pISSN 2454-5929 | eISSN 2454-5937

DOI: http://dx.doi.org/10.18203/issn.2454-5929.ijohns20185296

Original Research Article

A study of microbial gamut and antibiograms in chronic suppurative otitis media

Raj Tajamul Hussain[1]*, Sanam Altaf[1], Owais Makhdoomi[1], Mariya Ali[2]

[1]Department of ENT and HNS, Government Medical College, Srinagar, Jammu and Kashmir, India
[2]PIMS, Islamabad, Pakistan

Received: 26 August 2018
Revised: 10 October 2018
Accepted: 13 October 2018

***Correspondence:**
Dr. Raj Tajamul Hussain,
E-mail: raj.tajamul@gmail.com

ABSTRACT

Background: The aim of the study was to discern the patterns in microbial diversity and the resistogram among the patients suffering from CSOM.
Methods: A total number of 100 ear swabs were investigated for the present study. Their gram staining, direct microscopy with KOH, culture sensitivity, and biochemical tests were carried out to identify the organisms and to know their sensitivity pattern. All the swabs were collected from clinically diagnosed cases of chronic suppurative otitis media visiting otolaryngology outpatient department of tertiary care hospital. The study period was one year, from January 2016 to December 2017.
Results: Out of total 100 cases, 90 were culture positives, 6 showed no growth and 4 were skin contaminants (mirococci). Out of 90 culture positives, fungal culture was positive in 5 (5.5%) while combined bacteria and fungi obtained in 18 (20%) cases and only bacteria in 67 (74.4%) cases. Among the aerobic bacterial isolates, Pseudomonas aeruginosa was the most common bacteria isolated from the bacterial culture (n=36; 34.95%) followed by *Staphylococcus aureus* (n=28; 27.18%) and *Proteus* (n=13; 12.62%). Among the fungal isolates, *Aspergillus niger* was predominant followed by Candida *albicans* & *Aspergillus flavus.* Amikacin and imipenem were found to be the most effective antibiotics with low resistance rates.
Conclusions: The present study gave an insight into the bacteriological profile of the cases of CSOM and their antibiotic sensitivity patterns. This in turn will ensure rational and judicious use of antibiotics and thus prevent emergence of resistant bugs and also the complications associated with CSOM.

Keywords: Chronic suppurative otitis media, Microbiology, Antibiotic resistance

INTRODUCTION

Chronic suppurative otitis media (CSOM) is an ignonimous infection and a major health issue in developing world causing serious local morbidity and life threatening complications. Early and effective treatment based on the knowledge of causative micro-organisms and their antimicrobial sensitivity ensures prompt clinical recovery and possible complications can thus be avoided.

CSOM is considered a multifactorial disease resulting from a complex series of interactions between environmental, bacterial, host and genetic risk factors.[1] It is a chronic inflammatory process in the middle ear space that results in long term or permanent changes in the tympanic membrane including atelectasis, dimeric membrane formation, perforation, tympanosclerosis, retraction pocket or cholesteatoma.[2] Most common manifestations of CSOM are ear discharge, perforation and hearing impairment.

Incidence of CSOM is higher in developing countries especially among low socioeconomic society because of malnutrition, overcrowding, poor hygiene, inadequate health care, and recurrent upper respiratory tract infection.[3] It is one of the most important causes of preventable hearing loss in India and other developing countries.[4]

CSOM in infants and children can result in conductive hearing loss which may in turn lead to delayed development of speech and language in children. The infection may occur during the first 5 years of child's life, with a peak around 2 years.[5]

The disease usually occurs after upper respiratory viral infections followed by invasion of pyogenic organisms[6]. The aerobic microorganisms most frequently found in CSOM are *Pseudomonas aeruginosa, Staphylococcus aureus*, and Gram negative organisms such as *Proteus spp, Klebsiella spp*, Escherichia coli, *Haemophilus influenza*, and *Moraxella catarrhalis*.[7] The most commonly isolated fungal isolates are *Aspergillus spp* especially *Aspergillus niger* and *Candida spp.*[8,9]

CSOM can cause severe adverse effects like intra and extra-cranial complications which can be life threatening. Infection can spread from middle ear to vital structures such as mastoid, facial nerve, labyrinth, lateral sinus, meninges and brain leading to mastoid abscess, facial nerve, paralysis, deafness, lateral sinus thrombosis, meningitis and intracranial abscess. Intracranial

Complications like brain abscess and meningitis are the most common causes of death in CSOM patients.[10-12]

The complications of CSOM have been curtailed to a large extent owing to the discovery of antibiotics. But irrational and indiscriminate use of antibiotics has led to the emergence of resistant organisms to the commonly used drugs. Among Gram-negative bacteria, the most resistant pathogens are *E. coli*, *Klebsiella* species and *Pseudomonas aeruginosa*, with increasing trends observed for all major anti-Gram negative agents (beta-lactams, fluorquinolones and aminoglycosides).[13]

Microbial drug resistance has emerged as a growing global problem. There is a need to understand the epidemiology and microbiology of CSOM in order to develop effective strategies for primary prevention and better management of the disease.[14] Therefore an intelligible knowledge about the bacterial flora causing the infection and their antibiotic susceptibility pattern is very important for avoiding the imperilment of injudicious use of anti-bacterial agents and prevention of emergence of resistant strains.

The objective of our study is to determine the microbial diversity and the resistogram among the patients suffering from CSOM who attended ENT OPD of our hospital, a tertiary care centre located in the Vale of Kashmir. To the best of our knowledge no such data is available from this part of India. Treatment of the cases after studying the antimicrobial susceptibility pattern will help in preventing the emergence of resistant strains in the community.

METHODS

This descriptive, cross sectional study was conducted in Department of Otorhinolaryngology of a tertiary care hospital in Srinagar, Jammu & Kashmir, India for a period of 12 months from January 2017 to December 2017 and 100 clinically diagnosed cases of CSOM were included in this study after the approval of Institutional Ethics Committee.

A detailed clinical history regarding name, age, sex, address and socioeconomic status, history of onset and duration of ear discharge, other associated symptoms and antibiotic therapy were taken from the patients.

Inclusion criteria

Inclusion criteria were patients of any age, both genders, discharge from unilateral or bilateral ears; patients with active ear discharge of more than 3 months duration; patients with tubo-tympanic type of CSOM with central perforation.

Exclusion criteria

Exclusion criteria were history of antibiotic use within preceding 2 weeks (topical or systemic); patient with attico-antral type of CSOM; acute suppurative otitis media; patients with draining ears but intact tympanic membrane (otitis externa); recent ear surgery, mastoid surgery or tympanostomy tube insertion.

Pus specimens from draining ears were taken on the first day of contact with the patient. The ears were inspected first; pus from the outer part of the ear canal was then cleaned by suction. Ear discharge was obtained from the diseased ear of the patients under strict aseptic precautions using two sterile cotton swabs with the help of aural speculum. Pus swabs collected were immediately sent to Microbiology department for further processing. The first swab was used for direct Gram stain and KOH mount. The second swab was cultured in nutrient agar, blood agar and MacConkey agar plates and incubated at 37^{0}C for 24–48 hrs. The second swab was also inoculated onto Sabouraud's Dextrose Agar (SDA) for isolation of fungal pathogens and was incubated at room temperature. In the case of yeast, germ tube fermentation test was employed for identification of Candida Albicans. The organisms isolated underwent antibiotic susceptibility testing (AST) on Mueller-Hinton agar by Kirby-Bauer disc diffusion method according to National Committee for Clinical Laboratory Standards (NCCLS) criteria.[15]

Data was entered in excel sheet and analysis was done using SPSS v23 and expressed as percentage.

RESULTS

In our study of 100 patients, 53.0% patients (n=53) were males and 47.0% (n=47) were females. Male to female ratio was 1.32:1 (Table 1).

Table 1: Gender wise distribution of cases.

Gender	Number	Percentage (%)
Male	53	53
Female	47	47

Age group of the patients ranged from 3 yrs to 64 yrs. The mean age of individuals participating in the study was 19.47±6.42. There was no statistically significant sex or age predilection for a sample to become culture positive in our study.

Out of total 100 cases, 90 were culture positives, 6 showed no growth and 4 were skin contaminants (micrococci) (Table 2).

Table 2: Growth pattern of CSOM cases.

Growth pattern	Number	Percentage (%)
Positive growth	90	90
No growth	6	6
Skin contaminants	4	4
Total	100	100

Out of 90 culture positives, fungal culture was positive in 5 (5.5%) while combined bacteria and fungi obtained in 18 (20%) cases and only bacteria in 67 (74.4%) cases (Table 3).

Table 3: Growth results in culture positive swabs

Growth Type	Number	Percentage (%)
Bacterial growth	67	74.4
Fungal growth	5	5.5
Bacterial and fungal growth	18	20
Total	90	100

Out of 90 culture positives, 116 aerobic organisms were isolated, of which 103 were bacterial and 13 were fungal isolates.

Among the aerobic bacterial isolates, *Pseudomonas aeruginosa* was the most common bacteria isolated from the bacterial culture (n=36; 34.95%) followed by *Staphylococcus aureus* (n=28; 27.18%) and *proteus* (n=13; 12.62%) (Table 4).

Among the fungal isolates, *Aspergillus niger* was predominant followed by *Candida albicans* & *Aspergillus flavus* (Table 5).

Table 4: Distribution of aerobic bacterial organisms causing CSOM.

Bacterial Isolate	Number	Percentage (%)
Pseudomonas Aeruginosa	36	34.95
Staphylococcus Aureus	28	27.18
Proteus	13	12.62
Klebsiella Spp	10	9.7
Escherichia coli	8	7.76
Streptococcus Pneumoniae	5	4.85
Enterococcus Avium	3	2.91
Total	103	100

Table 5: Distribution of Fungal Organisms causing CSOM

Fungal Isolate	Number	Percentage (%)
Aspergillus Niger	5	38.46
Aspergillus Flavus	2	15.38
Aspergillus Fumigatus	1	7.69
Candida Albicans	5	38.46
Total	13	100

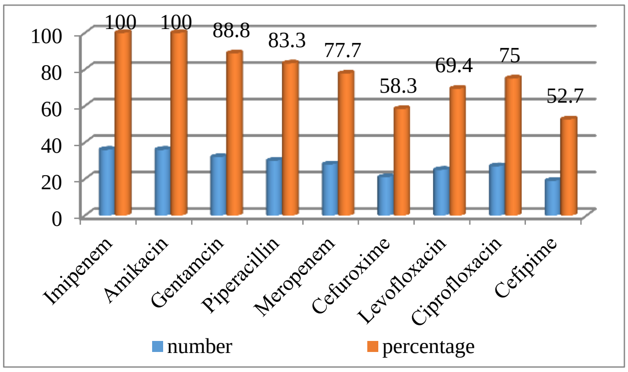

Figure 1: Antibiotic susceptibility pattern for *P. Aeruginosa.*

The antibiotic susceptibility pattern of *Pseudomonas aeruginosa* showed that the isolates were 100% sensitive to amikacin and imipenem followed by gentamicin, piperacillin, meropenem, and ciprofloxacin. They were less sensitive to cefuroxime, cefipime & levofloxacin (Figure 1).

Staphylococcus isolates were 100% sensitive to vancomycin. They were highly sensitive to linezolid and amikacin, followed by gentamicin and amoxyclav. They showed less sensitivity against cotrimoxazole, chloramphenicol and cefotaxime. They were resistant to piperacillin, ciprofloxacin & erythromycin (Figure 2).

Gram negative isolates other than *Pseudomonas* showed highest sensitivity to imipenem and amikacin. They were highly sensitive to colistin, meropenem and gentamicin followed by aztreonam, amoxiclav & ciprofloxacin. They were less sensitive towards cefoperazone, cefipime and erythromycin (Figure 3).

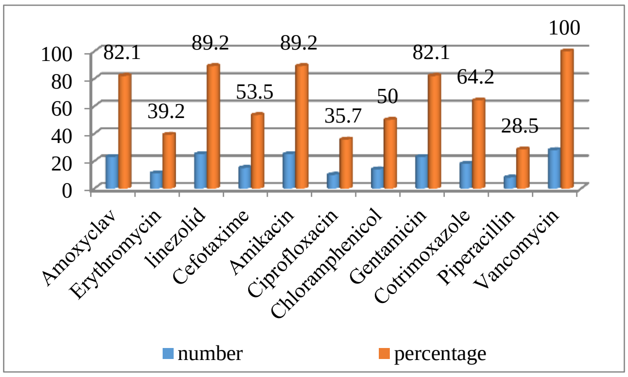

Figure 2: Antibiotic susceptibility pattern for *S. aureus*.

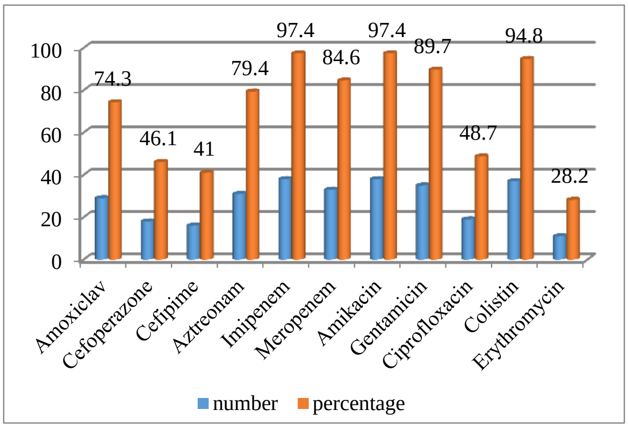

Figure 2: Antibiotic susceptibility pattern for gram negative bacilli.

DISCUSSION

CSOM is a serious healthcare concern worldwide and is an important cause of preventable hearing loss particularly in India. Early, microbiological diagnosis of CSOM ensures timely and effective treatment to avoid complications.

In our study, 53% were males and 47% were females. Thus males were affected more in our study which is in congruence with Ahmed et al who showed 57.3% males and 42.7% females affected by CSOM.[16]

No organism could be isolated from 6% ear swabs in the present study. This is in unison with Vijaya et al who found 5.28% sterile samples in their study whereas Fatma et al (16.9%) and Chakraborty et al (12.6%) found higher percentage of culture negative samples in their studies.[17-19] This may be the result of middle ear infections either due to strict anaerobes or due to viral agents like respiratory syncytial virus, adeno virus and influenza virus.

In our study, fungal culture was positive for 5 (5.5%) swabs, while combined growth of fungi and bacteria was seen in 18 (20%) swabs, only bacteria were isolated from 67 (74.4%) swabs.

In this study, *Pseudomonas aeruginosa* (34.95%) was found to be the most common organism followed by *Staphylococcus aureus* (27.18%), *Proteus* (12.62%), *Klebsiella spp* (9.7%) and E.coli (7.76%). These results are in harmony with various other studies that showed pseudomonas to be the most common bacteria cultured from CSOM cases.[20-25] Prakash et al reported Staphylococcus aureus to be the most predominant organism which is the second common isolate in our study.[26] Other isolates were *E. coli*, *Enterococcus spp*, and *streptococcus pneumonia*. The observations made from different studies indicate that there can be variation in causative organism based on ethnicity and geography.

The most commonly isolated fungi in CSOM are *Aspergillus* and *Candida* species. In our study, fungal etiology was found in 5 cases, out of which 61.53% were *Aspergillus* species, followed by Candida (38.46%). Among *Aspergillus* species maximum strains isolated was *Aspergillus niger* 5 (38.46%) followed by Aspergillus flavus 2 (15.38%) and Aspergillus fumigatus 1 (7.69%). Our findings correlated with studies of Loy et al. & Rejitha et al. wherein *Aspergillus Niger* was the predominant isolate followed by *Candida albicans*.[27, 28]

Thus clinician routinely prescribing anti-bacterial agents for COM, without performing antibiotic susceptibility tests is totally unjustified. Therefore a clear knowledge about the bacterial flora causing the infection and their susceptibility pattern is very important. The isolates are gradually becoming more resistant and the bacteriological as well as susceptibility pattern is changing from time to time requiring continuous surveillance of AST for effective management of COM.

Antibiotic susceptibility patterns serve as a useful guideline for choosing the appropriate antibiotic and it was employed for all the isolated organisms. The anitibiotic susceptibility pattern of *Pseudomonas aeruginosa* showed that the isolates were 100% sensitive to amikacin and imipenem followed by gentamicin, piperacillin, meropenem and ciprofloxacin. They were less sensitive to cefuroxime, cefipime and levofloxacin. Our findings correlate with the study done by Harvinder Kumar et al. wherein amikacin was found to be the most effective drug followed by ciprofloxacin, piperacillin and cotrimoxazole. Other studies have also corroborated these findings.[29-31]

Staphylococcus isolates were 100% sensitive to vancomycin. They were highly sensitive to linezolid and amikacin, followed by gentamicin and amoxyclav. They showed less sensitivity against cotrimoxazole, chloramphenicol and cefotaxime. They were resistant to piperacillin, ciprofloxacin & erythromycin.

Gram negative isolates showed highest sensitivity to imipenem and amikacin. They were highly sensitive to colistin, meropenem and gentamicin followed by aztreonam, amoxiclav & ciprofloxacin. The findings of our present study are in accordance with studies conducted by Poorey and Iyer, Bansal et al.[31,32] In the present study gram negative bacilli were less sensitive to cefoperazone, cefipime and erythromycin. The resistant pattern towards most commonly used antibiotics in the present study could be because of indiscriminate use of antibiotics.

The salient gospel that the clinician needs to remember is that the antibiotic susceptibility pattern of the CSOM causing organisms keeps changing and routine antibiotic susceptibility testing before treatment is imperative. Routine use of antibiotics for CSOM as empirical therapy must be reviewed and antibiotics need to be used judiciously. Relevant antimicrobial drugs should be prescribed after proper diagnosis of the causative organism and its antimicrobial susceptibility pattern. The patients need to be educated about the advantages of taking the drugs according to proper dosage and for prescribed duration without discontinuing midway. This will halt the progression of complications at an early stage and will also forestall the emergence of resistant organisms.

CONCLUSION

The isolation of causative organisms and their resistogram pattern is important for appropriate treatment to prevent morbidity and mortality associated with CSOM. It is prudent for any health center catering to a defined area of population to conduct periodically the microbiological study of CSOM in order to install effective treatment protocols for the population. As CSOM cases are more common in day to day practice, the general practitioners should be aware of the changing patterns of microbial etiology and their susceptibility pattern to antibiotics.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Rye MS, Blackwell JM, Jamieson SE. Genetic susceptibility to otitis media in childhood. Laryngoscope. 2012;122:665–75.
2. Quinton G. Pathology and clinical course of the inflammatory diseases of the middle ear. In: Aina JG, et al. (Eds.), Glasscock- Shambaugh’s Surgery of the Ear, (6th edn), People’s Medical Publishing House, USA; 6th edition; 2010: 427-428.
3. Kumar H, Seth S. Bacterial and fungal study of 100 cases of chronic suppurative otitis media. J Clin Diagn Res. 2011;5:1224–7.
4. Acuin J. Geneva:World Health Organisation;Global burden of disease due to chronic suppurative otitis media:Disease, deafness, deaths and DALYs. Chronic Suppurative Otitis Media–Burden of Illness and Management Options. 2004;9–23.
5. Bluestone CD. Epidemiology and pathogenesis of chronic Suppurative otitis media:Implications for prevention and treatment. Int J Pediatr Otorhinolaryngol. 1998;42:207-23.
6. Fliss DM, Shoham I, Leiberman A, Dagan R. Chronic suppurative otitis media without cholesteatoma in children in southern Israel:incidence and risk factors. Paediatric Infection Disease J. 1991;10:895-9.
7. Verhoeff M, van der Veen EL, Rovers M, Sanders EA, Schilder AG. Chronic suppurative otitis media:a review. Int J Pediatr Otorhinolaryngol. 2006;70:1-12.
8. Poorey VK, Iyer A. Study of Bacterial Flora in Chronic Suppurative Otitis Media and its clinical significance. Ind J Otolaryngol H N Surg. 2002;54(2):91-5.
9. Kumar H, Seth S. Bacterial and Fungal Study of 100 cases of Chronic Suppurative Otitis Media. J Clin Diagnos Res. 2011;5(6):1224-1227.
10. Dubey SP, Larawin V, Molumi CP. Intracranial spread of chronic middle ear suppuration. Am J Otolaryngol. 2010;31:73–7.
11. Chew YK, Cheong JP, Khir A, Brito-Mutunayagam S, Prepageran N. Complications of chronic suppurative otitis media:a left otogenic brain abscess and a right mastoid fistula. Ear Nose Throat J. 2012;91:428–30.
12. Sun J, Sun J. Intracranial complications of chronic otitis media. Eur Arch Otorhinolaryngol. 2014;271:2923–6.
13. Rossolini GM, Mantengoli E, Docquier JD, Musmanno RA, Coratza G. Epidemiology of infections caused by multiresistant Gram-negatives:ESBLs, MBLs, panresistant strains. New Microbiol. 2007;30(3):332-9.
14. Ghonaim MM, El-Edel RH, Basiony LA. Risk factors and causative organisms of otitis media in children. Ibnosina J Med BS. 2011;3(5):172-81.
15. National Committee for Clinical Laboratory Standards (NCCLS), “Performance Standards for Antimicrobial Disc Susceptibility Test,” 6th Edition, Approved Standard Wayne, PA, NCCLS, 1997, NCCLS Document M2-A6, 1997.
16. Ahmed A, Usman J, Hashim R. Isolates from chronic suppurative otitis media and their antimicrobical sensitivity. Pak Armed Forces Med J. 1999;49:82-5.

17. Vijaya D, Nagarathnamma T. Microbiological study of chronic suppurative otitis media. Indian J Otol. 1998;4:172-4.
18. Fatma AA, Assiry S, Siraj MZ. Microbiological evaluation and aspects on management of chronic suppurative otitis media in Riyadh. Indian J Otol. 1998;4:115-20.
19. Chakraborty A, Bhattacharjee A, Purkaystha P. Microbiological profile of chronic suppurative otitis media: Its significance in North-East India. Indian J Otol. 2005;11:39-44.
20. Afolabi O, Salaudeen A, Ologe F, Nwabuisi C, Nwalolo C. Pattern of bacterial isolates in the middle ear discharge of patients with chronic suppurative otitis media in a tertiary hospital in North central Nigeria. Afr Health Sci. 2012;12(3):362-8.
21. Vishwanath S, Mukhopadhyay C, Prakash R, Pillai S, Pujary K, Pujary P, et al. Chronic Suppurative Otitis Media:Optimizing Initial Antibiotic Therapy in a Tertiary Care Setup. Indian J Otolaryngol Head Neck Surg. 2012;64(3):285-9.
22. Indudharan R, Haq JA, Aiyar S. Antibiotics in chronic suppurative otitis media:a bacteriologic study. Ann Otol Rhinol Laryngol. 1999;108:440-5.
23. Kumar S, Sharma R, Saxena A, Pandey A, Gautam P, Taneja V. Bacterial flora of infected unsafe CSOM. Indian J Otol. 2012;18:208-11.
24. Goyal R, Aher A, De S, Kumar A. Chronic suppurative otitis media- A Clinico-Microbiological study. Indian J Otol. 2009;15:18-22.
25. Malkappa SK. Study of aerobic bacterial isolates and their antibiotic susceptibility pattern in chronic suppurative otitis media. Indian J Otol. 2012;18:136-9.
26. Prakash R, Juyal D, Negi V, Pal S, Adekhandi S, Sharma M, et al. Microbiology of chronic suppurative otitis media in a tertiary care setup of Uttarakhand state, India. N Am J Med Sci. 2013;5(4):282-7.
27. Loy AHC, Tan AL, Lu PKS. Microbiology of chronic Suppurative otitis media in Singapore. Singapore Med. J. 2002;43(6):296–9.
28. Rejitha IM, Sucilathangam, G, Kanagapriya M. Microbiological Profile of CSOM in a Tertiary Care Hospital. Int J Scientific Res. 2014;3(2):474-5.
29. Agarwal A, Kumar D, Goyal A, Goyal S, Singh N, Khandewal G. Microbiological profile and their antimicrobial sensitivity pattern in patients of otitis media with ear discharge. Indian J Otol. 2013;19(1):5-8.
30. Prakash M, Lakshmi K, Anuradha S, Swathi GN. Bacteriological Profile and their Antibiotic Susceptibility Pattern of cases of CSOM. Asian J Pharm Clin Res. 2013;6(3):210-2.
31. Bansal S, Ojha T, Kumar S, Singhal A, Vyas P. Changing Microbiological trends in cases of CSOM. Int J Cur Rev. 2013;5(15):76-81.
32. Poorey VK, Iyer A. Study of Bacterial Flora in Chronic Suppurative Otitis Media and its clinical significance. Ind J Otolaryngol H N Surg. 2002;54(2):91-5.

Cite this article as: Hussain RT, Altaf S, Makhdoomi O, Ali M. A study of microbial gamut and antibiograms in chronic suppurative otitis media. Int J Otorhinolaryngol Head Neck Surg 2019;5:110-5.