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Microbial study of pre and postoperative mastoid cavities: a comparative study

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ABSTRACT

Background: This was a comparative microbial study of pre and postoperative mastoidectomy. The aim of the present study was to evaluate various causes responsible for discharging mastoid cavity.
Methods: Total of 160 patients of which 100 cases were of preoperative group and 60 cases were postoperative group included in the study.
Results: Mono infection was seen in 95% and 86.7% in pre and postoperative cases respectively; where as 5% of preoperative and 13.3% of postoperative cases were diinfections. *Pseudomonas* (32%) was found in highest number followed by *Staphylococcus aureus* (16%), *Klebsiella spp*. (16%), *Escherichia coli* (15%), *Proteus mirabilis* (14%), *Aspergillus fumigatus* (2%), *Candida* (1%), and *Cladosporium* (1%) in preoperative cases. In postoperative cases, 46.7% of *Pseudomonas spp*, followed by 16.5% *Staphylococcus*, 16.7% *Klebsiella spp*, 11.7% *Proteus mirabilis*, 10% *Escherichia coli*, 8.3% *Aspergillus fumigatus* and 5% *Candida* were isolated.
Conclusions: Multiple factors were responsible for otorhhoea with significant contribution from the microbes.

Keywords: Bacterial Infection, Preoperative, Postoperative, Mastoid cavities, Otorrhoea

INTRODUCTION

The problem with persisting foul smelling aural discharge is a miserable condition to the patient and the management of it is a challenging problem. The incidence of persistent or recurrent postoperative otorrhoeae has been mentioned as high as 43.9%.[1-3] The rate has been reported to be 60% in some other studies.[4,5] It was reported that 10% of the surgical cavity discharged continuously and 20% occasionally, probably due to recurrence of infection of insufficient disease eradication.[6]

The discharging mastoid cavities are due to inadequate surgery such as high facial ridge, presence of anterior and posterior buttresses, incomplete saucerisation of cortical bony edges and small external auditory canal. The main aim of treating otorrhoea by surgery is to produce a safe dry and useful fear which can be accomplished by doing mastoid surgery with tympanoplasty procedure. Obtaining a dry ear after mastoid surgery is being uncertain because of the fear that in removing all diseased structures, the vital structures in the temporal bone may get injured. In malignant type of otorrhoea the diseased process is usually unilateral and therefore a loss of hearing is not the complaint but complicated by discharge, pain, headache, giddiness etc. and therefore it will be desirable to offer the patient a successful dry cavity postoperatively.

The study high lightens the various factors responsible for postoperative otorrhoea, with special reference to the microbes, biological and systemic factors interfering with the process of healing mastoid cavities.

METHODS

This comparative study was carried out in department of ENT Viswabhrathi Medical College. Total 160 patients with discharging ear were included in this study in which 100 were preoperative group and 60 in postoperative group. They were evaluated according to physical examination, aggravating and relieving factors of pain in ear if present, past history like major operation done on ear, postoperative period, recurrent rhinorrhoea/ pain in throat, treatment and clinical examination including examining pre and post aurical region, type of discharge (mucoid, purulent, mucopurulent), tympanic membrane perforation, potency of meatoplasty if present, systemic examination and other investigations including radiography and biochemical parameters.

For microbial study, aural secretions were collected by advising the patient not to mop the ear for 24 hours prior to day of collection of sample. Thus adequate quantity of sample was obtained. Sample was collected using (i) sterile swab introduced inside external auditory canal without touching the surrounding to prevent contamination and (ii) using Romson's suction trap, in patients where the aural secretion was copious. Patients were advised a weekly follow up for the inspection and to recheck the findings of previous week. Microbial study was carried out monthly till a dry ear was obtained. After collecting the aural secretions patient was started with nonspecific broad spectrum antibiotic till receiving the sensitivity report, and then proceed with local and systemic specific antibiotic therapy. The samples were inoculated on routine bacterial culture media, Saboraud's medium for mycotic pathogens in aerobic incubation and in Robertson's cooked medium for anaerobic bacteria, incubated in McIntosch Filde's jar. Antibiotic sensitivity test was performed by using drugs like ampicillin, erythromycin, gentamycin, penicillin, tretracycline, ciprofloxacin, norfloxacin and ceftazidine.

30 patients from total of 160 included in the study were scheduled for surgery by canal wall up technique or closed cavity technique including simple mastoidactomy and canal wall down procedure or open cavity technique including radical mastoidactomy and modified radical mastoidactomy. Selection of the technique was based on assessment of eustachian tube function, pneumatization of mastoid, location and extent of the disease and size of mastoid. Preparation of otomicroscopy, audiometry, radiography was done and informed consent of the patient and taken preoperatively. Skin sterilization was carried with povidone-iodine solution, avoiding shaving of the post aural region which may traumatize the skin there by increases the chances of infection. Postoperative care like change of mastoid dressing every 24 hours, strict asepsis while mopping, proper method of instillation of antibiotic ear drops, was explained to the patient. At the time of discharge from hospital patient is asked for review after 1 week, second review after 6 weeks, and after 2 months for inspection of the cavity. In the weekly follow up postoperatively, when symptomatic, analysis regarding the finding i.e., improvement or worsening with other complications leading to postoperative otorrhoea was observed. Further the patient is asked to come for follow up after every six months or whenever any problem arises in operated cavity. All the patients postoperatively were also taught the proper procedure for instillation of ear drops. Granulation tissue if present was taken care manually by chemical cauterization in cavity or external auditory canal and removal of debris was also done.

RESULTS

Among 100 patients in preoperative group, problem of discharging ear was common in paediatric age, where the mean age is 10.17 years, including 40% patients who were below 10 years of age. In postoperative group mean age group are 17.9 with 33.3% patients from 21-30 years of age.

In both the preoperative and postoperative groups, males are more commonly involved than females whose ratio is 1.7:1 and 2:1 respectively.

Table 1: Sex distribution of discharging ear.

Sex	Preoperative		Postoperative	
	No.	%	No.	%
Male	63	63	40	66.7%
Female	37	37	20	33.3%

Monoinfection with single bacterial strain in 95% and dual infection with more than one bacterial strain in 5% of cases were identified in preoperative group of patients. The percentage of mono and dual infection in postoperative cases were 86.7% and 13.3% respectively.

Table 2: Bacterial isolates in preoperative and postoperative cases.

Organism	Preoperative		Postoperative	
	No.	%	No.	%
Pseudomonas aeruginosa	32	32	28	46.7
Klebsiella spp.	16	16	10	16.7
Staphylococcus aureus	16	16	10	16.7
Proteus mirabilis	14	14	7	11.7
Escherichia coli	15	15	6	10
Candida	1	1	3	5
Aspergillus fumigates	2	2	5	8.3
Cladosporium	1	1	-	-
Anaerobic bacteria	-	-	-	-

As shown in Table 2, a total of 97 bacterial strains were isolated from 100 cases in preoperative group. The most frequent bacterial strain was *Pseudomonas aeruginosa*

(32.7%), followed by *Klebsiella spp* (16.4%), *Staphylococcus aureus* (16.4%), *Escherichia coli* (15.4%), *Proteus mirabilis* (14.4%), *Aspergillus fumigates* (2%), *Candida* (1%), *Cladosporium* (1%) and 0% of anaerobic bacteria.

Among 60 postoperative cases, a total of 69 bacterial isolates were identified with 46.7% of *Pseudomonas aeruginosa* being the highest percentage followed by *Klebsiella species* (16.7%), *Staphylococcus aureus* (16.7%), *Proteus mirabilis* (11.7%), *Escherichia coli* (10%), *Aspergillus fumigates* (8.3%) and *Candida species* (5%).

In both groups, mucopurulent discharge was commonest type of aural discharge with 86% in preoperative and 85% in postoperative cases. There was 9% of mucoid type and 5% of purulent type in preoperative and 11.7% of mucoid type and 3.3% of purulent type in postoperative patients. On 60 postoperative cases, 53.9% among 13 patients who underwent Modified radical mastoidectomy showed postoperative otorrhoea while it was 51.3% of 39 Radical mastoidectomy patients. There were no postoperative ottorrhoea in 8 patients with simple mastoidectomy operation as given in Table 3.

Table 3: Relationship of postoperative otorrhoea with type of operation done.

Type of operation done	Total number	Postoperative ottorrhoea	
		No.	%
Simple mastoidectomy	8	-	-
Modified radical mastoidectomy	13	7	53.9
Radical mastoidectomy	39	20	51.3

Most of the cases with positive postoperative bacterial culture turned culture negative with proper management and use of sensitive antibiotics in follow up for a least period of four months as given in Table 4. Fungal infections were controlled earlier than others within three months. Gram negative bacilli were continued to be there beyond four months. *Pseudomonas* and mixed infections were slowest to get cleared off.

Table 4: Co-relation with pre and postoperative bacterial flora with postoperative ottorrhoea.

Microbial culture	Preop	First month	Second month	Third month	Fourth month
	N=100	N=90	N=83	N=74	N=25
Mixed infections	5	5	4	4	2
Pseudomonas aeruginosa	32	32	30	33	15
Klebsiella	16	10	10	7	3
Proteus	14	16	15	9	5
Staphylococcus aureus	16	16	15	10	3
E.coli	15	10	10	10	6
Mycosis	6	4	1	1	6
Anaerobes	-	-	-	-	-

30 postoperative cases were followed up for 2 months to 2and half years which were complicated by postoperative otorrhoea by chronic mastoiditis in 22 cases and acute mastoiditis in 8 cases. 22.7% of chronic mastoiditis patients obtained postoperative dry ear while it was only 3.3% cases who obtain the same in acute mastoiditis cases.

18.3% of all *Pseudomonas* strains showed resistant to all antibiotics used. On an average, 38.5% of all postoperative strains were sensitive to ampicillin, 29.4% to tetracycline, 55.8% to erythromycin, 56.7% to gentamycin, 53.15% to norfloxacin, 47.8% to ciprofloxacin and 22.1% to ceftazidine. Thus the most effective drugs sensitive were gentamycin, norfloxacin and ciprofloxacin and erythromycin.

Table 5 shows treatment modalities used to obtain dry ear in which 38.5% cases responded well to regular mopping, where as in 19.2% cases, desired results were achieved on use of combination of more than treatment modalities. 11.5% cases were cleared off with systemic antibiotic therapy and chemical cauterization.

Table 5: Treatment modalities used to obtain dry ear.

Treatment modality used (N=52)	Cases	
	N0.	%
Local and systemic antibiotic	**6**	**11.5%**
Suction clearance	**4**	**7.7%**
Revision mastoidectomy	**2**	**3.9%**
Revision meatoplasty	**4**	**7.7%**
Chemical cauterization	**6**	**11.5%**
Regular mopping	**20**	**38.5%**
Combination	**10**	**19.2%**

DISCUSSION

The problem of postoperative discharging ear is not a new one. Though many studies have been done on this topic, no steady protocol was achieved for a dry ear.

Many factors have been described for the presence of postoperative otorrhoea. Obliteration of the mastoid cavity leaves a smaller surface which epithelializes easily and rapidly, with a reduced likelihood of developing cavity granulations. The cavity, being smaller, is also more likely to retain its epithelial migratory potential and be self-cleaning. Exposed bone following mastoidectomy secretes tissue fluid, which is a rich medium for bacterial proliferation. When the bony walls are covered with obliteration material, this process of secretion is reduced, with a resultant reduction in the risk of infection.[7] It was reported by Mishra et al that most of the cases of postoperatice otorhoea was due to bacterial infection.[8] In the present study the cause of postoperative otorrhoea was studied and the bacterial study of the pre and postoperative was compared. Gram negative bacilli, especially *Pseudomonas aeruginosa* were dominant over the other organisms. Preoperatively, *Pseudomonas* was observed in 32% of the cases followed by *Staphylococcus aureus* (16%). 14-16% was other organisms such as *Proteus, Klebsiella* and *E.coli*. Mycoses were seen in 6% of the cases.

Similar results were observed by other researchers and *Pseudomonas* was found to be the most common organism.[9-11] In yet another study by Mousa, *Pseudomonas* was the most common organism isolated (23.5% of cases) followed by, which was followed by *Proteus spp*, coagulase-negative *Staphylococci*, and *Prevotela melaninogenica*.[12] The high prevalence was attributed to the improper use of antibiotic ear drops that transmit this organism from skin into middle ear and mastoid. Moreover, *Pseudomonas* was resistant to most of the antibiotics.[12]

A study by Verhoeff et al reported the most common organism to cause CSOM was *Pseudomonas* and this organism was particularly implicated in in the causation of bony necrosis and mucosal disease.[13] Another study involving CSOM also considers *Pseudomonas* to me the most common causative organism.[14]

However, in a study of chronic mastoiditis by Elango et al, *Proteus mirabilis* was found to be the most common organism isolated which was followed by *Pseudomonas aeroginosa*, and *Staphylococcus aureus.*[15]

In a study by Xu An-ting et al, coagulase negative *Staphylococcus* (CONS) was found to be most common organism isolated, both before and after the surgical procedure. Although this organism s most of the time considered to be a skin contaminant, of late it has been recognised as one of the pathogens which can cause infection after a surgical procedure. Of them in their study An-ting et al isolated *Staphylococcus epidermidis* in over 50% of the cases followed by *Staphlococcus. saprophyticus, Staphylococcus haemolyticus, Staphylo-coccus hominis*, etc.[11]

38.5% of the cases responded well to regular mopping, where as in 19.2% cases, desired results were achieved on use of combination of more than treatment modalities. 11.5% cases were cleared off with systemic antibiotic therapy and chemical cauterization. In a study by Apte et al, inadequate removal of disease and large cavities were found to be the major cause of otoorrhoesa, as was seen in another study by Palva et al.[6,16]

CONCLUSION

The incidence of infections postoperatively was considerably lesser than preoperatively, though mixed infections was higher than infection with a single organism in the case of postoperative infections. Multiple factors were responsible for otorhhoea with significant contribution from the microbes.

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