



## Original Research Article

### *Pseudomonas aeruginosa*: A Common Causative Agent of Ear Infections in South Asian Children

Somia Gul<sup>1\*</sup>, Asma Eraj<sup>1</sup> and Zehra Ashraf<sup>1,2</sup>

<sup>1</sup>Faculty of Pharmacy, Jinnah University for Women, 74600 Karachi, Pakistan

<sup>2</sup>Essa's Laboratory & Diagnostic Centre, B-122, Block-H, (Blue Building), Shahra-e- Jahangir, North Nazimabad, Karachi, Pakistan

\*Corresponding author

#### A B S T R A C T

#### Keywords

*Pseudomonas aeruginosa*,  
ear infection  
(otitis),  
otorrhoea,  
Ear swab

Ear infection is commonly caused by bacteria and sometime by virus and fungi. The bacteria involve in causing ear infection is *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus*, *E. coli* and *Proteus*, and it is investigated in various age groups but the incidence is increased in children as compare to adult. This study was designed to evaluate that which type bacteria is most common causative agent for ear infection in children and young adults, and which age group is mostly affected by such ear infections. The present study based on 100 patients (n= 100) carried on multiple lab result. Statistical Analysis of lab results concluded that 60% of patient infected by *Pseudomonas aeruginosa* and 19% of patient is in between 1 day-12 month of age and 30% is 1 – 10 years of age.

## Introduction

Ear is the organ of hearing and balance. It has three parts: the outer, middle, and inner ear. The outer ear collects sound waves, which move through the ear canal to the tympanic membrane, commonly called the eardrum (Koopman, 2008). The inner ear is filled with fluid. Here, hair-like structures stimulate nerves to change sound waves into electrochemical impulses (Guyton, 1999). The Eustachian tube, an important structure in the ear, runs from the middle ear to the passages behind the nose and the upper part of the throat. This tube helps equalizes the air pressure in the middle ear to the outside air

pressure (Bree Normandin, 2012). Ear infection is commonly known as otitis. There are three type of ear infection. Otitis externa is commonly known as outer ear infection. Otitis media is commonly known as middle ear infection .It may be acute, chronic suppurative and serous. Inner ear infection includes labrynthitis and vestibular neuritis/ vestibular disorder (NIH publication, 2013, Thomas, 2013). Common causative agents are bacteria and sometime are also by virus and fungi. The most common bacterial causative agent are *Pseudomonas aeruginosa*, *Proteus*, *E. coli*, *Staphylococcus aureus*, *Streptococcus*

*pneumonia, Haemophilis influenza, Moraxella catarrhalis, Strptococcus pyogens and common aerobes include Peptostreptococcus, Prevotella melaninogenica and B. fragilis* (Purushothama V. Dasaraju, 2005). Ear infection is widely occur in children because immune system is still developing, this make harder to fight infection (Di Francesco R, 2008). The other important factor is of smaller Eustachian tube. This makes it difficult to drain out of the ear even in the normal condition (Kilpi, 2001, Browning G, 2008). If the Eustachian tube are swollen or blocked with mucous, due to cold or any other respiratory infection, fluid not able to drain. The ear infection most commonly presented with pain is usually unilateral and may or may not associate with fever. Otorrhoea is discharge from ear which causes relieve of pain with spontaneous perforation of ear drum (Sani S, 2005, NIH publication, 2012). It may also present with hear loss and may or may not lymphadenopathy. Drainage from the ear may be thick and yellow or bloody. If this occurs, the eardrum has probably burst (rupture). The hole in the eardrum often heals by itself in a few weeks. Untreated ear infection complicate into mastoiditis, damage of adjacent structure example facial nerve, semicircular canals which result into vertigo and conductive deafness (Hazel everit, 2012) The untreated internal ear infection complicate in to meningitis and also lead to complate deafness when labyrinthitis is diffuse all or almost all the endings of the acoustic nerve in the internal ear (Coker TR, 2010 and Hazel everit, 2012).

In 2011, a prospective study was conducted at IGM hospital, in India towards Clinico microbial evaluation of

chronic supravative otitis media, the commonest bacteria isolated were pseudomonas. Prevalence of organism is same in children and adult. It incidence occur more in low socioeconomic group, malnourish, and poor sanitation (Tanmoy tab, 2011). In 2010, a comparative study has been conducted on bilaterally discharge ear infection at Government medical college, India towards baercteriological profile of either ear. 60% left ear, 50% right ear. 65 % male were affected mainly in right ear about 35% mild, 20% moderate and 5% severe infection (NAMJ, 2013). In 2012, the study of Christophe G, discuss about the evaluation of otorrhea (ear discharge) in children and evaluation of ear ache differential diagnosis of otorrhea which is mostly due to middle ear infection (Strophen, 2013). The aim of our study is to find out the major bacterial causative agent of ear infection. Through survey report we also investigate in which age group ear infection is mostly common.

## **Materials and Methods**

The survey was conducted among 100 individuals are include infants, children and adult (either male or female) of various age group (1 day- 60 year), belonging to various categories of our society in Karachi. This study based on evidences of bacterial infection specially. For this purpose general interview were taken from various laboratories. Survey was scrutinized using common language and general health care questionnaire include were name, age, sex, pain, fever, ear discharge either from right ear. The patients who were selected were finally subjected to a complete ear pus discharge (otorrhoea) investigation. According to a survey report we observed that different age group infected by different bacteria having ear infection.

## Statistical Analysis

The result was expressed in percentage to investigate the common cause of ear infection and in which age group it is commonly occur by using standard statistical tool.

## Results and Discussion

Among total 100 sample size studies we observed that 60% cases were found to be caused by *Pseudomonas aeruginosa*. According to age ear infection is 19% is between 1day – 12 month and 22% is between 1 year- 10 years of children.

Ear infection is also known as otitis and it may be bacterial, viral and fungal. This study based on bacterial ear infection. It present with symptom of pain, edema, tenderness of soft tissue with a purulent discharge. As microbiological factor the bacteria such as *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Proteus mirabilis*, *Bacillus* and *E.coli* (Brain Bullard, 2005). *Pseudomonas aeruginosa* has become an important cause of infection especially in immunocompromized patient it may be life threatening if infection is complicated; other most frequent found organism is gram negative organism staph aureus. This survey study of 100 patients was observed that in South Asia commonly ear infection caused by *Pseudomonas*. Other organism mostly found is staphylococcus. According to observation of (Table # 1) illustrate that 60% cases was found to be caused by *Pseudomonas aeruginosa*, 31% of *Staphylococcus aureus*, 5% of *Proteus*, 2% of *Bacillus* and 2% of *E. coli*. These entire organism involved in otitis. The graphical representation of no. of patient

verses microorganism (figure:1) conclude that the common causative agent is *Pseudomonas aeruginosa*. The second most common organism found is staph aureus. It is gram negative organism also effected to immunocompromized patient. The prevalence of organism is same in children and adult . In our study there is no evidence found related to organism difference in children and adult. These organism have mostly effected to low socioeconomic group due to poor hygienic condition and poor living condition. According to literature review discuss in this study evaluate that prevalence of middle ear infection is frequently found (Strophen, 2013).

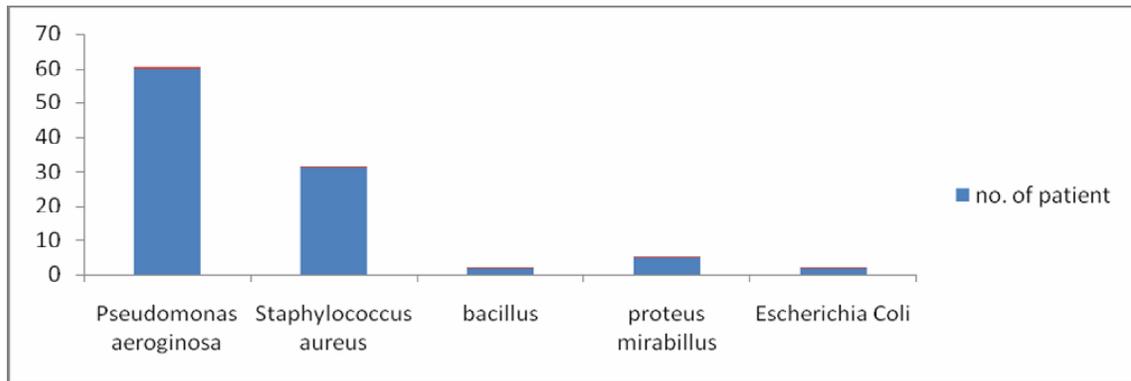
Ear infection is mostly found in infant and children due to allergy, mechanical obstruction, birth trauma, top feeding, pacifier use and iatrogenic or medical cause, bacterial infection in infant and children frequently found due to small Eustachian tube and during inflammation with increase mucous production lead to pressure change in middle ear and obstruction in Eustachian tube, immunodeficiency due to recent illness in children. It can obtain infection from mother during pregnancy as in chorioamniotitis, traumatic delivery by forceps and vaccum as well as frequent use of certain drug during pregnancy weaken the immune system of baby.

Another observation according to survey in (table.2) illustrate in which age group otitis is commonly found. This study showed that almost infant and children are mostly affected. The previous study also showed that under five year of children was effected by ear infection (IshKR, 2004, Ferede, 2001).

**Table.1** Percentage of Micro organism causes Infection.

S.no	Micro organism	No. of patient	Percentage %
1.	<i>Pseudomonas aeruginosa</i>	60	60%
2.	<i>Staphylococcus aureus</i>	31	31%
3.	<i>Bacillus</i>	2	2%
4.	<i>Proteius mirabillus</i>	5	5%
5.	<i>Escherichia Coli</i>	2	2%

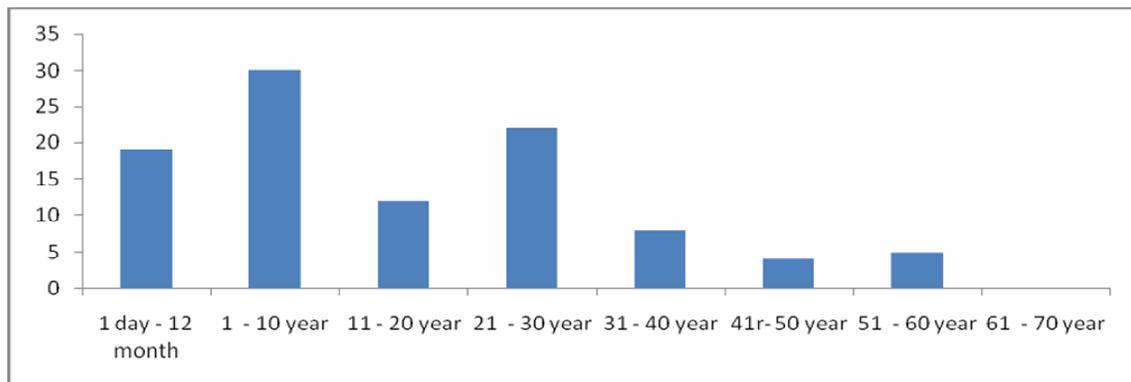
**Figure.1** Graphical Representation



**Table.2** Percentage of Different Age Group infected by Ear infection

Age group	No. of patient	Percentage
1 day - 12 month	19	19%
1 - 10 year	30	30%
11 - 20 year	12	12%
21 - 30 year	22	22%
31 - 40 year	8	8%
41 - 50 year	4	4%
51 - 60 year	5	5%
61 - 70 year	0	0%

**Figure.2** Graphical Representation



The Figure.2 represents age verses no. of patient. The infection percentage of 1 day – 12 month is 19%, 1 - 10 year is 30% ,11- 20 year is 12%, 21-30year is 22%, 31- 40 year is 8% , 41- 50 year is 4%, and 51- 60 year is 5 %,.This study also shows that it is found under 10 years of children.

According to observation and result it was concluded that Ear infection (otitis) is mostly due to *Pseudomonas aeruginosa* and secondly by staphylococcus aureus. And according to age this infection is mostly found in infant or children because immune system is still developing, this make harder to fight infection. The other important factor is of smaller Eustachian tube. This makes it difficult to drain out of the ear even in the normal condition.

## References

- Arthur C. Guyton, M.D. ,1996, Textbook of Medical Physiology, 9<sup>th</sup> Edition, pg#663-665.
- Brain Bullard, year 2005, journal: infection & immunity volume: 73, page: 5127-5136.
- Browning GG, Merchant SN, Kelly G, Swan IRC, Canter R, McKerrow WS.: 2008, book name; Chronic otitis media chapter 237c: In Kerr AG (ed.), Scott-Brown's otolaryngology 7th edn. Vol 3. London: Arnold, page number: 3395-3445.
- Chantral Simson, Hazel everitt, francoisevan drop :2012, book: Oxford Hand boDi Francesco R, Paulucci B, Nery C, Bento RF, 2008,journal: Craniofacial morphology and otitis media with effusion in children. Int J Pediatr Otorhinolaryngol.; volume: 72(8); page number :1151-8.
- Coker TR, 2010: Diagnosis of epidemiology and antibiotic treatment of acute otitis media in children, v: 304(19), pg # 2161-9.
- Ferede D, Geyid A, Lulseged S, et al.:2001; Drug susceptibility pattern of bacterial isolates from children with chronic suppurative otitis media. *Ethiopian J Health Develop*, 15(2):89-96.
- Hooberman A ,Paraise JL , et al 2011,Treatment of acute otitis media in children under 2 year of age, 364(2). Pg: 105-15.
- Iseh KR, Adegbite T:2004: Pattern and bacteriology of acute suppurative otitis media in Sokoto, Nigeria. *Ann Afri Med* , 3(4):164-166.
- Joseph E.Dohar, 2005, laryngoscope , V : 115 pg no#1469-1472
- Kilpi, Terhl, Herva, Elja, Takala, year 2001, name of journal :The Pediatric Infections disease Journal, vol 20, page number 654-662
- Koopman L, hoes AW, Glasziou PP, et al: 2008; Antibiotic therapy to prevent the development of acute otitis media in children, v: 134, p :128-132.
- Luanne Hall - stoddley, year : 2006 , journal : American medical association, volume: 296, page number: 695-700
- Marc Foca ,year 2000,journal : The new England journal of medicine, volume: 343, page number 695-700
- N.AM J , 2013: Journal: Microbiology of chronic suppurative otitis media in tertiary care setup of Harakand state of India, volume, 5 (4), page number: 282-287.
- Namj Med Science: 2011, Journal: Etiologic agent of otitis media in Benin city, volume: 3 , page number: 95-98.
- Saini S, Gupta N, Aparana Seema, Sachdeva OP, 2005, journal:. Bacteriological study of paediatric and adult chronic suppurative otitis media. *Indian J Pathol Microbiol.* volume; 48(3), page number:413-416
- Tanmoy Tab and Debabrata, 2011: A study of bacteriological profile of chronic suppurative otitis media: v: 64; p:326-329.