Evaluation of the spectrum of bacteria encountered in patients with chronic suppurative otitis media with their antibiotic sensitivity pattern

تقييم مجال الجراثيم المسببة لالتهاب الأذن الوسطى التقيحي المزمن مع نمط حساسيتها للمضادات الحيوية

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الخلاصة/الأهداف: تحديد نوع الجراثيم المسببة لالتهاب الأذن الوسطى التقيحي المزمن ومعرفة نمط حساسيتها للمضادات الحيوية ليتسنى معالجة الالتهاب بالمضاد الحيوي المناسب أثناء انتظار نتيجة الزرع البكتيري واختبار حساسية البكتيريا للمضاد الحيوي .**منهجية البحث:** أجريت هذه الدراسة التطبيقية في مستشفى الفرات الأوسط- قسم الأذن والأنف والحنجرة في محافظة النجف الأشرف للفترة من كانون الأول 2010 إلى نيسان 2011 حيث تضمنت الدراسة أخذ 51 مسحة من إفرازات الأذن للمرضى المصابين بالتهاب الأذن الوسطى التقيحي المزمن وإجراء الزرع البكتيري واختبار حساسية البكتريا للمضادات الحيوية باستخدام التحاليل المختبرية المعتمدة علميا وإجراء مقارنة إحصائية بين الجراثيم المسببة من حيث نوعها وكثرة ترددها ومدى حساسيتها للمضادات الحيوية المختلفة اعتمادا على النسبة المئوية. **النتائج:** أظهرت الدراسة ان نسبة إصابة الإناث بالمرض أكثر من نسبة إصابة الذكور بمقدار1.8 : 1 والأعمار الأكثر تعرضا للإصابة هي التي تقع بين3 أشهر- 15 سنة كما بينت أن البكتريا الأكثر شيوعا في إحداث التهاب الأذن الوسطى التقيحي المزمن هي :aeruginosa Pseudomonas تليها سالبة الگرام Staphylococcus aureus الى البكتيريا موجبة سالبة الگرام وبصورة عامة كانت نسبة الإصابة بالبكتيريا سالبة الگرام Proteus mirabilisثم موجبة الگرام للمضاد الحيوي سيبروفلوكساسين وهو من مجموعة aeruginosa Pseudomonas،حساسية هي 2.64 :1 الگرام أما Staphylococcus aureusالفلوروكونيلونز أكثر من حساسيتها للجنتامايسين وهو من مجموعة الأمينوگلايكوسايدز وكذلك كانت حساسيتها للمضادين المذكورين آنفا بنفس الدرجة . **الإستنتاجات :** 1- ان الأطفال هم الأكثر عرضة Proteus mirabilis للإصابة بالتهاب الأذن الوسطى التقيحي المزمن وذلك لصغر حجم قناة أوستاكي وقلة المناعة لديهم.2- نسبة الإصابة بالبكتيريا سالبة تعتبر البكتريا الأكثر ترددا في aeruginosa Pseudomonas 3- ان أكثر من نسبة الإصابة بالبكتيريا موجبة الگرام. الگرام . 4-حساسية Proteus mirabilisثم Staphylococcus aureus تليها التسبب بحدوث التهاب الأذن الوسطى التقيحي المزمن للسيبروفلوكساسين أعلى منها للجنتامايسين بالرغم من كون الجنتامايسين أكثر فاعلية ضد البكتريا aeruginosa Pseudomonas وذلك ربما يعزى الى سوء استخدام المضادات الحيوية وحدوث aeruginosa Pseudomonasسالبة الگرام والتي تنتمي إليها طفرات وراثية في البكتريا مما يؤدي الى نشوء أنواع جديدة مقاومة لتلك المضادات.

Abstract:

Objectives: The aim of this study was to determine the most frequent bacteria that cause chronic suppurative otitis media(CSOM) and their sensitivity to various antimicrobials so that an appropriate therapy can be started promptly while awaiting the results of the culture and sensitivity of the isolate to various antibiotics. **Methodology**: This study was conducted at Alforat teaching hospital in Najaf city at the ear-nose-throat (ENT) department from December 2010 to April 2011. The swab was taken from ear discharge before starting the antibiotics and cultured on MacConckey agar(Oxoid, England) and blood agar(HiMedia, India).Gram positive bacteria were identified on the bases of colony morphology ,Gram staining, catalase test and coagulase test while the Gram negative bacteria were identified by oxidase test and API 20E(API BioMerieux, France). The sensitivity of the isolates to various antibiotics was tested by Kirby Bauer disk diffusion technique. **Results**: The study showed that females are more prone to get the infection than males in a ratio of 1.8: 1 and the frequent ages liable for infection lie between 3months – 15 year, also it revealed that the gram negative bacteria were more frequent in causing the infection than gram positive bacteria in a ratio of 2.64 :1 and Pseudomonas aeruginosa was the most frequent species that causes CSOM then Staphylococcus aureus and Proteus mirabilis. Pseudomonas aeruginosa was more sensitive to ciprofloxacin than to gentamicin, Staphylococcus aureus also showed more sensitivity to ciprofloxacin than gentamicin, while Proteus mirabilis had the same degree of sensitivity to those 2 antibiotics. **Conclusions**: 1- Children are more prone to be infected with CSOM because of their small Eustachian tube and low immunity. 2- Gram negative bacteria were more common in causing the infection than gram-positive bacteria in this study. 3- Pseudomonas aeruginosa was the most frequent bacteria that cause CSOM then Staphylococcus aureus and Proteus mirabilis. 4- Pseudomonas aeruginosa was more sensitive to ciprofloxacin than to gentamicin despite the fact that gentamicin is known to be effective against gram negative bacteria

including Pseudomonas aeruginosa propably because of antibiotic miss use and genetic mutation of Pseudomonas aeruginosa .

Key words: Chronic suppurative otitis media, Pseudomonas aeruginosa, Staphylococcus aureus , ciprofloxacin , gentamicin.

INTRODUCTION

Chronic suppurative otitis media (CSOM) is a perforated tympanic membrane with persistent drainage from the middle ear. It is defined as chronic otorrhea (i.e., lasting >6-12 wk) through a perforated tympanic membrane[1,2],it occurs as a complication of acute otitis media[3] . Detection of middle ear by pneumatic otoscopy is key in establishing the diagnosis [4], CSOM differs from chronic serous otitis media in that chronic serous otitis media is a middle ear effusion without perforation that is reported to persist for more than 1-3 months[5]. CSOM is a common infection in both developing and industrialized countries [6]. It causes considerable morbidity and is a major global cause of hearing impairment in children [7] Because fluid buildup behind the tympanic membrane can cause poor transmission of sound waves[8] . Moreover, it may lead to serious intracranial and extracranial complications like mastoiditis and meningitis [9].Antibiotics have produced an overall decline in the frequency of complications of OM relative to the preantibiotic time. However, severe complications still occur and may be associated with high mortality [10] . In order to avoid serious complications an active and prompt approach in the management of chronic suppurative otitis media is mandatory [11]. However, in order to start appropriate therapy according to the causative organisms and its sensitivity to various antibiotics we have to wait for 48-72 hrs for the culture and sensitivity report. Delaying the therapy for 2 to 3 days may further aggravate symptoms of the patient or may contribute to long term complications. Despite being so common there are still many questions and controversies concerning the best treatment option for patients suffering from chronic ear infections. The aim of this study was to determine the most frequent bacteria that cause chronic suppurative otitis media and their sensitivity to various antimicrobials so that an appropriate therapy can be started promptly while awaiting the results of the culture and sensitivity of the isolate to various antibiotics. Once the result of the culture is available, the antibiotic being given to the patient may be modified if required.

PATIENTS AND METHODS:

This study was conducted at Alforat teaching hospital in Najaf city at the ear-nose-throat (ENT) department from December 2010 to April 2011 .In the study a total of 51 patients of age between(3months-55 years) who were having discharge from one or both ears with tympanic membrane perforation for a duration of (1month-1.5year) were included .

Exclusion criteria:

Current febrile illness, current antibiotic use, allergy to a specific antibiotic, recent ear surgery, congenital ear, or hearing problems.

Method

The swab was taken from ear discharge before starting the antibiotics and cultured on MacConckey agar(Oxoid, England) and blood agar(HiMedia, India) and incubated aerobically and anaerobically at 37 ℃ for 24-48 hrs. Gram positive bacteria were identified on the bases of colony morphology, Gram staining, catalase test and coagulase test while the Gram negative bacteria were identified by oxidase test and API 20E(API BioMerieux, France) according to the method of McFadden[12]. The sensitivity of the isolates to various antibiotics was tested by Kirby Bauer disk diffusion technique in accordance with the Clinical and Laboratory Standards institute (CLSI) guidelines (table 1-Antibiotic types and concentrations).

Table (1): Types and concentrations of antibiotics that are used in the study

Antibiotic	Content	Symbol	Origin
Ciprofloxacin	5 µg	CIP	England- Oxoid
Cephalexin	30 µg	CE	England- Oxoid
Cephalothin	30 µg	CF	England- Oxoid
Clindamycin	30 µg	CLN	England- Oxoid
Gentamicin	10 µg	GN	England- Oxoid
Tobramycin	10 µg	Tob	England- Oxoid
Amikacin	30 µg	AK	England- Oxoid
Trimethoprim	5 µg	TMP	England- Oxoid
Nitrofurantoin	300 µg	F	England- Oxoid
Nalidixic acid	30 µg	NA	England- Oxoid
Cotrimoxazole	25 µg	COM	England- Oxoid

RESULTS:

A total of 51 patients were included in the study of which 33 (64.7%) were females and 18 (35.3%) were males. Female to male ratio was 1.8: 1. The mean age of the patients were 27.63 years and the age of the patients ranged between 3 months and 55 years(figure-1 the age distribution of the patients).The percentage was considered in determining the results in this study.

The discharge was present in both ears in 15 patients (29.41%) whereas it was unilateral in 36 patients (70.59)%.The organisms isolated were Pseudomonas aeruginosa(gram negative bacteria) in 25 patients (49%) , Staphylococcus aureus(gram positive bacteria) in 13 patients(25.49%), Proteus mirabilis(gram negative bacteria) in 6patients (11.8%), Klebsiella(gram negative bacteria) in 3 patients (5.9%), and Escherichia coli(gram negative bacteria) in 2 patients(3.9%) , the rest were with Enterobacter(gram negative bacteria) and Hemolytic streptococcus(gram positive bacteria) .Gram negative bacterial infection: gram positive bacterial infection ratio was 2.64:1. Pseudomonas aeruginosa was the commonest organism isolated followed by Staphylococcus aureus and Proteus mirabilis (figure2). Out of total 51 isolates 28(54.9%) were sensitive to ciprofloxacin and 23(45.1%) were resistant to it, while 19 (37.25%) isolates were sensitive to gentamicin and 32(62.75%) were resistant to it (figure-3).

Antibiotic sensitivity of Pseudomonas aeruginosa: 10 (40%) to ciprofloxacin, 6(24%) to ciprofloxacin and gentamicin, 4(16%) to gentamicin, 3(12%) to cephalothin and cephalexin, 1(4%) to tobramycin, 1(4%) to nitrofurantoin (figure-4). Antibiotic sensitivity of Staphylococcus aureus: 3(23.08%) to ciprofloxacin, 5 (38.46%) to both ciprofloxacin and gentamicin, 3(23.08%) to clindamycin, 1(7.69%) to amikacin, 1 (7.69%) to trimethoprim (figure-5).

Antibiotic sensitivity of Proteus: 2 (33.3%) to ciprofloxacin, 2 (33.3%) to gentamicin, 1(16.7%) to both ciprofloxacin and gentamicin, 1(16.7%) to cephalothin (figure-6). Antibiotic sensitivity of Klebsiella: 1 case to ciprofloxacin, 1 case to tobramycin and 1 case to cotrimoxazole. Antibiotic sensitivity of Escherichia coli: 1 case to gentamicin, 1 case to nitrofurantoin. Sensitivity of Enterobacter was to nalidixic acid, while Hemolytic streptococcus was sensitive to ciprofloxacin.

Figure -1:Age ranges in CSOM patients

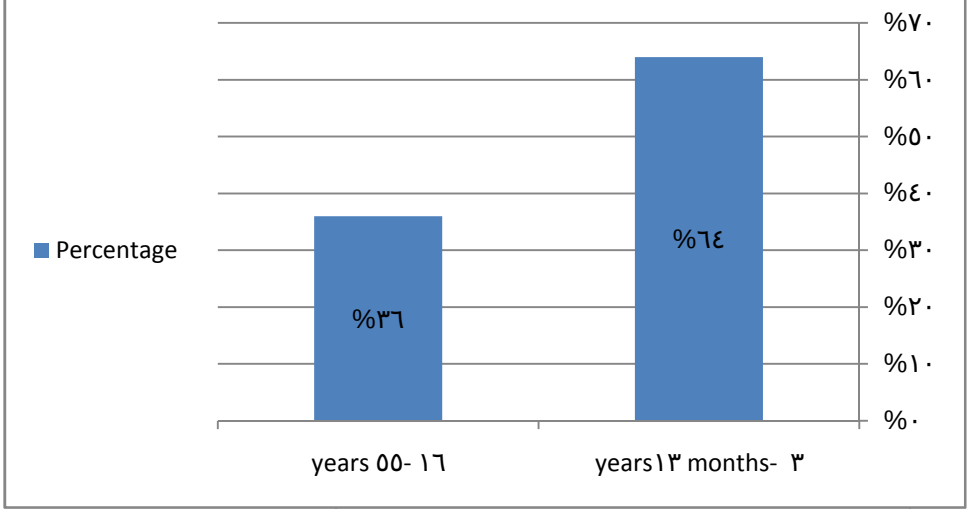


Figure-2 :Frequency of microorganisms causingCSOM

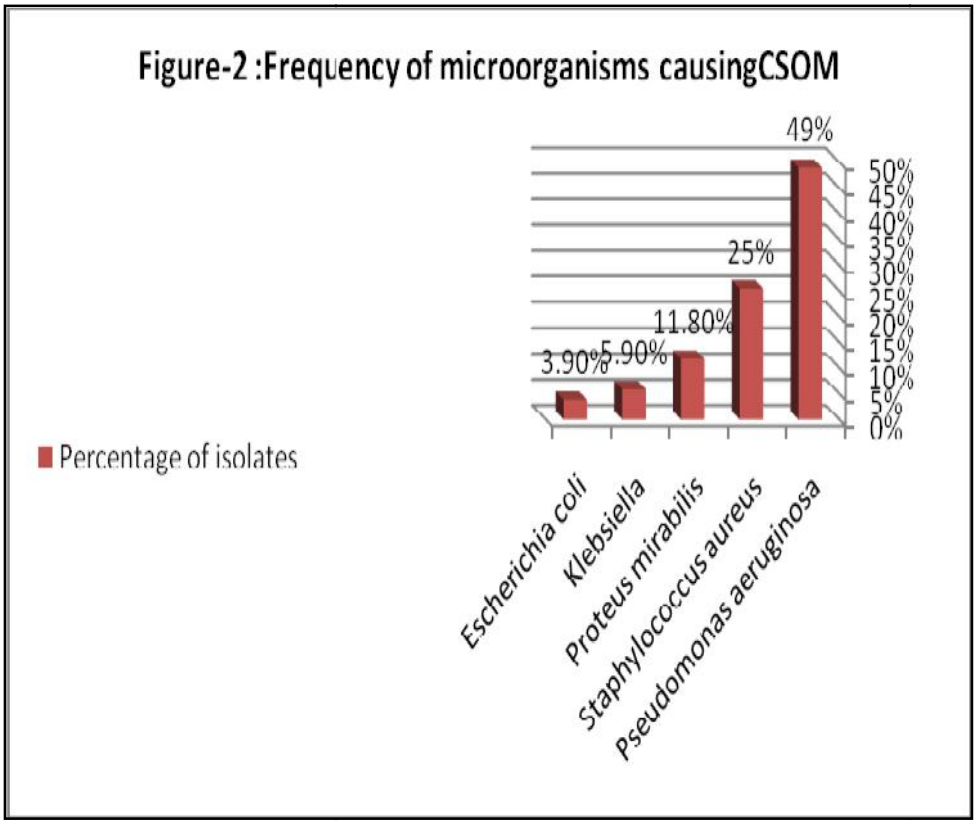


Figure-3:sesnsitivity pattern of isolates in CSOM patients

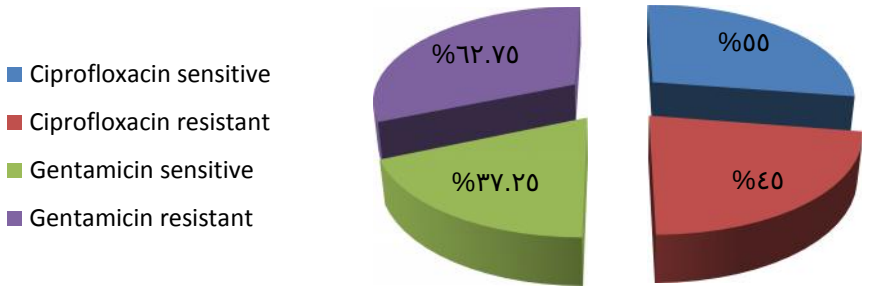


Figure-4: Pseudomonas antibiotic sensitivity pattern

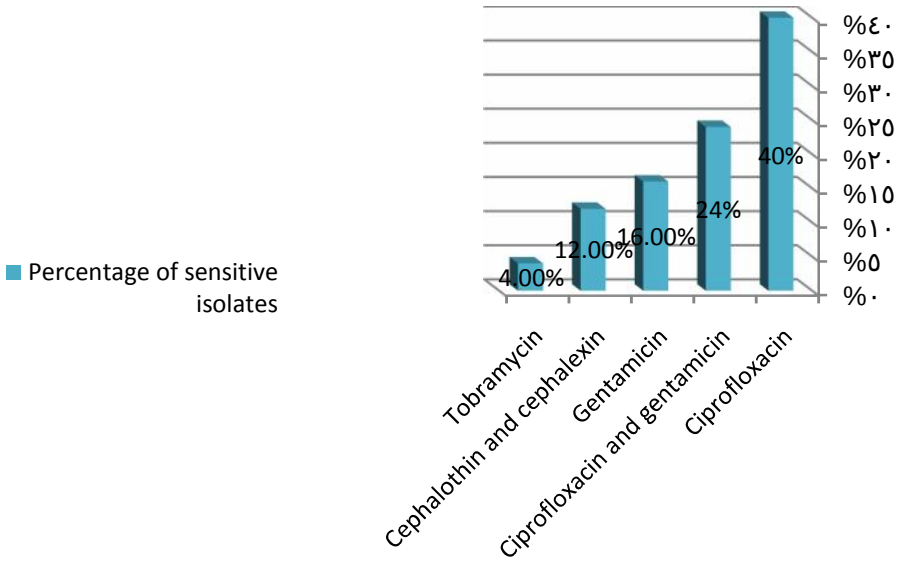
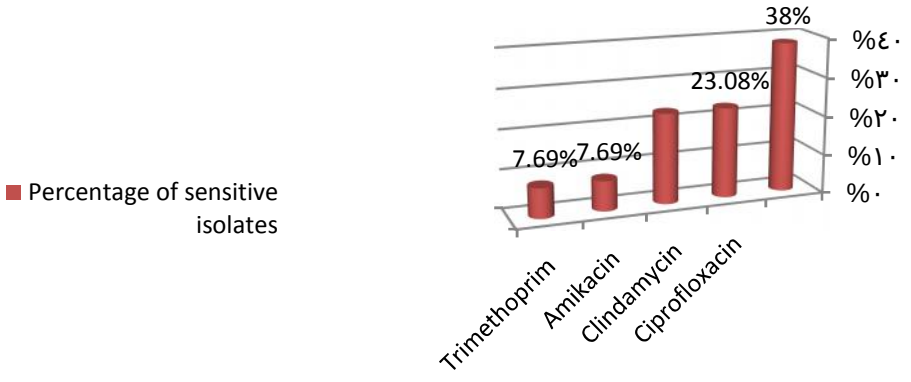
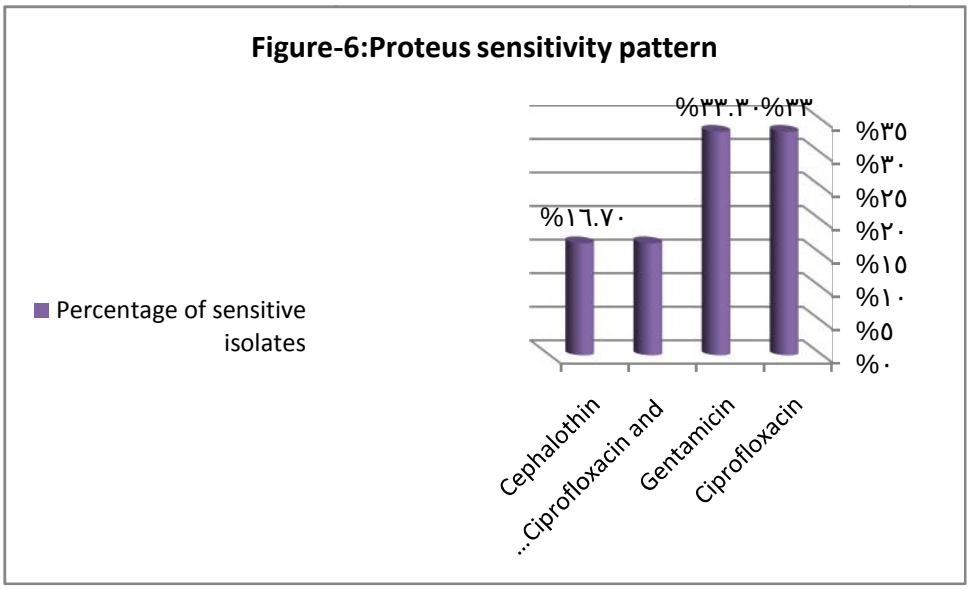


Figure-5 Staphylococcus sensitivity pattern





DISCUSSION

Chronic suppurative otitis media (CSOM) and various complications associated with the disease are among the most common conditions seen by the otologist, pediatrician and the general practitioner. It is a persistent disease and often causes irreversible local destruction of middle ear[13].

In this study, CSOM was found mostly among children and in young adults (Figure-1). Same results were obtained by Wariso BA [14] , Poorey VK[15] and World Health Organization-2004[9]. This may be due to multiple reasons as young children and infants have low resistance and also because of relative short and straight Eustachian tube (inner ear tube). Females were more commonly affected than males and it is also supported by a study carried by Loy AHC[16]. In contrast to this some studies showed opposite trend reported male 57.3% and female 42.7% [17]and this can be due to geographical variation. This study shows that Pseudomonas aeruginosa was the commonest organism isolated in chronic suppurative otitis media followed by Staphylococcus aureus and then Proteus mirabilis. Klebsiella and E. coli were also found(figure-2). As Pseudomonas aeruginosa was the most prevalent microorganism is also supported by Wariso BA [14], Loy AHC[16], , Sharma S et al[18], and Yeo SG et al[19].However different results were obtained by other studies (Anwar -us- Salam[20] and Ahmed B et al[21]), this could be due to variation in microorganisms in different locality and effect of climate[22].

Flouroquinolones have a broad range of activity and it is found to be active against Pseudomonas aeruginosa. It inhibits the bacterial DNA replication and transcription.64% of Pseudomonas aeruginosa isolates in this study were sensitive to ciprofloxacin(40% to ciprofloxacin ,24% to both ciprofloxacin and gentamicin) , 61.54% of Staphylococcus aureus isolates were sensitive to it (23.08% to ciprofloxacin , 38.46% to both ciprofloxacin and gentamicin) and 49.7% of Proteus

mirabilis isolates were sensitive to it(33.3% to ciprofloxacin ,16.4% to both ciprofloxacin and gentamicin). In general 54.9% of total cases in this study were sensitive to ciprofloxacin whereas in other studies 90% of Pseudomonas aeruginosa isolates were sensitive to it(Anwar-us- Salam[20], Aslam MA[23] and Gul AA [24]). 37.25% of the total isolates were sensitive to the aminoglycoside derivative; gentamicin that interferes with bacterial protein synthesis while 62.75% of them were resistant to it, this indicates the increasing resistance of the microorganisms against this antibiotic, Sensitivity of Pseudomonas aeruginosa to gentamicin came in second place after ciprofloxacin in this study despite the fact that aminoglycosides are more effective against gram negative bacteria, this is may be related to the inappropriate duration and dose of antibiotics and this result was supported by Yeo SG et al[19]and Ahmed S et al[25]. Sensitivity of Staphylococcus aureus to ciprofloxacin was also higher than its sensitivity to gentamicin this was agreed by Lodhi M et al [26].

CONCLUSIONS:

1-Children are more prone to be infected with CSOM because of their small Eustachian tube and low immunity.

2- That pseudomonas aeruginosa was the most frequent bacteria that cause CSOM then Staphylococcus aureus and Proteus mirabilis. In general gram negative bacteria were more common in causing the infection than gram positive bacteria in the current study. 3- pseudomonas aeruginosa was more sensitive to ciprofloxacin than to gentamicin despite the fact that gentamicin is known to be effective against gram negative bacteria including pseudomonas aeruginosa propably because of antibiotic miss use and genetic mutation of pseudomonas aeruginosa .

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