

INTRATYMPANIC DEXAMETHASONE IN THE TREATMENT OF INTRACTABLE TINNITUS

Hafiza Hamna Sadaqat^{*1}, Zeeshan Ali², Sheeza Munir³, Iqra Safoor Iqra⁴, Umer Farooq⁵,
Muhmmad Moaz⁶

^{*1,2,3,4,5,6} CMH Gujranwala

¹hamna.sadaqat12@gmail.com, ²drzeeshan32@gmail.com, ³sheezamunir89@gmail.com,
⁴safoor@hotmail.com, ⁵dromer223@gmail.com, ⁶moazarshad1@gmail.com

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Corresponding Author: *
Hafiza Hamna Sadaqat

Abstract

Objectives

To evaluate the effectiveness and safety of intratympanic dexamethasone in patients with intractable tinnitus who were unresponsive to conventional medical therapy, and to assess both objective clinical outcomes and subjective patient-reported improvements.

Methodology

This observational and interventional study was conducted in a CMH Gujranwala using a mixed-method approach. Patients with persistent tinnitus were selected through purposive sampling. Intratympanic dexamethasone was administered under aseptic conditions at regular intervals. Quantitative assessment included Tinnitus Handicap Inventory (THI), Visual Analog Scale (VAS), frequency and duration of tinnitus episodes, and audiometric hearing thresholds. Pre- and post-treatment values were compared using paired t-tests. Qualitative data were collected through semi-structured interviews focusing on quality of life, sleep, emotional well-being, and patient satisfaction.

Results

The study demonstrated a statistically significant reduction in tinnitus severity, frequency, and distress following treatment ($p < 0.05$). Mean THI and VAS scores decreased markedly, with many patients shifting from moderate-severe to mild categories. Improvements were also observed in episode frequency, duration, and hearing thresholds. Qualitative findings revealed enhanced quality of life, improved sleep, reduced anxiety, and better concentration. Most patients reported moderate to complete relief, although a small proportion showed minimal or no improvement. The treatment was well tolerated with only minor, transient side effects.

Conclusion

Intratympanic dexamethasone is an effective and safe treatment modality for intractable tinnitus, providing both measurable clinical improvement and meaningful subjective relief. It may be considered a viable option for patients resistant to conventional therapies.

INTRODUCTION

Systemic steroids are known to improve hearing levels in sudden sensorineural hearing loss (SNHL), Menière's disease and many other inner ear diseases. Higher steroid concentrations could be achieved in the inner ear and the systemic side effects could be avoided by using intratympanic injection. Recent clinical studies have demonstrated that gadolinium can readily diffuse through the round window membrane ¹. In 1996 Sakata *et al.* treated patients with chronic otitis media (COM), labyrinthine syphilis, Menière's disease, vertigo, sudden SNHL, streptomycin intoxication, acoustic trauma, head injury, or other otological diseases by infusing a dexamethasone solution into their middle ear ². In 2005 Araújo *et al.* in a randomized single-blind study showed no difference between intratympanic injection of dexamethasone and saline in patients with severe, disabling tinnitus ³. Tinnitus is a disabling symptom that can occur alone or with other disorders such as hearing loss ⁴. Subjective tinnitus is the most common form of tinnitus and can be detected in nearly 10% of the general population ⁵. Other factors associated with tinnitus are noise exposure, head injuries, middle ear disorders, ototoxic drugs, and Meniere's disease but idiopathic cases are the most prevalent group ⁶.

Reduced input to the auditory nerve shifts the balance of central excitation and inhibition, which may lead to hyperactivity, increased burst activity, and a more predominant pattern of synchrony ⁷. The 2014 American Academy of Otolaryngology-Head and Neck Surgery Foundation Clinical Practice Guidelines for Tinnitus only recommend cognitive behavioral therapy as an evidence-based therapy for persistent, inconvenient tinnitus ⁸. When the causes of tinnitus are examined, the most common cause of tinnitus is idiopathic tinnitus (62%). The cause of known tinnitus was reported as exposure to noise (20%), head-and-neck injuries (9%), ear problems (7%), ototoxic drug use, and Meniere's disease (2%) ⁹. The pathophysiology of MD remains unclear; the exact cause of it is not very well understood. Modern High- Resolution MRI studies for

patients complying with strict criteria for MD showed Endolymphatic hydrops. However, endolymphatic hydrops may be seen in other ear diseases and has been also confirmed in postmortem studies of some humans with no history of dizziness ¹⁰.

METHODOLOGY

The study design was observational and interventional in nature, carried out over a period of 6 months Jan 2024- Dec 2024, in a CMH Gujranwala. Patients diagnosed with persistent tinnitus, unresponsive to conventional medical therapy, were selected through a non-probability purposive sampling technique. Ethical approval was obtained prior to the initiation of the study from ethical review board of CMH Gujranwala, and informed consent was secured from all participants. The procedure involved the administration of dexamethasone directly into the middle ear through the tympanic membrane under aseptic conditions. Patients were placed in a supine position with the affected ear facing upward, and a specific dose of dexamethasone was injected using a fine needle. The intervention was repeated at regular intervals, depending on the severity of symptoms and clinical response. Patients were followed up periodically to monitor improvements, side effects, and overall tolerance to the treatment. Standardized tools and clinical examinations were used to ensure consistency in data collection.

Quantitative variables were measured to objectively assess the effectiveness of the treatment. These included the severity and intensity of tinnitus, which were evaluated using validated scales such as the Tinnitus Handicap Inventory (THI) and Visual Analog Scale (VAS). Pre-treatment and post-treatment scores were recorded and compared to determine the degree of improvement. Additional quantitative measures included frequency of tinnitus episodes, duration of symptoms, and hearing thresholds assessed through audiometry. Statistical analysis was performed using appropriate software, where mean values, standard deviations, and paired t-tests were applied to evaluate the significance of

changes observed after treatment. Qualitative variables were also incorporated to capture the subjective experiences of patients. These included patient-reported outcomes such as perceived relief, changes in quality of life, sleep patterns, emotional well-being, and overall satisfaction with the treatment. Semi-structured interviews and open-ended questionnaires were used to gather in-depth insights into how tinnitus affected daily activities before and after the intervention. The qualitative data were analyzed thematically, allowing the identification of recurring patterns and personal experiences that could not be fully expressed through numerical data alone.

The integration of both qualitative and quantitative variables provided a holistic understanding of the treatment outcomes. While quantitative data offered measurable evidence of improvement, qualitative findings highlighted the personal and psychological impact of intratympanic dexamethasone therapy. This mixed-method approach strengthened the reliability and validity of the study, ensuring that both clinical effectiveness and patient-centered outcomes were thoroughly evaluated.

RESULTS

The results of the study demonstrated that intratympanic dexamethasone was effective in reducing the severity and impact of intractable tinnitus among a significant proportion of patients. A total of patients who completed the study showed noticeable improvement in both objective measurements and subjective experiences after receiving the intervention. The comparison between pre-treatment and post-treatment findings revealed a statistically significant reduction in tinnitus severity, frequency, and associated distress. Quantitative analysis showed that the mean Tinnitus Handicap Inventory (THI) scores decreased markedly following treatment. Before the

intervention, most patients fell within the moderate to severe handicap category; however, after repeated intratympanic injections, a considerable number shifted to mild or no handicap categories. Similarly, Visual Analog Scale (VAS) scores, which measured tinnitus loudness and annoyance, showed a significant decline. Audiometric evaluations also indicated slight improvements or stabilization in hearing thresholds in some patients. The reduction in the frequency and duration of tinnitus episodes further supported the effectiveness of the treatment. Statistical testing using paired t-tests confirmed that these improvements were significant ($p < 0.05$), indicating that the observed changes were not due to chance.

Qualitative findings complemented the numerical data by highlighting substantial improvements in patients' quality of life. Many patients reported better sleep patterns, reduced anxiety, and improved concentration after the treatment. Emotional distress associated with persistent tinnitus decreased notably, and patients expressed greater satisfaction with their daily functioning. Some participants described complete or near-complete relief, while others experienced partial but meaningful improvement. A small number of patients reported minimal or no change, indicating variability in individual response to the therapy. Overall, patient feedback suggested that intratympanic dexamethasone was well tolerated, with only minor and transient side effects such as mild discomfort at the injection site. The integration of these findings indicated that intratympanic dexamethasone provided both clinically measurable benefits and meaningful subjective relief. The consistency between quantitative reductions in scores and qualitative improvements in patient experiences strengthened the overall conclusion that this treatment modality is a viable option for managing intractable tinnitus.

Table I: Quantitative Outcomes Before and After Treatment

Variable	Pre-Treatment (Mean $\pm$ SD)	Post-Treatment (Mean $\pm$ SD)	Mean Difference	p-value
THI Score	65.4 $\pm$ 12.3	32.1 $\pm$ 10.5	-33.3	<0.001
VAS (Loudness)	8.2 $\pm$ 1.1	4.3 $\pm$ 1.5	-3.9	<0.001
VAS (Annoyance)	8.5 $\pm$ 1.0	4.6 $\pm$ 1.4	-3.9	<0.001
Frequency of Episodes (per day)	10.2 $\pm$ 3.5	4.8 $\pm$ 2.6	-5.4	<0.01
Duration of Episodes (minutes/day)	180 $\pm$ 60	75 $\pm$ 40	-105	<0.01
Hearing Threshold (dB)	45.0 $\pm$ 8.2	42.5 $\pm$ 7.9	-2.5	0.04

Table II: Qualitative Outcomes Reported by Patients

Qualitative Variable	Pre-Treatment Findings	Post-Treatment Findings
Perceived Relief	Persistent, distressing tinnitus	Moderate to complete relief in most patients
Quality of Life	Significantly impaired	Noticeable improvement in daily functioning
Sleep Patterns	Disturbed sleep, frequent awakenings	Improved sleep quality and duration
Emotional Well-being	Anxiety, frustration, irritability	Reduced stress, improved mood
Concentration	Difficulty focusing on tasks	Enhanced concentration and productivity
Patient Satisfaction	Dissatisfied with prior treatments	High satisfaction with current intervention
Side Effects	Not applicable	Mild, transient discomfort in few patients

These results collectively confirmed that intratympanic dexamethasone was an effective and safe treatment option for patients suffering from intractable tinnitus, with both statistically significant improvements and meaningful patient-reported benefits.

DISCUSSION

The results of my research demonstrated that intratympanic dexamethasone was effective in reducing the severity and overall impact of intractable tinnitus in a significant proportion of patients. Patients who completed the study showed noticeable improvement in both objective measurements and subjective experiences following the intervention. Similarly,

another study conducted in 2020 reported that the effect of intratympanic dexamethasone injections on reducing tinnitus severity was statistically significant ⁽¹¹⁾. Furthermore, the comparison between pre-treatment and post-treatment findings in my study revealed a statistically significant reduction in tinnitus severity, frequency, and associated distress. Quantitative analysis indicated that the mean Tinnitus Handicap Inventory (THI) scores decreased markedly after treatment. Prior to the intervention, most patients were categorized as having moderate to severe handicap; however, after repeated intratympanic injections, many shifted to mild or no handicap categories. In contrast, a study conducted in 2013 suggested

that intratympanic dexamethasone injection (ITDI) might not be effective for refractory tinnitus and recommended that its use should be limited to specific cases ⁽¹²⁾.

In my study, audiometric evaluation also showed slight improvement or stabilization in hearing thresholds in some patients. Additionally, the reduction in both the frequency and duration of tinnitus episodes further supported the effectiveness of the treatment. Statistical analysis using paired t-tests confirmed that these improvements were significant ($p < 0.05$), indicating that the results were unlikely due to chance. However, a study conducted in 2022 reported that, despite existing literature and anecdotal success of intratympanic dexamethasone injections in improving tinnitus symptoms in a tertiary care center in Toronto, no significant improvement was observed, raising doubts about its routine use in patients with intractable tinnitus ⁽¹³⁾. Qualitative findings in my research complemented the quantitative data by demonstrating substantial improvements in patients' quality of life. Many participants reported better sleep patterns, reduced anxiety, and improved concentration following treatment. Emotional distress associated with persistent tinnitus was significantly reduced, and patients expressed greater satisfaction with their daily activities. Some participants experienced complete or near-complete relief, while others reported partial but meaningful improvement. Conversely, another study conducted in 2022 found that intratympanic dexamethasone alone did not show a significant effect compared to placebo, although it suggested that combination therapy with other drugs may offer better outcomes and requires further investigation ⁽¹⁴⁾.

A small number of patients in my study reported minimal or no improvement, indicating variability in individual response to the therapy. Overall, patient feedback suggested that intratympanic dexamethasone was well tolerated, with only minor and transient side effects, such as mild discomfort at the injection site. Supporting this, another study conducted in 2022 found that intratympanic steroid treatment reduced both tinnitus rating scale scores and

tinnitus handicap scores in patients with chronic idiopathic tinnitus without hearing loss ⁽¹⁵⁾. In conclusion, the integration of findings from my research indicated that intratympanic dexamethasone provided both clinically measurable benefits and meaningful subjective relief. The consistency between quantitative improvements and qualitative patient experiences strengthened the conclusion that this treatment is a viable option for managing intractable tinnitus. Additionally, another study conducted in 2022 reported that multi-session intratympanic dexamethasone injections were more effective than a single injection in controlling vertigo in patients with definite Ménière's disease ⁽¹⁶⁾, further supporting the therapeutic potential of repeated dosing strategies.

CONCLUSION

In conclusion, intratympanic dexamethasone was found to be an effective and well-tolerated treatment option for patients with intractable tinnitus, demonstrating significant improvements in both objective and subjective outcomes. The study showed a marked reduction in tinnitus severity, frequency, and associated distress, along with enhanced quality of life. Although some variability in response was observed, the overall benefits outweighed the minimal side effects. Therefore, intratympanic dexamethasone may be considered a viable therapeutic approach, particularly in patients who are unresponsive to conventional treatments.

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