Comparison of bacteriology in bilaterally discharging ears in chronic suppurative otitis media

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Abstract Chronic suppurative otitis media is a disease with worldwide prevalence having potentially serious long term effects. It is a disease well known for its recurrence and persistence despite treatment. A study on culture and sensitivity of aural discharge collected from 40 cases of bilateral chronic suppurative otitis media was done to compare the bacteriological profile of either ear. *Pseudomonas aeruginosa* was the major organism isolated in both ears and was sensitive to Amikacin and newer drugs like Gatifloxacin. It was concluded that the infecting organisms in case of bilateral chronic suppurative otitis media are remarkably similar. If adequate treatment is instituted early, it can go a long way in reducing the prevalence of this socially embarrassing disease.

Keywords Bilateral chronic suppurative otitis media · Culture and sensitivity · *Pseudomonas aeruginosa*

Introduction

Chronic suppurative otitis media is a disease of mucoperiosteal lining of the middle ear cleft. The history of middle ear cleft infection can be traced back to as early as 460 B.C, when Hippocrates (460–377 BC) noted that acute pain in the ear with continued strong fever is to be dreaded, for the patient may become delirious and die. The disease remains an important global public health problem leading to hearing impairment, which may have serious long term effects on language, auditory and cognitive development and educational progress and is a nuisance both for the surgeon as well as for the patient. Today the majority of otogenic complications like facial nerve palsy, intracranial abscess and meningitis are a result of chronic suppurative otitis media, the characteristic of bacteriology of which is a shift towards gram negative side with *P. aeruginosa* being most common along with other organisms like *Bacillus proteus* and *Escherichia coli* as shown by a host of studies [1–5] conducted over the years. These days' potent antibiotics, both systemic and topical are in use. It is nowadays rare for an otologist to see ears with discharge that have not already had the bacterial flora modified by antibiotic therapy since most patients attend the hospital very late when treatment becomes a problem and cultures are frequently sterile. This may be because of microbial resistance to these antibiotics thereby suggesting their failure leading to continuation of purulent discharge in the discharging ear. It is hence important to know what type of bacteria take part in event of suppuration. So that appropriate antibiotics may be given for treatment and to prevent complications. The present study was therefore undertaken with the aim of comparing the bacteriological profile and antibiotic sensitivity pattern in bilaterally chronically discharging ears.

Material and methods

The material for the present study consisted of 40 cases of bilaterally chronically discharging ears selected from ENT

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outpatient Department, in the age group of 15–50 years of both sexes. The cases taken up in our study had bilateral chronic suppurative otitis media which was intermittent with a central perforation. All cases were of safe type and none had a history of trauma to the ear. After thorough ENT examination supported by blood and radiological investigations. Pure tone audiometry was done in all cases to assess the damage done to the middle ear cleft in terms of hearing loss. Seven days prior to the collection of aural discharge, all antibiotics (systemic and topical) were stopped. Patients were called on every alternate day for aural toilet of both ears. Two days before the collection of the discharge, aural toilet and cleaning of external auditory canal were done with spirit. Introitus of the external auditory canal was plugged with sterilized cotton ball. The discharge from each ear was collected in a sterilized test tube (without contamination) on wash bottle principle consisting of a glass tube made air tight with the help of a cork with an inlet and outlet facility, plugged with glass tubes having an obtuse angle. One tube was longer while the other was shorter. The former was attached to a suction tip having a small rubber tube while the latter was attached to the tube of a suction apparatus (Fig. 1). The specimens so collected were subjected to culture and sensitivity in the Department of Microbiology. The organisms isolated were identified by morphological, cultural and biochemical characteristics [6]. Anaerobic organisms were not cultured in the present study, nor were fungi. The following antibiotics with their concentrations per disc were included Ampicillin (10 µg), Cefotaxime (10 µg), Cephelexin (30 µg), Ciprofloxacin

(5 µg), Amikacin (30 µg), Gentamycin (10 µg), Norfloxacin (10 µg), Nitrofurantoin (10 µg), Nalidixic Acid (10 µg), Piperacillin (30 µg), Gatifloxacin (30 µg), Imipenem (30 µg) and Sulbactam/Cefoperazone (30/75 µg).

Observations

Out of 40 cases examined, 65% were males. The youngest was 15 years of age and the eldest was of 48 years. Sixty percent cases were from rural areas. The duration of discharge in majority of cases in both ears was 0–20 months (50% in right ear and 60% in left ear) with the mean duration being 15 months. Both the ears presented predominantly with non-offensive type of discharge (75% in right ear and 85% in left ear). Pain was not a major presenting symptom in either ear (Table 1). Mastoid air cell sclerosis was seen in 75% cases on right side and 65% on left side. Fourteen cases required further investigations in the form of X-ray of paranasal sinuses in water's view. This was because they had complaints of nasal obstruction/post nasal discharge/headache and it was necessary to rule out allergy and/or deviated nasal septum as an additional factor for ear discharge. None of the cases required further investigations in the form of X-ray nasopharynx, chest X-ray or plain CT head/paranasal sinuses/temporal bones. Since the rate of isolation of *P. aeruginosa* was similar in both ears, the type of hearing loss was also similar in both ears, as shown by the audiometric results (Table 2).

Discussion

Otitis media can be classified according to the duration of symptoms [7] into:

- Acute (upto 3 weeks duration)
- Sub acute (from 3 weeks to 3 months in duration)
- Chronic (>3 months in duration).

Table 1 Comparing type of symptoms in both ears

Symptoms	Right ear		Left ear	
	No. of cases	% age	No. of cases	% age
Otorrhoea only	8	20	14	35
Pain only	—	—	—	—
Deafness only	—	—	—	—
Otorrhoea and pain	2	5	2	5
Otorrhoea and deafness	20	50	22	55
Otorrhoea, pain and deafness	10	25	2	5
Total	40	100	40	100

Fig. 1 Middle ear suction aspiration apparatus

Table 2 Comparing audiogram results in both ears

Audiogram	Right ear		Left ear	
	No. of cases	% age	No. of cases	%age
Normal hearing	10	25	16	40
Conductive hearing				
Mild (24–40 dB)	14	35	14	35
Moderate (41–55 dB)	8	20	6	15
Moderately severe (56–70 dB)	2	5	–	–
Total	40	100	40	100

In some cases of ‘safe’ chronic suppurative otitis media, ears keep on discharging and do not become dry despite using topical antibiotic ear drops or systemic antibiotics. The intractable otorrhoea could be attributed due to various factors such as:

- Vascularity of middle ear mucosa is not rich enough for the systemic antibiotics to reach there in the desired concentrations.
- Squamous metaplasia of middle ear mucosa and fibrosis in the submucosa may result in decreased absorption of local antibiotic ear drops.
- Development of resistant strains of bacteria.
- Allergy, which may be the main etiopathogenic factor.
- Tuberculous infection of middle ear cleft.

Many a times, it is seen in our clinical settings that in bilateral cases of chronic suppurative otitis media, the discharge in one ear dries up with treatment while the other ear keeps on discharging inspite of repeated courses of different antibiotics. In such cases, the persistence of discharge can be attributed either to presence of resistant organisms or completely different flora in both ears.

Adequate antibiotic therapy depends upon knowing the nature of the infecting organisms. For this purpose, various methods have been utilized to obtain the specimens for culturing the organisms producing chronic suppurative otitis media. These include use of cotton wool swab, collection of discharge from external auditory canal, needle aspiration of middle ear (tympanocentesis) and suction aspiration of the discharge from the middle ear through the tympanic membrane perforation which was used in our study. Although the method of sample collection by middle ear aspiration through an intact tympanic membrane by needle aspiration (tympanocentesis) increase the specificity of the culture yet it loses its utility once the tympanic membrane ruptures and the discharge from the middle ear comes to be in the external auditory canal. The discharge here intermingles with the preexisting flora in the external auditory canal and the identification of causative organisms is lost.

Under the existing Indian conditions, due to paucity of health services both in rural and urban area, patients approach the ENT clinics only after the discharge has appeared in the external auditory canal in majority of cases. Under such circumstances the clinician has to rely on the culture of discharge present in the external auditory canal mostly using a cotton wool swab or collecting it in a container or test tube. This may not be a true indicator of the etiological agents in all the cases.

The middle ear aspiration suction technique, in contrast to both the above methods is a more sensitive technique since the discharge is collected right from the middle ear cavity through the perforated tympanic membrane. This leaves very little scope for external contamination provided the apparatus is thoroughly sterilized and all previous antimicrobials/topical antibiotic drops have been stopped at least 48 hours prior to sample collection since these also carry organisms from the external auditory canal to the middle ear cavity which can alter the bacteriological picture.

In the sample takes from the right ear, maximum showed monomicrobial culture (80%). Similar was the case in samples cultured from left ear which showed monomicrobial growth in 70% cases. Sterile culture was obtained in 15% samples from right ear and 20% from left ear (Table 3). Other studies have reported monomicrobial cultures in 84%, 63% and 88.4% cases respectively [8–10]. Loy et al. [9] also obtained sterile growth from 22% samples. However, Kenna et al. [11] obtained polymicrobial culture in 65% cases and monomicrobial in just 31% cases of chronic discharging ears.

When a comparison was made of the organisms cultured from samples of discharge taken from either ear, it was found that *P. aeruginosa* was the most common organism prevalent. The rate of isolation was 60% in both ears (Table 4). The occurrence of *P. aeruginosa* as the predominant offending organism could be attributed to several factors. Pollock [12] stated that the ability of *P. aeruginosa* to survive in competition with other organisms could be due to minimum nutritional requirements, its relative resistance to antibiotics and its armamentarium of antibacterial products i.e., pyocyanin and bacteriocin. Apart from the above said reasons, *P. aeruginosa* uses its pili to attach to the necrotic or diseased epithelium of middle ear. Once

Table 3 Comparing type of culture seen in both ears

Type of culture	Right ear		Left ear	
	No. of cases	% age	No. of cases	% age
Monomicrobial	32	80	28	70
Polymicrobial	2	5	4	10
No growth	6	15	8	20
Total	40	100	40	100

Table 4 Comparing type of organisms isolated in both ears

Type of organism	Right ear		Left ear	
	No. of cases	% age	No. of cases	% age
<i>P. aeruginosa</i>	24	60	24	60
<i>E. coli</i>	6	15	2	5
<i>Citrobacter</i>	2	5	2	5
<i>P. aeruginosa</i> and <i>E. coli</i>	2	5	4	10
No growth	6	15	8	20
Total	40	100	40	100

attached, the organism produces enzymes like proteases, lipopolysaccharides, etc. to elude from normal defense mechanism of the body required for fighting infections. Our observations are supported by the findings of other workers like Kenna et al. [11] and Chandrasekhar et al. [10] who found *Pseudomonas aeruginosa* as the predominant organism in 67% and 46.7% cultures, respectively. Kenna et al. [11] also found that *P. aeruginosa* was the major organisms in both ears (73%) which were discharging at the same time. Apart from *Pseudomonas*, other organisms cultured in our study were *E. Coli* (15% from right ear, 5% from left ear) and *Citrobacter* (5% from both ears). Gulati and Coworkers [1] cultured *E. Coli* in 21.7% samples of chronically discharging ears. Chandrasekhar et al. [10] isolated *Citrobacter* in 11.5% cases, other organisms being *Staph aureus* (17.98%) and *Klebsiella* (12.2%). However, the other common bacteria found in external auditory canal

like *S. aureus*, *Streptococcus pyogenes* and *Staph albus* were not found in any of the isolates in our study. This finding confirms that the method of collecting discharge by suction aspiration through the tympanic membrane perforation is superior to other methods which can lead to contamination and altered bacteriological profile.

P. aeruginosa showed maximum sensitivity to Amikacin in both ears samples (77% in right ear and 79% in left ear) in our study. It also showed marked sensitivity to Gatifloxacin (54% in right ear and 57% in left ear) (Table 5). Loy et al. [9] reported that *Pseudomonas* was sensitive to Gentamycin (82.6%) and neomycin (67.8%) and also to Ceftazidime, Ciprofloxacin and Amikacin. Chandrasekhar et al. [10] have found that *Pseudomonas* was sensitive to Ceftazidime (100%), Ciprofloxacin (98.9%), Amikacin (97%) and polymixin-B (95.4%). *E. Coli* was found to be completely sensitive to Amikacin, Imipenem and Gatifloxacin from both ear isolates in our study. Chandrasekhar also *E. Coli* to be 100% sensitive to Amikacin and ceftazidime and 90% sensitive to Ciprofloxacin and polymixin-B. Our study also showed that *Citrobacter* was 100% sensitive to Cefotaxime, Amikacin, Ciprofloxacin, Gentamycin and Piperacillin from both ear samples.

Thus, Amikacin appears to be the most potent drug against all the causative organisms isolated in our study. Another drug which was found to be fairly effective was Gatifloxacin (except for *Citrobacter*). Drugs like Ampicillin, Nalidixic acid, Nitrofurantoin, Norfloxacin and Cephelexin were found to be totally ineffective against the bacterial isolates in our study. None of the patient developed any symptom suggestive of intracranial/extracranial complications.

Table 5 Comparing antibiotic sensitivity of organisms isolated in both ears (number of positive cultures/total cultures)

Antibiotic	<i>P. aeruginosa</i>				<i>E. Coli</i>				<i>Citrobacter</i>			
	Right ear	%	Left ear	%	Right ear	%	Left ear	%	Right ear	%	Left ear	%
Ampicillin	0/26	-	0/28	-	0/8	-	0/6	-	0/2	-	0/2	-
/Cefotaxime	8/26	31	6/28	21	0/8	-	0/6	-	2/2	100	2/2	100
Cephelexin	0/26	-	0/28	-	0/8	-	0/6	-	0/2	-	0/2	-
Ciprofloxacin	0/26	-	0/28	-	0/8	-	0/6	-	2/2	100	2/2	100
Amikacin	20/26	77	22/28	79	8/8	100	6/6	100	2/2	100	2/2	100
Gentamycin	8/26	31	8/28	29	0/8	-	0/6	-	2/2	100	2/2	100
Norfloxacin	0/26	-	0/28	-	0/8	-	0/6	-	0/2	-	0/2	-
Nalidixic acid	0/26	-	0/28	-	0/8	-	0/6	-	0/2	-	0/2	-
Nitrofurantoin	0/26	-	0/28	-	0/8	-	0/6	-	0/2	-	0/2	-
Piperacillin	4/26	16	10/28	36	0/8	-	0/6	-	2/2	100	2/2	100
Imipenem	10/26	38	14/28	50	8/8	100	6/6	100	0/2	-	0/2	-
Getifloxacin	14/26	54	16/28	57	8/8	100	6/6	100	0/2	-	0/2	-
SB-CP	2/26	8	4/28	14	6/8	75	4/6	67	0/2	-	0/2	-

Conclusions

Chronic suppurative otitis media is predominantly a disease of early adulthood with deafness as an early and frequent symptom alongwith ear discharge. The organisms obtained from bilaterally discharging ears are the same in both the ears in majority of cases. Majority of cultures obtained from both ear samples are monomicrobial and mixed infections are less common. *P. aeruginosa* is the most common causative organism isolated from both the ears, followed by *E. Coli* and *Citrobacter* and is sensitive to most of the antipseudomonal drugs. Early and effective intervention with appropriate topical and systemic antibiotics in chronic suppurative otitis media can decrease its chronicity and prevent long term complications like mastoid abscess, meningitis and brain abscess.

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