



Canal Wall Reconstruction and Mastoid Cavity Obliteration with Silicone Blocks and Platelets Rich Plasma

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ABSTRACT

Background: Reducing nitrogen-absorbing mucosa in the mastoid cavity, preventing cholesteatoma recurrence in patients with dysfunctional eustachian tube and avoiding mastoid cavity problems are The main goals of mastoid cavity obliteration. Platelet rich plasma represents a recent biotechnology providing a high concentration of growth factors, which found to be highly effective in healing acceleration and infection prevention. Our Aim To evaluate using of silicone blocks and platelet rich plasma in canal wall reconstruction and mastoid cavity obliteration after mastoidectomy.

Methods: Our study applied on 20 patients with cholesteatoma who underwent mastoid obliteration with silicone blocks and platelet rich plasma, the used surgical technique composed four major steps: First, Mastoidectomy and the middle ear clearing from all pathologic lesions were achieved Then, reconstruction of the canal wall then filling up the the epitympanic space and the mastoidectomized cavity by silicone blocks. Finally, covering the surface of the silicone blocks by Platelet rich plasma and Temporalis fascia \pm bone pate and Reinforcing the reconstructed canal wall by anterior based periosteal flap.

Results: (90%) of the operated cases maintained a near normal shape and contour with healed ear drum, the air-bone gap mean was improved by about 19 dB ($P < .001$)

Conclusions: Silicone blocks and platelet rich plasma considered as a good material for mastoid cavity obliteration.

Key Words: Cholesteatoma; Silicones; platelet rich plasma; Mastoid



INTRODUCTION

CWD mastoidectomy has many advantages over CWU technique including, excellent exposure and low residual and recurrent rates. However, cavity problems including continuous discharge, debris accumulation, dizziness following temperature or pressure changes, and difficulty in fitting a hearing aid are its main disadvantages [1]. Reducing nitrogen-absorbing mucosa in the mastoid cavity, preventing cholesteatoma recurrence in patients with dysfunctional eustachian tube and avoiding mastoid cavity problems occurrence are The main advantages of mastoid cavity obliteration. Free graft, fat, cartilage, bone chips, bone pate, hydroxyapatite, and several kinds of muscle flap were used to fill the cavity [2]. Each technique has advantages and disadvantages. In this study, we use silicone blocks as the mastoid obliterating material. Silicone blocks are flexible to be fitted into variable size cavities, and rigid to the degree that prevent its collapse. Regarding to its price,

silicone blocks are cheaper than other alloplastic materials. Platelet rich plasma is a simple and minimally invasive method to obtain a high concentrate of Growth factors (GF) [3].

PRP represents an excellent recent biotechnology, in future it will be widely used for soft and bony tissue embalmment [4]. PRP acting as a rich source of GFs that provide several advantages such as:(1) Decreases the probability of bleeding during and after surgery. [(2) Soft tissue wound healing acceleration. (3) Regarding its cohesive and adhesive nature helping in the initial stability of the graft at the grantee sites). (4) Enhance vascularization and regeneration of the healing tissue. (5) Decrease opportunity of infectious disease transmission as it is produced from the patient's own blood. (6) Can be used in many outpatient surgical procedure because of easily preparation in the clinic. (7) Fasten wound healing. (8) NO patient morbidity Since it is prepared with only 8 to 10 ml of his own blood. (9) Improving application of bone substitute materials by making

them more gel like. (10) Short time Preparation, Prp is prepared within 12 minutes [5].

METHODS

Selection of patients was applied on 20 patients in the Department of Otorhinolaryngology, Head and Neck Surgery, Zagazig University, in the period from march 2017 to May 2020. Tympanomastoidectomies and mastoid obliteration with silicone blocks and PRP were performed for All patients. A written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion criteria include patients with chronic suppurative otitis media (Cholesteatoma) , Primary or revision surgery.

Exclusion criteria include complicated cases of chronic suppurative otitis media, Patients having any ear anomalies, Medically and surgically unfit patients and Patients who cannot provide informed consent.

Pre-operative evaluation done after written informative consent, General and ENT examination (including otoendoscopy). Fig (1) were offered. Audiological assessment followed. High resolution computerized tomography (HRCT) of the temporal bone. Fig (2) was requested for all patients.

Silicone and PRP preparation was done by cut the silicone into small pieces ranging from 4 to 15 mm using a surgical ruler stainless steel. 5 mL of peripheral venous blood. The collected blood was put in 5-mL tubes (without an anticoagulant or calcium). Tubes were immediately centrifuged in a tabletop centrifuge (Low Speed Centrifuge [800]; Jiangsu Zhengji Instruments, Jiangsu, China) machine for 12 minutes at 3200 rpm. Blood would separate into the 3 layers: the bottom layer (red blood cells), the middle layer (PRP; platelets and white blood cells), and the top layer (platelet-poor plasma) The PRP layer was extracted just before application [6]. Fig (3)

Surgical technique

Under general anesthesia with hypotensive technique, our surgical technique started with

Skin disinfection with povidone iodine 10%, Drapping and Injection is done by 1/200000 adrenalin lidocain solution injected in the external auditory canal under posterior meatal wall skin, at 6th O'clock and 12th O'clock and postauricular ,this is followed by a classic post-auricular skin incision and the anterior based periosteal flap were done, then the deep layer of Temporalis fascia was harvested and posterior meatal skin flap was elevated, We collect Healthy cortical bone pate in some cases, Mastoidectomy was done and all pathologic lesions within the mastoid and middle ear cavities including hidden areas were removed with endoscopic assessment to reduce residual and recurrence , Silicone blocks were used to reconstruct canal wall , obliterate the epitympanic space allowing recreation the annulus superiorly again and to obliterate the mastoid cavity after that we cover silicone blocks with platelet rich plasma and the previously harvested temporalis fascia. Fig (4) We use collected bone pate in some cases, finally, the anterior based flap was placed to strengthen the reconstructed EAC which later on was packed by several pieces of gel foam over the tympanoplasty graft, followed by gauze strip impregnated with ointment (inner pack). The postauricular wound was closed using vicryl sutures in 2 layers.

Postoperative care involves discharging The patients in the operative day with oral analgesic and oral antibiotic to 2week course. The dressing, sutures and the outer pack were removed after 1 week postoperatively. Antibiotic and antifungal ear drops were instilled on the inner pack until removing it 3 weeks later on. The patients were instructed to keep the external auditory canal dry.

Follow up of All patients once weekly for the first 2 months postoperatively, then once monthly for another 6 months by otoendoscopic examination. Pure tone audiometry, CT scan and DW MRI were done 6 months after surgery.

STATISTICAL ANALYSIS

The data were computerized and statistically analyzed using program of Statistical Package for Social Science (version 24). We represent Qualitative data as frequencies and relative percentages. Quantitative data were presented as mean \pm Standard deviation.

RESULTS

Table (1): Intraoperative difficulties:

		Number	Frequency
Dural exposure	Exposed dura was Covered	2	10.0%
	By Bone Wax		
Facial nerve Injury	No	0	0.0%

		Number	Frequency
Sigmoid sinus exposure	Exposed sinus was covered by bone pate and bone wax	1	5.0%
Corda tympani injury	Taste alteration(metallic taste)	4	20.0%



Fig (1): preoperative otoendoscopy
Fig (2):: preoperative HRCT temporal bone coronal view showing It ear opacity in attic and tympanic cavity and external canal.

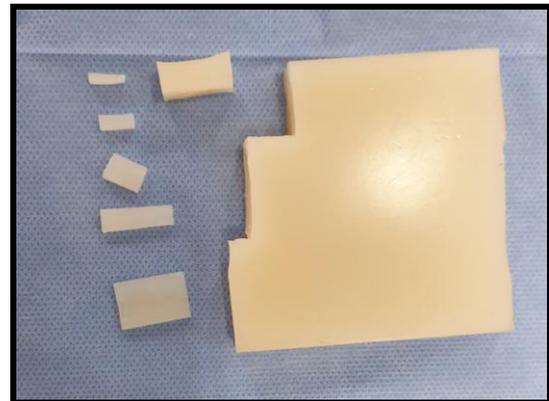


Fig (3): silicon blocks and PRP

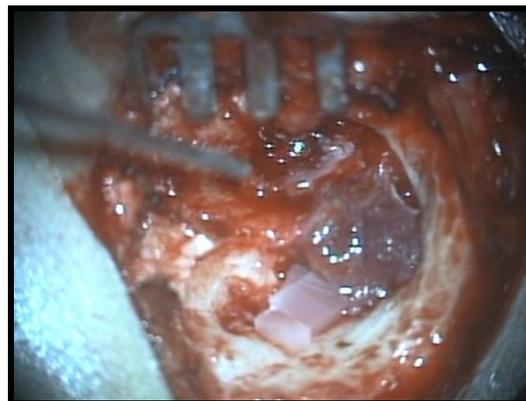


Fig (4): silicone blocks were covered with platelet rich plasma and then the previously harvested temporalis fascia.

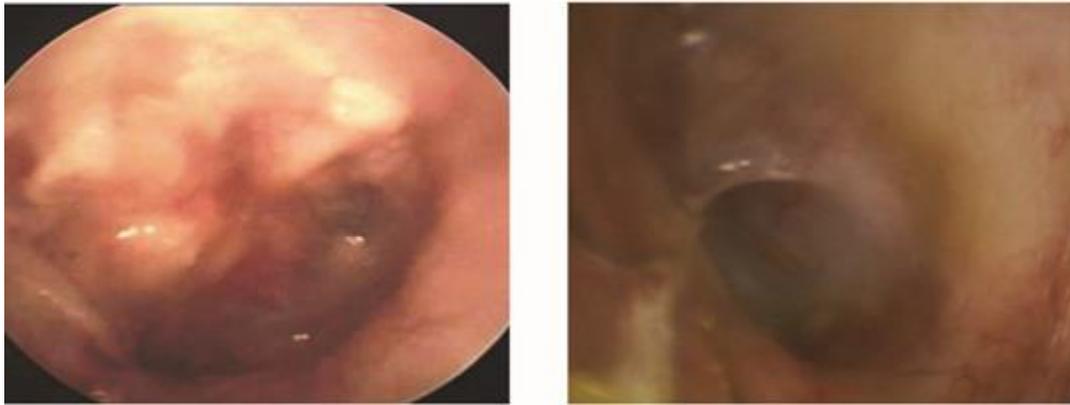


Fig (5): A,B: Otoendoscopic view 6 months after surgery showing EAC near normal in shape and contour, healed Tympanic membrane grafting.

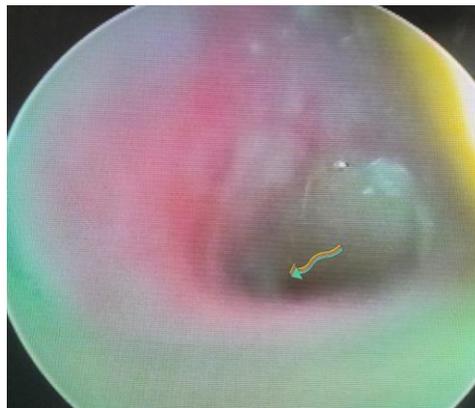


Fig (6): Extrusion of silicone pieces and discharge in EAC without healing of tympanic membrane grafting.

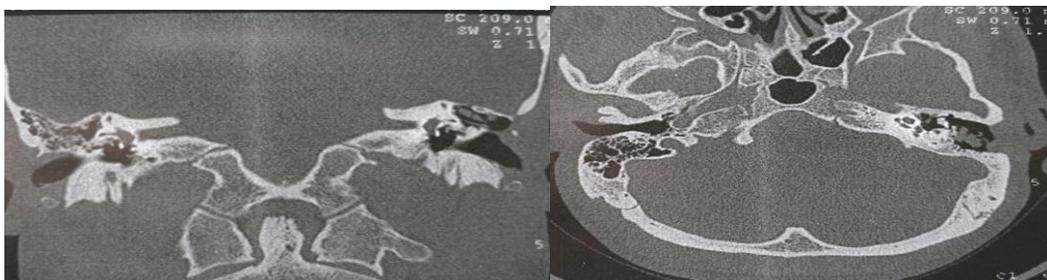


Fig (7): A, B: Axial and Coronal temporal bone CT scan Showing Obliterated mastoid cavity and epitympanic space with near normal EAC concerning shape and contour (cylindrical).

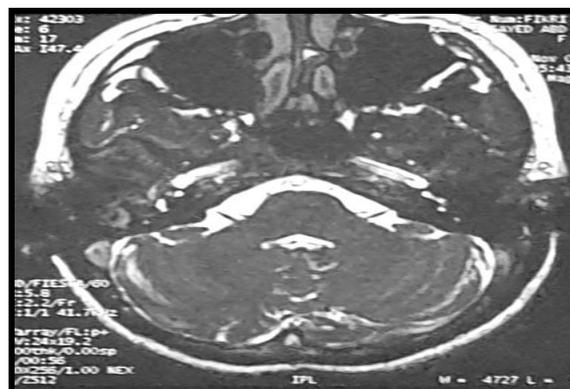


Fig (8): DW MRI axial view 6 months after surgery showing no recidivistic lesion.

This study was carried out on 20 ears of 20 patients in our Department of Otorhinolaryngology, Head and Neck Surgery, Zagazig University from March 2017 till May 2020. The patients consisted of 6 females (30%) and 14 males (70%), their ages ranged from 14 to 53 years. The mean age of patients was 30 ± 10 SD.

Intraoperative difficulties: Dural exposure during burring has occurred in two patients (10%), and the defect was covered with bone wax and complete the surgical procedure. No intraoperative facial nerve injury. sigmoid sinus exposure was found in one case the defect was covered with bone pate and bone Wax. Corda tympani injury in four patients (20%) The patients complained from taste alteration for about 4 to 6 months postoperatively which compensated and disappeared through the period of follow up. table (1)

Through follow up: One patient (5%) only had infection-related signs in the incision site as discharge and gapping for about 3 weeks postoperatively, patient readmitted. the infection responded to conservative treatment, in the form of IV systemic antibiotic and topical antibiotic ointment, and then the site of incision` healded by secondry intension. All patients expiernced a well healed external ear canal and tympanic membrane grafting and the healing was rapid similar to that of CWU surgery and the reconstructed canal wall found to be unimpaired and the new canal appeared near normal regading its shape and contour, Fig (5). Healing alterations occure in two patients (10%), one of them the reconstructed posterior canal wall (silicone sheet) displaced anteriorly causing mild stenosis of the canal, the other one show disruption of the reconstructed wall and extrusion of silicone pieces in EAC without healing of tympanic membrane grafting. Fig (6)

Audiological follow up

Preoperatively: All patients had preoperative conductive hearing loss, the preoperative PTA-ABG ranged from 25 to 40 dB HL and the mean preoperative PTA-ABG was 32 ± 7 dB HL.

Postoperatively: Pure tone audiogram has been done for all patients 6 months After surgery. postoperative PTA-ABG ranged from 5 to 40 dB HL. the mean postoperative PTA-ABG was 13 ± 11 dB HL. The mean improvement in air-bone gap was about 19 dB ($P < .001$) which is highly significant.

Radiological follow up by High Resolution Computerized Tomography (HRCT) which has been done for all patients 6 months after surgery. The external canal wall appeared smooth and the newly reconstructed canal appeared normal in

shape and contour. Silicone blocks in epitympanic space and the mastoidectomized cavity easily identified in follow up by HRCT. Fig (7)

Post-operative DW MRI 6 months after surgery show no recidivistic lesion. Fig (8)

DISCUSSION

Cholesteatoma management sometimes requires canal wall down mastoidectomy for adequate surgical management. To overcome problematic mastoid cavities Otologists, develop a new techniques and use a number of materials including biological and alloplastic ones for mastoid obliteration [7] Each technique has advantages and disadvantages. Fat, cartilage, bone and various flaps, all are Biological materials which particulized by resisting the infection, however they have the disadvantage of atrophy, difficulty in reformation and donor site morbidity. Alloplastic materials such as hydroxyapatite, active bioglass and titanium mesh...etc., having the advantages of being easily available, no atrophy, and no donor site morbidity; but it has the disadvantage of infection and exposure [8] Silicone materials are safe because there is no evidence of an immunotoxic response according to Many reports [9]. Generaly silicone materials are used as a medical device, such as CSF shunts, IV tubing, arthroplasty prostheses, cardiac valves, intraocular lens implants, and rhinoplasty implants.... etc. In ear surgery, silicone sheets, tubes of middle ear ventilation, cochlear implants and silicone ossiculoplasty prostheses are used. Clinical studies had shown that application of autologous PRP during surgery enhances soft tissue healing, bone healing and decrease postoperative infection, pain and blood loss [10]. According to these advantages and disadvantages, silicone blocks with PRP are considered to be avaluable materials in mastoid obliteration.

In our study, 18 case showed a well formed dry canal with a near normal contour on their follow up visit. Otorrhea and disrupted ear drum and destructed posterior ear canal were reported in the 23th months after surgery. The reason for failure was infection of the bone pate. Simple maneuver with local anathesia was performed and removal of the silicone blocks piecemeal and the ear get dry preparing patient for a revision surgery. The results of our study proved that silicone blocks with Platelet rich plasma and are likely to be avaluable materials for mastoid obliteration.

LIMITATIONS

A large number of participant and a long term follow up (5-10 years) will be necessary for better evaluation the stability of the material over a long period of time.

CONCLUSIONS

Piecemeal silicone blocks plus PRP are very valuable materials in reconstructing the canal wall and obliterating mastoid cavity. Covering the silicone blocks with PRP and fascia appears to enhance healing and then prevent infection and the exposure of the silicone blocks.

Conflict of interest: No potential conflict of interest relevant to this article was reported.

Financial disclosure: No

REFERENCES

- 1- *Sade J, Weinberg J, Berco E, Brown M, Halevy A.* The marsupialized (radical) mastoid J Laryngol Otol 1982; 96(10) : 869 - 75.
- 2- *Ghiasi S.* Mastoid Cavity Obliteration with Combined Palva Flap and Bone Pâté Iranian Journal of Otorhinolaryngology 2015; 27(1).
- 3- *Creaney L, Hamilton B.* Growth factor delivery methods in the management of sports injuries: the state of play. Br J Sports Med 2008; 42(5): 314-320.
- 4- *Mazzucco L, Balbo V, Cattana E, Borzini P.* Platelet-rich plasma and platelet gel preparation using Plateltex ; Vox Sanguinis 2008 ; 94 : 202-208.
- 5- *Kanemaru SI, Umeda H, Kitani Y, Nakamura T, Hirano, Ito J.* Regenerative Treatment for Tympanic

Membrane Perforation, Otol Neurotol 2011; 32 :1218-1223.

- 6- *Askar SM, Saber IM, Omar M.* Mastoid Reconstruction with Platelet-Rich Plasma and Bone Pate After Canal Wall Down Mastoidectomy: A Preliminary Report. Ear, Nose & Throat Journal 2019; 1: 5.
- 7- *Kakigi A, Taguchi D, Takeda T.* Mastoid obliteration using calcium phosphate bone paste with an artificial dermis soaked with basic fibroblast growth factor: preliminary clinical report. Auris Nasus Larynx 2009; 36(1): 15-9.
- 8- *Ridenour JS, Poe DS, Roberson DW.* Complications with hydroxyapatite cement in mastoid cavity obliteration Otolaryngol Head Neck Surg 2008; 139(5): 641-5.
- 9- *Bondurant S, Ernster VL, Herdman R.* Institute of Medicine, Committee on the Safety of Silicone Breast Implants. Safety of silicone breast implants. Washington, DC: Institute of Medicine 2000.
- 10- *Bielecki TM, Gazdzik TS, Arendt J, Szczepanski T, Król W, Wielkoszynski T.* Antibacterial effect of autologous platelet gel enriched with growth factors and other active substances; an in vitro study. The Journal of Bone and Joint Surgery 2007 ;89(3): 417-420.

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