

Original Research Article

A cross sectional study to assess effects of mastoid drill on hearing levels in chronic suppurative otitis media cases in a tertiary care hospital in northern Maharashtra

Amit Patil*, Poonam Khairnar

Department of ENT, SBHGMC, Dhule, Maharashtra, India

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*Correspondence:

Dr. Amit Patil,

E-mail: dramolkinge@gmail.com

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ABSTRACT

Background: Chronic suppurative otitis media (CSOM) is most common middle ear disease that is encountered in daily practice. It is accepted that middle ear surgery carries a small risk of sensorineural hearing loss. The present study was done to assess the effects of mastoid drilling on hearing loss in operating ear and contralateral ear in cases of CSOM.

Methods: 80 patients with CSOM (with or without complications) age group 15 - 60 years attended the ENT outpatient department of Government Medical College and Hospital after taking consent were selected for the study using universal sampling technique, between August 2014 to August 2016.

Results: The study was conducted on 80 patients, aged between 15 to 60 years, who underwent ear surgery for CSOM at Government Medical College Hospital, from August 2014 to August 2016. We found no postoperative SNHL in 28 patients, while 52 patients (48 patients with temporary SNHL & 4 patients with permanent SNHL) had suffered from development of mild SNHL after middle ear surgery.

Conclusions: Mastoid drilling used during ear surgery can cause mild sensorineural hearing loss in immediate postoperative period in operated ear.

Keywords: CSOM, Mastoid drill, Postoperative SNHL

INTRODUCTION

Chronic suppurative otitis media (CSOM) is most common middle ear disease that is encountered in daily practice. There are various surgical procedures that are performed as a treatment of CSOM and other similar conditions of the middle ear. It is accepted that middle ear surgery carries a small risk of sensorineural hearing loss. Manipulation of ossicles can result in inner ear injury and cause hearing loss. Drilling can cause hearing loss when used on adjacent to the ossicular chain and stapes footplate and during drilling on the mastoid bone.¹ When a drill is used, the ipsilateral cochlea is exposed to

noise levels of about 100 dB and the contralateral cochlea to levels of 5 to 10 dB lower.² Therefore the drill generated noise has been incriminated as a cause of SNHL in the operated ear. Noise exposure results in dysfunction of the outer hair cells, which may produce a temporary hearing loss in operating or contralateral ear.³ This study aims to study effect of mastoid drill on bone conduction hearing levels. The present study was aimed to study the effects of mastoid drilling on hearing loss in operating ear and contralateral ear in cases of CSOM and hence to correlate the degree of hearing loss and time of exposure to mastoid drilling in cases of CSOM and to recommend various measures to reduce postoperative SNHL.

METHODS

80 patients with CSOM (with or without complications) age group 15-60 years attended the ENT outpatient department of Government Medical College and Hospital after taking consent were selected for the study using universal sampling technique, between August 2014 to August 2016.

Exclusion criteria were Operated cases of mastoid surgeries, patients with sensorineural hearing loss, patients with hypertension and diabetes mellitus, patients with congenital anomalies of ear, patients with cochlear damage, patients using ototoxic drugs.

Patient evaluation

Cases selected for the study were subjected to detailed history taking, clinical examination, otoscopic examination, and laboratory evaluation. Hearing evaluation was done by using tuning fork tests (Rinne, Weber's and absolute bone conduction test). Patients confirmed to have CSOM (safe and unsafe) were subjected to surgical intervention. Surgical procedures employed to treat disease were - tympanoplasty, cortical mastoidectomy with tympanoplasty, MRM with tympanoplasty. And cases were followed up for three months for development of SNHL and frequencies affected. All patients were divided into three major groups according to the results of post-operative hearing loss.

- Group 1: No SNHL post-operatively (till 3rd month).
- Group 2: Early SNHL (7th postoperative day).
- Group 3: Gradually progressive SNHL, which was subdivided into
 1. Group 3-A: All frequencies affected
 2. Group 3-L: Lower frequencies affected

The data was compiled and tabulated using MS Excel 20.0 software, the data was analyzed statistically using the paired t test. The Paired-Samples T test procedure was used to test the level of significance between variables.

RESULTS

In this study, females outnumbered males by a ratio of The study was conducted on 80 patients, aged between 15 to 60 years, who underwent ear surgery for CSOM at Government Medical College Hospital, from August 2014 to August 2016. Out of them, 60% were females and 40% were males as shown in Figure 1.

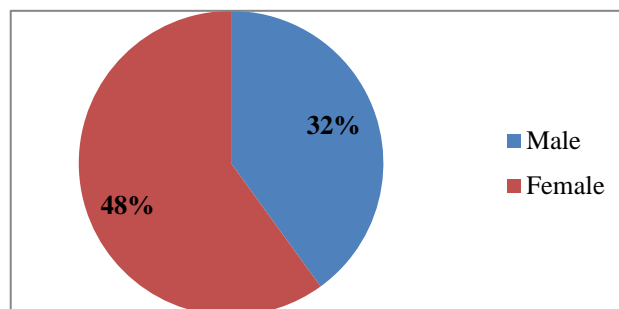


Figure 1: Gender wise distribution.

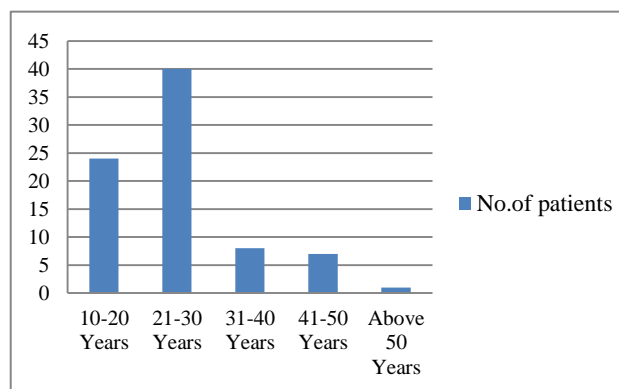


Figure 2: Age wise distribution of participants.

Out of 80 participants, 40 had central perforation, 25 had subtotal perforation, 7 had total perforation, 5 had Attic retraction pocket and 3 with intact membrane. In surgical management of the cases, 24 patients underwent tympanoplasty, 40 patients underwent cortical mastoidectomy with tympanoplasty and rest 16 patients underwent MRM with tympanoplasty as in Table 1.

Table 1: Surgical procedures performed.

Surgical procedure	No. of patients	Percentage	P-value
Tympanoplasty	24	30	0.3282
Cortical mastoidectomy with tympanoplasty	40	50	<0.01
MRM with tympanoplasty	16	20	<0.01

Table 2: Duration of surgery.

Duration (hours)	No. of patients	Percentage	P-value
1-2	32	40	<0.01
2-3	40	50	<0.01
>3	08	10	<0.01

Table 3: Distribution of participants according to various surgeries performed according to postoperative SNHL cases groups.

Group	Tympanoplasty	Cortical mastoidectomy with tympanoplasty	MRM with tympanoplasty	Total
1	23	04	01	28
2	01	34	13	48
3-A	00	01	01	02
3-L	00	01	01	02
Total	24	40	16	80

Table 4: Distribution of postoperative SNHL cases according to frequencies affected.

Group	Common affected frequencies (Hz)	Maximum SNHL on 7 th postoperative day (db)	Average SNHL at third month
2	4000	25	5
3-A	All frequencies	30	12
3-L	250 , 500	35	20

We found no postoperative SNHL in 28 patients, while 52 patients (48 patients with temporary SNHL & 4 patients with permanent SNHL) had suffered from development of mild SNHL after middle ear surgery. Majority of patients who suffered from hearing loss were those undergoing mastoidectomy compared to those undergoing plain tympanoplasty. In 32 cases duration of surgery was between 1 to 2 hours, in 40 patients it was between 2 to 3 hours and in rest of the patients the duration was more than 3 hours as given in Table 2. This correlation between duration of surgery and sensory neural hearing loss was found to be statistically significant (p value <0.05).

DISCUSSION

It is known that noise of significant intensity and duration may be harmful to the ear. Mastoid surgeries in CSOM themselves are associated with sensory neural hearing loss; drilling is the major surgical part of tympanomastoid procedure. As interaural attenuation of the skull is minimal, the noise generated by the drill during mastoid surgery may be transmitted directly to the both cochleas via bone vibration. During otologic drilling, this strong oscillation is transmitted into the cochlea.

In our study carried out among 80 cases at ENT department in a government medical college and hospital in northern Maharashtra, 24 patients undergone tympanoplasty, 40 patients undergone cortical mastoidectomy with tympanoplasty and 16 patients undergone MRM with tympanoplasty, we found no post-operative SNHL in 28 patients, while 52 patients (48 patients with temporary SNHL & 4 patients with permanent SNHL) had suffered development of mild SNHL after middle ear surgery was a significant finding as given in Table 3. Majority of patients who suffered from hearing loss were those undergoing mastoidectomy (70%) compared to those undergoing plain

tympanoplasty (30%). Thus probable causes for development of immediate postoperative SNHL are excessive manipulation of ossicles, noise due to drills and vibrations etc. Most of the patients who suffered from immediate mild SNHL had high frequency (around 4000 Hz) loss as shown in Table 4. So we can consider noise and vibrations produced by drills as a prime cause for postoperative mild SNHL. Of the 52 patients who developed SNHL, 48 patients recover completely, so it can be stated that postoperative SNHL that develops after middle ear surgery is usually mild and may recover within a short period of time. We found 4 patients who developed gradual SNHL after surgery, in these cases the pathology could be slowly progressive like labyrinthitis due to irrigating fluid or perilymph leak or some unknown factors. None of the patients had suffered from profound SNHL postoperatively. Thus we can say that trauma due to noise and vibration due to drills can be the main cause of postoperative SNHL. In 48 patients who underwent middle ear surgery, temporary sensorineural hearing loss was observed at higher frequencies (4000 Hz) in operated ear on 7th postoperative day which was reached to normal level after 3 months. In only two patients underwent cortical mastoidectomy with tympanoplasty and MRM with tympanoplasty, sensorineural hearing loss observed at lower frequencies postoperatively. Tos et al reported that in 50 patients of acoustic neuroma who underwent translabyrinthine tumour removal, no sensory neural hearing loss was noted. The patients underwent audiometric tests preoperatively and at 30th postoperative day. In the present study, the patients underwent audiometric tests preoperatively, at 7th postoperative day and at third month post operatively. In patients underwent cortical mastoidectomy with tympanoplasty and MRM with tympanoplasty, temporary SNHL was observed in 48 patients immediately on 7th postoperative day which came to normal level after 3 months. 4 patients had gradually progressive sensorineural hearing loss after 3 months.

Palva and Sorri, found sensorineural hearing loss on the contralateral side during first week postoperatively and concluded that it increased with increased duration of surgery.⁶ Our study did not show any statistically significant correlation between pre-op and post-op bone conduction thresholds in contralateral ear.

Schick et al studied the temporary threshold shift after ear surgery in 393 patients. They concluded that temporary threshold shift can be observed at 2000 Hz and 4000 Hz after ear surgery.⁵ Use of drill and preparation at the ossicular chain usually results in no significant sensory hearing deficit. Similarly in our study, maximum number of patients had temporary sensorineural hearing loss at higher frequencies (4000 Hz) in operated ear on 7th postoperative day which reached to normal level after 3 months. Da Cruz et al, determined intraoperative temporary drill related outer hair cell dysfunction in only two of a total 12 patients, which is similar to our study results.³ Kylen and Arlinger, concluded that noise trauma may in fact have been responsible for some of the high-tone sensorineural hearing losses after tympanoplasty.² It has also been shown on cadavers that size of the burr has an influence on the noise levels. The larger cutting burrs produced a louder noise than diamond burrs. Drill induced noise and vibration of the skull are the main reasons for hearing loss. Kylen et al found a statistically significant correlation between the duration of noise exposure and the temporary threshold shift recorded at 4000 and 8000 Hz.⁴ Our study results are similar to this study results but our study did not include any comparison between the noise levels produced by large burrs and diamond burrs.

Holmquist et al, analysed the intensity of the noise generated by the drill during mastoid surgery and this study revealed that burr caused noise levels constantly exceeding 100 dB.⁷ It was also reported that the contralateral cochlea suffered from the noise at 5-10 dB lower level. Parkin et al, found that sound levels above 115 dB can cause sensorineural hearing loss if sustained for more than 15 minutes.⁸

CONCLUSION

Mastoid drilling used during ear surgery can cause mild sensorineural hearing loss in immediate postoperative period in operated ear, which may go undetected and has tendency to recover spontaneously. Mild degree of temporary SNHL is associated with longer duration of

surgery. There is no effect of drilling on hearing in contralateral ear.

Recommendations

Better equipments, experienced surgeons are particularly advised for the minimal sensorineural trauma to the operated ear. Pure tone audiometry is easy, reliable and safe method to measure immediate postoperative SNHL.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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