received medical treatment and improved initially then pain returned despite increase the dose of medication.

Clinical examination

No surgery or trauma to head and neck, no history of visual & sensory changes and no history of transient neurological deficits or difficulty walking

Radiological investigation

MRI FIESTA Normal.

Operative data

She was underwent percutaneous radiofrequency rhizotomy. These procedures are performed under fluoroscopic guidance. A 22 gauge, 10 cm RF cannula is introduced at point two-three cm lateral to, & one cm inferior to, commissura labialis. It is aimed at pupil from three cm anterior to external auditory meatus. A submentovertex, or oblique submental fluoroscopic view, can be used to envision foramen ovale. Once within foramen, straight lateral view is used to confirm location within Meckel's cave. The cannula is advanced such that the tip of electrode is located at junction of the petrous ridge & clivus. Needle repositioning may be necessary. When location is confirmed, thermo ablation at 50° for 60 seconds is performed with the patient sedated. Adequate lessening is confirmed

by loss of pinprick discrimination in the target distribution, and the needle is withdrawn.



Figure 3. Photo to the patient after insertion of the canula (permission taken)

Follow-up: Smooth recovery, no post-operative complications and studied case was free of pain & we follow up to 6 months.

Case (2)

Clinical data

A 59-y old male patient Not DM or HTN presented with typical trigeminal neuralgia of supraorbital distribution only of 4 y ago not responded to medical treatment. Pain was sharp and stabbing in nature and scored 9 on VAS (Visual Analogue Scale)

Clinical examination

No surgery or trauma to head and neck, no history of visual & sensory changes and no history of transient neurological deficits or difficulty walking

Radiological investigation

MRI and arterial MR FIESTA normal.

Operative data

She went supra orbital neurectomy after discussion with the patient of different modalities by neurectomy or RF according to advantages and complication we choose to do supra orbital neurectomy under sedation.



Figure 4. Supra orbital neurectomy

Follow-up: smooth recovery, no post-operative complications and post-operative follow up showed any recurrence of pain

Discussion

Even though drug treatment is first-line cure for TN, surgical intervention is effective substitute cure option for studied cases who have refractory TN & are experiencing intolerable side effects. Surgical intervention for cure of TN is classified into 2 types: Ablation & non-ablation.¹² This potential observational research was showed in department of neurosurgery- Functional unit -Faculty of medicine Al-Azhar University from 2017 to 2021. This research was showed on twenty studied cases who were admitted & operated for Trigeminal neuralgia by different modalities according to patient age and comorbidity. Our tam of functioanl unit describe the different modalities to the patient and describe the operation and its side effect of any intervention .and choose the operation according to patient age and presentation of symptoms and comorbidity and any compressing vascular loop or no. and if there is 2 modalities of treatment to the patient, the patient can chose the type of operation.

Regarding the demographic data in studied patients, we found that the years old was 48.65 ± 11.84 years, as regard Sex 60 % of the patients were males. Mean follow up duration was 16.2 ± 9.24 months. Th present study can be supported by Hitchon et al.,¹³ who conducted retrospective evaluation of their experience with 195 TN cases 195 studied cases with previously untreated TN were enrolled in research. Seventy nine studied cases had MVD, thirty six had RF, & surviving eighty had SRS. ($p = 0.045$) There were seventy three males & 122 females. Studied cases undergoing more invasive MVD were younger (57 ± 14 yrs) than those currently conducting less invasive RF & SRS (75 ± 15 & 73 ± 13 yrs, $p < 0.0001$). In 195, there was thirty two $\pm$ forty six month follow-up obtainable. In the current study the TN morbidity is greater in women than in men, & it rises with years old. thirteen In line with meta-analysis by Foley et al., (12) who discovered that females outnumber men by 60.5percent, with average years old of

onset of TN being 45.4 years. Also, the present study was supported by the systematic review by Zakrzewska et al.,¹⁵ who aimed to assess the clinical effectiveness of treatments in studied cases with trigeminal neuralgia & multiple sclerosis. The study included 26 studies with a total of 803 patients. And found that years old at onset was forty nine years and majority was females 60.5%.

In the current study we found the most studied cases, TN impacts only one side of face, & right side is more commonly involved than left.¹⁶ In the current study As regard Side distribution among the studied patients, the present study showed that the left side was affected in 40% of the patients and right was in (60%). This was in bargain with Hitchon et al.,¹⁷ who noted that right side was most impacted, with 115 studied cases impacted on right side & eighty studied cases on left. In current study Regarding trigeminal Type distribution among the studied patients, the present study reported that most of the patients was type 1 (85%), secondary to herpes zoster was 10% and only one patient was type 2. However, Wang et al.,¹⁸ reported that all patients were trigeminal type 1.

In this study Regarding MRI FIESTA radiology findings distribution among the studied patients, we found that the major findings was no loop compassing (50%) in patients followed by Arterial loop compassing trigeminal nerve (35%). So, the main cause of trigeminal neuralgia in the current study was Arterial loop compassing trigeminal nerve. Regarding the History of previous intervention among the studied patients, the present study showed that one patient had previous MVD, and one patient had Rf on V2, 3 and other patient show no previous intervention of trigeminal neuralgia. Also, regarding the Roots affected distribution among the studied patients, we found that most of the patients had V1, V2, V3 affected in 70% of the patients, and 20% of the patients had V2, V3 affected. However, Wang et al.,¹⁸ reported that the most common affected roots were V2 + V3 in 48 (28%) patients followed by V3 in 35 (21%) patients then V2 in 27 (16%) patients.

V1, V2, & V3 involvement was 10.5percent, 52.3percent, & 37.2percent,¹⁹ while only one division, two divisions, & three divisions of trigeminal nerve were implicated in 58.2, 32.6, & 9.2percent.²⁰ Regarding Surgery distribution among the studied patients, we found that the 20 patients who admitted to our hospital that the major surgery done was Radiofrequency (40%) followed by MVD (30%). However, Hitchon et al.,¹⁷ reported that TN were managed: with microvascular decompression (MVD) in 79/195 patients, radiofrequency rhizotomy (RF) in 36/195 patients, and stereotactic radiosurgery (SRS) in 80/195 patients. Also, Wang et al.,¹⁸ reported that 340 studied cases underwent first-time cure for idiopathic TN out of them 164 patients were treated with MVD, 168 SRS, and 8 RF. The present study showed that the major complication was Dizziness and ataxia (15%) which 2 of them were improved and one patient with facial palsy and partially improved on treatment. Another study by Artz et al. was conducted on 20 TN patients who underwent MVD and reported lower incidence of complications and a better outcome were also described in other researches

Research by Wang et al.,¹⁸ adverse reactions were more common in MVD group than in SRS cohort. There were six CSF leaks, five pseudo meningoceles, six wound infections, one postoperative hematoma that required evacuation, &

one studied case who feel better from facial nerve palsy. 9 studied cases needed additional surgery for wound revision & washout. There were no cases of long-term hearing loss & neuropathic facial pain. Overall problem rate for MVD in this series was around eleven percent. Sandell et al.,²¹ reported that the most common complications among 19 cases treated with MVD were bacterial meningitis in 1 case, facial numbness in 2 cases, dizziness in 1 case and impaired hearing in 2 cases. The meta-analysis by Li et al.,²² reported that when likened to RF, MVD was linked to higher rates of pain relief & lower occurrences of facial numbness, but higher postoperative problems & total costs. We found that there is a significant decrease in VAS from preoperative to postoperative among the studied group of patients. And according to Surgery type we also found that all procedures resulted in a significant improvement in pain score. In accordance with our results Sandell et al.,²¹ described that VAS score was significantly decreased in patients treated with MVD. Also, Salama et al.,²³ reported that 95.2percent (n = 20) of MVD studied cases experienced instant pain relief, & 90.5percent (n = 19) experienced long-term relief during two-year follow-up period.

Conclusion

In conclusion, TN impacted females more frequently than males. All of processes investigated, especially MVD & RF, were found to be safe & important role in cure of TN. More comparative researches with larger sample size & longer follow-up period are required to verify our findings & identify risk factors for adverse outcomes.

Conflict of interest: no conflicts of interest.

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