Study of Microbes that cause Ear infection associated with the use of pacifiers in children under 5 years old

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Abstract

The study was carried out in Kirkuk city from May 1st to November 1st 2015. These patients admitted to Kirkuk Children Hospital and primary health care centers of Kirkuk first health care sector. The number of children with Ear infection was 221 patients whom their ages were under 5 years old. The control group included 50 children who appeared healthy and they have never used pacifiers in the past. Ear swabs were cultured for all the patients and control. 70% of ear-cultured specimens gave positive results. Most isolates were *Staph. aureus* with 31% . *Strep. pyogenes* 4% . *Strep. pneumonia* 6% and 9%. *Pseudomonas aeruginosa* were present in ear in about 10% of the isolates. *M. catarrhalis* was also found in 3%. Some members of enterobacteriaceae were also found such as (*E. coli* in 5%, *K. pneumonia* in 3% and 6%, while *P. mirabilis* was found in 5%). A member of (yeast-like fungi) *Candida alpicans* was also found in ear in about 11%. As for the use of pacifiers, it shows that 66% of the total patients were using pacifiers or dummies, While 34% of them were not using pacifiers at all. The aim of this study was to explore possibility to limit the use of pacifiers in children to prevent ear infection.

Conclusion : a possible connection may occur between the pacifiers use and ear infection due to the possible movement of the throat microbes through the auditory canal to the middle ear, which leads to otitis media infection.

Tikrit Medical Journal 2017;Vol(23) No(1) :189-197

DOI:http://dx.doi.org/10.25130/mjotu.23.1.20

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Introduction

Otitis media (OM) means inflammation of the middle ear (ME). It constitutes the most common respiratory tract infection of infancy and early childhood (1). Otitis media may be acute or chronic supportive type. Children are mostly affected with acute type, while adults are mostly affected with chronic supportive types (2). The infection of otitis media might result from viral or bacterial agents; however many complications were reported that may persist in some individuals into adult years (1).

The most common bacteriological agents associated with otitis media differ according to the type ; *S. pneumonia* ,non-typable *H. influenza* , and *M. catarrhalis* are most common bacterial of acute OM (3), *P. aeruginosa, S. aureus ,and Proteus spp.* are predominant pathogen of chronic supportive otitis media, and it was also seen that non-spore forming anaerobes such as *Bacteroides* spp. can be isolated from exudates obtained from patients with chronic otitis media.

Chronic otitis media is an inflammation of the middle ear cleft that persists or keeps coming back, and causes a long-term or permanent damage to the ear(4). It has been an important cause of middle ear disease since prehistoric times (5). Its incidence appears to be depending for some extent on race and socioeconomic factors for example; it is significantly more common in cold and damp areas like Inuit (Eskimos) and American Indians.(6) Poor hygiene and nutrition has been suggested as abases for the wide spread prevalence of chronic otitis media in developing countries (7).

Ear infections are common in children because their Eustachian tubes are shorter, narrower and more horizontal than in adults (8). Most common presentation of the disease is discharging ear associated with hearing difficulty and sometime earache when superadded by acute attack (9). A wide range of microorganisms were isolated in the cultures of the ear discharge, vary from study to other but *pseudomonas aeruginosa* and *Proteus* species are most frequently isolated (10).

Aim of study

The aim of this study was to explore possibility to limit the use of pacifiers in children to prevent ear infection.

Materials and Methods

The number of children with Ear infection was 221 patients whose ages were under 5 years old. These patients admitted to Kirkuk Children Hospital and primary health care centers of Kirkuk first health care sector. An interview was carried out with the patients using questionnaire form designed by the investigator and consisted of the following variables; age, gender, medical history and details related to the current use of pacifiers.

A sterile transport swabs have been used to collect ear discharges under a sterile conditions. The swabs were dipped in a transport media used for maintaining the specimens for several hours to prevent the specimens dehydration or damage till the specimens reach the laboratory for the specific tests. The researcher and the physician in charge collected specimens. An ear discharge swabs were also collected from children diagnosed with acute otitis media with perforation.

The culture had been done as described by Morris et al. (11) and specifically targeted *S. pneumonia, H. influenza, and M. catarrhalis*, Group A streptococci,

pseudomonas and Enterobacteriaceae. Moreover, Ronald M. Atlas (12) prepared the culture media. Briefly, the swabs were inoculated onto horse blood agar and chocolate agar using 10µL sterile plastic loops. MacConkey agar was used for Enterobacteriaceae detection. Plates were incubated overnight at 37ºC in a humid environment containing 5% CO2. Capsular pneumococcal isolates were identified based on α-hemolytic colony morphology, optochin susceptibility (13). *M. catarrhalis* isolates were identified based on colony morphology, Gram stain and oxidase production (14). Manitol salt agar was also used to distinguish Staphylococci species. Although specifically sought, the presence of colonies consistent with *Pseudomonas aeruginosa*, β-hemolytic *streptococci, Proteus* species, *E. coli*, *Klebsiella pneumonia* and *staphylococcal* species were also recorded. Sabouraud dextrose agar was also used for C. alpicans isolation. Bacterial identification confirmed according to by microscopic examination and biochemical tests; catalase test and coagulase test.

Results

221 patients with the symptoms of ear infection were collected by using a sterile swab. swabs were subjected for culturing on different types of culture media, the results revealed that ear infection samples gave 154 (69.68%) positive bacterial culture, that leaves 67 (30.32%) of samples registered as a negative bacterial culture.

Staph. aureus was the most common bacterial species isolated from ear infection species 47 (30.52%) as well as *Staph. epidermidis* in 25(16.23%). *Pseudomonas aeruginosa* was the next most common type of bacteria isolated from ear 15 (9.74%). *Streptococcus pneumonia* that is considered from the microbiota of nasopharynx in healthy adults has constituted 10 (6.49%), as shown in (Table 1).

The other bacteria that had been isolated in this study was *E.coli* and *Proteus mirabilis* each have constituted an equal number of 8 (5.19%). *Klebsiella pneumonia* and *Moraxella catarrhalis* were also found in five (3.25%) each. *Streptococcus pyogenes* has also appeared in six (3.90%) of the positive isolates. *Staph. epidermidis* and *Micrococcus* spp. which are considers from the microbiota were found in 25 (16.23%) and four (2.60%) respectively. *Bacillus cerius* was unusually found in ear in four (2.60%). *Candida alpicans* was also found in relatively high number 17 (11.04%) of the positive isolates in ear as shown in (Table 1).

221 of children with ear infection under five years were distinguished into two groups according to the use of pacifiers. It shows that 145 (65.61%) of the total patients were using pacifiers or dummies, While 76 (34.39%) of them were not using pacifiers at all (Figure 1). The use of pacifiers in those children distributed according to their age groups (Figure 2).

Sensitivity tests revealed that *Staph. aureus* was sensitive to ciprofloxacin, tobramycin, Ofloxacin and Gentamicin, while it was completely resistant to amoxicillin, cefotaxime and ampicillin. *Strep. pneumonia* was sensitive to each one of ciprofloxacin and Gentamicin respectively, while it showed high resistant to amoxicillin, cefotaxime, ampicillin and ofloxacin. *Strep. pyogenes* showed a high sensitivity to ciprofloxacin, gentamicin, cefotaxime and ofloxacin and a high resistant to amoxicillin and ampicillin. *M.catarrhalis* was sensitive to ciprofloxacin,cefotaxime, tobramycin, ofloxacin and gentamicin. Moreover, it was

highly resistant to amoxicillin and ampicillin. *P. mirabilis* was 100% sensitive to Ciprofloxacin and amikacin. *E. coli* and *K. pneumonia* was nearly sensitive to the all antibiotics except for amoxicillin and ampicillin. As for *Pseudomonas aeruginosa*, it was highly resistant to the all antibiotics used (Table 2).

Discussion

Results showed that ear infection samples gave about 154 (69.68%) positive bacterial culture, and about 67 (30.32%) of samples registered as a negative bacterial culture even after 48 hours, which may be due to the consumption of antibiotics by the patients or the presence of another type of causative agents.

This study included 221 of children with ear infection under 5 years old. They were distinguished into two groups according to the use of pacifiers. It shows that 145 (65.61%) of the total population were using pacifiers. While 76 (34.39%) of them were not using pacifiers at all. Moreover, these results were almost similar to the results of Viviane and Regina (15). The fact that a high number of pacifiers users were found within 221 children whom were all suffering from ear infection. This may suggests that there is a possible connection between the use of pacifiers and ear infection and this suggestion was described early in the 20th century, and many studies reached the same conclusion such as in Hanafin and Griffiths in the US (16), Garrelts and Melnyk (17).

Staph. aureus was the most common bacterial species isolated from ear infection species 47 (30.52%). This frequency may be due to the fact that it may enter the middle ear from external canal as a normal flora and by reflux OM when the tympanic membrane was not intact. *Staphylococcus aureus* represents the major cause of nosocomial and community-acquired infections because of their autochthonic properties. The importance of *Staphylococcus aureus* as a causative pathogen of OM came from the developing antibiotics-resistance of these bacteria and their high ability of colonization (18, 19). This agrees with the result mentioned by (20) reported that *S. aureus* was the dominant causative agent of CSOM in children older than six years. *Pseudomonas aeruginosa* was the second type of bacteria isolated from ear. It is one of the main pathogens that cause CSOM. This result was expected for this organism, due to many reasons; *P. aeruginosa* is the secondary invaders when the resistance of the middle ear is lowered. The high incidence of *P .aeruginosa* indicates more general antibiotic resistance than in the case with gram positive strains and resistance for phagocytosis and opsonization by producing a large number of extracellular products leading to inhibit the function of the immune system of the cells , this agrees with the result mentioned by (21). *Streptococcus pneumonia* and *Moraxella catarrhalis* that is considered from the microbiota of nasopharynx in healthy adults has constituted 10 (6.49%) and 5 (3.25%) respectively. Many researchers such as (22) reported these microorganisms; from the common bacterial species, causing acute OM. *S. pneumonia* was regarded as a pathogen in immunodeficient patients, and produced many virulence factors.

The point view of (23) is that otitis media infections resultant from *Streptococcus pneumonia* are usually chronic exudative discharge cases. While (24, 25) stated that otitis media infections caused by *S. pneumonia* in children are mostly develops after respiratory tract infections. Mixed isolates for both *Staphylococcus* aureus and *Streptococcus pneumonia* can be explained

as chronic otitis media infections when the body surface defenses get low autochthonic bacteria will take their place and induce secondary infection. These findings were supported by the results of (23).

M. catarrhalis infections are encountered more often now than in the past in ear infection, such as in Kufa City (26) reported (1.1%), in Babylon Governorate (27) reported (3.6%), and (28) reported (6.48%). This is probably due to bacterium antibiotics resistance properties, and they are commensals of mucosal surfaces of upper respiratory tract.

The source of infection with gram negative enterobacteriaceae may not in necessarily come from the nasopharyngeal passage, it may come from the ear canal contamination with feces, and that due to the poor hygiene or the ignorance to the importance of the daily cleansing of the ear that the child must receive regularly (29).

The former results were almost similar to a study in Nigeria by Shamsuddeen (30). Whereas the *Staph. aureus* was the most common isolated bacteria followed by *Proteus* and *Pseudomonas.*

In addition to the bacterial isolates, (yeast-like fungi) *Candida alpicans* was unlikely found in the ear swab in about 17(11.04%). The occurrence of this microorganism in ear may resulted from the migration of this organism through the nasopharyngeal cavity to the Eustachian tube which is usually leads to the inner and middle ear inflammation and that usually occurs in case of chronic supportive otitis media.

The antibiotic susceptibility test showed that antibiotics were affecting bacteria in different degrees as its shown in Table 2; it was found that the highest susceptibility of organism was to amikacin, cefotaxime, gentamicin, tobramycin and ofloxacin. As for amoxicillin and ampicillin, the organisms gave an absolute resistance to the said antibiotics. The other antibiotics were affecting bacteria in different degrees. We can see from the results above that some of the bacteria's resistance to some of antibiotics that it may due to the uncoordinated random use of antibiotics, which may lead to the bacterial acquirement to some resistance genes by the conjugation process (31).

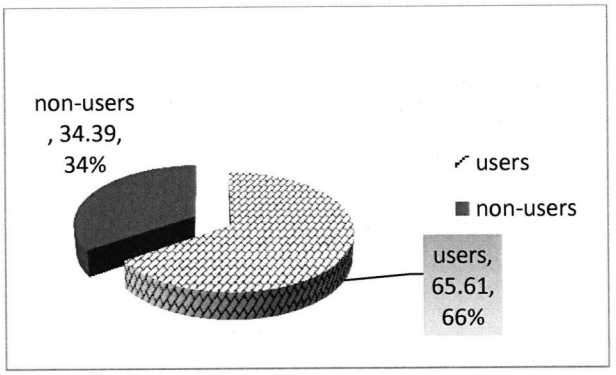

Figure 1: Distribution of children according to the use of pacifiers

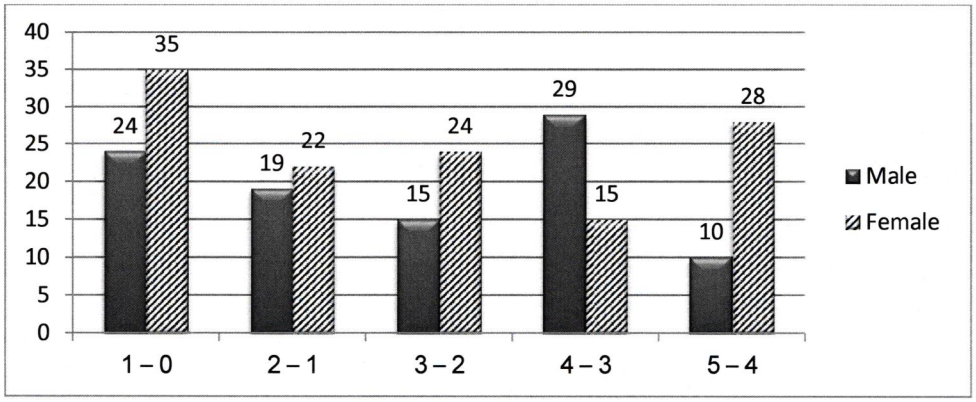

Figure 2: Age and gender distribution

Table 1: Distribution and type of microbes isolated from Ear and Throat.

Type of microbes of the isolates	Number of isolates in Ear	
	No.	%
Staph. aureus	47	30.52
Staph. epidermidis	25	16.23
E. coli	8	5.19
K. pneumonia	5	3.25
Proteus mirabilis	8	5.19
Pseudomonas aeruginosa	15	9.74
Moraxella catarrhalis	5	3.25
Bacillus cereus	4	2.60

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Type of microbes of the isolates	Number of isolates in Ear	
	No.	%
Strep. pneumonia	10	6.49
Strep. pyogenes	6	3.90
Candida alpicans	17	11.04
Micrococcus spp.	4	2.60
Total	**154**	**100**

Table 2: The antimicrobial susceptibility test that shows the sensitivity of the total microbes to some of the most used antibiotics

Bacterial isolates (No.)	CIP No. (%)	AK No. (%)	AX No. (%)	CTX No. (%)	AM No. (%)	TOB No. (%)	OFX No. (%)	CN No. (%)
Staph. aureus (70)	58 82.86	10 14.29	0	0	0	55 78.57	64 91.43	46 65.71
p. aeruginosa (23)	3 13.04	0	0	0	0	0	0	0
Strep. pneumonia (22)	17 77.27	3 13.64	0	0	0	4 18.18	0	18 81.82
Strep. pyogenes (22)	22 100	3 13.64	0	19 86.36	0	3 13.64	20 90.91	22 100
M. catarrhalis (11)	11 100	3 27.27	0	11 100	0	11 100	11 100	11 100
P. mirabilis (8)	8 100	8 100	0	0	0	2 25	0	3 37.5
E. coli (14)	12 85.71	14 100	0	14 100	0	11 78.57	13 92.86	14 100
K. pneumonia (13)	13 100	2 15.38	0	13 100	0	12 92.31	13 100	13 100

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