

Role of Platelet Rich Plasma in Sensory Neuronal Hearing LossTrupti Savariya^{1*}, Arpit D. Prajapati²¹M.S., ENT, Consultant, Maruti Hospital, Morbi, Gujarat, India²Second Year DNB Resident, GMERS Medical College Dharpur, Patan, Gujarat, India

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Abstract:

Introduction: Platelet-Rich Plasma (PRP) emerges as a promising solution for sensory neuronal hearing loss. PRP's regenerative potential, rooted in its growth factors, offers hope for restoring damaged sensory neurons and improving auditory function. This autologous approach minimizes the risk of adverse reactions, making PRP a safe option for patients. Our study delves into the use of activated PRP in the treatment of Sensorineural Hearing Loss (SNHL), assessing its impact on hearing restoration and quality of life, potentially providing a novel therapeutic avenue for this challenging condition.

Material and Methods: In this 12-month prospective study at a tertiary care medical college, 55 eligible participants aged 1 to 45 years with Sensorineural Hearing Loss (SNHL) were enrolled. Fresh PRP was prepared and administered via intratympanic injections over three consecutive weeks. A follow-up at 6 months post-treatment assessed efficacy using Pure Tone Audiometry. Data analysis utilized the Chi-squared test for evaluating the impact of the PRP intervention.

Results: In this study of 55 patients with idiopathic Sensorineural Hearing Loss (SNHL), results showed a relatively equal gender distribution (53% male, 47% female) across various age groups. The majority of patients exhibited decreased hearing, with additional symptoms reported in varying percentages. Bilateral involvement was common, and hearing loss severity ranged from mild to profound. Patients with mild hearing loss showed the highest rate of complete recovery (55%), while severe cases had a 5% chance of no recovery. Duration of SNHL and the subsequent recovery levels revealed a strong association, with shorter duration correlating with better recovery. Notably, transient dizziness (35%) and injection pain (58%) were common, but increased tinnitus was not reported as a complication following intratympanic Platelet-Rich Plasma (PRP) injections.

Conclusion: Our study suggests that PRP shows promise in the management of Sensorineural Hearing Loss, with potential benefits in terms of efficacy and safety. Further research is warranted to validate and explore the mechanisms underlying these findings.

Keywords: Platelet-Rich Plasma (PRP), Sensorineural Hearing Loss (SNHL), Intratympanic Injections.

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Introduction

Sensory neuronal hearing loss, characterized by the impairment of auditory perception, remains a significant global health concern, affecting millions of individuals of all age groups. [1] This condition not only diminishes one's quality of life but also presents a considerable socio-economic burden. [2] The underlying etiology of sensory neuronal hearing loss is multifaceted, encompassing a range of factors such as genetic predisposition, noise-induced trauma, ototoxic medications, and age-related degeneration. [3] While conventional treatment options include hearing aids and cochlear implants, there remains a pressing need for novel therapeutic approaches that target the fundamental mechanisms underlying hearing loss. [4] One such promising avenue is the utilization of Platelet-Rich Plasma (PRP), a biologically active autologous substance derived from the patient's blood, which is rich in growth factors and cytokines. [5] Our study explores

the emerging role of PRP in the management of sensory neuronal hearing loss and reports the outcomes of a study conducted at a tertiary care center.

The concept of using PRP in the treatment of hearing loss is founded on the regenerative potential of growth factors within this plasma. The regenerative properties of PRP have shown promise in various medical and surgical fields, particularly in orthopedics, dermatology, and dentistry, where PRP has been used to enhance tissue repair and stimulate cellular growth. [6] Within the auditory system, this regenerative potential offers the possibility of restoring damaged sensory neurons and enhancing auditory function. [7] Furthermore, the autologous nature of PRP minimizes the risk of allergic reactions and transplant rejections, making it a safe

and potentially effective option for patients with sensory neuronal hearing loss. [8]

Sensory neuronal hearing loss poses a significant challenge with limited treatment options. Platelet-Rich Plasma (PRP) holds promise as a potential solution due to its regenerative properties. [9] Our study explores the use of activated platelet-rich plasma (PRP) in the treatment of Sensorineural Hearing Loss (SNHL). PRP contains bioactive molecules and growth factors that have shown potential in promoting tissue repair. We aim to evaluate the impact of PRP on hearing restoration and quality of life in individuals with SNHL, potentially offering a promising therapeutic approach for this condition.

Material and Methods

This prospective interventional study was conducted in the Department of Ear, Nose, and Throat (ENT) at a tertiary care medical college and its affiliated hospital. The study spanned 12 months, from January 2022 to December 2023.

A total of 55 patients meeting specific criteria were enrolled in this study. Eligible participants were aged between 1 and 45 years and presented with confirmed Sensorineural Hearing Loss (SNHL). Exclusion criteria included patients with conductive hearing loss, tympanic membrane perforations, or contraindications for PRP injection. Informed, written consent was obtained from each patient, and the study received ethical clearance from the institutional review board.

Fresh PRP was prepared in the Department of Transfusion Medicine on the scheduled day for injections. A 5 mL blood sample was collected in a sodium citrate vial and processed at the hospital's blood bank. PRP separation from whole blood was achieved using the single-spin method in a Cryofuge machine, with centrifugation at 1,720 rpm for 10 minutes. Patients received intratympanic injections

in a supine position on the operating table after local anesthesia with 10% lox spray. A precise 0.5 mL of PRP was administered into the round window niche under the guidance of a surgical microscope.

Participants received three consecutive weekly intratympanic PRP injections to optimize potential therapeutic benefits. A comprehensive follow-up assessment occurred at the 6-month post-treatment point, with hearing evaluations conducted using Pure Tone Audiometry (PTA) to measure changes in hearing thresholds and assess the efficacy of the PRP intervention.

Data collected during the study underwent meticulous analysis using the Chi-squared test, a robust statistical method chosen to determine the statistical significance of the observed outcomes. This rigorous analysis allowed for a thorough evaluation of the PRP intervention's impact on the study's parameters.

Results

Among the 55 patients with idiopathic Sensorineural Hearing Loss (SNHL), there were 29 males (52.73%) and 26 females (47.27%). Among the participants, the age distribution showed that 23.64% were under 18 years, 30.91% fell within the 19-30 age group, 27.27% were in the 31-40 range, and 18.18% were aged 41-45 years. In terms of geographical distribution among the 55 patients with idiopathic Sensorineural Hearing Loss (SNHL), 31 patients (56.36%) were from rural areas, while 24 patients (43.64%) resided in urban settings. Among the 55 patients with idiopathic Sensorineural Hearing Loss (SNHL), symptoms varied. Decreased hearing affected all patients (100%), while other symptoms included tinnitus (20%), ear fullness (24%), muffled sounds (27%), dizziness (38%), vertigo (45%), and difficulty understanding speech (56%). (Table 1)

Table 1: Symptomatology among patients

Symptoms	% of patients	Number of patients
Tinnitus	20	11
Decrease hearing	100	55
Ear fullness	24	13
Muffled sounds	27	15
Dizziness	38	21
Vertigo	45	25
Difficulty Understanding Speech	56	31

Among 55 patients with idiopathic Sensorineural Hearing Loss, 9% had symptoms in the right ear, 11% in the left ear, and 35% experienced bilateral involvement. Among the 55 patients with idiopathic Sensorineural Hearing Loss, the severity of hearing

loss, classified according to WHO criteria, revealed that 29.09% had mild, 41.82% had moderate, 16.36% had moderately severe, 10.91% had severe, and 1.82% had profound hearing loss. (Fig 1)

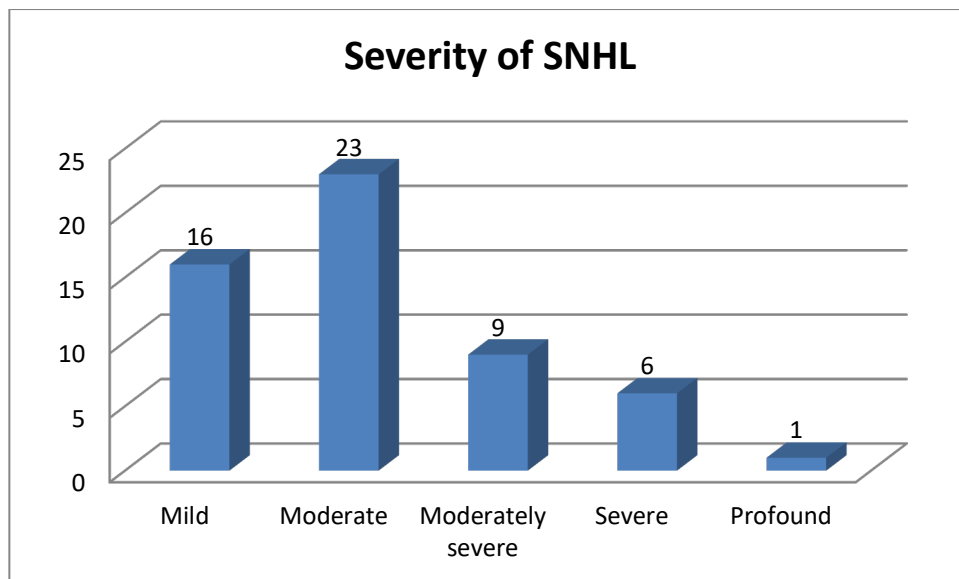


Figure 1: Severity of SNHL

Regarding the duration of SNHL, we found that 40% of patients had for less than 6 months, 23.64% for 6 months to 1 year, 12.73% for 1-2 years, 16.36% for 2-3 years, and 7.27% had it for over 3 years. (Fig 2)

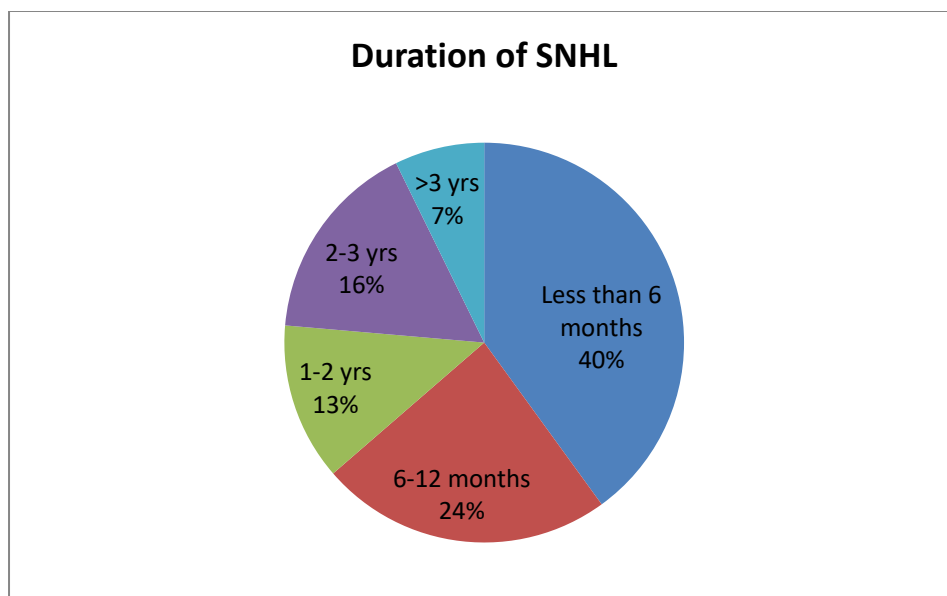


Figure 2: Duration of SNHL

In present study, for 55 patients with Sensorineural Hearing Loss, recovery levels varied based on illness duration: 7.27% had no recovery (0 dB), 18.18% experienced partial recovery (1-10 dB), and 29.09% achieved complete recovery (>10 dB). (Table 2)

Table 2: Recovery according to duration of illness (n=55)

Recovery	<6M	6-12M	1-2Yrs	2-3Yrs	>3Yrs	% of patients	P value
No of recovery (0 dB)	0	3	1	2	1	7.27%	0.001
Partial recovery (1-10 dB)	3	6	4	4	2	18.18%	
Complete recovery (>10 dB)	19	4	2	3	0	29.09%	

Among those with mild hearing loss, complete recoveries were observed in 13 patients, comprising approximately 54.55% of the group. For patients with moderate initial hearing loss, 4 out of 55 patients, or 9.09%, achieved no complete recovery (0 dB). The category of moderately severe hearing loss demonstrated one complete recovery (1.82%)

out of 55 patients. Patients with severe initial hearing loss saw 3 patients (approximately 5.45%) experience no complete recovery. In this study group, there were no cases of profound hearing loss. (Table 3) The distribution of hearing recovery among patients with different durations of illness

and varying degrees of initial severity is indeed statistically significant ($p < 0.05$).

Table 3: Recovery according to severity of Illness after PRP treatment (n=55)

Recovery	Mild	Moderate	Moderately severe	Severe	Profound	P value
No of recovery (0 dB)	0	4	1	3	0	0.001
Partial recovery (1-10 dB)	3	16	2	1	1	
Complete recovery (>10 dB)	13	3	6	2	0	

Among the 55 patients with idiopathic Sensorineural Hearing Loss who underwent intratympanic Platelet-Rich Plasma (PRP) injections, certain complications were observed. Transient dizziness was reported by approximately 34.55% of the patients, suggesting a common and temporary side effect. Injection pain was experienced by approximately 58.18% of patients, highlighting a prevalent but typically short-lived discomfort associated with the procedure. A small perforation of the tympanic membrane was identified in approximately 1.82% of patients, representing a rare complication. Importantly, there were no reported instances of increased tinnitus among the patients following the PRP injections.

Discussion

The study aims to investigate the potential of PRP in the management of sensorineural hearing loss. PRP, derived from the patient's blood, is rich in growth factors and has shown promise in various medical fields for its regenerative and healing properties. The study evaluates the safety and efficacy of intratympanic PRP injections in a controlled clinical setting.

In our study with 55 patients having idiopathic Sensorineural Hearing Loss (SNHL), we identified intriguing patterns in hearing loss distribution. Specifically, 9% exhibited symptoms in the right ear, 11% in the left ear, and 35% experienced bilateral involvement. Our findings highlight the diversity of SNHL and varying ear involvement. Comparisons with studies by Tyagi et al. [10], Thakkar et al. [11], and Ruchika et al. [12] reveal consistent trends in bilateral hearing impairment prevalence, severity variations, and the importance of ongoing research to understand SNHL's complexity.

In present study, the severity of hearing loss, classified according to WHO criteria, demonstrated variations. Approximately 29.09% had mild hearing loss, 41.82% had moderate, 16.36% had moderately severe, 10.91% had severe, and 1.82% had profound hearing loss. Notably, among those with mild hearing loss, approximately 54.55% achieved complete recovery, whereas 9.09% of patients with moderate hearing loss and 1.82% of those with moderately severe hearing loss experienced complete recovery. Comparatively, findings from Ruchika et al. [12] indicate a trend where the degree

of initial hearing loss influences recovery rates. For mild SNHL, complete recovery was observed in 70.8% of cases, while moderate SNHL showed complete recovery in 25%, and moderately severe cases achieved complete recovery in 66.7%. However, in patients with severe SNHL, complete recovery was less common, occurring in only 42.9% of cases. Ferri et al.'s [13] study on intratympanic steroids reveals that the severity of hearing loss impacts recovery. Patients with losses greater than 90 dB had a poorer recovery rate of 7.2% compared to those with less than 90 dB, with an improvement rate of 35.6%.

The study by Bansal et al. [14] on unilateral sensory neural hearing loss highlights the varied severity of cases, ranging from mild to profound. Quan et al. [15] reported notable improvements in hearing levels after PRP instillation in our study, emphasizing the effectiveness of this treatment. Similarly, Yi Qian et al. [15] reported a 70% overall recovery rate in children with SNHL using intratympanic methylprednisolone and compound betamethasone injections. These findings collectively suggest that the degree of hearing loss severity may influence recovery rates, with milder cases showing higher rates of complete recovery. The mechanism underlying these variations in recovery could be multifactorial, potentially related to the extent of damage to sensory cells, the regenerative capacity of the inner ear, and the efficacy of the administered treatment. [16,17]

In our study of 55 patients with idiopathic Sensorineural Hearing Loss, PRP injections led to specific complications. Transient dizziness (34.55%) and injection pain (58.18%) were common but short-lived side effects, while small tympanic membrane perforations were rare (1.82%). Notably, increased tinnitus was not observed. When analyzing hearing recovery, a 7.27% complete recovery rate was found for patients with less than 6 months of hearing loss, while no complete recoveries were noted for those with 6-12 months of hearing loss. Patients with mild hearing loss had a 29.09% complete recovery rate, indicating the impact of initial severity on outcomes. A study by Ruchika et al. [12] observed differences in recovery rates based on illness duration. Our study demonstrated a lower complete recovery rate for patients with mild hearing loss but a higher complete recovery rate for patients with hearing loss for less

than 6 months. In contrast, Ruchika et al. [12] reported an 85.2% complete recovery rate for patients with hearing loss for less than six months. These variations underscore the importance of assessing different factors influencing recovery.

Huang et al.'s [18] study reinforced the effectiveness of PRP in improving the closure rate of tympanic membrane perforations, with a significant effect on healing. However, it didn't reveal statistical differences in hearing results between the PRP and control groups. Nevertheless, the PRP group experienced fewer complications, emphasizing the potential advantages of PRP in middle ear surgeries. Taneja et al.'s [19] study, along with Bielecki et al.'s [20] research, highlighted the role of PRP in enhancing the success rate of tympanic membrane closure. PRP's ability to prevent adhesion formation and optimize cell proliferation has the potential to improve overall outcomes in ear surgeries. [21] Our study findings, when compared to these existing studies, suggest that PRP can play a beneficial role in promoting recovery and minimizing complications in patients with idiopathic Sensorineural Hearing Loss.

Our study has several limitations. It involved a relatively small sample size of 55 patients and had a relatively short 6-month follow-up period, limiting the generalizability and long-term assessment of treatment effects. The absence of a control group, being a single-center study, potential selection bias, and symptomatic variability among patients further complicate the interpretation of outcomes. Additionally, the study did not extensively explore the underlying mechanisms of PRP treatment or provide extensive data on long-term safety outcomes. The absence of blinding techniques and the potential for a learning curve effect in administering PRP injections introduce additional considerations when evaluating the results.

Conclusion

This study underscores the potential of PRP as a valuable alternative treatment for patients with Sensorineural Hearing Loss (SNHL). While these findings hold promise, it is essential to recognize that additional data and further research are necessary to establish the full extent of PRP's efficacy in SNHL patients. The implications are encouraging, suggesting that PRP may effectively promote recovery and reduce complications in SNHL patients, aligning with the broader understanding of PRP's regenerative potential in ear surgeries.

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