

Role of Platelet-rich Plasma in Sensory Neural Hearing Loss

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ABSTRACT

Introduction: Platelet-rich plasma (PRP) is also known as autologous plasma. Platelets release various growth factors, some of which are recognized to improve nerve growth by contents within the alpha and dense granules.

Material and methods: A prospective hospital-based interventional study was carried out at a tertiary care center for a period of 22 months from January 2020 to October 2021.

Results: A total of 70 patients were selected according to inclusion criteria and exclusion criteria. In our study, 70 patients with sensory neural hearing loss (SNHL) were selected on the basis of pure-tone audiometry (PTA) and intratympanic PRP injections were given in the affected ear. Post-PRP, patients were followed up till 6 months. Among those patients who had hearing loss for less than six months duration, 85.2% recovered completely while in 14.8% partial recovery was observed. Patients with mild SNHL showed complete recovery in 70.8% and partial recovery in 29.2%. Individuals having moderate SNHL showed complete recovery in 25%, partial in 50%, and no recovery in 25% of cases. Patients in the moderately severe deafness category showed complete recovery in 66.7%, partial in 11.1%, and no recovery in 22.2%. However, in patients with severe SNHL complete recovery was seen only in 42.9%, partial in 14.2%, and in as high as 42.9% no recovery was observed. Only partial improvement was observed in 50% while the remaining 50% showed no recovery. In our study, 41.4% of cases complained of transient dizziness after PRP injection while 61.4% reported pain.

Keywords: Intratympanic injection, Platelet-rich plasma, Sensory neural hearing loss.

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INTRODUCTION

Sensory neural hearing loss refers to deafness secondary to conditions affecting the inner ear, internal acoustic canal, cerebellopontine angle or vestibulocochlear nerve. It is the most common cause of deafness in adults accounting for almost 90% of cases.¹ Platelet-rich plasma also known as autologous plasma, is a concentrate of PRP protein derived from whole blood, centrifuged to remove blood cells. Platelet-rich plasma is basically a reversal of the ratio between red blood cells and platelets. Platelets release various growth factors, some of which are recognized to improve nerve growth by contents within the alpha and dense granules.^{2,3} The aim of this study is to evaluate the safety, efficacy, and outcome of intratympanic PRP injection in patients of SNHL.

MATERIALS AND METHODS

A prospective hospital-based interventional study was carried out in the department of ear, nose, and throat (ENT) of a tertiary care medical college and associated hospital during a period of 22 months from January 2020 to October 2021. A total of 70 patients were selected according to inclusion criteria (patients between 1 and 45 years of age and patients with pure SNHL) and exclusion criteria (cases with conductive hearing loss, patients with perforated tympanic membrane, and medical contraindications for PRP injection). After taking proper written informed consent and institutional ethical clearance, each of these patients was administered three injections of 0.5 mL PRP.

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Preparation of PRP and Technique of Intratympanic Injection (ITI)

Fresh preparation of PRP was done in the department of transfusion medicine on the scheduled day for injection. A 5 mL of blood was drawn in a sodium citrate vial and sent to the blood bank. Also, PRP was made in the Cryofuge machine by using the single-spin method at 1,720 rpm for 10 minutes and PRP was separated from whole blood. The participant was laid supine on the operating table

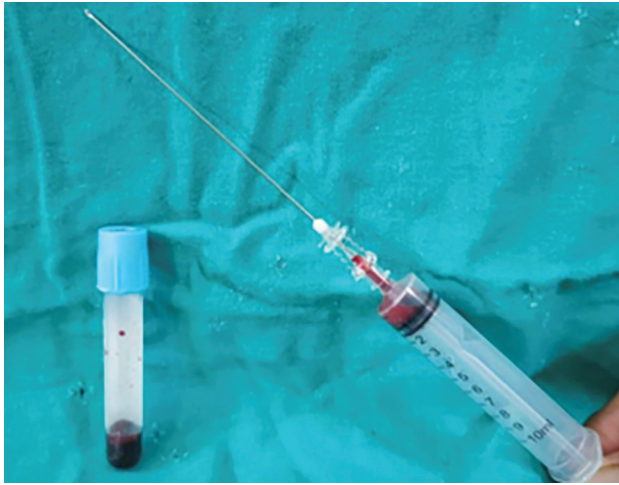


Fig. 1: Showing PRP and syringe with lumber puncture (LP) needle



Fig. 2: Endoscopic view of ITI

(OT), and 10% lox spray was used for local anesthesia. A 0.5 mL of PRP was injected intratympanic in a round window niche under a microscope (Figs 1 and 2).

Three such injections were given once a week for 3 consecutive weeks and follow-up was done at 6 months, in which patients were evaluated for hearing using PTA. The relevant data were collected and statistically analyzed using the Chi-squared test.

RESULTS

In our study, 70 patients with SNHL were selected on the basis of PTA and intratympanic PRP injections were given in the affected ear. Male patients 37 (53%) outnumbered females 33 (47%) (Table 1). The age of patients ranged from 10 to 45 years with a mean age of 25.08 ± 9.1 (Table 2). Most of our patients came from rural areas 39 (56%) as compared to urban 31 (44%) (Table 3). The most common clinical presentation was hearing loss seen in all 70 (100%) patients followed by tinnitus in 11 (15.7%) and aural fullness in 8 (11.4%) patients (Table 4). Of these 70 patients with hearing loss, 46 (65.7%) had bilateral ear involvement while 24 (34.3%) patients were suffering from unilateral hearing loss in which 21.42% patients had right ear SNHL and 12.85%

Table 1: Gender distribution among 70 patients of idiopathic SNHL

Gender	Number of patients	%
Male	37	53.0
Female	33	47.0
Total	70	100

Table 2: Age distribution among 70 patients of idiopathic SNHL

Age	Number of patients	%
0–10	02	02.9
11–20	20	28.6
21–30	27	38.6
31–40	16	22.8
41–45	5	07.1
Total	70	100

Table 3: Geographical distribution among 70 patients of idiopathic SNHL

Geographical distribution	Number of patients	%
Rural	39	56.0
Urban	31	44.0
Total	70	100

Table 4: Symptomatology among 70 patients of idiopathic SNHL

Symptoms	Number of cases	%
Decreased hearing	70	100
Tinnitus	11	15.7
Ear fullness	8	11.4

Table 5: Distribution of laterality among 70 patients of idiopathic SNHL

Laterality	Number of cases	%
Right	15	21.5
Left	9	12.8
Bilateral	46	65.7
Total	70	100

Table 6: Degree of hearing loss among 70 patients of idiopathic SNHL on basis of WHO criteria

Degree hearing loss	Severity of hearing loss (number of cases)	%
Mild	24	34.2
Moderate	28	40.0
Moderately severe	9	13.0
Severe	7	10.0
Profound	2	02.8
Total	70	100

had left ear disease (Table 5). In terms of severity of deafness, 24 (34.2%) patients had mild SNHL, 28 (40%) patients had moderate SNHL, 9 (13%) patients fell in moderately severe grade, 7 (10%) patients presented with severe while 2 (2.8%) patients had profound deafness (Table 6). The mean duration of illness was 1.4 ± 1.5 years,

Table 7: Distribution according to duration of illness among 70 patients of idiopathic SNHL

<i>Duration sensorineural hearing loss</i>	<i>Number of cases</i>	<i>%</i>
<6 months	27	38.6
From 6 months to 2 years	14	20.0
2–3.5 years	22	31.4
3.6–5 years	6	08.6
>5 years	01	01.4
Total	70	100

Table 8: Distribution of hearing recovery according to duration of illness among 70 patients of idiopathic sensory hearing loss

<i>Hearing recovery</i>	<i>Number of cases, N (%)</i>					<i>Total, n (%)</i>
	<i><6 months</i>	<i>6 months–2 years</i>	<i>2.1–3.5 years</i>	<i>3.6–5 years</i>	<i>>5 years</i>	
Number of recovery (0 dB)	00	05	03	05	00	18.6%
Partial recovery (1–10 dB)	04	13	05	01	01	34.3%
Complete recovery (>10 dB)	23	09	01	00	00	47.1%

On applying Chi-squared test, $\chi^2 = 42.45$. The result is highly significant as $p = 0.000001112$

Table 9: Distribution of hearing recovery according to severity of illness after intratympanic platelets rich plasma injection among 70 patients of idiopathic sensory hearing loss

<i>Hearing recovery</i>	<i>Severity of hearing loss (number of cases)</i>				
	<i>Mild</i>	<i>Moderate</i>	<i>Moderately severe</i>	<i>Severe</i>	<i>Profound</i>
NR	00	7	2	3	01
PR	07	14	1	1	1
CR	17	7	6	3	0
Total	24	28	9	7	02

On applying Chi-squared test, $\chi^2 = 20.47$, $df = 8$. Result is significant as $p = 0.008699$, $p < 0.005$

with patients presenting as early as 1 month and as delayed as 6 years (Table 7). Post-PRP, patients were followed up till 6 months and significant improvement in the hearing was seen with time (Table 8). Among those patients who had hearing loss for less than 6 months duration, 85.2% recovered completely (>10 dB) while in 14.8%, partial recovery (1–10 dB) was observed. Improvement in these patients was significantly greater than in patients who had a long history of illness. Patients with mild SNHL showed complete recovery (>10 dB) in 70.8% and partial recovery (1–10 dB) in 29.2%. Individuals having moderate SNHL showed complete recovery (>10 dB) in 25%, partial (1–10 dB) in 50%, and no recovery (0 dB) in 25% of cases. Patients in the moderately severe deafness category showed complete recovery (>10 dB) in 66.7%, partial (1–10 dB) in 11.1%, and no recovery (0 dB) in 22.2%. However, in patients with severe SNHL, complete recovery (>10 dB) was seen only in 42.9%, partial (1–10 dB) in 14.2%, and in as high as 42.9%, no recovery (0 dB) was observed. None of the patients having profound deafness showed complete recovery (>10 dB). Only partial improvement (1–10 dB) was observed in 50% while the remaining 50% showed no recovery (0 dB) (Table 9). In our study, 41.4% of cases complained of transient dizziness after PRP injection while 61.4% reported pain (Table 10).

DISCUSSION

Sensory neural hearing loss refers to deafness secondary to conditions affecting the inner ear, internal acoustic canal, and cerebellopontine angle or vestibulocochlear nerve. It is the most common cause of deafness in adults accounting for almost 90%

Table 10: Complications after intratympanic platelets rich plasma injection among 70 patients of idiopathic sensory hearing loss

<i>Complication</i>	<i>Number of patients</i>	<i>%</i>
Transient dizziness	29	41.4
Injection pain	43	61.4
Small perforation	0	0
Increased tinnitus	0	0

On applying Chi-squared test, $\chi^2 = 5.564$. The result is significant as $p < 0.05$, $df = 1$

of cases. Due to rapid environmental changes, urbanization, and industrialization, morbidity due to hearing loss has shown an increasing trend in the community.

Choi et al. suggested that PRP is inherently safe as it is an autologous preparation. Platelet-rich plasma is no different in substrate than the blood clot that is formed in every wound and therefore does not support bacterial growth any more than any other blood clot. In fact, PRP has a pH of 6.5–6.7 compared with a mature blood clot of 7.0–7.2. It has thus been counter-suggested that PRP actually inhibits bacterial growth.⁴ Ding et al. suggested that clinical application of PRP has a potential repairing effect on cranial nerve (CN) and peripheral nerves.⁵ In our study, we are injecting PRP intratympanic where it may promote regeneration of the cochlear nerve and reduce inflammation in acute cases through a round window. Bansal et al. conducted a retrospective study on 155 patients with pure unilateral sensory neural hearing loss (USNHL)

based on PTA. Their results are in accordance with our study. Out of 155 patients, 56.7% were male, 74 (47.7%) had their right ear involved while in 81 (52.3%) left ear was affected. The age of patients ranged from 9 to 76 years (mean age: 41.5 years). The majority of the patients were in their third decade (23.82%), followed by the second decade (21.29%) and fourth decade (21.29%). The severity of USNHL ranged from mild (34.2%) to profound (31.96%).⁶ Ferri et al. conducted a study on the effect of intratympanic steroids and concluded that a total of 16 patients (29.1%) had a hearing loss greater than 90 dB with an improvement rate of 7.2%; 29 patients (52.7%) had hearing loss of 90 dB or less and greater than to 50 dB with an improvement rate of 21.2% while 10 patients (18.2%) had hearing loss less than 50 dB and greater than 30 dB with an improvement rate of 47.6%. Patients with severe losses greater than 90 dB had a poorer recovery (7.2%) compared with losses less than 90 dB (35.6%).⁷ Similarly, in our study, PRP showed better results in patients with severe hearing loss with 57.14% of patients showing either partial or complete recovery. Tyagi Rout concluded that out of 200 patients with 5 intratympanic PRP injections, 172 (86%) patients had improvement in hearing while 28 patients did not show any audiological gain.⁸ These findings were consistent with our results where the majority of the patients (47.1%) recovered completely, 34.3% showed partial recovery, and only 18.6% of patients had no change. On applying Chi-squared test, $\chi^2 = 52.86$, $p < 0.0001$, significant improvement in hearing was noted. Yu-Chuang Liu et al. did an assessment on complication of ITI where they concluded that increasing tinnitus was noted 15 out of 278 times (about 5.4%) after ITI.⁹ Transient dizziness and vertigo were noted 47 times (16.9%) and 5 times (1.8%), respectively. Most patients 211 (75.9%) underwent only mild, painful sensations. There was only one female who suffered from severe pain after ITI and refused further. In our study, we observed that 41.4% had transient dizziness and 61.4% complaint of injection pain.

CONCLUSION

Intratympanic PRP injection significantly improved the hearing status in acute mild-to-severe cases of sensory hearing loss without

any complication. So PRP can be a valuable alternative treatment method for SNHL patients. However, more data and further study are still required to establish the concrete effect of PRP in SNHL patients.

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