

*Research Article***Efficacy of Platelet-Rich Plasma on Fat Grafts in the Repair of Tympanic Membrane Perforations**

Adel A. Abdallah*, Mostafa S. Hammad*, Ahmad A. Sadeq*, Zaki Mohamed Zaki**, Heballa A. Ali* and Mostafa T. Abd-El Hakeem*

* Department of Otorhinolaryngology; Faculty of Medicine – Minia University- Egypt

** Department of clinical pathology; Faculty of Medicine – Minia University- Egypt

Abstract

Purpose: A retrospective clinical study for reporting the efficacy of fat grafting for small tympanic membrane perforations due to: trauma, infection, post-tympanostomy tube extraction and post myringoplasty residual perforations with topical use of autologous platelet rich plasma (PRP). **Patients and Methods:** Thirty patients aged between 18 to 58 years; with fat graft myringoplasty were operated for closure of tympanic membrane perforation due to the above causes. Half the patients underwent fat graft myringoplasty (group A), while others received the fat graft with PRP (group B). **Results:** The graft was taken in 13 patients (86.7%) in group A, and in 14 patients (93.3%) in group B. Healing time was shorter in group B (2 months) than in group A (3 months). There was insignificant difference between the two graft types in hearing gain, but in each graft type there was significant decrease in the mean ABG postoperatively. **Conclusion:** Fat graft myringoplasty is an easy, simple, fast and minimally invasive procedure for the repair of small tympanic membrane perforations with favorable results with topical autologous PRP.

Keywords: Myringoplasty, Platelet Rich Plasma, tympanic membrane, traumatic perforation, small and medium sized perforation, fat graft, Chronic Suppurative Otitis Media.

Introduction

Tympanic membrane perforations (TMs) are particularly common in our community. Various grafting materials have been used to reconstruct the TM, including skin, fascia, vein, fat, perichondrium, dura mater, and cartilage. Tragal cartilage is the most frequently used grafting material. Fat grafts are easier to harvest; however, they are known to be absorbable. Performing simple fat plug myringoplasty, defined here as the closure of TMs without elevation of the annulus, is usually reserved for small, traumatic perforations.

Complementing the fat graft with platelet-rich plasma (PRP) to render the graft more stable can encourage the use of fat grafts in larger perforations. PRP is an autologous product. Platelets are key factors in tissue repair mechanisms. They provide essential growth factors, which stimulate fibroblasts and endothelial cells to create extracellular matrix deposition and neovascularization.

Plasma contains many factors essential for cell survival, including nutrients, vitamins, hormones, electrolytes, growth factors, and proteins. They serve as a promoter for cell migration and new tissue generation.

Patients and Methods

This retrospective study was conducted on patients with dry central small and medium sized TM perforation caused by tubotympanic chronic suppurative otitis media scheduled for FGM during the period from June 2019 to May 2020. Patients were categorized into two groups: FGM group: included patients who were operated without PRP.

PRP-FGM group: included patients who were operated by PRP with FGM.

TM perforation was considered medium sized if its surface area is more than quarter of the TM surface and less than half of the TM surface, as described by Saliba, 2008³ into:

Perforation	Size in percent	TM quadrant affected	
Small	Less than 25%	Less than one Q size	
Medium	More than 25% Less than 50%	More than 1 Q size and Less than 2 Q size	
Large	More than 50% Not total	More than 2 Q size and Not total	
Total	100% or total	Completely 4 Q size	

Figure (1): Perforation size subdivision based on the four tympanic membrane quadrant size (Saliba's subdivision). Q=quadrant

Preparation of autologous PRP:

During induction of anesthesia and first steps of surgery, 10ml of peripheral venous blood was drawn from the patient with a 10 ml syringe to avoid irritation and damage of the platelets; then collected blood was kept in a 5 ml plain vacuum tubes, and then the tubes were immediately centrifuged using a tabletop centrifuge machine and finally the temperature of the centrifugation was kept at 20°C to 24°C. So blood was separated out into the three layers owing to the density of its inner contents: the bottom layer consists of red blood cells, the middle layer contains PRP (about 1.5 ml³), which is composed of platelets and white blood cells (WBCs; buffy coat) that could be easily obtained and the top layer contains platelet poor plasma. The PRP layer was taken out at time of use.

Technique:

The ear lobe was infiltrated using 2% lidocaine with 1:100,000 adrenaline to prevent bleeding. A 5 mm incision was made at the medial surface of the tip of the ear lobe. The skin was undermined and an amount of fat as twice as the size of the perforation was harvested in one piece and was put in a sterile saline solution. The

incision was closed by one or two 3/0 silk sutures.

The whole procedure was performed transcanally, with no external incision. The margins of the perforation were de-epithelialized circumferentially with sharp curved needle, under vision of 0°, 2.7mm × 9 cm rigid endoscope connected to single chip STORZ camera. Gelfoam pieces were placed into the middle ear through the perforation to support the fat graft in the cases of medium and large perforation but not in small sized one. The fat graft was then inserted through the perforation as an hourglass shaped plug, bulging through the perforation. For adequate closure of the perforation, it is important to ensure that the fat contacts all the margins of the perforation, with some fat bulging over the perforation. Gelfoam was inserted on the lateral surface of the graft and tympanic membrane remnant in external auditory canal (EAC).

In group A: No PRP is added to the graft.

In group B: Before and after placing and adjusting the graft in its place, PRP is applied on fat graft and gel foam in the middle ear and EAC.

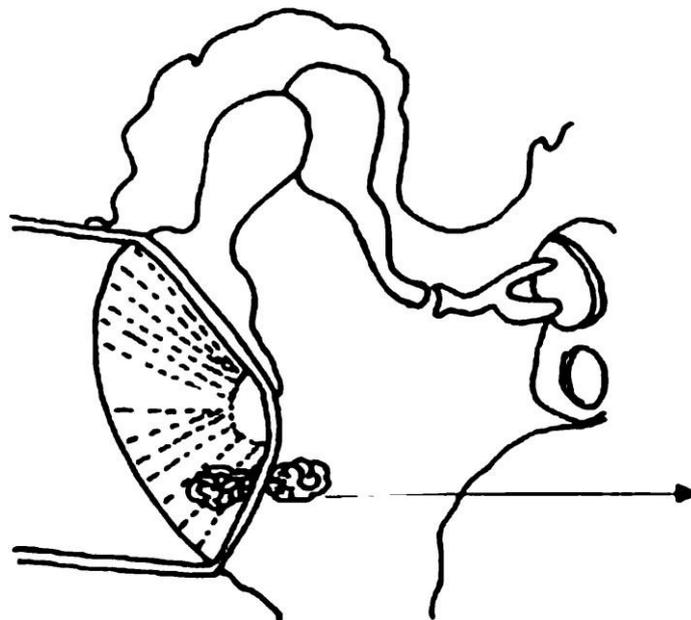


Figure (2): The arrow showing Fat Plug through the perforation.

In both groups, the external ear is filled with pieces of gelfoam, external ear opening is sealed with a merocel ear pack. The dressing was left over the operated ear for 1 week.

Postoperative follow-up:

Broad spectrum systemic antibiotic, decongestant as well as non-steroid anti-inflammatory agents were described for 1 week with advice to avoid blowing nose, straining or any vigorous exercise and general water precautions. All were followed up at 6 weeks, 3 months and 9 months. The patients in this study were evaluated on the basis of postoperative graft taking, hearing improvement and complications. Successful closure of

perforation was defined as an intact TM at 3 months postoperatively. Success in terms of hearing was defined as an improvement of 10 dB or greater at 3 months.

Results

The graft success was achieved in 27 patients, 13 patients (86.7%) in group A, and in 14 patients (93.3%) in group B. No lateralization or medialization was seen in the successful cases.

As regarding pre- and postoperative mean ABG and hearing gain, there was insignificant difference between the two graft types, but in each graft type there was significant decrease in the mean ABG postoperatively.

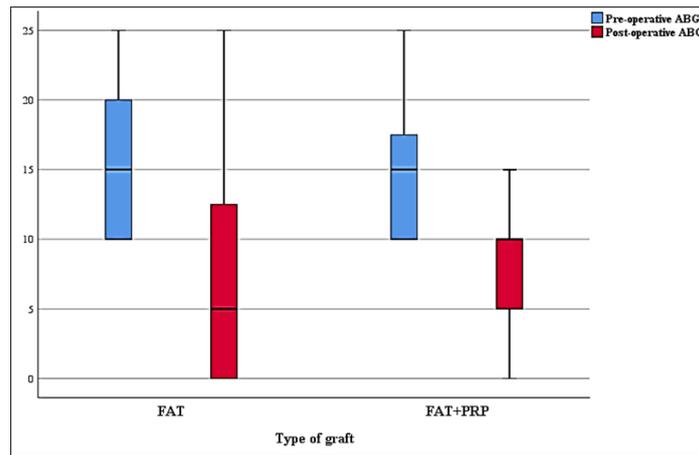


Figure (3): Relation between preoperative and postoperative ABG and graft type.

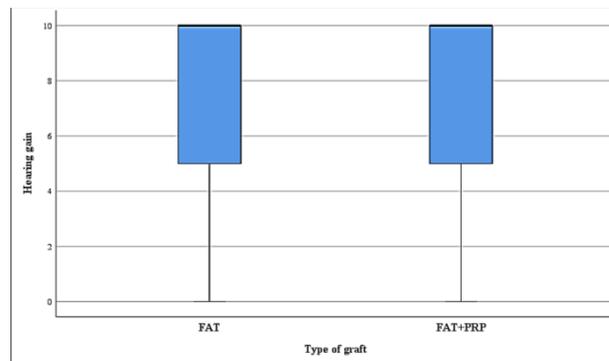


Figure (4): Relation between hearing gain and type of graft.

As regarding healing, there was insignificant difference between the two graft types, but FAT showed significant increase in time to heal compared to FAT+PRP as shown in table (2).

Table (2): Healing and time to heal in relation to type of graft

		Type of graft		P value
		FAT	FAT+PRP	
		N=15	N=15	
Healing	Not healed	2(13.3%)	1(6.7%)	1
	Healed	13(86.7%)	14(93.3%)	
Time to heal	<i>Median</i> <i>IQR</i>	3 (2-4)	2 (2-3)	0.035*

- Fisher’s Exact test for qualitative data between the two groups
- *Significant level at P value < 0.05

Time to heal showed significant positive correlation with perforation size, the correlation was strong and moderate in FAT and FAT+PRP respectively.

Discussion

FGM has many advantages; it is usually performed by transtympanic approach which is simpler and easier to be performed under local anesthesia than other approaches used in the classic underlay myringoplasty. There is no elevation of the tympanomeatal flap resulting in low risk of injury of the tympanic annulus, chorda tympani, and middle ear ossicles; also low risk of medialization or lateralization of the graft. In addition, the donor site in FGM is easy accessible through a small skin incision with minimal morbidity.

However, in transtympanic approach, exploration of the tympanic cavity and the integrity and mobility of the ossicular chain could not be properly evaluated. For this reason, we excluded in our study any case with suspected middle ear pathology rather than TM perforation.

The autologous PRP is simple and easy to be prepared with no reported side effects. Erkilet et al., suggested that autologous PRP is effective in accelerating TM perforation healing in rats. This encourages us to try it in myringoplasty in large TM perforation in human, particularly as it is an autologous material. In current study, the graft take rate was excellent in almost all cases (93.3% success rate) with the use of PRP with significant higher take rate than without PRP use with no reported complication including infection that was reported to be significantly higher in control group.

These results prove the role of autologous PRP in enhancing healing of TM even in large perforation. In addition, PRP as prepared in current study has a significant role against infection. This is not consistent with Bielecki et al., and Tate and Crane who reported that the presence of WBCs in high concentrations in PRP makes it act as bacteriocidal. No effect of PRP use on hearing gain in graft taked cases because hearing gain related to closure of TM.

Conclusions

In our study, we found that autologous PRP application accelerates TM closure following fat plug myringoplasty, and prevents graft displacement.

It also decreases time of healing, highly efficient and successful with no reported complication.

Conflict of interest: None

Funding Sources: This study was supported by personal funds and funds from Minia University.

Ethical approval: All procedures performed in this study followed the 1964 Helsinki declaration and its later amendments and was approved by the local research ethics committee at Minia Faculty of Medicine. Informed consent was obtained from all the study participants.

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