

A STUDY OF EFFICIENCY OF AUTOLOGOUS PLATELET RICH PLASMA IN MYRINGOPLASTY

¹Dr.Anish Narayan Sur, ^{2*}Dr.Vinod Shinde, ³Dr.Ruchir Dashora, ⁴Dr.Vallari Jadhav,

¹Otorhinolaryngology department, Resident, Dr. D. Y. Patil Medical College and Hospital, Pune, India

^{2*}Otorhinolaryngology department, Professor, Dr. D. Y. Patil Medical College and Hospital, Pune, India

³Otorhinolaryngology department, Resident, Dr. D. Y. Patil Medical College and Hospital, Pune, India

⁴Community Medicine department, Resident, Dr. D. Y. Patil Medical College and Hospital, Pune, India

ABSTRACT

Introduction: Chronic otitis media (COM) is a condition in which middle ear inflammation causes changes in the tympanic membrane. These changes are tympanic membrane (TM) perforation, retraction pockets, tympanosclerotic patch, cholesteatoma, etc. Ossicles may or may not be involved. Platelet rich plasma is an autologous platelet rich concentrate containing several growth factors and cytokines. It accelerates wound healing. Myringoplasty is defined as the surgical repair of the tympanic membrane.

Objective: To assess the efficacy of use of autologous platelet rich plasma in tympanic membrane perforation closure during myringoplasty.

Materials And Methods: For this study 66 patients were observed during the study period. Among them 33 patients were in group 1 in which platelet rich plasma was used in myringoplasty and the remaining 33 patients were in group 2 in which platelet rich plasma was not used in myringoplasty. Post operatively patients were followed up.

Results: In group 1 the tympanic membrane closure was found to be 100% with no failure. In group 2 the tympanic membrane closure was found to be 78.79% with failure seen in 21.21%. Odds ratio came to be 18.96 and the results were statistically significant. Conclusion: Platelet rich plasma helps in better tympanic membrane closure and thus improves the outcome of myringoplasty

Keywords: chronic otitis media, tympanic membrane, platelet rich plasma, myringoplasty

INTRODUCTION

Chronic otitis media (COM) is a condition in which middle ear inflammation causes changes in the tympanic membrane. These changes are tympanic membrane perforation, retraction pockets, tympanosclerotic patch, cholesteatoma, etc. Ossicles may or may not be involved. Recurrent acute otitis media, long standing middle ear infection, long-term Eustachian tube dysfunction, or any chronic inflammatory trigger can all contribute to chronic otitis media.

The infection severity, the immunity response against the infection, and the time duration to manifest, etc. all of this depends how COM will present. It is not unusual for COM to have no symptoms at all, especially in toddlers who frequently do not express hearing loss. Conductive hearing loss is typically the main symptom of COM, but patients may also present with ear pain, ear discharge, aural fullness, pulsatile tinnitus, etc.

The World Health Organization (WHO) estimated that 65–330 million individuals globally are affected with chronic otitis media of whom 50% have hearing loss, and that otitis media sequelae account for about 28000 deaths annually. It is more widespread in lower socioeconomic levels and is prevalent in developing nations like India. Compared to urban populations, the incidence is much higher among rural populations. ⁽¹⁾

Platelet rich plasma (PRP) is an autologous platelet rich concentrate. In 1954 Kingsley used the term —platelet-rich plasma for the first time. In 1960s preparation of platelet rich plasma was started in blood banks which later became popular in 1970s, during which it was used as transfusion for treatment of 11 thrombocytopenia. Cardiothoracic surgery was the first field to employ platelet rich plasma. After an open heart surgery in 1987, M. Ferrari used platelet rich plasma.⁽²⁾

It contains several growth factors and cytokines. It helps in mitogenesis, angiogenesis, vasculogenesis, cell growth, proliferation and differentiation. It accelerates and enhances healing of the wound. It is prepared by centrifuging patient's own blood.

The growth factors and cytokines which are present in PRP are:^(3, 4, 5, 6)

- platelet-derived growth factor
- platelet derived angiogenesis factor
- platelet factor 4
- transforming growth factor beta
- fibroblast growth factor
- insulin-like growth factor
- vascular endothelial growth factor
- epidermal growth factor
- interleukin 8
- keratinocyte growth factor
- connective tissue growth factor
- hepatocyte growth factor
- stromal cell-derived factor 1
- endostatin

Myringoplasty is defined as the surgical repair of the tympanic membrane.⁽⁷⁾

The first true myringoplasty is said to be performed by Berthold in 1878. He de-epithelialized the tympanic membrane remnant by applying plaster against it for 3 days. Then removing it along with the underlying epithelium, and then placing a skin graft over the defect.⁽⁸⁾

The principle indications of myringoplasty are: recurrent otorrhoea due to infection; hearing loss due to infection. The contraindications include: presence of cholesteatoma; eustachian tube dysfunction; contralateral dead ear.⁽⁹⁾

Myringoplasty can be performed using a variety of approaches, like endaural approach, post-auricular approach and transcanal approach. For graft placement both overlay and underlay techniques are frequently employed. Underlay technique is more frequently used at present

AIM OF THE STUDY

To assess the efficacy of use of autologous platelet rich plasma in tympanic membrane perforation closure during myringoplasty

MATERIALS AND METHODS

STUDY DESIGN

Prospective Randomized Case Control study of myringoplasty done in our institution during the study period.

STUDY SETTING

The study was carried out in the Department of ENT at a tertiary health care centre.

STUDY PERIOD

May 2021 to October 2022.

SAMPLE SIZE-As per the study “Safety and Efficacy of Autologous Platelet-rich Fibrin on Graft Uptake in Myringoplasty” done by Nair et. al. showed that 100% graft uptake is seen in group with platelet rich plasma and 79% graft uptake is seen in group without platelet rich plasma. Entering this data in Winpepi and considering significance level at 5% and power at 80%, the sample size is 66.

INCLUSION CRITERIA

- Chronic otitis media.
- No active discharge (central perforation with dry ear).
- Age limit-11 years and above.

EXCLUSION CRITERIA

- Children below 11 years of age.
- Presence of active ear discharge.
- External ear disease.
- Diabetes mellitus.
- Presence of other systemic illness like malignancy, autoimmune disease, etc.
- Persons on immunosuppressant therapy.

STUDY GROUP (GROUP 1)

Platelet rich plasma is used during myringoplasty in this group of patients.

CONTROL GROUP (GROUP 2)

Platelet rich plasma is not used during myringoplasty in this group of patients.

DATA COLLECTION METHOD

All patients who met the inclusion requirements and fit the study's operational definition had a thorough history of their complaints recorded. Each patient had undergone a routine comprehensive general examination and ENT examination. A pre-made proforma was filled up with all the information.

Prior to inclusion in the study, a written informed consent was obtained from each participant once they had been told of the study's goal and explained all the necessary details. Patients were randomized into group 1 and group 2. All routine investigations were done.

Otomicroscopy was done which is an important part of the ear evaluation since it gives better magnification and we confirm our otoscopic findings with it. External auditory canal is properly seen, margins of the perforation are visualised for ingrowth of epithelium, and middle ear mucosa is also examined. If required aural cleaning is done by mopping or suctioning. Other findings like presence of granulation tissue, tympanosclerosis, etc are noted.

Pure tone audiometry was done in all patients to know the type and degree of hearing loss. Mostly the patients had a conductive type of hearing loss. It is also done to check if there is any associated sensorineural component of hearing loss in the patient, In case of bilateral ear disease it helps in deciding which ear to be operated.

X-ray bilateral mastoid (Schuller's view) was done to see if the mastoid is cellular or sclerosed. Depending on it the surgery is planned. If the mastoid is cellular, then myringoplasty is done, but if mastoid is sclerotic then cortical mastoidectomy is done with myringoplasty.

To prepare PRP,(in group 1 patients) patient's venous blood(is withdrawn and taken in sodium citrate tube. It is put in centrifuge and first given a spin for 10 minutes at 2400 rpm (revolutions per minute). This separates it into three layers:

1. Upper layer is the platelet poor plasma
2. Middle layer is the platelet rich plasma
3. Lower layer is the RBC(red blood corpuscles)

Now the platelet poor plasma and the platelet rich plasma are taken in a syringe and put in a plain tube and subjected to centrifugation for 15 minutes at 3600 rpm. This causes the platelet rich plasma to settle at the bottom of the tube and on the top lies the acellular plasma. This platelet rich plasma is then collected and administered during surgery. In our study we have locally applied PRP with gelfoam after the placement of the graft.

Myringoplasty is a treatment that can be used to close tympanic membrane perforations. It is often accompanied with cortical mastoidectomy in instances that showed sclerosed mastoid on x ray. In this operation, the middle ear and mastoid are aerated, chronically inflammatory tissue is removed, and the tympanic membrane is repaired.

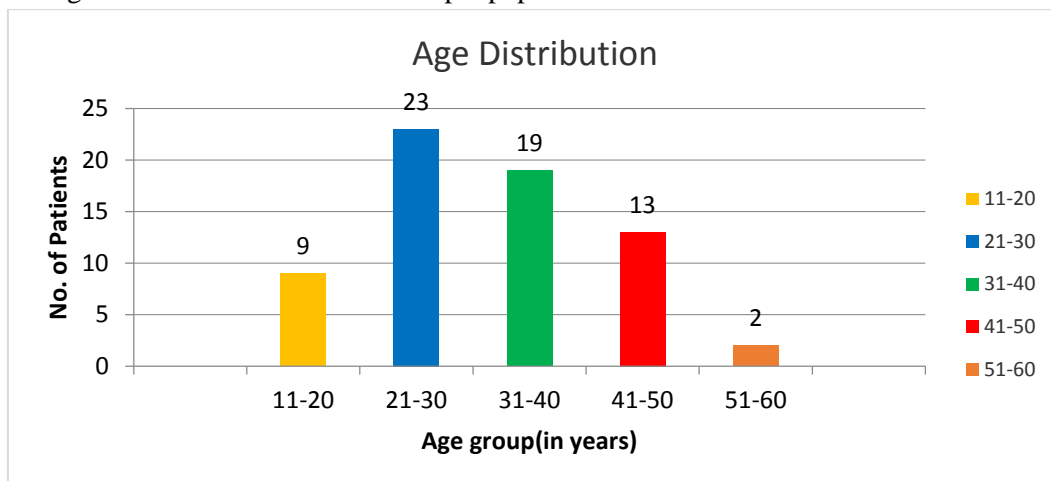
Postoperatively patients were followed up.

OBSERVATION AND RESULTS

Table 1- Age wise distribution of total sample population

Age group (in years)	No. of patients	Percentage (%)	95% CI (confidence interval)
11-20	9	13.64	6.86-23.55
21-30	23	34.85	24.11-46.89
31-40	19	28.79	18.85-40.55
41-50	13	19.69	11.42-30.59
51-60	2	3.03	0.51-9.65
Total	66	100	

Graph 1- Age wise distribution of total sample population

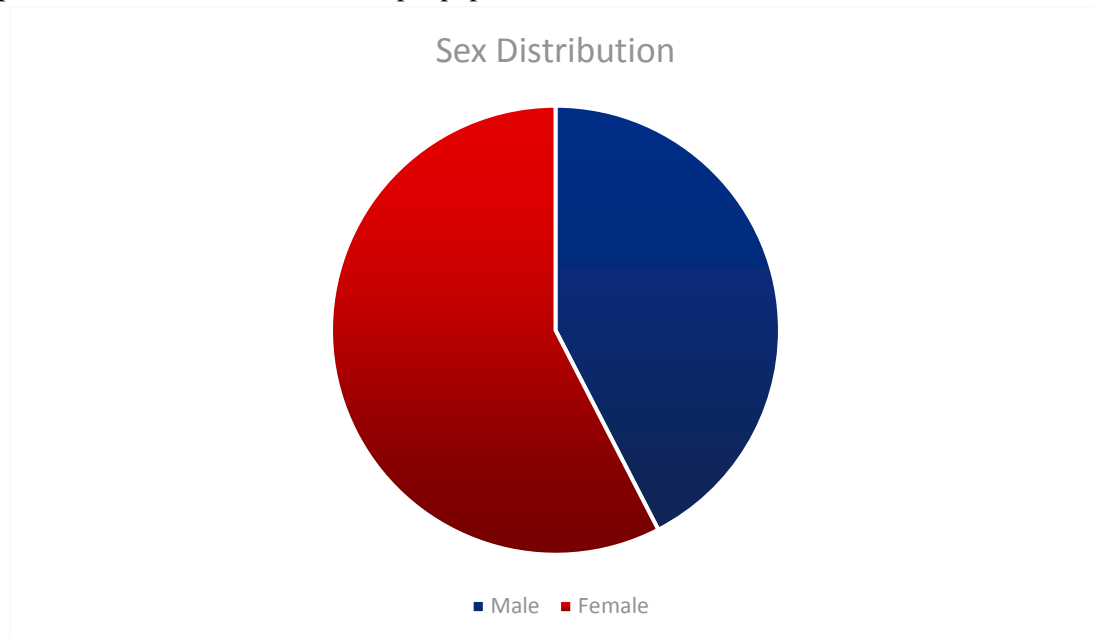


In table 1 and graph 1 we see the age wise distribution among the patients. Most of the patients fall in the age group of 21-30 years.

Table 2: Sex distribution of total sample population

Sex	No. of Patients	Percentage (%)	95% CI
Male	28	42.43	30.95-54.55
Female	38	57.57	45.45-69.05
Total	66	100	

Graph 2: Sex distribution of total sample population



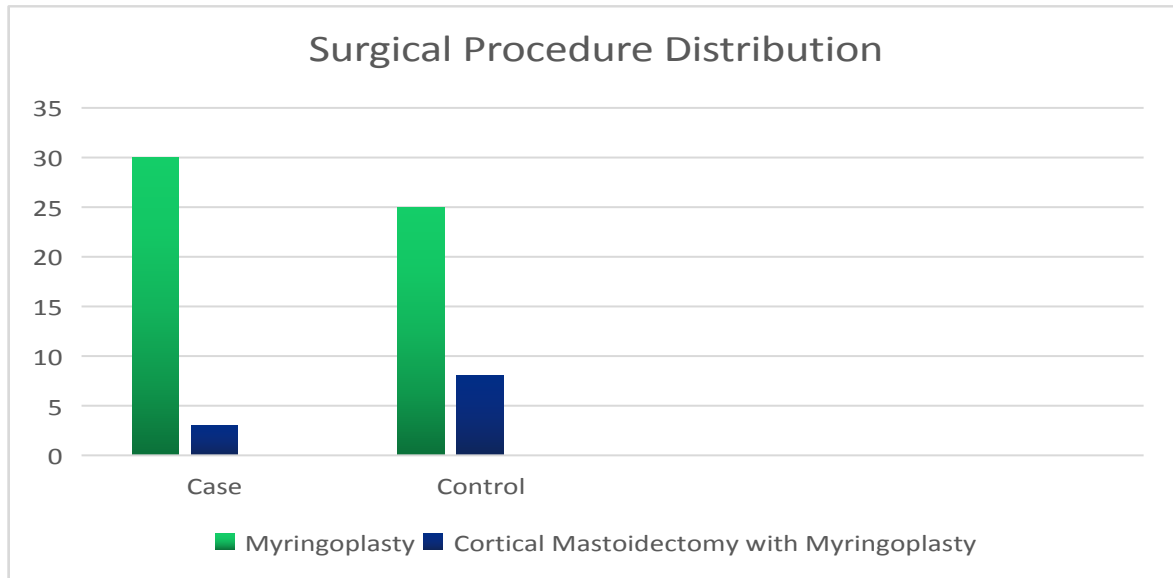
In table 2 and graph 2 we see the sex distribution among the patients. In our study 28 patients (i.e. 42.43% of study population) were male and 38 patients (i.e. 57.57% of study population) were female.

Table 3: Surgical procedure distribution

Procedure	Group 1	Group 2	Total N(%)
Myringoplasty	30	25	55(83.33%)
Cortical Mastoidectomy with Myringoplasty	3	8	11(16.67%)

*N- percentage of patients

Graph 3: Schematic representation of surgical procedure distribution



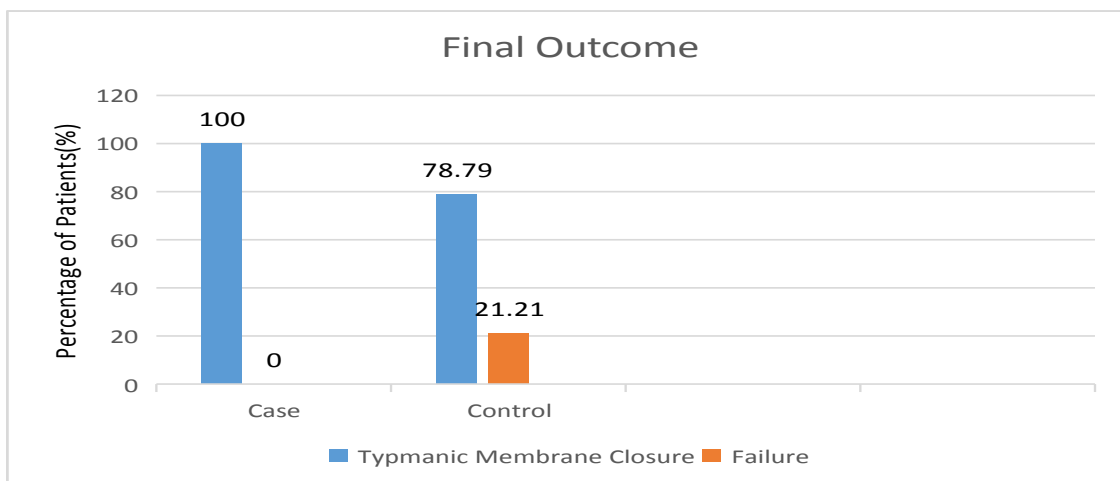
In table 3 and graph 3 we see the surgical procedure distribution among the patients. Overall 55(83.33%) patients underwent only myringoplasty and 11(16.67%) patients underwent cortical mastoidectomy with myringoplasty.

Table 4-Final outcome

Final Outcome	Group 1 N (%)	Group 2 N (%)	Odds Ratio* (95% CI)	p- value
Tympanic Membrane Closure	33(100%)	26(78.79%)	18.96 (1.036-347.2)	0.004912
Failure	0(0%)	7(21.21%)		

*Haldane-Anscombe Correction

Graph 4: Schematic representation of final outcome



In table 4 and graph 4 we see the final outcome among the patients of both the groups. The patients of group 1 showed 100% TM closure whereas patients of group 2 showed 78.79% TM closure and failure in 21.21% of them. Applying Haldane Anscombe correction,we have done chisquare test and

the odds ratio is 18.96. Thus the odds of TM closure with PRP is 18.96 times more than the odds of TM closure without PRP. The study is statistically significant.

DISCUSSION

In our study we took a sample size of 66 out of which 33 in group 1 were cases and 33 in group 2 were control.

In our study chronic otitis media was seen commonly in the young adults between age group of 21 to 30 years (as seen in Table 1 and Graph 1), whereas in UK National Study of Hearing where chronic otitis media was most common in the age group of 41 to 80 years.

The majority of the patients in our study with chronic otitis media were female, which comprised of 38 patients, i.e. 57.57% of the sample (Table 2 and Graph 2), whereas in UK National Study of Hearing showed no difference in the prevalence of chronic otitis media in male and female.

Myringoplasty as surgical treatment was done in 55 patients (i.e. 83.33% of the sample size) among which 30 are in group 1 and 25 are in group 2. Myringoplasty alone was done in patients who had cellular mastoid. Cortical Mastoidectomy along with myringoplasty was done in 11 patients (i.e. 16.67% of the sample size) among which 3 are in group 1 and 8 are in group 2. (Table 3 and Graph 3) Cortical Mastoidectomy with myringoplasty was done in patients with sclerosed mastoid or clouding of air cells.

Now in group 1 among 33 patients, all of them (i.e. 100% of the group 1 patients) showed tympanic membrane closure and graft uptake was good with no failure.

In group 2, 26 (i.e. 78.79% of the group 2 patients) showed tympanic membrane closure and 7 (i.e. 21.21% of the group 2 patient) showed failure (Table 4 and Graph 4).

Now the odd's ratio of the study is 18.96. Thus the odds of graft uptake and tympanic membrane closure using platelet rich plasma is 18.96 times more than the odds of graft uptake and tympanic membrane closure without platelet rich plasma.

The p value of 0.004912 is obtained which shows that the study is significant.

The findings of our study coincided with other similar studies.

El-Anwar *et al.* has assessed the use of autologous PRP topically and concluded that it is very efficient in rapid healing of long standing tympanic membrane perforation. ⁽¹⁰⁾

In this study tympanic membrane perforation cause was not limited to chronic otitis media patients only, patients with tympanic membrane perforation due to other causes were also taken into account.

Yadav *et al.* conducted study of underlay myringoplasty using platelet rich plasma and found that graft uptake is 95% with platelet rich plasma and 85% without it. ⁽¹¹⁾ Thus concluding better graft uptake with PRP. In our study also we advocated underlay myringoplasty.

Sankaranarayanan *et al.* assessed the use of PRP in tympanoplasty and found that tympanic membrane closure rate of 92% was seen in the group where platelet rich plasma was used and 70% was seen in the group where it was not used. ⁽¹²⁾ Thus it concluded the benefit of using PRP in myringoplasty. This study was not only limited to myringoplasty but also took into account COM patients requiring ossicular reconstruction.

Fawzy *et al.* in their study shows, the group in which PRP was used in myringoplasty, 90% of them showed an intact tympanic membrane (TM), the other group in which PRP was not used in myringoplasty, 55% were successful. ⁽¹³⁾ Thus it concluded that autologous PRP application in myringoplasty showed more success in TM closure.

Nair *et al.* studied the efficacy of autologous platelet rich fibrin in myringoplasty. ⁽¹⁴⁾ It showed 100% tympanic membrane(TM) closure and better graft uptake on using platelet rich fibrin, on the other hand it showed 79% TM closure without using platelet rich fibrin. Thus it concluded better graft uptake and TM closure using platelet rich fibrin. The findings of this study also coincided with our study.

CONCLUSION

Newer advances are necessary in the surgery of myringoplasty for better graft uptake and using platelet rich plasma can be considered as one of them. Platelet rich plasma is a concentrate of growth factors that helps in mitogenesis, angiogenesis, vasculogenesis, cell growth, proliferation and differentiation. It accelerates and enhances healing of the wound. Platelet rich plasma is now being used as a clinical tool in various branches of medicine.

In our study we have used platelet rich plasma to see it's efficacy in myringoplasty by seeing the TM closure. Here the group where platelet rich plasma was used showed more rate of TM closure than the group in which platelet rich plasma was not used.

Thus, from our study it can be concluded that platelet rich plasma is a concentrate of growth factor which helps in better uptake of graft in myringoplasty.

It accelerates tympanic membrane closure and prevents graft displacement.

Thus it improves the outcome of myringoplasty.

BIBLIOGRAPHY

1. Acuin J.- Chronic suppurative otitis media: Burden of illness and management options. Geneva, Switzerland: World Health Organization; 2004.7-19
2. Mościcka P.; Przyłipiak A. -History of autologous platelet- rich plasma: A short review. - Journal of Cosmetic Dermatology. 2021, 20 (9): 2712–2714.
3. Borrione P, Gianfrancesco AD, Pereira MT, Pigozzi F.-Platelet-rich plasma in muscle healing.- American Journal of Physical Medicine & Rehabilitation.2010,89 (10):854–61.
4. Yu W, Wang J, Yin J. -Platelet-rich plasma: a promising product for treatment of peripheral nerve regeneration after nerve injury. - The International Journal of Neuroscience.2011, 121 (4): 176–80.
5. Wartiovaara U.; Salven P.; Mikkola H.; Lassila R.; Kaukonen, J.; Joukov V. et al.- Peripheral blood platelets express VEGF-C and VEGF which are released during platelet activation.- Thrombosis and Haemostasis.1998, 80 (1): 171–175.
6. Custo S; Baron B; Felice A.; Seria E.- A comparative profile of total protein and six angiogenically-active growth factors in three platelet products. GMS Interdisciplinary Plastic and Reconstructive Surgery DGPW. 2022, 11.
7. Mudry A.- History of myringoplasty and tympanoplasty type I.- Otolaryngol Head Neck Surg 2008; 139(5): 613–14.
8. Sarkar S. -A Review on the History of Tympanoplasty-Indian J Otolaryngol Head Neck Surg. 2013 Dec; 65(Suppl 3): 455–460.
9. Aggarwal R, Saeed SR, Green KJ. -Myringoplasty. - J Laryngol Otol 2006; 120(6): 429–32.
10. El-Anwar MW, El-Ahl MA, Zidan AA, Yacoup MA. -Topical use of autologous platelet rich plasma in myringoplasty.- Auris Nasus Larynx. 2015 Oct;42(5):365-8.
11. Yadav SPS, Malik JS, Malik P et al. -Studying the result of underlay myringoplasty using platelet-rich plasma.-The Journal of Laryngology & Otology- 2018, 132 (11): 990-994.

12. Saeedi M, Ajalloueian M, Zare E et al.-The Effect of PRP-enriched Gelfoam on Chronic Tympanic Membrane Perforation: A Double-blind Randomized Clinical Trial.- *Int Tinnitus J.*, 2017,21 (2): 108-111.
13. Fawzy T, Hussein M, Eid S et al.- Effect of adding platelet- rich plasma to fat grafts in myringoplasty.- *The Egyptian Journal of Otolaryngology.*, 2018, 34: 224-228.
14. Nair NP, Alexander A, Abhishekh B, Hegde JS, Ganesan S, Saxena SK. Safety and Efficacy of Autologous Platelet-rich Fibrin on Graft Uptake in Myringoplasty: A Randomized Controlled Trial. *Int Arch Otorhinolaryngol.* 2019 Jan;23(1):77-82