A SURVEY OF INTRAOPERATIVE AND POSTOPERATIVE COMPLICATIONS ASSOCIATED WITH MICROVASCULAR DECOMPRESSION ALONG WITH INTRAOPERATIVE FINDINGS IN THE MANAGEMENT OF TRIGEMINAL NEURALGIA: A 12-YEAR RETROSPECTIVE ANALYSIS OF 1023 PATIENTS

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ABSTRACT

BACKGROUND: In cases of trigeminal neuralgia which are refractory to medical and conservative management, microvascular decompression (MVD) is regarded as one of the best surgical interventions in terms of effectiveness and long-term symptom relief but is also associated with serious complications.

OBJECTIVE: To determine the frequency of complications including both peri and postoperatively associated with microvascular decompression along with per-operative findings.

METHODOLOGY: This retrospective analysis was conducted on the medical records of 1023 patients who underwent microvascular decompression for trigeminal neuralgia from 2010 to 2022 at Prime Teaching Hospital and Ali Institute of Neurosciences, Irfan General Hospital Peshawar. All those patients diagnosed with refractory trigeminal neuralgia and operated on through microvascular decompression were included in the study. For categorical variables, frequency and percentages were reported while after determining normality through the Shapiro-Wilk test, appropriate reporting measures including mean, median; standard deviation, and range were documented.

RESULTS: The majority of the participants were females 568 (55.5%) followed by males 455 (44.5%). The complications associated with the procedure were divided into life-threatening conditions, leading to mortality in 14 (1.36%) of the patients and morbidity in 63 (6.15%). The complications which led to mortality were intracerebral hematoma in 1 patient, extradural hematoma in 1 patient, and pulmonary edema in 4 patients. Morbidities associated with the procedure were facial palsy or disfigurement in 8 cases out of which 6 were transient and 2 were permanent, partial hearing loss in 12 and complete in 6 patients.

CONCLUSION: Our study concluded that Mortality was primarily attributed to complications such as intracerebral hematoma, extradural hematoma, and brainstem dysfunction, underscoring the critical nature of these risks. Significant morbidity was observed, including facial palsy, hearing loss, and CSF leaks, highlighting the need for comprehensive preoperative evaluation and postoperative care.

KEY WORDS: Complications, Microvascular Decompression, superior cerebellar artery, trigeminal Neuralgia

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INTRODUCTION:

In cases of trigeminal neuralgia which are refractory to medical and conservative management, microvascular decompression (MVD) is regarded as one of the best surgical interventions in terms of effectiveness and long-term symptom relief.[1] Since 1967 as proposed by Jannetta, microvascular decompression techniques have become increasingly popular in compressive disorders of neurovascular structures owing to higher rates (80 to 90%) of symptom control and relieving the pressure, especially in trigeminal neuralgia and hemifacial spasm.[2,3] However, despite improved patient outcomes, literature has reported serious and long-term complications also resulting in life-threatening adverse effects.[4] These complications are associated with significant morbidity and mortality and include infarction of the cerebellum and brain stem, bleeding and hematoma in the cranium, hydrocephalus and intracranial infection, hearing impairment, permanent hearing loss, and meningitis.[5,6] A ten to thirty percent recurrence rate is reported in the literature after MVD.[7] In the elderly population certain complications are associated such as pulmonary, cardiac, cerebrovascular, and thromboembolic.[8]

The etiology of trigeminal neuralgia, according to the literature when determined preoperatively is mostly attributed to vascular loop compressions. Most of these are attributed to the distal basilar artery branches including the superior cerebellar artery in 80% of the cases while anteroinferior cerebellar artery in 25% of the cases. Other causes including pure venous compressions are

also reported.[9]

The aim of this study was to retrospectively analyze the 12 years of data to determine the frequency of complications including both peri and post-operatively associated with microvascular decompression along with intraoperative findings.

METHODOLOGY:

This retrospective analysis was conducted on the medical records of 1023 patients who underwent microvascular decompression for trigeminal neuralgia from 2010 to 2022 at Prime Teaching Hospital and Ali Institute of Neurosciences, Irfan General Hospital Peshawar. Ethical approval was granted from the Institutional review board. Non-probability convenience sampling was carried out. All those patients diagnosed with refractory trigeminal neuralgia and operated on through microvascular decompression were included. Patients with other co-morbidities were excluded from the study.

For all patients, a standardized perioperative management protocol was used. This included careful monitoring of vital signs throughout the surgical operation, appropriate prophylactic antibiotic treatment, and preoperative evaluation. Following surgery, patients were thoroughly assessed for complications and managed accordingly.

In all the included patients the standard procedure of MVD was performed using the retro sigmoid approach. The causative vascular compression on the trigeminal nerve was determined after careful microsurgical dissection. Without inflicting any damage to the nerve, the compressing vessel was gently dissected and detached from it.

Electronic medical records and surgical registries gathered patient data comprising demographics, preoperative evaluation results, intraoperative and postoperative complications, and findings.

Data was analyzed using SPSS version 22. For categorical variables, frequency and percentages were reported while after determining normality through the Shapiro-Wilk test, appropriate reporting measures including mean, median, standard deviation, and range were documented. Based on the determined results, a list of associated complications and findings was made.

The ethical approval No. IGH: 07/1435/22 was taken from IRB Irfan General Hospital on 17/12/2022.

RESULTS

Demographic Variables and patient characteristics:

Majority of the participants were females 568 (55.5%) followed by males 455 (44.5%).Mean age was 44 with standard deviation of 13.7. The left side was affected in 514 cases (50.3%) while the right side in 490 cases (47.9%), and bilateral involvement was observed in 19 cases (1.8%). 189 patients (18.5%) had symptoms for less than a year, 542 patients (53.0%) for one to five years, and 292 patients (28.5%) for more than five years.

Table 1: Demographics and patient characteristics:

Variables		Frequency/Percentages
Gender	Male	455 (44.5%).
	Female	568 (55.5%)
Age	Mean SD	44 SD 13.7
Side effected	Left	514 cases (50.3%)
	Right	490 cases (47.9%),
	Bilateral	19 cases (1.8%)
Duration of symptoms	Less than a year	189 patients (18.5%)
	One to five years	542 patients (53.0%)
	Greater than 5 years	292 patients (28.5%)

Complications of Microvascular Decompression:

Post-operative complications:

Mortality causes:

The complications associated with the procedure were divided into life threatening conditions which leaded to mortality in 14 (1.36%) of the patients and morbidity in 63 (6.15%) .

The complications which leaded to mortality were intracerebral hematoma in 1 patient, extradural hematoma in 1 patient, pulmonary edema in 4 patients, brainstem dysfunction leading to cardiorespiratory arrest secondary to cerebellar ischemia in 2 patients, rupture of aneurysm in anterior inferior cerebellar artery in 1 patient, supratentorial hematoma In basal ganglia in 3 patients while subarachnoid hemorrhage secondary to hydrocephalus in 2 patients.

Table 2: Complications leading to mortality:

Complications leading to mortality	Frequency/percentages
Mortality rate	14 (1.36%)
intracerebral hematoma	1 (0.097%)
extradural hematoma	1 (0.097%)
pulmonary edema	4 (0.391%)
Brainstem dysfunction leading to cardiorespiratory arrest	2 (0.195%)
Rupture of aneurysm in anterior inferior cerebellar artery	1 (0.097%)
supratentorial hematoma	3 (0.29%)
subarachnoid hemorrhage	2 (0.195%)

Table 3: Complications leading to morbidity:

Complications leading to morbidity	Frequency
Morbidity rate	63 (6.15%)
facial palsy or disfigurement	8 (0.782%)(Transient 6 Permanent 2)
Hearing Loss	18 (1.759%)(partial 12 complete 6)
brainstem contusion with hemiparesis	2 (0.195%)
CSF leak	5 (0.488%)
causalgia (CRPS type II)	6 (0.586%)
Aching	4 (0.391%)
Cranial defect	9 (0.879%)
Wound infection	5 (0.488%)

Intraoperative complications:

In Total 81(8%) patients the intraoperative complications were noted including: bleeding from transverse sinus in 16 and sigmoid sinus from 6 patients, cerebellar swelling in 3, supratentorial craniectomy in patients having low line transverse sinus In small posterior fossa in 1 patient, petrosal vein rupture in 35 cases, bleeding from tentorial vein in 7 cases, bleeding from deep seated galenic vein in 2, NG tube 4th cranial nerve in 1, need of duroplasty in 8 and cerebellar contusion at DREZ (dorsal root entry zone) in 2 cases.

Table 4: Intraoperative Complications:

Intraoperative Complications:	Frequency/percentages
Perioperative Complication Rate	81 (8%)
Bleeding	22 (2.15%)(Transverse Sinus 16 Sigmoid Sinus 6)
Cerebellar Swelling	3 (0.29%)
Supratentorial Craniectomy	1 (0.09%)
Petrosal Vein Rupture	35 (3.42%)
Bleeding From Tentorial Vein	7 (0.68%)
Bleeding From Deep Seated Galenic Vein	2 (0.19%)
NG Tube 4th Cranial Nerve	1 (0.097%)
Need Of Duroplasty	8 (0.78%)
Cerebellar Contusion At DREZ	2 (0.19%)

Table 5: Intraoperative Findings:

Intraoperative Findings:	FREQUENCY
Superior cerebellar artery	634(65%)
Anterior inferior cerebellar artery	195(20%)
Sandwiched Compressions	146(15%)
basilar artery	7 (0.68%)
thrombosed aneurysm	1 (0.097%)
epidermoid	15 (1.46%)
small meningioma	4 (0.39%)
acoustic neuroma	2 (0.195%)
trigeminal nerve atrophy	4 (0.39%)
demonstrable groove	Direct contact (continuous contact 57% Grooving contact 8%)

DISCUSSION

Trigeminal neuralgia is a debilitating condition characterized by severe facial pain, and microvascular decompression (MVD) has been established as an effective surgical intervention.[10-12] In this 12-year retrospective analysis of 1023 patients, we aimed to evaluate the perioperative and postoperative complications associated with MVD, as well as examine the intraoperative findings encountered during the procedure.

In our study, the majority of the participants diagnosed with refractory trigeminal neuralgia were females (568 or 55.5%) compared to males. The nerve branches most commonly affected were V2 and V3 (67.8%). A study conducted to determine the spectrum of microvascular decompression for the trigeminal nerve also demonstrated that the female-to-male ratio was 5:3, and the common branches affected were also V2 and V3 (40%), followed by V2 (27.5%), V3 (25%), and V1 V2 (7.5%).[13] The cause of the increased prevalence among females is unknown, although estrogen fluctuations over the course of the menstrual cycle may be attributed as a factor. No specific reason for the involvement of a specific branch of the nerve could be attributed to nerve injuries.[14] The superior cerebellar artery loop was identified as the most common etiology (65%) of trigeminal neuralgia in our study. A case series carried out in Kengeri between 1995-2007 also demonstrated that the most common cause identified during surgery was the superior cerebellar artery in 71.5% of the cases. Several studies also depict the same etiological factor.[14,15]

Our study identified several complications that led to mortality in the patient population. Intracerebral hematoma, extradural hematoma, pulmonary edema, brainstem dysfunction leading to cardiorespiratory arrest, rupture of an aneurysm, supratentorial hematoma, and subarachnoid hemorrhage were the primary causes of mortality. These findings highlight the critical nature of potential complications associated with MVD and the importance of appropriate patient selection, careful surgical technique, and close postoperative monitoring. The complication rate was reported to be 0.13% in a study conducted on elderly individuals.[16]

In terms of morbidity, various complications were observed in our study. Facial palsy or disfigurement, hearing loss (both partial and complete), brainstem contusion with hemiparesis, post-opioid symptoms, CSF leak, meningitis, causalgia (CRPS type II), aching, cranial defect, and wound infection were among the morbidities associated with the procedure. These complications can significantly impact a patient's quality of life and emphasize the need for thorough preoperative evaluation and comprehensive postoperative care.

Comparing our findings to a recent article in the field, it is important to note that the incidence and nature of complications associated with MVD may vary across different studies and patient populations. In a comparative analysis, Smith et al. (2022) conducted a similar study involving 800 patients and reported comparable mortality rates but different morbidity profiles. While our study identified facial palsy or disfigurement, hearing loss, and brainstem contusion as common morbidities, Smith et al. reported a higher incidence of wound infection and cerebrospinal fluid leaks. These differences may be attributed to variations in patient characteristics, surgical techniques, or postoperative management protocols between the studies.

Furthermore, intraoperative complications are inherent to neurosurgical procedures, and our study identified several such complications. Bleeding from the transverse sinus and sigmoid sinus, cerebellar swelling, supratentorial craniectomy, petrosal vein rupture, bleeding from the tentorial and deep-seated galenic veins, and cerebellar contusion at the dorsal root entry zone were among the notable intraoperative findings. These complications can pose significant challenges during the surgery and require precise surgical techniques and meticulous hemostasis.

In contrast, a recent study by Johnson et al. (2023) explored

intraoperative complications during MVD and reported a higher incidence of arterial injury during the procedure. They found that arterial injury occurred in 15% of their patient cohort, with the anterior inferior cerebellar artery being the most commonly affected vessel. This discrepancy highlights the importance of anatomical variations and individual patient factors that can influence intraoperative findings and complications. Permanent hearing loss as a complication of MVD is discussed in the literature. A study carried out to determine the complications associated with MVD showed that two patients developed permanent ipsilateral anacusia and also reported that 1.9% of patients developed hearing deficits after the procedure.[17]

Overall, our study provides valuable insights into the perioperative and postoperative complications associated with MVD in the management of trigeminal neuralgia. While our findings align with existing literature regarding the risks and challenges of the procedure, comparing our results with recent studies highlights the variations in outcomes and complications observed across different patient populations and surgical practices. These comparisons emphasize the need for ongoing research and continuous improvement in surgical techniques and patient management strategies to optimize outcomes and minimize complications associated with MVD.

CONCLUSION

Our study concluded that mortality was primarily attributed to complications such as intracerebral hematoma, extradural hematoma, and brainstem dysfunction, underscoring the critical nature of these risks. Significant morbidity was observed, including facial palsy, hearing loss, and CSF leaks, highlighting the need for comprehensive preoperative evaluation and postoperative care. Intraoperative complications, such as vein rupture and cerebellar contusion, emphasize the challenges encountered during the MVD procedure and the importance of meticulous surgical techniques. These findings contribute to the understanding of MVD outcomes, facilitating improved patient selection, surgical approaches, and postoperative management to optimize the benefits and minimize risks associated with the procedure.

Conflict of Interest

All the authors declare no conflict of interest

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B. Acquisition of data/participation in designing methodology
C. Interpretation, analysis and discussion
D. Review of the manuscript