

## Platelet Rich Plasma (PRP): A Revolutionary Treatment of Sensorineural Hearing Loss

BPS Tyagi<sup>1,2\*</sup> and Mamatarani Rout<sup>3</sup>

<sup>1</sup>Head of Department of ENT, Colombia Asia Hospital Ghaziabad

<sup>2</sup>Head of Department of ENT, Harsh ENT Hospital, Ghaziabad

<sup>3</sup>Junior Consultant Department of ENT, Harsh ENT Hospital, Ghaziabad

**\*Corresponding Author:** BPS Tyagi, Head of Department of ENT, Colombia Asia Hospital and Harsh ENT Hospital, Ghaziabad.

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### Abstract

Sensorineural hearing loss is the collective term for hearing damage to the cochlea and auditory nerve, and is by far the most common type of hearing loss in adults, accounting for over 90% of all cases. Sensorineural hearing loss is a heterogeneous disorder, which can arise due to damage to pathway for sound impulses from the hair cells of inner ear to auditory nerve and less commonly brain. Sensorineural hearing loss is a challenge to physicians, as it progresses with age and causes significant reductions in quality of life and there are no treatments to reverse its effects, other than sound amplification with the use of hearing aids or direct auditory nerve stimulation via cochlear implantation.

Platelet-rich Plasma (PRP) Therapy is a cutting edge procedure that is revolutionizing the hearing loss and deafness. Intratympanic instillation of Platelet-rich Plasma (PRP) does wonder to the hair cells of inner ear, thus improving the hearing.

**Keywords:** Sensorineural Hearing Loss; Platelet Rich Plasma; Intratympanic

### Introduction

Platelet rich plasma (PRP) is a form of blood plasma that has been enriched with platelets and growth factors. Platelets are tiny cell fragments that stop bleeding and bruising and contain growth factors and natural substances that encourage cellular growth and stimulate healing.

Platelet-rich plasma (PRP), also known as autologous conditioned plasma, is a concentrate of platelet-rich plasma protein derived from whole blood, centrifuged to remove red blood cells.

### Composition

There are four general categories of preparation of PRP based on its leukocyte and fibrin content: leukocyte-rich PRP (L-PRP), leukocyte reduced PRP (P-PRP; leukocyte reduced or pure PRP), leukocyte platelet-rich fibrin and pure platelet-rich fibrin.

The efficacy of certain growth factors in healing various injuries and the concentrations of these growth factors found within PRP are the theoretical basis for the use of PRP in tissue repair.

The platelets collected in PRP are activated by the addition of thrombin and calcium chloride, which induces the release of the mentioned factors from alpha granules. The growth factors and other cytokines present in PRP include:

- Platelet-derived growth factor.
- Transforming growth factor beta.
- Fibroblast growth factor.
- Insulin-like growth factor 1.
- Insulin-like growth factor 2.
- Vascular endothelial growth factor.
- Epidermal growth factor.
- Interleukin 8.
- Keratinocyte growth factor.
- Connective tissue growth factor.

## Preparation

PRP is obtained from a sample of patients' blood draw at the time of treatment. A 30 cc venous blood draw will yield 3 - 5 cc of PRP depending on the baseline platelet count of an individual, the device used, and the technique employed. The blood draw occurs with the addition of an anticoagulant, such as citrate dextrose A to prevent platelet activation prior to its use.

PRP is prepared by taking blood from the person, and then putting it through two stages of centrifugation designed to separate PRP from platelet-poor plasma and red blood cells. This is usually done by the clinic offering the treatment, using commercially available kits and equipment. The resulting substance varies from person to person and from facility to facility.

PRP is prepared by a process known as differential centrifugation. In differential centrifugation, acceleration force is adjusted to sediment certain cellular constituents based on different specific gravity. There are many ways of preparing PRP. It can be prepared by the PRP method or by the buffy-coat method. In the PRP method, an initial centrifugation to separate red blood cells (RBC) is followed by a second centrifugation to concentrate platelets, which are mainly white blood cells (WBCs) and platelets, from the underlying RBC layer.

## PRP method

1. Obtain whole blood by venipuncture in acid citrate dextrose (ACD) tubes.
2. Do not chill the blood at any time, before or during platelet separation.
3. Centrifuge the blood using a 'soft' spin.
4. Transfer the supernatant plasma containing platelets into another sterile tube (without anticoagulant).
5. Centrifuge tube at a higher speed (a hard spin) to obtain a platelet concentrate.
6. The lower 1/3rd is PRP and upper 2/3rd is platelet-poor plasma (PPP). At the bottom of the tube, platelet pellets are formed.
7. Remove PPP and suspend the platelet pellets in a minimum quantity of plasma (2-4 mL) by gently shaking the tube.

## Buffy coat method

1. Whole blood should be stored at 20°C to 24°C before centrifugation.
2. Centrifuge whole blood at a 'high' speed.
3. Three layers are formed because of its density: The bottom layer consisting of RBCs, the middle layer consisting of platelets and WBCs and the top PPP layer.
4. Remove supernatant plasma from the top of the container.
5. Transfer the buffy-coat layer to another sterile tube.
6. Centrifuge at low speed to separate WBCs or use leucocyte filtration filter.

## Factors influencing PRP yield

Various factors influence the yield of PRP such as draw of blood; speed, time and temperature of centrifugation and use of anticoagulants.

## Draw of blood

The clotting process is influenced from the time of the draw. To avoid unintentional activation of platelets, most protocols use large bore needles (> 22) to draw the blood.

## Centrifugation

Separation of cellular constituents within blood can be achieved by a process known as differential centrifugation.

## Temperature

Temperature during processing is crucial to prevent platelet activation. AABB manual recommends 21°C-24°C for centrifugation of blood for obtaining PRP.

## Activation of PRP

PRP activation prior to injection is another parameter that requires further discussion. PRP can be activated exogenously by thrombin, calcium chloride or mechanical trauma.

**Mechanism of action:** PRP has the potential to deliver a high concentration of growth factors to target tissues by virtue of the contents within the alpha and dense granules.

- Alpha granules contain seven fundamental growth factors: platelet-derived growth factors (PDG Faa, PDG Fbb and PDG Fab); transforming growth factor beta (isoforms TGF $\beta$ 1 and 2); epithelial growth factor (EGF); and vascular endothelial growth factor (VEGF). These modulate cell proliferation, cellular migration, differentiation, angio-

genesis and chemotaxis. The dense granules contain bioactive agents including serotonin, histamine, dopamine, calcium and adenosine; these can increase membrane permeability and modulate inflammatory processes.

- Degranulation of these organelles results in the release of pre-packaged growth factors, many of which have short half-lives; therefore, greater effectiveness may result if they are activated at or just before application. PRP has 3 - 5 times the concentration of platelets normally found in wounds and the resulting growth factor release following activation can further stimulate cell proliferation and differentiation towards tissue regeneration.

## Discussion

Patients with sensorineural hearing loss comes with c/o Plugged feeling or fullness in the ear, tinnitus, vertigo, hearing loss. There is limited options for treatment of SNHL. Pharmacological treatment such as antioxidant vitamins, coenzyme Q10 options are very limited and clinically unproven. Such pharmaceutical treatments as are employed are palliative rather than curative, and addressed to the underlying cause if one can be identified, in order to avert progressive damage. Profound or total hearing loss may be amenable to management by cochlear implants, which stimulate cochlear nerve endings directly. A cochlear implant is surgical implantation of a battery powered electronic medical device in the inner ear. Cochlear implant can be done under 3years of age which is helpful. In our center we use PRP (platelet rich plasma) injection as treatment for SNHL along with few medications.

### Dose and time interval

Injection PRP 0.5 ml is injected intratympanic in round window niche. S Can be monitored with audiogram results each time patient reviews. After injection patient should be on 5days of antibiotic, antihistamines and antacids and analgesics sos.

### Side effects

No side effects has been reported.

### Contraindications

Cancer, Chronic liver disease, Hemodynamic instability, Hypofibrinogenemia, Platelet dysfunction syndromes, Systemic disorder, sepsis, Low platelet count.

### Method

This case series study was carried out in ENT department of Harsh ENT hospital, Ghaziabad during June 2018. All patients who

came with reduced hearing and fullness of ear were evaluated with adequate investigations such as PTA, BERA.

The samples were assessed based on gender, age, duration of hearing loss, laterality of hearing loss (unilateral, bilateral), type of hearing loss (conductive, sensorineural) and presence of pathological tissues (perforation, granulation, cholesteatoma, destruction of ossicles). Based on audiogram 200 patients were selected with pure sensorineural and mixed hearing loss. Study conducted in 200 patients over a period of 1 year. We instilled injection PRP 0.5ml intratympanic in patients (n = 200). Injections were repeated every 3weeks with audiogram and compared with previous audiogram.

Out of 200 patients with injection PRP intratympanic, 172 patients were having improvement in hearing after 5 times of repeated injections and 28 patients didn't show any improvement in hearing. Out of 28 patients, 19 patients were above 70years and with diabetes, and 9 were above 70 years old.

Out of 200 patients: total no of patients =200.

Age group in years	No of patients
0-5	5
6-20	31
20-40	82
40-60	45
>60	37

**Table 1**

This table shows the maximum number of incidence of SNHL is in the age group of 20 to 40 years of age.

### Conclusions

Previously there was no specific treatment management for sensorineural hearing loss except antioxidants and steroids. Introduction of platelet rich plasma in otorhinolaryngology and especially in sensorineural hearing loss is doing revolutionary wonders in treatment as we can see in our case study report.

### Conflict of Interest

None.

### Source of funds

Nil.

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