

Research Article

Pathogenic bacteria profile and antimicrobial susceptibility patterns of ear infection at Ayub Medical Complex Abbottabad, Pakistan

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Abstract

The aim of this study was to determine the bacterial etiologic agents of ear infections and their antibiogram among patients of all age groups visited to Ayub Medical complex Abbottad. This cross sectional study was designed at Microbiology laboratory, Ayub Medical complex Abbottabad from February 2019 to July 2019. Patients of any age and both sexes were involved. For the culturing of bacteria and susceptibility testing swabs from infected ears were analyzed. Anitbiogram was perform according to CLSI standards. A total of 100 samples were collected. Of them, (55 %) were males and (45 %) female patients. Overall, (72 %) samples were positive in which (76 %) were male. Highest number of isolates 20 (76 %) were identified in patients from 1-10 years of age. The predominant bacteria were *P. aeruginosa* 32 (44.4 %), *S. aureus* 15 (20.83 %) and *K.pneumoniae* 8 (11.11 %). Gram positive bacterial isolates exhibited high level of resistance to Tetracycline, Penicillin, Oxacillin and Vancomycin respectively while Cotrimoxazole, Clindamycin, Ciprofloxacin, Linezolid, Erythromycin and chloramphenicol were effective drugs. Gram negative bacteria were resistant to Amoxicillin and Ampicillin. However, Amikacin, Pipra-tazobactum, Ceftriaxone, Gentamicin, Ciprofloxacin, Chloramphenicol and Cotrimoxazole were effective against most of these isolates. Bacteriological Ear infection is reasonably common in Abbottabad and the most pathogenic bacteria associated with infection are *P.seudomonas* *S.aureus* and *K.pneumoniae* which are resistant to Beta Lactam antibiotics. Therefore, for the cure of ear infection antibiogram is vital.

Keywords: Ear infection; Pathogenic bacteria; *P.seudomonas*; *S.aureus*; Antibiogram

Introduction

The infection of middle ear or tympanic tissue is termed as otitis media (OM) which is characterized by ear irritation or ear discharge (otorrhoe) [1]. Ear infection may be acute or chronic purulent type [2]. Approximately 330 million peoples are suffered from ear infection throughout the

world in which about 60% lost hearing capability [3]. Both in developing and developed countries its high prevalence has created problems for public health [4]. Mainly ear infection is common in young children and infants but also affect adults as well [5]. The infection may initiate in babyhood due to unnoticed treatment [4].

The microorganisms may spread to the middle ear through a long-lasting perforation. As compared to adults children are at risk of ear infection due to non-developed Eustachian tube in children allows easier entrée of organism over the nasopharynx. Besides, the ratio of infection is higher in men than in women [6]. The frequency of otitis media fluctuates from region to region. In the advanced countries, it is decreasing due to wakefulness; but in emerging world, it is on the upsurge [7]. In developed countries untreated ear problems leads to middle ear infection often with impairment and more difficulties comprising persistent acute otitis media, persistence of middle ear inflammation which requires the insertion of drainage tube and often results in loss of hearing and chronic middle ear infection [6]. The causative agents, incidence and antibiogram of ear diseases is varied with environmental area and meteorological conditions surroundings [2]. A number of studies, documented that *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and *Proteus mirabilis* are the topmost organisms isolated from circumstances of ear illnesses [8]. Wide-spectrum antibiotics are used in huge amount and in inappropriate way that has triggered difficulties to treat the bacterial isolates which became worldwide wellbeing risk [2]. In ear infection high numbers of antibiotic are used to treat bacteria results in the initiation of secondary infections of brain [9]. In addition, ear infections can cause the formation of middle ear tumors, auditory inflammation and auditory problems [9, 10]. The prevalence, antibiotic resistance and causative agents of ear infection from region to region varies due to differences in antibacterial recommending practices and incidence of resistant bacterial strains. Thus up to date information on microbial resistance need to be available at national and local level to guide the rational use of existing antimicrobials. Therefore, this study was

carried out to determine bacterial etiologic agents of ear infections and their antimicrobial susceptibility profiles among patients who referred to Ayub Medical Complex Abbottabad.

Materials and methods

Area of study

This cross sectional study was designed at Microbiology section, Pathology Department, Ayub Medical complex Abbottabad from February 2019 to July 2019.

Sample collection

A total of 100 patients of suspecting otitis media presenting with ear discharge were involved in the study. Patients of any age and both sexes were involved. Auditory swabs wetted with sterilized normal saline were used to assemble samples and transported directly to lab for culture. Swabs were reserved prior start medical treatment.

Sample processing for isolation of pathogenic bacteria

Discharge swabs were cultivated on blood agar, MacConkey agar and Chocolate agar. Swabs were processed using standard bacteriological methods to isolate bacteria and identify growing organisms according to standard bacteriological procedures. [11].

Antibiotic susceptibility testing

After 72 hours of incubation, all cases of bacterial growth were tested for antibiotic susceptibility using a modified Kirby Bauer disk diffusion method and analyzed using standard guidelines. [12].

Antibiotic used in the study

The antibiotic tested in the study against the isolated bacteria are Clindamycin, Oxacillin, Tetracycline, Chloramphenicol, Erythromycin, Penicillin, Linezolid, Vancomycin Amoxicillin, Ampicillin, Ciprofloxacin, Ceftriaxone, Cotrimoxazole Gentamycin, Amikacin, Pipra-tazobactam, Ceftazidim, Levofloxacin,

Results

Overall 100 specimens from patients of otitis media were evaluated both from men 55 (55 %) and female 45 (45 %). They

were (range from 1 to above 30) years. Total, 72 (72 %) of otitis media had bacteriological isolates. The ratio of infection was 42 (76 %) in men and 30 (66 %) in female. The incidence isolates were identified in 20 (76 %) 25 (73.3 %), and 27(67%) patients from 1 to 10, 21 to 30, and 11 to 20 years of age, respectively (**Table 1**).

Of 72 isolates, Gram negative bacteria were 52 (72.2 %) in contrast to Gram positive 20 (27.7 %). So a total of nine bacteria were isolated. The predominant bacteria were *P. aeruginosa* 32 (44.4 %) *S. aureus* 15 (20.83 %) and *K.pneumoniae* 8 (11.11 %), *E.coli* (6.94%) *S.pneumoniae* (4.16%) *Acinetobacter* (4.16%) and *Proteus* (2.77%) as tabulated in (**Table 2**).

Mostly, gram positive isolates exhibited (9.9–90.0 %) resistance against the

antibiotics used. Out Of 15 *S. aureus* isolates, (90.0, 39.0, 32.0 and 26 %) were resistant to Penicillin, Tetracycline Oxacillin and Vancomycin correspondingly. But resistance was minimum against Cotrimoxazole, Clindamycin, Ciprofloxacin, Linezolid, Erythromycin and Chloramphenicol by Gram positive bacteria (**Table 3**).

Gram negative bacteria were (6.0–91.0 %) resistance to the antimicrobials practiced. *P. aeruginosa*, *Proteus* spp., *E. coli* and *K. pneumoniae* *Acinetobacter* were resistant to Amoxicillin/Clavulanic acid (60–80 %) and Ampicillin (85–100 %). On the other side, Amikacin, Pipra-tazobactam, Ceftriaxone, Gentamycin, Ciprofloxacin, Chloramphenicol and Cotrimoxazole were effective against Gram negative bacterial isolates (**Table 4**).

Table1. Infection of ear in relation to age and gender of patients visited at Ayub Medical Complex Abbottabad

Variables	Ear infection N (%)	Total N (%)
Male	42(76.36)	55(55)
Female	30(66.66)	45(44)
Age (years)		
1-10	20(76.92)	26(26)
11-20	27(67.5)	40(40)
21-30	25(73.53)	34(34)
Total	72	100(100)

Table 2. Frequency of bacterial isolates (n = 72) of ear infection at Ayub Medical Complex Abbottabad

Bacteriological profile			
Bacterial isolates		Total N=72	Percentage
Gram positive bacteria	<i>S.pneumonia</i>	3	4.16
	<i>S.aureus</i>	15	20.83
	<i>Enterococcus</i>	2	2.77
Gram negative bacteria	<i>P. aeruginosa</i>	32	44.44
	<i>E.coli</i>	5	6.94
	<i>K.pneumoniae</i>	8	11.11
	<i>Acinetobacter</i>	3	4.16
	<i>Proteus</i>	2	2.77
	<i>Citrobacter</i>	2	2.77

Table 3. Antibacterial resistance patterns of Gram positive bacterial isolates (n =20) from pus swab taken from ears infection of patients, at Ayub Medical Complex Abbottabad

Isolated bacteria	Resistant pattern of antibacterial agents (R %)										
	*T	DA	OXA	TE	SXT	CAF	CIP	ERY	PEN	LZD	VA
<i>S. aureus</i>	15	10	32	39	20	5.4	0.0	20	90	0.0	26
<i>S. pneumonia</i>	3	ND	ND	9.9	0.0	2	0.0	0.0	20	0	0
<i>Enterococcus</i>	2	290	ND	ND	ND	0	0	ND	ND	50	ND
Total	20										

Key: #T total number of bacteria experienced against each antibacterial agent, R % percent of bacteria resistance to antimicrobial agent, ND not done, DA Clindamycin, OXA Oxacillin, TE Tetracycline, SXT Cotrimoxazol, CAF chloramphenicol, CIP ciprofloxacin, ERY Erythromycin, PEN penicillin, LZD Linezolid, VA Vancomycin

Table 4. Antibacterial resistance patterns of Gram negative bacteria (n =52) isolated from patients of ears infection, at Ayub Medical Complex Abbottabad

Isolated bacteria	Resistant pattern of antimicrobial agents(R %)										
	*T	AMC	AMP	CIP	CRO	SXT	GEN	AK	TZP	CAZ	LEV
<i>P. aeruginosa</i>	52	80	100	6	18	20.1	10	6	5	15	9
<i>K. pneumonia</i>	8	70	100	12	18	13	10	3.0	ND	25	0.0
<i>E.coli</i>	5	69	89.1	10	30	0.0	35	0.0	0.0	20	0.0
<i>Acinetobacter</i>	3	88	85	ND	ND	ND	ND	2.5	ND	ND	ND
<i>Proteus SPP</i>	2	60	90	10	25	20	26	0.0	0.0	26	ND
<i>Citrobacter</i>	2	ND	ND	ND	ND	ND	ND	ND	90	ND	ND
Total	72										

Key: #T total bacteria tested against each antibiotic, R % percent of isolates resistant to antimicrobial agent, AMC amoxicillin, AMP Ampicillin, CIP Ciprofloxacin, CRO Ceftriaxone, SXT Cotrimoxazole, GEN Gentamycin, AK Amikacin, TZP Pipra-tazobactam, CAZ Ceftazidim, Lev Levofloxacin, ND not done

Discussion

Patients use antibiotics and make appointment with clinicians for the treatment of disturbing ear infection [20]. For diagnostic purpose, ear discharge sample is one of the most commonly desired sample from medical sites. Correspondingly, our study, 72.0 % specimens of infected ear displayed bacterial growth. Similarly, with an insignificant dissimilarity few former authors in Ethiopia reported 89.5 % [8], 89.4 % and [6]. This designates that otitis media is problematic to public health and humanity. In the current research ear infection was suggestively greater in man with comparison to females this is similar to consequences of [14]. But dissimilarity was reported by the study of females had higher ratio of ear infection than males [13]. In this study, the otitis media was greater (76.92%) in people from 1 to 10 years of age which come to an agreement

with data from [10, 17]. Greater occurrence of otitis amongst undeveloped age individuals might be due to the small, wide and orthodox nature of the Ear channel, absence of sanitization, weak immunity, frequent contact to upper respiratory tract infections and undernourishment [10]. In our study, the most significant bacteria were gram-negative 52 (72.2 %) of ear discharge associated to gram-positive bacteria which is parallel to previously studies in Dessie [9] and Ethiopia [14].

In the current research, *P. aeruginosa* (44.44 %) tailed by *S. aureus* (20.83%) and *Proteus* spp. (2.77 %). This fashion is analogous to studies of other scientists [14, 16, 21]. However the finding of Denboba [22] showed contrast to our results. The reason of differences in bacterial profile of ear infection is due to deviation in type of weather and natural features, further nationwide study is important. The most dominant isolate in our study was of *P.*

aeruginosa, could be associated to its potential of survival in antagonism with other creatures and fight to antibiotics. Besides, *P. aeruginosa* has virulence factors such as Pili which helps in the attachment of the pathogen to the epithelial layer of inflamed middle ear. When involved, the pathogen yields proteins degrading enzymes to evade the usual resistance procedure of organ vital to combat infections [6].

The occurrence of *K. pneumoniae* and *E. coli* in this research was 11.11 and 6.94 %, respectively. Similarly, 11.1 and 3.7 % of *K. pneumoniae* and *E. coli* was, correspondingly described in Ethiopia [2]. However, a study in India [18] described 8 and 4 % of *K. pneumoniae* and *E. coli*, separately although the percentage differs. Separation of fecal bacteria like *K. pneumoniae* and *E. coli* might designate that personages were at danger of problems due to underprivileged cleanliness environments. In this study *P. aeruginosa* exhibited extraordinary level of resistance (80–100 %) to ampicillin and amoxicillin. This was parallel with results in Ethiopia [14] where 90–89 the levels of resistance to Ampicillin and Amoxicillin were observed separately. However, *Pseudomonas aeruginosa* is highly susceptible to ciprofloxacin, chloramphenicol, gentamicin and amikacin. This is similar to the Ethiopian results. [2].

In the current study, 90% and 36 % *S. aureus* growth were resilient to Penicillin and Oxacillin, correspondingly. These findings were similar to previous studies [14, 19]. This recommends the dissemination of all *S. aureus* not sensitive to every β -lactem medicines and Methicillin to public which offers a vigilant for extra huge balance research on the occurrence and vulnerability patterns of public assimilated Methicillin resistant *S. aureus* middle ear disease in Abbottabad. Additional, *S. aureus* showed minimum resistance to Ciproflaxacin, Chloramphenical, Clindamcin, Erythromycen and Cotrimaxazole. These

were same to the outcomes of other studies [6, 9] for Ciproflaxacin and Erythromcin. In the existing study, *Proteus* spp. displayed extraordinary resistance (80 %) to ampecillin and adequate resistance (60 %) to amoxcilin/clavulenic acid. Though, *Proteus* spp. shown low levels of resistance to ciproflxacin, gentamycin and ceftriaxone which were similar to former results [2, 6, 8, 9]. The existence of high levels of resistance to beta lactam antibiotics and the bacteria linked with internal ear dysfunctions in our research may be due to absence of study on antibacterial resistance amongst doctors and indulges, inaccessibility of inadequate antibiogram minutes, exploitation of medicines, and self-use and carelessness on patient part.

Conclusion

The study indicates that ear infection is most common in Abbottabad. The major bacteria involved in infection are *P. aeruginosa*, *S. aureus* and *K.pneumoniae*. Most of the isolates were resistant to amoxicillin/clavulanic acid and ampicillin and oxacillin. However, Amikacin, cotrimoxazole, ciprofloxacin, chloramphenicol and gentamicin were effective against most of the bacterial isolates. Therefore, for the treatment of otitis media in the study area antibiogram is essential.

Authors' contributions

Prepared and supervised the research project: MA Khan, Performed the experiment and helped in proofreading of the manuscript: M Javeed & M Arshad.

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