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HEARING OUTCOME FOLLOWING CANAL WALL DOWN MASTOIDECTOMY WITH AND WITHOUT MASTOID CAVITY OBLITERATION AND ROUND WINDOW SHIELDING- A COMPARATIVE OBSERVATIONAL STUDY

Otolaryngology

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ABSTRACT

OBJECTIVE: Following canal wall down mastoidectomy, cavity obliteration is one of the recognized methods to reduce cavity size. In this study we have tried to find out if cavity obliteration along with Round Window shielding can improve hearing.

This prospective comparative observational study was conducted in 66 patients who presented in Department of Otorhinolaryngology and Head & Neck Surgery, JMMC &RI , with chronic otitis media – squamosal type, meeting the inclusion criteria. Patients in whom cavity obliteration and RW shielding was included in group 1 and others in group 2.Hearing was reassessed after 6months of surgery.

Postoperatively there was a closure of 12.33dB in ABG and 16 dB hearing gain .

There is statistically significant improvement in hearing following mastoid cavity obliteration and RW shielding. Significant reduction in Air-bone gap is also obtained.

KEYWORDS

Mastoid cavity obliteration, Round window shielding, Airbone gap.

INTRODUCTION

Chronic otitis media is persistent inflammation of the middle ear cleft. It is classified into mucosal and squamous disease. Patients with squamous disease may have to undergo canal wall down mastoidectomy for their complete disease clearance, in which the bony tympanic annulus and much of the ear canal are removed, and the tympanic membrane graft is placed onto the facial ridge and medial attic wall. This results in a significant reduction in the size of the residual middle ear air space, thus causing absence of air column in front of round widow niche which is essential for the same to vibrate during transmission of sound.

A canal wall down procedure also results in the creation of a large air space lateral to the eardrum, that is,the air space within the mastoid bowl including the external auditory canal. This mastoid bowl and ear canal air space hamper the resonances that can influence middle ear sound transmission.

Thus in our study we have tried to restore the physiological environment by obliterating the cavity and shielding the round window. Cavity obliteration help inreducing the size of cavity, better and faster healing and more physiological pathway in view of sound resonance. Round window shielding is done with the aim of ensuring phase difference during sound transmission between oval and roundwindow.

METHODS

This prospective comparative observational study was conducted in 66 patients who presented in Department of Otorhinolaryngology and Head & Neck Surgery, JMMC &RI, Thrissur with chronic otitis media – squamosal type, meeting the inclusion criteria. The study period was from December 2015 – October 2017 including a 6 months follow up time.

Inclusion criteria -patients more than 6 years of age posted for canal wall down mastoidectomy. Who were willing to undergo the study.

Exclusion criteria -chronic otitis media patients with intracranial complications, Patients below the age of 6 years, Patients with Sensory neural hearing loss (SNHL).

Informed written consent was obtained .Detailed history was taken, followed by a thorough examination. Examination of ears were done using an otoscope & subsequently under a microscope to know the status of tympanic membrane, to evaluate status of middle ear, ossicles etc. All details and positive findings were recorded in a pretested structured questionnaire.Pure tone audiogram values are assessed mainly in the speech frequencies of 500Hz,1000Hz, 2000Hz.Type of hearing loss, degree of hearing loss and the air bone gap are recorded. Air-bone gap measured as the difference between the average air conduction and bone conduction threshold at frequencies 500Hz,1000Hz and 2000Hz.

All cases were done under general anaesthesia. Post auricular incision made and subcutaneous tissue dissected. Temporalis fascia graft was harvested.During surgery changes in middle ear and mastoid compartment were noted which included size of perforation if any, ossicularstatus, extend of cholesteatoma. Canal wall down mastoidectomy was performed.Ossiculoplasty was done. If the stapes head is present, temporalis fascia graft was placed on the stapes head .If the stapes suprastructure is eroded by the disease, then long columella ossiculoplasty using sculptured incus or sculptured conchal cartilage(if incus is completely eroded) was performed followed by temporalis fascia grafting. . Total clearance of cholesteatoma and granulations from mastoid cavity, attic and middle ear was done along with saucerization of mastoid cavity. This step was followed by underlay myringoplasty, anterior tucking and ossiculoplasty. Mastoid cavity was then obliterated with the postauricular soft tissue overlying the mastoid bone by advancing it forwards and also with the bone pate collected during drilling. A small piece of cartilage was placed in front of round window to create a continuous air column between sinus tympani, RW niche and hypotympanum. Meatoplasty was done and the postauricular incision closed with absorbable sutures. The external auditory canal was filled with gelfoam and gauze pack soaked in ointment. Mastoid bandage wasalso applied. Patients in which obliteration and round window shielding is carried outwere taken into group 1and in which same is not carried out were assigned to group 2.

Patients were reviewed in OPD at 1,3 weeks 3, 6 months postoperatively. In all cases, otomicroscopy was done and condition of the graft was assessed. Post operatively PTA recorded at 6 months.

RESULTS AND ANALYSIS

Numerical variables were expressed as mean and standard deviation. Categorical variables were expressed as frequency and percentages. To test the mean difference of study, variables between two groups independent two sample t test were applied for parametric variables and Mann Whitney U test were applied for non-parametric variables. To obtain the association of study variables between two groups Chi-square test were applied.

Both the groups were matched in terms of age, gender, symptoms ,duration, type of hearing loss ,mean pre operative PTA and ABG values.

Among the 66 cases majority of patients belonged to the age group of less than 15 years and 25-35 years, with marked male preponderance .65.2 % patients presented with complaints of ear discharge alone & 34.8 %with both ear discharge and hearing loss.

The mean preoperative air-bone gap was 24.24dB & 24.19 dB in group 1 and 2 respectively. Postoperatively there was a reduction of 12.33dB & 3.82dB in ABG in group 1 and 2 respectively. This difference is statistically significant with a p value of <0.001.78% patients had ABG <15 dB among patients who underwent cavity obliteration & RW shielding. In our study the group which had undergone cavity obliteration and RW shielding had average post operative ABG of 11.9dB (figure 1). Hearing gain mean in those patients who had undergone cavity obliteration and round window shielding was 16 dB and in second group was 6.2 dB.(figure 2) It showed a statistically significant difference with p value <0.001.

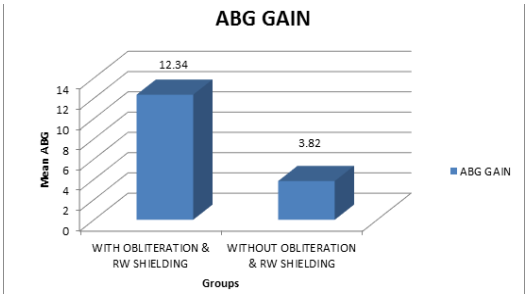

FIGURE 1: COMPARISON OF ABG GAIN BETWEEN TWO GROUPS

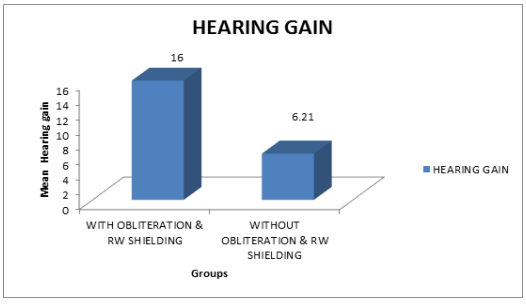

FIGURE 2: COMPARISON OF HEARING GAIN BETWEEN TWO GROUPS

Incus was found to be the most common ossicle to get necrosed. Cholesteatoma was found to be the most consistent intra operative finding followed by PSRP & granulations. Mostly the hearing loss was conductive in nature followed by mixed hearing loss.

DISCUSSION

Surgeons nowadays do anything to leave the canal wall intact, despite the fact that there are clear intraoperative reasons for removing it. In most patients having chronic otitis media with cholesteatoma, the mastoid cell system is usually significantly sclerotic, therefore, a properly done canal-wall-down (CWD) procedure results in a small, manageable mastoid bowl to maintain. Second, middle ear grafting is more than possible with a CWD procedure together with reconstruction of the middle ear and transformer mechanism when indicated and when feasible. Third, in ears with extensive cholesteatoma where disease itself and anatomic constraints indicate the need for a CWD procedure, residual disease usually results when the surgeon persists in attempting to remove disease with the wall intact. Its always advisable to go for a canal wall down procedure in indicated cases.

Our study aims at providing the patients who had undergone a canal wall down mastoidectomy with a small, well healed cavity along with restoration of hearing mechanism by preserving the physiology . Mastoid cavity obliteration could reduce problems of a large mastoid cavity.A range of materials can be used like free grafts-biologic techniques (bone pâté, bone chip, cartilage, fat, fascia); non-biologic techniques(hydroxyapatite, calcium phosphate ceramic granules, bioactive glass ceramic, andsilicone bocks); local flaps (Palva, Hong Kong, temporoparietal fascia, pedicled superficial temporal fascia, postauricular-periosteal-pericranial, inferiorly based fascioperiosteal, postauricular myocutaneous). In our study we have used bone pate and posteriorly based muscular flaps. Complete removal of the cholesteatoma should be ensured if obliteration is planned. In addition to obliteration, we also did RW shielding to maintain air column in front and inferior to the round window.

65.2% of our patients presented with complaints of ear discharge.

34.8% had complaints"of both ear discharge and hearing loss,similar to study by **Jothiramalingam et al.**

The main symptoms included discharge from ear (100%) and hearing impairment (75%) patients in study by **Navjot Kaur et al**[2].

In our study 72.7% had conductive hearing loss. Rest had mixed hearing loss.

In study by **Navjot Kaur et al**[2]Most of them (82.5%) had a conductive hearing loss . Mixed hearing loss was recorded in 12.5% patients .

Cholesteatoma was the most common finding followed by PSRP and granulations.

Jothiramalingam et al[1]intraoperative findings showed cholesteatoma involving the epitympanum and the mastoid cavity in 84% of the patients.The additional findings recorded were cholesteatoma flakes (42.50%), granulation tissue (10%) according to **Navjot Kaur et al .**

The destruction pattern of the ossicles was similar to the intraoperative findings of **Wadhwa V et al**[3]and **Jothiramalingam et al**. The incus being the

most common ossicle involved.
In our study the group which had undergone cavity obliteration and RWshielding had average post operative ABG of 11.9dB.(table **I).**

TABLE I: COMPARISON OF AVERAGE POST OPERATIVE ABG

STUDY	AVERAGE POST OPERATIVE ABG
Lee WS et al [4]	17.8dB
Visvanathan et al [5]	24.8dB
Charles et al [6]	11±16 dB
Zhou Y et al [7]	less than 20 dB

Hearing gain mean in those patients who had undergone cavity obliteration and round window shielding was 16 dB and in second group was 6.2 dB which is statistically significant with p value <0.001.Study by Zhou Y et al yielded a hearing gain of 17.5 dB .

There was an ABG gain of 12.34 dB following obliteration and RW shielding against 3.82db gain in the second group, which is statistically significant. Comparison with other studies in literature is shown in **TABLE II**

TABLE II: COMPARISON OF ABG GAIN IN SIMILAR STUDIES

STUDY	ABG GAIN
Bryan et al[8]	20 dB
Charles C. Della Santina et al[6]	11±16dB
Akram M Abdel Rahman et al [9]	No significant ABG gain
Mangal Singh et al [10]	11-30 dB

CONCLUSION

Mastoid cavity obliteration and RW shielding is an effective method not only to reduce cavity problems but also help in providing the patient with a serviceable hearing. This can help in obtaining hearing gain and significant reduction in air bone gap.

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