

## Otitis externa and the use of different antibiotics

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## Abstract

A descriptive study , microbiological and pharmacological study was done on 330ives with otitis externa 10 years of age and less attending the pediatrics and the Ear Nose and Throat department at the Tikrit Teaching hospitals during the period from 1<sup>st</sup> of August to 2007 to the last of February 2008. The aim of this study is to evaluate the response of bacteria causing otitis externa to the newly used antibiotics as compared with other old drugs. The total number of cases were 27 cases , males were 21 (77.8% ) while the rest were females , 6 cases (22.2% ). Most of the study cases were between the age of 5-10 years 22 cases (81.5%). Most of the study cases were from the rural areas 18 cases (66.7%) . Chronic otitis externa is the commonest form of disease in the study cases 25 cases (92.6% ). Most of the study cases have bilateral OE 22 cases (81.5%). Most of the cases have infection at the auricle in both male and females , 13 cases (48.1% ) and 5 cases (18.5% ) respectively. Most of the study cases have onset of the disease during summer time , 21 cases (77.8% ). Most of the study cases had history of swimming 19 cases (70.4% ). All the study cases had history of auricular pain 27 cases (100%), followed by feeling of itching in 16 cases (59.3%. All the study cases have tenderness of the external ear specially on moving the pinna 27 cases (100%), followed by swelling of the pinna 16 cases (59.3% ). *Staph aureus* was the commonest microorganism encountered 18 cases ( 66.7%) followed by *psuedomonas aeruginosa* 2 cases (7.4% ). No growth was found in 6 cases (22.2% ). Regarding *rigid aeres*, there is significant response to both erythromycin and to the ciprofloxacin , 18 cases ( 100%) and 17 cases (94.4% ) respectively. Regarding the *psuedomonas* , only the ciprofloxacin and norfloxacin shows response 2 cases for each (100%),the study concludes that the use of new regime in the treatment of otitis externa have a better results than the use of old regimes.

## استخدام مضادات حيوية مختلفة في علاج التهاب الأذن الخارجية

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## المستخلص

أجريت دراسة وصفية لغرض تقييم استجابة الأطفال المصابين بالتهاب الأذن الخارجية لعدد من المضادات الحيوية المستخدمة في علاج الأذن والأنف والحنجرة في مستشفى تكريت التعليمي خلال الفترة من الأول من شهر الثامن 2007 إلى الأخير من شهر 2008. هدف الدراسة هو دراسة استجابة البكتريا المسببة لتهاب الأذن الخارجية لطريقة العلاج الحديثة مقارنة بالطريقة القديمة. المصنوع الكلي للمضاد كان 27 حالة ، عند الذكور 21 (77.8%) و البقية 6 حالات (22.2%) . لكثير الحالات كانت بين عمري الخامسة والعاشر 22 حالة (81.5%) لكثير الحالات كانت من القرى 18 حالة (66.7%) . التهاب الأذن المزمن كان الأكثر شيوعاً 25 حالة (92.6%) . لكثير الحالات أصابت الأذن وأما 22 حالة (81.5%)

المزلة أن عدد تعريفها ٢٧ حالة (١٠٠%) بأنه تورم الأذن ١٦ حالة (٥٩.٣%) كانت المفورات الذهبية هي الكثرة الأكثر شيوعاً بين المرضى ١٥ حالة (٦٦.٧%) تلاها السونوموناس ٢ حالة (٧.٤%). كانت النتائج ملبية (لا يوجد نمو بكتيري) في ١ حالات (٤.٤%). فيما يخص المفورات الذهبية كانت هناك استجابة جيدة لعلاج الأرتروميسين و عقار السوروفازونامين ١٥ حالة (١٠٠%) و ١٧ حالة (٦١.٤%) على التوالي. فيما يخص السونوموناس كانت هناك استجابة فقط جيدة لعقار السوروفازونامين و زوروكسامين ٢ حالة لكل واحد (١٠٠%). تؤمنى الدراسة بالتشغيل الطريقة الجديدة في علاج التهاب الأذن الخارجية.

## Introduction

Otitis externa is inflammation of the outer ear. It includes all the inflammatory conditions of the auricle, external auditory canal and outer surface of the eardrum. It can be local, diffuse, acute or chronic. (1)Acute OE usually occurs during the summer months in more temperate climates or at any time of year in warm climates. In general, it occurs with higher frequency in warm, humid climates. Approximately 10% of people suffer from acute OE at some point; 90% of cases are unilateral. (2)The normal flora of the external canal consists mainly of aerobic bacteria and includes coagulase-negative staphylococci, *Corynebacterium* (diphtheroids), *Micrococccus* species, and occasionally *Staphylococcus aureus*, viridans streptococci, and *Pseudomonas aeruginosa*. External otitis (also called "swimmer's ear," although it can occur without swimming) is most commonly caused by *P. aeruginosa*, but *S. aureus*, *Enterobacter aerogenes*, *Photes mirabilis*, *Klebsiella pneumoniae*, streptococci, coagulase-negative staphylococci, diptheroids, Fungal infection usually follows prolonged treatment with antibiotics, with or without steroids. *Candida albicans* and *Aspergillus* species are commonest.(3)Infection can take many forms. There may be an infected hair follicle when *Staphylococcus aureus* is the usual infecting organism. Infection is localized. In more general infection of the outer ear the organisms may be bacterial or fungal. OEA significant number experienced severe symptoms such as ear discharge, ear canal swelling, pain, periauricular cellulitis, and fever.The severity of the pain and tenderness may be

disproportionate to the degree of inflammation, because the skin of the external ear canal is closely adherent to the underlying perichondrium and periosteum. Itching is a frequent precursor of pain and is usually characteristic of chronic inflammation of the canal or resolving acute otitis externa. Conductive hearing loss may result from edema of the skin and tympanic membrane (TM), serous or purulent secretions, or the canal skin thickening associated with chronic external otitis.(4)Other physical findings may include palpable and tender lymph nodes in the periauricular region, and erythema and swelling of the pinna and periauricular skin. Rarely, facial palsy, other cranial nerve abnormalities, vertigo, and/or sensorineural hearing loss are present. If these occur, secretizing (maligned) external otitis is probable. (5)Surgical intervention to obtain cultures or debride devitalized tissue may be necessary. *P. aeruginosa* is the most common causative organism of necrotizing otitis externa; fortunately, this disease is rare in children and is seen only in association with immunocompromise or severe malnutrition.(6)The treatment objectives for otitis externa have remained consistent while treatment approaches have evolved. The main goal of therapy is to eradicate the pathogens responsible for the infection, commonly *P. aeruginosa* and *S. aureus*; eradication is most efficiently achieved with antibiotic that have antimicrobial activity against these pathogens. compared with oral antibiotic, topical antibiotic are more effective and result in lower disease persistence rates and recurrence rates. this is because topical antibiotic are applied directly to

the bacteria in the ear at concentration well over the minimum inhibitory concentration needed for pathogen eradication. A second objective of treatment in addition to eradicating the infectious pathogen is reduction of ear pain. Otache is a common and significant symptom of otitis externa, and its intensity is directly related to disease severity. (7) Topical otic preparations containing neomycin (active against gram-positive organisms and some gram-negative organisms, notably *Proteus* species) with either colistin or polymyxin active against gram-negative bacilli, notably *Pseudomonas* species and corticosteroids are effective in treating most forms of acute external otitis. hydrocortisone has anti-inflammatory activity and is added to otic antibiotic treatment to relieve the symptoms of inflammation, such as swelling, itching and pain. Some studies found that the addition of hydrocortisone to ciprofloxacin reduced the time to end of ear pain by only 0.8 day. aminoglycosides, including gentamicin and neomycin may cause ototoxicity when used in the presence of non intact tympanic membrane. a separated study found clinical success (resolution or improvement) in 90 and 47% of patients treated with ciprofloxacin plus hydrocortisone given twice daily and neomycin-polymyxin B-hydrocortisone given three or four times daily, respectively. ofloxacin and ciprofloxacin are generally considered equivalent with respect to efficacy in otitis externa. the older combination drugs contains both neomycin and polymyxin B because neither drug alone is effective against *P. aeruginosa* and *S. aureus*. topical ofloxacin and ciprofloxacin are now the preferred treatments, in part because adverse effects with these drugs have been seen in otitis externa. Newer preparations of ear drops are available that do not contain potentially ototoxic antibiotics. When the pain is severe, oral analgesics (ibuprofen, codeine) may be necessary. (8) As the

inflammatory process subsides, clearing the canal with a suction or cotton-tipped applicator to remove the debris enhances the effectiveness of the topical medications. In subacute and chronic infections, periodic cleansing of the canal is essential. In severe, acute external otitis associated with fever and lymphadenitis, oral or parenteral antibiotics may be indicated; an ear canal culture should be done, and empiric antibiotic treatment can then be modified if necessary, based on susceptibility of the organisms cultured. A fungal infection (otomycosis) of the external auditory canal is characterized by fluffy white debris, sometimes with black spores seen; treatment includes cleansing and application of antifungal solutions such as clotrimazole or nystatin. other antifungal agents include *m-cresyl acetate* 25%, gentian violet 2%, and thimothal 1:1,000. (9) **The aim of this study is to evaluate the response of bacteria causing otitis externa to the newly used antibiotics as compared with other old drugs.**

#### Material and methods

A descriptive study, microbiological and pharmacological study was done on children with otitis externa under 10 years of age attending the pediatrics and the Ear Nose and Throat department at the Tibet Teaching hospital during the period from 1<sup>st</sup> of August to 2007 to the last of February 2008.

#### 1. Patients character

The child was diagnosed to have otitis externa when he have the typical clinical picture of the disease which includes the history of pain and ear swelling, ear discharge, fever, itching, erythema and swelling of the pinna and the presence of specific clinical signs which includes ear swelling and tenderness, preauricular adenitis, swelling of pinna and the presence of preauricular lymph nodes. Each child diagnosed to have the disease was assessed by a prepared questionnaire which includes name, age, sex,

residence, symptoms and signs of otitis externa ( mentioned above) each patient was looked for history of swimming. The infection with otitis externa were classified according to site ( infection of the auricle, external auditory canal or at the outer surface of ear drum ), acute or chronic, unilateral or bilateral, occur at summer or winter.

### 2. Microbiology

The cerumen (ear wax) is collected by the stick and keep in clean sterile container. All the antibiotics were discontinued 72 hours before sending the cerumen for culture and sensitivity, the sample was delivered to the laboratory within 1 hour of collection. The samples were cultured in 5% sheep blood agar and MacConkey's media. All the sample plates were incubated for 48 hrs at 37°C.

### 3. The antibiotic sensitivity

Antibiotics sensitivity testing was performed at the laboratory and by use laboratory standards guidelines for Kirby -bauer disk diffusion and micro dilution techniques to determine MIC .

## Results

### 1. Patients character:

The total number of cases were 27 cases , males were 21 (77.8% ) while the rest were females , 6 cases (22.2% ). Most of the study cases were between the age of 5-10 years 22 cases (81.5%) followed by the age range 1-5 years 5 cases (18.5%) while no cases were diagnosed at or the age group less than 1 year. Most of the study cases were from the rural areas 18 cases (66.7% ) while the rest were from the urban areas , 9 cases (33.3% ). Chronic otitis externa is the commonest form of disease in the study cases 25 cases (92.6%) while acute one was present only in 2 cases (7.4% ). Most of the study cases have unilateral OE: 22 cases (81.5%) and 5 cases identified to have bilateral type (18.5% ). Table (1) shows the distribution of the sites of

infection at the external ears. Most of the cases have infection at the auricle is both male and females , 13 cases (48.1% ) and 5 cases (18.5% ) respectively. Table (2) shows the distribution of the study cases according to the time of onset. Most of the study cases have been onset of the disease during warmer time , 21 cases (77.8% ) while the rest occur in winter months 6 cases (22.2% ). No cases had onset of disease during fall or spring. Table (3) shows the distribution of the study cases according to the swimming history. Most of the study cases had history of swimming 19 cases (70.4% ). Table (4) shows the distribution of the symptoms among the study cases . All the study cases had history of auricular pain 27 cases (100%), followed by feeling of itching in 16 cases (59.3% ). Table (5) shows the distribution of the signs among the study cases. All the study cases have tenderness of the external ears specially on moving the pinna 27 cases (100%), followed by swelling of the pinna 16 cases (59.3% ).

### 2. Microbiological study:

Table (6) shows the distribution of pathogenic bacteria revealed after culture of external ear swabs. *Staph aureus* was the commonest microorganism encountered 18 cases (66.7%) followed by *proteobacteria* *Aeruginosa* 2 cases (7.4% ). No growth was found in 6 cases (22.2% ).

### 3. The antibiotic sensitivity:

Table (7) shows the antibiotic sensitivity results of isolated strains of pathogenic bacteria. Regarding *staph aureus*, there is significant response to both erythromycin and to the ciprofloxacin , 18 cases ( 100%) and 17 cases (94.4% ) respectively. Regarding the *proteobacteria* , only the ciprofloxacin and norfloxacin shows response 2 cases for each (100%). Regarding *Stibiella* , only intramucous response was shown for ciprofloxacin

one cases (100%) with no response seen for other drugs.

Table (1): The distribution of the sites of infection at the external ears in regard to sex.

Sex	Site of infection		
	Auricle	External auditory canal	Outer surface of ear drum
Male	15 (40%)	8 (20.6%)	-
Female	5 (12.5%)	1 (2.5%)	-
Total	18 (66.7%)	9 (33.3%)	-

Table (2): The distribution of the study cases according to the time of onset.

Time of onset	Sex		
	Male	Female	Total
Summer	16 (54.3%)	5 (16.5%)	21 (77.8%)
Fall	-	-	-
Winter	5 (16.5%)	6 (22.2%)	11 (40.3%)
Spring	-	-	-
Total	21 (77.8%)	11 (40.3%)	27 (100%)

Table (3) shows the distribution of the study cases according to the swimming history.

History of swimming	History of swimming		
	Male	Female	Total
Yes	19 (30.4%)	-	19 (30.4%)
No	2 (7.4%)	6 (22.2%)	8 (29.6%)
Total	21 (77.8%)	6 (22.2%)	27 (100%)

Table (4) shows the distribution of the symptoms among the study cases.

Symptoms	No.	%
Ear discharge	13	48.1
Ear swelling	7	25.9
Auricular pain	27	100
Fever	11	40.4
Itching	16	59.3
Hearing disturbance	4	14.8
Vertigo	5	18.5
History of immune deficiency	-	0

Table (5) shows the distribution of the signs among the study cases.

Signs	No.	%
Periauricular cellulitis	2	7.4
Tenderness	27	100
Conductive hearing loss	4	14.8
Sensorineural hearing loss	-	-
Periauricular lymph nodes	7	25.9
Erythema of pinna	13	48.1
Swelling of pinna	16	59.3
Facial paralysis	-	-
Malnutrition	13	48.1

Table (6): The distribution of pathogenic bacteria after culture of external ear swab.

Species	No.	%
Staph aureus	18	66.7
Pseudomonas	2	7.4
Klebsiella pneumoniae	1	3.7
Total	21	77.8
No growth	6	22.2
Total	27	100

**Table (7) :** The antibiotic sensitivity results of isolated strains of pathogenic bacteria.

	Staph aureus No. (R)		Pseudomonas No. (R)		Klebsiella Pneumoniae No. (R)	
	S	R	S	R	S	R
Sulfoximides	3	1	5	1	1	1
Caproic acids	3	1	1	2	-	-
Erythromycin	3	1	-	-	2	-
Gentamicin	2	1	1	1	-	-
Novobiocin	0	-	1	1	-	-

S- Sensitive R- Resistance P- value=0.05 (Significant)

**Discussion**

Otitis externa is a common condition, and most cases are treated by family physicians and general practitioners.

**1. Patients character:**Most of the study cases were males. This goes with other study by Wong DL (14) who shows that most cases of otitis externa were males. This may be due to the fact that swimming is a known risk factor for otitis externa and the fact that most of the swimmers specially at our society were males so that they are more prone to otitis externa than females.Older children (the age of 3-10 years) were affected more commonly than the young (age 1-5 years age) while no cases were diagnosed at or the age group less than 1 year. This does not goes with other studies by Sander R. and Siger D.(2,5). The reason for this difference may be due to the difference in the age at which the child start swimming which is little later at our society than the society of the other studies.Rural areas were most commonly affected by the disease.

This goes with Wong study (10) which shows similar results. This may be due to the reason above is that swimming is a risk factor for otitis externa and this behavior (no swimming) is a very popular behavior at that society.Chronic otitis externa is the commonest form of disease in the study cases.This is goes with other study by Sander R. study (2) which shows a similar results is that chronic otitis externa was constitutes 63% of cases. This may be due to the reason that most of the cases were delayed in its diagnosis and the patients were wandering her and their looking for proper help and this may aggravate the condition and may it more chronic.Most of the study cases have unilateral OE. This does not goes with the Sander R. study (2) which shows the otitis externa were commonly to be bilateral. This difference may be due to the difference in the sample size. Although the patient with otitis externa may have unilateral infection to start with, this may become bilateral later as a result of cross infection between the two ears because of repeated manipulation of the initially infected ears. Other study by Howaki M. shows that there was no difference in incidence between left and right ear involvement. However, unilateral infection was twice as common as bilateral infection. No explanation can be offered for this difference after analyzing the various causative factors. Most of the cases have infection at the middle (a both male and females). This is goes with the Singer D. study which shows a comparable results. (5)Most of the study cases have be onset of the disease during summer time while the rest occur in winter months. This does not goes with other study by Podszkiis I (6) which shows that most of the cases of otitis externa were at the winter time. This is due to the fact that otitis externa is most common at the summer

time at the temperate climates while it is more common at winter at the cold climate. History of swimming was found in most of the study cases. This goes with other study by Wong et al (10) which shows that swimming was present in about 80 % of the study cases. This is due to the fact that swimming is a known risk factor for otitis externa which appreciate the risk of acquiring otitis externa by the effect of humidity of the water which enhance the growth of bacteria at such environment. All the study cases had history of auricular pain followed by feeling of itching. This goes with other study by Hossain M. (9) which shows nearly a similar results. This is due to the fact that auricular pain is the most distressing symptom that make the child seeking help than the other symptoms. All the study cases have tenderness of the external ear specially on moving the pinna followed by swelling of the pinna. This due to the fact that swelling and tenderness are two of the most essential sign of inflammation ( in addition to the hotness, redness and loss of function ) which was shown as hearing difficulties (2). **Microbiological study:** *Staph aureus* was the commonest microorganism encountered followed by *psuedomonas aeruginosa*. No growth was found in 6 cases (22.2%) (This goes with several other studies ( 9,11,12) which shows that *Staph aureus* was the commonest microorganism encountered in otitis externa patients. This is due that high rate of *Staph aureus* carriage among many people which is may symptomatic or asymptomatic. With any breachage of the skin in patients who were *Staph aureus* carrier (by any surgical procedure or by hand cleansing of the external ear ) or by decrease immunity due to any disease , this leads to growth of the infection with *Staph aureus* at the external ear.

Brook I (13) stated that carriage of *S. aureus* appears to play a key role in the epidemiology and pathogenesis of infection. The ecological niches of *S. aureus* are the anterior nares. In healthy subjects, over time, three patterns of carriage can be distinguished: about 20% of people are persistent carriers, 60% are intermittent carriers, and approximately 20% almost never carry *S. aureus*. Carriage has been identified as an important risk factor for infection in patients undergoing surgery, those on hemodialysis or CAPD, those with HIV infection and AIDS, those with intravascular devices, and those colonized with MRSA. Elimination of carriage has been found to reduce the infection rates in surgical patients and those on hemodialysis and CAPD. Elimination of carriage appears to be an attractive preventive strategy in patients at risk. Further studies are needed to optimize this strategy and to define the groups at risk. The very low incidence of infection by *psuedomonas aeruginosa* found by this study is goes with similar results seen by other many studies (11,12,13,14). this is due to the fact that by *psuedomonas aeruginosa* infection is usually associated with malignant otitis externa (which is very rare) and usually occur in immune compromised patients. No growth was found in 6 cases (22.2%) at this study. This may be due to the infection by non bacterial microorganism like fungi which needs special media and the presence of certain environmental conditions and needed a longer duration to identify the fungal infection. 3. The antibiotic sensitivity (regarding *staph aureus*, there is significant response to both erythromycin and to the ciprofloxacin while in *psuedomonas* , only the ciprofloxacin and norfloxacin shows response 2 cases for each (100%). In regard to *Klebsiella* , only intermediate response was shown for ciprofloxacin one case

(100%) with no response seen for other drugs. The good results to the use of the new regimen of Fluoroquinolones such as ciprofloxacin and ofloxacin comparing with old regimen of local neomycin and steroid is very popular and reported by several other studies (1,2,3,10). Fluoroquinolones such as ciprofloxacin and ofloxacin are the drugs of choice. Polymyxin Biviscosityhydrocortisone has been used in the past with good results but increasing bacterial resistance and pain during administration along with sensitivity to neomycin and potential for ototoxicity is limiting its use. The most common therapy for otitis externa is a topical agent containing antibiotics (an aminoglycoside and polymyxin B) and a corticosteroid. These medications are thought to both reduce the inflammation and treat the (putative) underlying pathogen. These medications, however, require four administrations per day (based on package labeling), and as with other forms of medications, compliance decreases with increased number of daily administrations. Compliance might also be affected by stinging or burning, which commonly occurs following administration ofotic medication.<sup>(12)</sup> Furthermore, otic aminoglycoside therapy can lead to ototoxicity or cutaneous sensitization.<sup>(13)</sup> It might be useful to evaluate compliance with these topical medications, including the impact of symptoms experienced in administering these medications on compliance. Ofloxacin and ciprofloxacin with dexamethasone may be used with tympanic membrane perforation or pressure-equalizing tubes as they are not ototoxic. Systemic antibiotics are usually not necessary for most patients but may be used with infections beyond the canal or immunocompromised patients. Historically, some physicians have

used a small cotton wick placed into the ear to aid medication delivery but this has not been systematically evaluated. Prevention centers on trying to keep the external canal as dry as possible. Using ear plugs and/or bathing caps, or blow drying with a low dryer setting after swimming may help. Decreasing the pH of the ear also helps by using a few drops of isopropyl alcohol, acetic acid or boric acid after swimming.

### Conclusion

Most of the cases are unilateral and had infection at the earicles and most of the infections occur during summer time. *Staph aureus* was the commonest bacteria recovered followed by *psuedomonas* and then by *Klebsiella*. Regarding there is significant response to the use of ciprofloxacin in both *staph aureus* and *psuedomonas* growth.

### References

- 1-Myer: otitis externa: a historical perspective on the use of otic antimicrobial agents. *pediatr infect dis j* 2001; 28:98-101.
- 2- Sander: otitis externa : practical guide to treatment and prevention. *ann fam physician* 2001;63:927-36.
- 3-Slak: re-a study of three preparation in treatment of otitis externa. *j laryngol otol* 1987;101:533-5.
- 4-Gordon a. otitis externa: hell as any real days 1948;8:245-6.
- 5- Singer d, buzman a, bofferl a. otitis externa: bacteriological and mycological studies. *ann otol rhinol laryngol* 1952; 61:317-30.
- 6- Jones m, milano j, weiden m. ofloxacin otic solution for treatment of otitis externa in children and adults - such otolaryngol head and neck surg 1997;123:1193-1200.
- 7- Gates ga. safety of ofloxacin otic and other otopical treatment in



animals and human. *pediatr infect dis j* 2001; 20:104-7.

8-Padoshis I, frais ex, boi david  
Jeasomlicity of ear drops in patients  
suffering from chronic otitis externa. *J*  
*laryngol otol* 1989;103:46-50.

9- Hawaka M, wong J, kraiden S.  
Clinical and microbiological of otitis  
externa. *Otolaryngol* 1984;13:289-95.

10-Wong d, Raka ja Jo  
unintentional otis preposition cause  
ototoxicity in the presence of tympanic  
membrane perforation? *Otolaryngol*  
head and neck surg 1997;116:404-10.

11-Kooijachorn-Lazersons E, van de  
Lindok E, van der Hoogen H, van der  
Velden J. Otitis externa: klachten en  
medicamentosa beleid. *Maandb Wet*  
1993;36: 212-3.

12-Ondrejz GE, Kiric CU, Udigruff  
WR, Glasman JM, Soyka JP.

Effective treatment of acute diffuse  
otitis externa. *ch* 56: 27-9.

13- Brook I, Frazer EL, Thompson  
DH. Aerobic and anaerobic  
microbiology of external otitis. *Clin*  
*Infect Dis* 1992;15:955-958.

14- Gibetto P. Ciprofloxacin in the  
treatment of malignant external otitis.  
*Chemotherapy* 1994;40(Suppl 1):35-  
40.

15- Wikke AD, England J, Jones AS.  
An alternative to regular dressings for  
otitis externa and chronic suppurative  
otitis media? *J Laryngol Otol*  
1995;109:101-105.