



Research Article

PSEUDOMONAS AERUGINOSA IN CHRONIC SUPPURATIVE OTITIS MEDIA: FREQUENCY AND ITS SENSITIVITY TO VARIOUS ANTIBIOTICS

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Abstract- Aim: Chronic suppurative otitis media is a significant health problem especially in underdeveloped countries. *Pseudomonas aeruginosa* is very common causes of inflammation with distinct tendency for multi-resistance development, which can cause significant and even life-threatening complications. This study aims to determine the microbial profile and sensitivity of *Pseudomonas aeruginosa* isolates to antibiotics, which would greatly help in the treatment of disease, preventing the development of complications and the development of pathogens resistant to certain antibiotics. **Methodology:** The standard microbiological procedures were followed for isolation, culture and antimicrobial assay. **Results:** *Pseudomonas aeruginosa* was present in 27.18% and isolates showed full susceptibility to Imipenem and Ceftizidim (100%), meaningly susceptibility to Ciprofloxacin (92.68%), and slightly less to Cefoperazone (78.95%) and Piperacillin (76.92%). There was also relatively considerable resistance to aminoglycosides Gentamycin (50%) and Amikacin (53.85%), and complete resistance to Ampicillin, Amoxicillin-clavulanate, Cephalexin and Cefuroxime. **Conclusion:** Given the high affinity multi-resistance of *Pseudomonas aeruginosa* it is necessary to continuously and periodically evaluate the aetiological agents of chronic suppurative otitis media and their susceptibility to antibiotics.

Keywords- Otitis media Chronica, Microbial sensitivity, Antibiotics, *Pseudomonas aeruginosa*

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Introduction

Chronic suppurative otitis media (Chronic suppurative otitis media, CSOM) is defined as the permanent purulent discharge through a perforated eardrum for more than two weeks (WHO criteria) [1] according to some authors for more than 6-12 weeks [2, 3]. It is a significant health problem especially in underdeveloped countries and developing countries, and can cause significant and even life-threatening complications that were particularly common in pre-antibiotic era. With the introduction of antibiotics, complications are rare, the prevalence of chronic suppurative otitis media is reduced, but the indiscriminate use of antibiotics has led to the emergence of multidrug-resistant pathogens, which complicates the treatment and makes it more expensive and can increase complications [4-6]. All this makes microbiological diagnostics an essential step in the diagnosis and treatment of this disease. *Pseudomonas aeruginosa* is one of the most common causes of chronic purulent inflammation of the middle ear and is also known for its multi-drug resistant properties [7-9].

The aim was to determine the frequency of *Pseudomonas aeruginosa* in chronic suppurative otitis media and analyze its sensitivity to antibiotics. The results could be a guiding principle in the choice of antibiotic therapy and contribute not only to a more successful rehabilitation of inflammation, but also preventing and reducing the incidence of life-threatening complications and to provide data for the control and monitoring of the trend of resistance.

Materials and Methods

Patients and methods

This prospective study was conducted at ENT department of County Hospital Livno in the period of 2009-2013, with the consent of the institutional ethics committee and with informed consent of patients diagnosed with chronic

suppurative otitis media. The study included 90 patients, of which 103 swabs were taken, of which 92 were positive; in nine patients it was a mutual chronic suppurative otitis media and in 4 patients from one ear two isolates were obtained. The study included patients who had unilateral or bilateral chronic suppurative otitis media, patients who previously did not receive antibiotic therapy for two weeks, local or systemic, and where the pathogen *Pseudomonas aeruginosa* was isolated.

After examining the patient is swabbed with disposable swab, wooden stick with cotton wool on its top, in a sterile individual packaging [Plain Swab cotton tipped applicator], through the ear funnel to avoid "contamination" in ear canal. Then the sample is delivered in the microbiological laboratory within an hour and sowed on surface in accordance with standard microbiological procedures; on blood agar, thioglycollate broth and chocolate agar. After incubation for 24-48 hours at 37 °C, in the case of enhanced culture the identification is carried out based on characteristics of culture, colony morphology, Gram-staining and possibly in other biochemical tests as required [10].

Test of sensitivity to antibiotics was performed by disk diffusion method according to CLSI recommendations. [11].

Results and Discussion

Results

The means age of patients where *Pseudomonas aeruginosa* was isolated was 51.45 yrs., in the range of 12-82 years of age, and predominantly aged 40-60 years (45.45%). There were no significant differences in the distribution by gender, 57.1% men and 42.9% women.

Pseudomonas aeruginosa was present in 28 (27.18%) isolates. Seventy-five

samples (72.82%) were positive for other micro-organisms; *Staphylococcus aureus*, 32 isolates (31.06%), *Klebsiella species* 7 isolates (6.79%), *Proteus species* 6 isolates (5.83%), *Streptococcus species* 3 isolates (2.92%), 2 *Haemophilus influenza* isolates (1, 94%), *Candida albicans* 8 isolates (7.77%), *Aspergillus species* 6 isolates (5.83%) and in 11 (10.68%) isolates increased normal saprophyte flora [Table-1].

Table-1 Microbiological profile of chronic suppurative otitis media

Type of organism	No (%) isolates
<i>Pseudomonas aeruginosa</i>	28 (27,18)
<i>Staphylococcus aureus</i>	32 (31,06)
<i>Klebsiella spp.</i>	7 (6,79)
<i>Proteus mirabilis</i>	6 (5,83)
<i>Streptococcus</i>	3 (2,92)
<i>Haemophilus influenzae</i>	2 (1,94)
<i>Candida spp.</i>	8 (7,77)
<i>Aspergillus spp.</i>	6 (5,83)
<i>Saprophytic flora</i>	11 (10,68)

Pseudomonas aeruginosa proved completely resistant to Ampicillin, Amoxicillin-clavulanate, Cefuroxime and Cephalexin (100%) and less resistant to Chloramphenicol (80%). It is fully susceptible to Imipenem and Ceftazidime (100%) extremely to Ciprofloxacin (92.86%) significantly in Cefoperazone (78.95%) and Piperacillin (76.92%). It is also interesting its relatively considerable resistance to aminoglycosides; Gentamycin (50%) and amikacin (53.85%) [Table-2], [Fig-1].

Table-2 Sensitivity pattern of *Pseudomonas aeruginosa* to various antibiotics

Antibiotics	S (%)	R (%)
Amoxicillin	0	100
Amoxicillin-clavulanic acid	0	100
Cefalexin	0	100
Cefuroxim	0	100
Ceftazidime	100	0
Ceftriaxone	46,15	53,85
Cefoperazone	78,95	21,05
Gentamycin	50	50
Amikacin	53,85	46,15
Trimethoprim/sulfamethoxazole	0	100
Ciprofloxacin	92,86	7,24
Imipenem	100	0
Piperacillin	76,92	23,08
Chloramphenicol	20	80

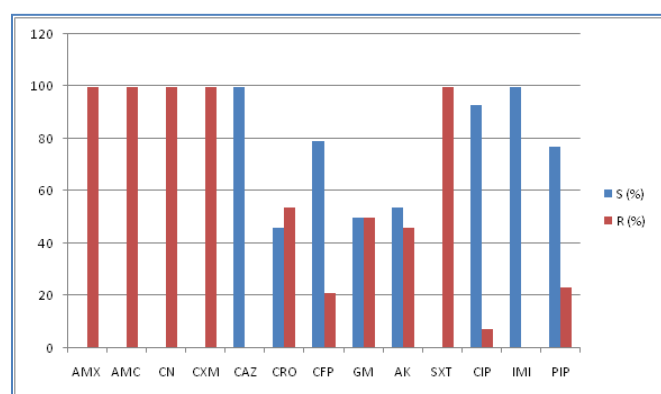


Fig-1 Antibacterial susceptibility pattern of *Pseudomonas aeruginosa*

*AMX; amoxicillin (10µg), AMC; amoxicillin-clavulanate (30µg), CN; cephalexin (30µg), CXM; cefuroxim (30µg), CAZ; ceftazidim (30µg), CRO; ceftriaxon (30µg), CFP; cefoperazone (30µg), GM; gentamycin (10µg), AK; amikacin (10µg), SXT; trimethoprim/sulfamethoxazole (25µg), CIP; ciprofloxacin (5µg), IMI; imipenem (10µg), PIP; piperacillin (100µg)

Discussion

The emergence of multi-resistant causes of chronic suppurative otitis media, caused by the indiscriminate use of antibiotics, complicates and makes treatment more expensive, and can result in an increase in complications [6]. Therefore,

identifying the cause and defining its sensitivity to antibiotics is essential for effective treatment, prevention of complications and development of pathogen resistance and possible ototoxicity and finally reducing the cost of treatment. Knowing about the resistance of some pathogens to antibiotics is of great importance since the therapy is often introduced before isolating the cause of inflammation, and often cause itself cannot be isolated due to technical reasons.

Pseudomonas aeruginosa is a well-known pathogen that causes various diseases in a series of minor skin infections to fulminant septicemia and is one of the main causes of nosocomial infections with strong multidrug resistance [12]. It is one of the predominant causes of chronic suppurative otitis media and since it is not often present in the upper respiratory tract, its presence in the middle ear must be interpreted as secondary invasion access through the eardrum defect [13]. Although careful cleansing of the ear and use of local antibiotic preparations are the main choice in the treatment of uncomplicated chronic suppurative otitis media, often irregular approach to treatment and use of non-conventional drops and resources as well as poor hygiene can contribute to its invasion of the middle ear.

The results of this study show that with *Staphylococcus aureus* (31.6%), *Pseudomonas aeruginosa* (27.18%) commonly isolated causative agent in chronic suppurative otitis media. These tandem agents were observed by many authors [14-17] while others studied *Pseudomonas aeruginosa* as the most common cause accompanied by *Staphylococcus aureus* infection [18-20]. Such differences may be caused by geographic, climatic variations and different groups of populations that have been studied. High percentages of isolation of *Pseudomonas aeruginosa* has significant implications because it is an important cause of nosocomial infections and also because of its great tendency to multi-resistance. [12].

Tests of sensitivity to specific antibiotics, in our study, showed 100% sensitivity of the isolates to Imipenem as according to several similar studies [21,22]. Although previous studies have described the most effective antibiotic imipenem against *Pseudomonas aeruginosa* [23], more recent studies show the evolution of resistance of *Pseudomonas aeruginosa* to imipenem [24].

Ceftazidime has also, in our study, demonstrated 100% effectiveness against isolates of *Pseudomonas aeruginosa* which is comparable with similar studies [25]. From other cephalosporins tested, only Cefoperazone showed satisfactory effectiveness; 78.95% of the isolates were sensitive to this antibiotic, while the cephalosporins of the first and second generation (Cephalexin and Cefuroxime) isolates showed complete resistance. The above phenomenon can be explained by the great propensity of *Pseudomonas aeruginosa* multidrug resistance and one of the major mechanisms of resistance is mediated by β -lactamases (Es β Ls; extended-spectrum beta-lactamases) which split the beta-lactam ring of these antibiotics. In the same way one can explain complete resistance to penicillins; Ampicillin, Amoxicillin-clavulonic acid. Unlike them Piperacillin still shows relatively high efficiency, and sensitivity of 76.92%.

While other studies have shown a declining trend of sensitivity of *Pseudomonas aeruginosa* to quinolones [26,27], our study suggests an extremely high percentage of the sensitivity of the Ciprofloxacin, 92.68%, which is consistent with the results of other similar studies [22]. This trend could be explained by many factors, including irregular, often unjustified use, inappropriate dosage as well as the development of enzymatic resistance *Pseudomonas aeruginosa* to quinolones.

Aminoglycosides, Amikacin and Gentamycin, showed worrying low efficiency (50% and 53.85%) in our region due to the frequent use, as the drug of choice in the local treatment of chronic otitis media. Perhaps this is one reason for the gradual development of drug resistance to this group of drugs due to the high sensitivity of *Pseudomonas aeruginosa* described in other studies [26,28]. Of course, one should bear in mind the possibility of aminoglycosides ototoxicity although it was never ascertained [27].

Since the local therapy is the first line treatment of uncomplicated chronic suppurative otitis media, which often eliminates the need for systemic therapy it is very important to know the sensitivity of the agent on locally applied antibiotic therapy [29,30]. We must point out the chance of achieving concentrations of antibiotic at the site of action in concentration 100-1000 times greater locally than

in the oral or parenteral administration [27]. Taking into account all of the above it seems reasonable to recommend the introduction of local forms of other antibiotics which *P. aeruginosa* is highly sensitive to (Colistin, etc.)

Conclusion

Knowing the cause of purulent otitis media and choice of antibiotics in accordance to sensitivity test should be guidelines for the treatment of diseases, the prevention of complications development and the development of the causes resistant to some antibiotics. Given the high propensity of multi-resistance development of *Pseudomonas aeruginosa*, without doubt, it is necessary to continuously and periodically evaluate the microbiological profile and sensitivity of isolates to antibiotics. In particular, that is important in areas where it is not technically possible to isolate the cause of the inflammation and urgent treatment is required for clearing up the inflammation and prevention of the development of complications. It is clear that exclusive reliance on empirical treatment is not reasonable in light of the growing multi-resistance, but it is also understandable that the best results are achieved by including therapy as soon as possible. Therefore, in accordance with the results of this study, we recommend starting the therapy with ear cleaning together with local therapy drops containing Imipenem or Ciprofloxacin. In the case of treatment failure, aetiological agent should definitely be isolated and treatment continued in accordance with the sensitivity test or empirically, by adding the oral or parenteral antibiotic therapy.

Conflict of interest: There's no conflict to declare

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