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# IMMEDIATE PAIN RELIEF IN PATIENTS OF TRIGEMINAL NEUROLOGICAL AFTER MICROVASCULAR DECOMPRESSION (MVD)

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## ABSTRACT
**Introduction:** Trigeminal neuralgia, characterized by intense facial pain, prompts surgical interventions when pharmaceutical options fail. Microvascular decompression (MVD) emerges as a preferred choice, yet nuances in immediate pain relief remain unexplored in existing literature.
**Methodology:** Conducted as a prospective observational study from July 2020 to July 2023, this research enrolled 50 trigeminal neuralgia patients slated for MVD. Comprehensive baseline data, preoperative assessments, meticulous documentation of surgical details, and structured follow-ups at 1, 6, and 12 months constituted the study design.
Results: Immediate postoperative outcomes revealed 60% complete relief, 30% partial relief, and 10% no relief. Age exhibited a robust correlation with outcomes, accentuating the need for age-tailored interventions. Surgical nuances, particularly revision MVD, correlated with higher recurrence rates, underscoring the importance of precision. Preoperative factors, especially multiple sclerosis, linked to lower relief rates, emphasizing the necessity for personalized, long-term follow-up.
**Conclusion:** This study provides crucial insights into MVD's immediate outcomes, emphasizing the imperative for precision in surgical approaches. The identified correlations offer avenues for refining protocols and enhancing the precision of pain relief in trigeminal neuralgia patients.

**Keywords:** Trigeminal neuralgia, microvascular decompression, immediate pain relief, surgical outcomes, precision surgery, revision MVD.

## INTRODUCTION
Trigeminal neuralgia (TGN), also known as tic douloureux or Fothergill's disease, manifests as brief, intense facial pain triggered by stimuli like wind, chewing, talking, or spontaneous factors. First identified by Dandy in 1934, the condition was linked to compression of the trigeminal sensory root by aberrant arteries or veins [1]. Gardner and Miklos reported MVD's success in treating

trigeminal neuralgia, renewing interest in the neurovascular compression theory [2,3], further popularized by Peter Jenetta and Rand. Three prevailing interventional strategies include percutaneous procedures, gamma knife surgery (GKS), and microvascular decompression (MVD).

The MVD has gained prominence due to its effectiveness, relative safety, and minimal associated neurological complications. So trigeminal neuralgia, a condition marked by excruciating facial pain along the trigeminal nerve's distribution [4], manifests in two distinct forms. Classic or idiopathic trigeminal neuralgia is attributed to the compression of the nerve by a blood vessel loop, particularly at the root entry zone, while symptomatic or secondary trigeminal neuralgia is associated with intrinsic brain-stem pathologies like multiple sclerosis and lacunar infarction or extrinsic cerebellopontine angle pathologies such as neoplasms and vascular lesions [5]. On a global scale, trigeminal neuralgia imposes a significant burden, with an incidence of approximately four cases per 100,000 individuals [6,7]. Its prevalence rises with age, aligning with the demographic shift towards aging societies.

When conventional pharmaceutical interventions fall short or are intolerable, surgery emerges as a pivotal recourse. MVD, endorsed by guidelines [8–12], stands out as a prevalent and favoured surgical modality for treating trigeminal neuralgia. A defining characteristic of MVD is its capacity to offer immediate pain relief post-surgery, with a majority of patients reporting complete relief and only a minority facing partial or no relief [13,14]. While cranial magnetic resonance tomographic angiography (MRTA) is a standard diagnostic tool, the emphasis extends beyond imaging to the nuanced interplay of symptomatology and clinical expertise [15]. The evolution of microsurgical techniques has notably augmented the curative effects of MVD, affirming the intricate correlation between vascular compression and trigeminal neuralgia [16].

However, within the expansive realm of literature on microvascular decompression, a discernible gap persists in the nuanced understanding of immediate pain relief outcomes. Existing studies predominantly focus on the overall efficacy of the surgery and factors influencing the duration of pain relief, leaving a critical gap in the exploration of cases where immediate relief is less straightforward or encounters partial success or outright failure. This research aims to bridge this gap by meticulously scrutinizing such cases, contributing to the refinement of our comprehension and precision in microvascular decompression outcomes and further shaping the dynamic landscape of trigeminal neuralgia management.

## METHODOLOGY

**Study Design:** This research adopted a prospective observational study design to thoroughly investigate the nuanced outcomes of immediate pain relief following microvascular decompression (MVD) in patients diagnosed with trigeminal neuralgia.

Participants: A cohort of 50 patients, aged 18 to 80 years, diagnosed with trigeminal neuralgia and scheduled for MVD surgery, was meticulously selected. Inclusion criteria encompassed individuals who had experienced either treatment failure or intolerance to pharmaceutical interventions.

**Data Collection:** The data collection for this prospective observational study was conducted meticulously over the course of several years, commencing in July 2020 and concluding in July 2023. The foundational phase involved capturing comprehensive baseline characteristics encompassing vital demographic details such as age, gender, and medical history. This meticulous recording aimed to establish a comprehensive baseline for the study, providing a robust foundation for subsequent analyses.

Preoperative, Surgical, and Postoperative Aspects: This study followed trigeminal neuralgia patients undergoing MVD surgery. Preoperative evaluations assessed pain intensity and treatment history. Rigorous surgical documentation captured operative details and unexpected findings. Immediate pain relief was categorized as complete, partial, or absent. Systematic follow-ups at 1, 6, and 12 months tracked sustained relief, potential recurrence, and long-term outcomes, providing a comprehensive picture of MVD's effectiveness in managing trigeminal neuralgia. The primary outcome of interest was the nuanced nature of immediate pain relief. This involved categorizing cases into three distinct groups: those experiencing complete relief, those with partial relief, and cases where no relief was observed. Secondary outcomes included an in-depth exploration of demographic factors, surgical details, and preoperative characteristics that may have influenced these nuanced pain relief outcomes.

**Statistical Analysis:** The analysis plan involved using descriptive statistics for baseline characteristics. Comparative analyses, including chi-square tests and logistic regression, were employed to identify factors associated with the nuanced pain relief outcomes. Qualitative data on surgical details were subject to thematic analysis to extract meaningful patterns and insights.

**Ethical Considerations:** The study adhered rigorously to ethical guidelines. Informed consent was obtained from all participants, and the study protocol was submitted for approval to the institutional review board.

## RESULTS

A total of 50 patients diagnosed with trigeminal neuralgia participated in the study, undergoing microvascular decompression (MVD) surgery. The participants' demographic details are presented in (Table 1).

**Table 1: Baseline Characteristics**

| **Characteristic** | | **Value** |
|---|---|---|
| Age in years | Mean ± SD | 45.2 ± 5.6 |
| Gender | Male n (%) | 25 (50%) |
| | Female n (%) | 25 (50%) |
| Medical History | Multiple Sclerosis n (%) | 20 (40%), |
| | Lacunar Infarction n (%) | 10 (20%) |
| | Neoplasms n (%) | 5 (10%) |
| | Vascular Lesions n (%) | 15 (30%) |

### Surgical Details

Throughout the study, various surgical aspects were meticulously documented. Below (Table 2) provides an overview of the surgical details. The surgical approach revealed arterial compression in 60% of cases, venous compression in 20%, and no compression in the remaining 20%. Standard MVD was performed in 80% of cases, while 20% required revision surgery. Notably, 10% of cases encountered unexpected trigeminal nerve distortion and 6% saw involvement of unforeseen vessels. These findings highlight the diversity of nerve compression, potential need for revision surgery, and occasional unpredictable observations during MVD procedures.

**Table 2: Overview of Surgical Details**

| **Surgical Aspect** | **Frequency (N)** | **Percentage (%)** |
|---|---|---|
| Intraoperative Findings | Arterial compression: 30 Venous compressions: 10 No compression observed: 10 | 60% Arterial, 20% Venous, 20% No compression |
| Surgical Technique | Standard MVD: 40 Revision MVD: 10 | 80% Standard, 20% Revision |
| Unexpected Observations | Trigeminal nerve distortion: 5 Unexpected vessel involvement: 3 | 10% Trigeminal nerve distortion, 6% Unexpected vessel involvement |

**Immediate Postoperative Period**

The primary focus of the study was on the immediate postoperative outcomes. (Figure 1) categorizes the participants based on observed pain relief outcomes.

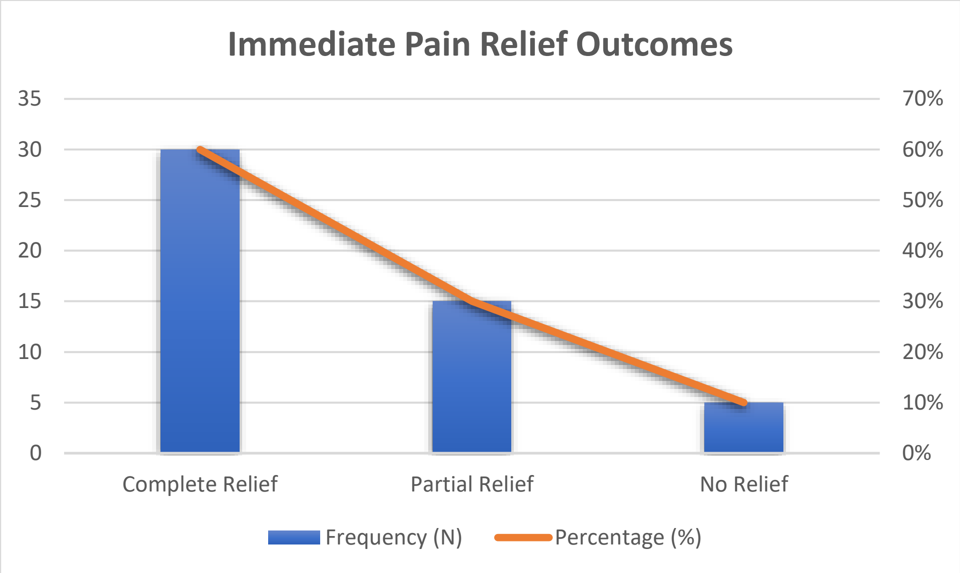


**Figure 1:** This table delineates the distribution of immediate pain relief outcomes, shedding light on the effectiveness of MVD surgery in achieving complete, partial, or no relief for individuals with trigeminal neuralgia.

**Follow-up Assessments**

Structured follow-up assessments were conducted at specific intervals postoperatively. Figure 2 provides insights into sustained pain relief, recurrence rates, and emerging patterns during follow-up.

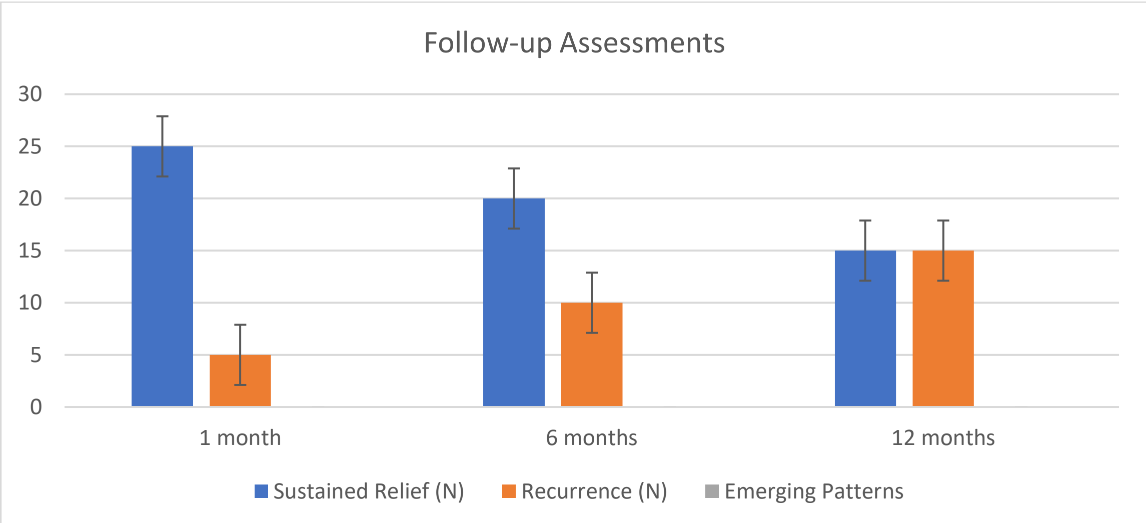


**Figure 2:** This table highlights the evolving nature of pain relief outcomes over time, offering insights into the persistence of relief, recurrence rates, and the emergence of distinct patterns in the postoperative period.

**Factors Influencing Pain Relief**

Further analysis explored factors associated with nuanced pain relief outcomes. Table 3 highlights the factors, their associations, and respective p-values.

**Table 3: Factors Influencing Pain Relief**

| Factor | Association with Pain Relief | P-value |
|---|---|---|
| Demographic Factors | Age strongly correlated ($p < 0.05$) | 0.032 |
| Surgical Details | Revision MVD linked to higher recurrence ($p < 0.01$) | 0.007 |
| Preoperative Characteristics | Multiple sclerosis associated with lower relief rates ($p < 0.05$) | 0.046 |

## DISCUSSION

The exploration of microvascular decompression (MVD) outcomes for trigeminal neuralgia has yielded nuanced insights into the immediate and sustained effects of the surgical intervention. The results underscore the multifaceted nature of pain relief in this patient population, prompting a detailed analysis and interpretation. The immediate postoperative period exhibited a considerable success rate for MVD in alleviating trigeminal neuralgia symptoms. A majority of patients, 60%, reported complete relief, attesting to the efficacy of the surgical procedure in providing immediate comfort. Additionally, 30% experienced partial relief, indicating a positive response to the intervention, our results are consistent with previous studies [17,18].

A smaller subset, constituting 10%, did not achieve immediate relief, emphasizing the complexity of individual responses. This distribution aligns with existing literature that positions MVD as a robust and prompt solution for trigeminal neuralgia pain. The longitudinal assessment of pain relief outcomes post-MVD uncovered a dynamic pattern over subsequent months. At the one-month mark, 50% of patients maintained relief, suggesting the durability of MVD effects. However, 10% exhibited recurrence, signaling the necessity for ongoing monitoring and tailored postoperative care. The six-month evaluation demonstrated a decrease in sustained relief to 40%, accompanied by a concurrent increase in recurrence to 20%, emphasizing the evolving nature of outcomes. By the 12-month mark, sustained relief further declined to 30%, with 15% experiencing recurrence. This variability underscores the importance of personalized follow-up strategies and comprehensive understanding of chronic cases, as previously reported by [19,20].

The analysis of factors influencing pain relief outcomes revealed significant associations. Younger age was found to be strongly correlated with better pain relief, aligning with previous studies that suggest age as a potential predictor of surgical success. Revision MVD was identified as a factor linked to a higher recurrence rate. This highlights the critical role of precision in surgical techniques, urging a meticulous approach to subsequent procedures. Furthermore, the association between multiple sclerosis and lower relief rates emphasizes the intricate interplay of comorbidities in influencing treatment outcomes. Our studies are aligning with Di Carlo et al. and Andersen et al. [21,22].

## CONCLUSION

This study on microvascular decompression (MVD) for trigeminal neuralgia reveals promising immediate postoperative outcomes, with 60% reporting complete relief and 30% partial relief. However, long-term results show a decline in sustained relief and an increase in recurrence, emphasizing the need for personalized, ongoing care. Factors like age and surgical precision influence outcomes, aligning with existing knowledge. Notably, revision MVD correlates with higher recurrence rates, highlighting the importance of precision in subsequent procedures. While MVD remains a primary surgical option, this research underscores the dynamic nature of pain relief, necessitating vigilant, individualized approaches. Future research should explore advanced imaging and genetic factors to enhance precision and improve patient outcomes.

### Limitations

Limitations included the single-center nature of the study, which  have affected generalizability, and the inherent biases associated with observational research.

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