

## Risk factors of acute otitis media among children in Mosul

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### ABSTRACT

**Context:** Acute otitis media (AOM) is the most frequent diagnosis in the children visiting offices. The prolonged and recurrent episodes of AOM may lead to hearing impairment and delayed speech development, which will influence the child's performance at school.

**Aim:** The aim of this study is to identify the risk factors of acute otitis media in preschool children attending ENT clinics at Al-jamhory Teaching Hospital in Mosul.

**Methods:** To achieve this aim, a case control study design was adopted. The sample of the present study included 150 children (cases) who have been diagnosed by the responsible ENT specialist according to the otoscopic examination with another 150 children (controls) who were diagnosed not to have AOM. Period of data collection was from 1<sup>st</sup> of October 2011 to the 1<sup>st</sup> of April 2012.

**Results:** The present study showed that the highest frequency of acute otitis media occurred in the age group 1-2 years 39 patients (26%), and more frequent AOM attacks occurred in males. Clinical presentation among the cases were fever, otalgia, otorrhea, irritability, loss of appetite, vomiting, diminished hearing, and few patients presented with tinnitus and vertigo. The significant risk factors for AOM were day care attendance, bottle feeding for the 1<sup>st</sup> 6 months of life, supine bottle feeding, pacifier use in the second 6 months of life, parental tobacco smoking, preterm baby, and allergy. No association was found between craniofacial anomaly and occurrence of AOM in the present study.

**Conclusion:** Day care attendance, bottle feeding during the 1<sup>st</sup> 6 months of life, supine bottle feeding, pacifier use in the second 6 months of life, parental tobacco smoking, preterm baby, and allergy were found to be a significant risk factors for AOM among study population.

**Recommendation:** Additional studies on potential measures to prevent AOM through the reduction of risk factors are needed.

**Keywords:** Acute otitis media, risk factors, children, Mosul City.

### عوامل الخطورة لإلتهاب الأذن الوسطى عند الأطفال في الموصل

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#### الخلاصة

**المقدمة:** إلتهاب الأذن الوسطى الحاد هو التشخيص الأكثر شيوعاً في الأطفال المراجعين للعيادات الطبية. إطالة أمد وتكرار النوبات لإلتهاب الأذن الوسطى الحاد قد تؤدي إلى ضعف السمع وتأخر تطوير النطق، والتي سوف تؤثر على أداء الطفل في وقت لاحق في المدرسة، ونظراً للزيادة الأخيرة في عدد الأطفال الصغار المصابين بهذه الإلتهابات فقد توجب إجراء مراجعة للأعراض، والسببية المرضية، بالإضافة إلى العوامل الخطيرة ذات العلاقة.

**الهدف:** من هذه الدراسة هو التعرف على عوامل الخطورة لإلتهاب الأذن الوسطى الحاد في الأطفال قبل سن المدرسة الذين يراجعون عيادات الأنف والحنجرة في مستشفى الجمهوري التعليمي في الموصل.

**طرق البحث:** إتمدت دراسة العينة والشاهد على ١٥٠ طفلاً (حالة) شخصوا من قبل أخصائي الأنف والحنجرة وفقاً للفحص بمنظار الأذن مع ١٥٠ طفلاً (شاهد) شخصوا بعدم إصابتهم بإلتهاب الأذن الوسطى الحاد. إتمدت فترة جمع الحالات

والشواهد من الأول من أكتوبر ٢٠١١ حتى الأول من أبريل ٢٠١٢، ولقد استخدمت إستمارة إستبيان خاصة وقد ملئت هذه الإستمارة عن طريق مقابلة أولياء الأمور لكل من الحالات والشواهد.

**النتائج:** أظهرت الدراسة أن أعلى معدل إصابة بالتهاب الأذن الوسطى الحاد وقعت في الفئة العمرية ١-٢ سنة (٢٦٪)، وفي الذكور أكثر بقليل من الإناث. الأعراض والعلامات لإلتهاب الإذن الوسطى الحاد بين الحالات كانت الحمى، ألم الأذن، خروج القيح من الأذن، التهيج، فقدان الشهية، القيء، تضاول السمع، أما الطنين والدوار فقد ظهر في القليل من الحالات.

**الاستنتاج:** عوامل الخطورة الهامة لإلتهاب الأذن الوسطى الحاد كانت دور الحضانة، الرضاعة الصناعية بواسطة الزجاجاة للسته أشهر الأولى من الحياة، رضاعة الزجاجاة بوضع منبطح، إستخدام المصاصة في الستة أشهر الثانية من العمر، تدخين الوالدين، الطفل الخديج، والحساسية.

**الكلمات المفتاحية:** إلتهاب الأذن الوسطى الحاد، عوامل الخطورة، الأطفال، مدينة الموصل.

## INTRODUCTION

Otitis media is an irritation of the middle ear cleft, without reference to aetiology or pathogenesis. The clinical range may expand from a benign, self-limiting state to an expanded and sometimes complicated illness. Although in industrialised countries serious complications are rare, the burden of acute otitis media (AOM) is large, with impaired quality of life and high direct and indirect socio-economic costs. Otitis media primary described by Hippocrates in 450 BC, this illness continues to present one of the more troublesome health troubles of Infancy and childhood.<sup>1</sup>

Acute otitis media is one of the most widespread communicable diseases occurring during childhood. Prolonged and recurrent attacks of AOM may lead to hearing impairment and late speech development, which will influence the child's later performance at school.<sup>2</sup>

The yearly cost of AOM in the United States is an estimated \$5 billion.<sup>3</sup>

AOM occurring most commonly between the ages of 3 months and 3 years.<sup>1</sup> By age of 7 years, 93% of children have had at least one incident of AOM and 75% have had repeated infections. AOM can occur at any age, 80-90% of cases occur in children younger than 6 years, and the highest incidence is between 6 months and 24 months of age in the United States.<sup>4</sup> Males are somewhat more affected than females; of unknown cause.<sup>5</sup>

Morbidity from this illness remains noteworthy, despite numerous use of systemic antibiotics to treat the sickness and its complications. Intratemporal and intracranial complications of OM are the 2 major types.<sup>6</sup> Risk factors of AOM are several including:<sup>4</sup>

### 1- Day Care attendance:

Contact to other children at home (siblings) or in a day-care surroundings increases the risk of otitis media, with the relative risk being proportionate to the quantity of kids in a setting.<sup>7</sup>

### 2- Type of Feeding:

In many studies, breast-feeding has been stated as reducing the risk of ear and pulmonary infections. A two-fold increase in hazard of first episodes of AOM was found in infants completely formula-fed as contrasting to those breast-fed for 6 months.<sup>8</sup>

### 3- Supine bottle feeding:

Lying position of the baby during feeding was associated with acute otitis media. Babies with otitis media were 38 times more likely to be fed in lying position than babies without otitis media.<sup>9</sup>

### 4- Use of Dummies (Pacifiers):

Studies from Finland have revealed that use of a pacifier is a hazard factor for otitis media.<sup>10</sup>

### 5- Passive Smoking and Environmental Pollution:

Meta-analyses confirm the increased incidence of otitis media associated with exposure to passive cigarette smoke.<sup>11</sup>

### 6- Premature birth:

Very low birth weight (<1500 g) or very preterm birth (<33 weeks of gestation) increases the risk of otitis media.<sup>12</sup>

### 7- Male gender:

A small but significantly higher incidence of AOM in males has been reported.<sup>13</sup>

### 8- Craniofacial anomaly:

Children with craniofacial defects or malformations are at risk for severe and recurrent AOM.<sup>4</sup>

### 9- Allergy:

Children with allergy were more probable to carry Hemophilus influenzae isolates than children with no allergies. Allergies in young children have also been defined as a risk factor for otitis media because upper respiratory mucosal swelling throughout an allergic episode may cause eustachian tube dysfunction.<sup>14</sup>

To prevent the beginning of AOM episodes and to decrease the occurrence of recurrent AOM, several environmental control measures are recommended. Prolonged breast feeding, restrictive pacifier use and eliminating exposure to tobacco smoke have been postulated as dropping the incidence of AOM.<sup>15</sup>

The aim of this study is to evaluate the main risk factors of acute otitis media in preschool children attending ENT clinic at Al-jamhory Teaching Hospital in Mosul.

## PATIENTS AND METHODS

The present study was conducted in the ENT clinic at Al\_ jamhory Teaching Hospital in Mosul city. The hospital is located in the right side of Tigris River and it delivers services to many areas in Mosul city.

Case control study design has been adopted in order to achieve the objectives of the present study.

Data were collected during six months period from 1<sup>st</sup> of Oct 2011 to the 1<sup>st</sup> of April 2012. The present study included 150 preschool child under the age of 6 years who attend the ENT clinic at Al jamhory Teaching Hospital and diagnosed to have AOM, and 150 control subjects in the same age group, in whom evaluation proved not to have AOM. A formal consent was obtained from parents before participation in the study. Moreover a convenient sample size was decided to be used in the study.

A questionnaire form was specially prepared in order to collect all the relevant information related to the study sample. The questionnaire form included information in regard to:

Age, gender, socioeconomic status, risk factors of acute otitis media which include day care attendance, bottle feeding during the first 6 months of life, supine bottle feeding, pacifier use in the second 6 months of life, passive tobacco smoke, craniofacial anomaly and allergy. Moreover the

questionnaire contained detailed history of the disease regarding present complaint and duration and presenting symptoms. The main source of data was obtained directly from parents or relatives of the child (cases and controls) by the investigator through direct interview and filling the questionnaire form.

Clinical assessment of the cases and controls has been performed by the responsible ENT specialist. Otoscopic examination has been done for tympanic membrane for its color, translucency, light reflex, and position.

Data analysis was carried out by using Pentium four computer through the use of Microsoft Office Excel software programs.

Odds ratio was calculated by using the following equation:

$$OR = \frac{a \times d}{b \times c}$$

95% confidence interval (CI) has been calculated by using the following equation:

$$95\% \text{ CI of the OR} = OR^{1 \pm 1.96 \sqrt{X^2}}$$

Chi squared ( $\chi^2$ ) test was used to find the statistical association.

P value < 0.05 used as a significance statistical association.

## RESULTS

This study revealed that the highest frequency of AOM was found in the age group 1-2 years [39 patients (26%)] followed by age group 2-3 years [34 patients (22.7%)] and the lowest frequency of AOM was observed in the age group 4-5 years [12 patients (8%)].

The differences in the age groups 1-2 years and 2-3 years are statistically significant ( $p=0.003$  and  $0.005$  respectively) as it shown in the **Table 1**.

Regarding the clinical presentation, the study showed that 99 patients (66%) out of 150 cases complained from otalgia; 58 patients (38.7%) complained from ear pulling; 28 patients (18.7%) and 123 patients (82%) complained from otorrhea and fever respectively. Moreover irritability, and vomiting were observed among 54%, and 16% respectively. On the other hand, vertigo was reported by only 4.7% of the patients. **Table 2**.

**Table 3** illustrates the association between risk factors and the occurrence of AOM. It is clear from the table that (14%) of cases gave history of day care attendance in comparison to only (4.7%) among controls.

**Table 1.** Socio demographic characteristics and occurrence of AOM.

| Age group (years) | Cases (No.=150) |      | Controls (No.=150) |      | OR   | P*-value |
|-------------------|-----------------|------|--------------------|------|------|----------|
|                   | No.             | %    | No.                | %    |      |          |
| 0-<1              | 20              | 13.3 | 11                 | 7.3  | 1.94 | 0.088    |
| 1-<2              | 39              | 26.0 | 19                 | 12.7 | 2.42 | 0.003    |
| 2-<3              | 34              | 22.7 | 16                 | 10.7 | 2.45 | 0.005    |
| 3-<4              | 19              | 12.7 | 33                 | 22.0 | 0.53 | 0.033    |
| 4-<5              | 12              | 8.0  | 28                 | 18.7 | 0.38 | 0.007    |
| 5-6               | 26              | 17.3 | 43                 | 28.6 | 0.52 | 0.020    |
| <b>Gender</b>     |                 |      |                    |      |      |          |
| Male              | 85              | 56.7 | 82                 | 54.7 | 1.08 | 0.727    |
| Female            | 65              | 43.3 | 68                 | 45.3 |      |          |
| <b>Residence</b>  |                 |      |                    |      |      |          |
| Rural             | 52              | 34.7 | 38                 | 25.3 | 1.56 | 0.078    |
| Urban             | 98              | 65.3 | 112                | 74.7 |      |          |

\*  $\chi^2$ -test was used.**Table 2.** Frequency distribution of cases according to their clinical presentation, Mosul, 2012.

| Clinical presentation | No. | %    |
|-----------------------|-----|------|
| Fever                 | 123 | 82.0 |
| Otalgia               | 99  | 66.0 |
| Irritability          | 81  | 54.0 |
| Loss of appetite      | 77  | 51.3 |
| Ear pulling           | 58  | 38.7 |
| Otorrhea              | 28  | 18.7 |
| Vomiting              | 24  | 16.0 |
| Diminished hearing    | 17  | 11.3 |
| Tinnitus              | 8   | 5.3  |
| Vertigo               | 7   | 4.7  |

With a strong association between AOM and day care attendance (OR =3.33, 95%CI= 1.40-7.89) and the difference is statistically highly significant (P=0.005). History of bottle feeding in the 1<sup>st</sup> 6 months of life was reported in (17.3%) of the cases and (6.7%) of the controls, with a strong association between the occurrence of AOM and bottle feeding for the 1<sup>st</sup> 6 months of life (OR=2.93, 95%CI=1.37-6.23) and the difference is statistically highly significant (P=0.004). Moreover supine bottle feeding was reported by (21.3%) of the mothers of cases compared to only (7.3%) of the controls, also **Table 2** clarifies a highly significant association between supine bottle feeding and the occurrence of AOM (OR=3.42, 95%CI=1.67-7.00). and the difference is statistically highly significant (P=0.001).

**Table 3** also shows that more than three quarters of mothers of cases gave a positive history of pacifier use in the second 6 months of life, on the other hand only 9 mothers (6%) gave positive history regarding pacifier use. There was a significant association between pacifier use in the second 6 months of life and the occurrence of AOM (OR=3.43, 95%CI=1.58-7.46) and the difference is statistically highly significant (P=0.001).

Regarding parental smoking, **Table 3** shows significant association with the occurrence of AOM (OR=2.46, 95%CI=1.54-3.92) and the difference is statistically highly significant (P=0.0001).

**Table 3** shows association between baby maturity at birth and the development of AOM (OR=2.28, 95%CI=1, 26-4.12), the difference found to be statistically significant (P=0.006).

It is clear from **Table 3** that there is association between allergy and the occurrence of AOM (OR=2.29, 95%CI=1.30-4.02) and the difference is statistically significant (P=0.004).

**Table 4** describes the parents education and occupations. It is clear from the table that (16.1%) and (8.1%) of the fathers and mothers of the cases had university education respectively compared to (25%) and (16.6%) among the control group respectively.

Moreover, the table shows that (6.7%) and (11.4%) of the mothers of cases and controls respectively were employed.

**Table 3.** Frequency distribution of study population according to risk factors for AOM, Mosul, 2012.

| Risk factor            | Cases<br>No.=150 |       | Controls<br>No.=150 |       | OR   | 95%CI of OR | P value * |
|------------------------|------------------|-------|---------------------|-------|------|-------------|-----------|
|                        | No.              | %     | No.                 | %     |      |             |           |
| Day care attendance    | 21               | 14.00 | 7                   | 4.66  | 3.33 | 1.40-7.89   | 0.005     |
| Bottle feeding         | 26               | 17.33 | 10                  | 6.66  | 2.93 | 1.37-6.23   | 0.004     |
| Supine bottle feeding  | 32               | 21.3  | 11                  | 7.33  | 3.42 | 1.67-7.00   | 0.001     |
| Pacifier use           | 27               | 18.00 | 9                   | 6.00  | 3.43 | 1.58-7.46   | 0.001     |
| Passive smoking        | 85               | 56.66 | 52                  | 34.66 | 2.46 | 1.54-3.92   | 0.0001    |
| Pre-term delivery      | 39               | 26.00 | 20                  | 13.33 | 2.28 | 1.26-4.12   | 0.006     |
| Craniofacial anomalies | 5                | 3.33  | 1                   | 0.66  | 5.13 | 0.78-33.47  | 0.099     |
| Allergy                | 44               | 29.33 | 23                  | 15.33 | 2.29 | 1.30-4.02   | 0.004     |

\*  $\chi^2$ -test was use.**Table 4.** Parents education and occupation of the study population.

| Parents education |              | Cases<br>(n=150) |      | Controls<br>(n=150) |      | P*-value |
|-------------------|--------------|------------------|------|---------------------|------|----------|
|                   |              | No.              | %    | No.                 | %    |          |
| Father            | Primary      | 62               | 41.3 | 58                  | 38.7 | 0.637    |
|                   | Secondary    | 47               | 31.3 | 46                  | 30.7 | 0.901    |
|                   | University   | 24               | 16.1 | 38                  | 25.3 | 0.046    |
|                   | Others       | 17               | 11.3 | 8                   | 5.3  | 0.060    |
| Mother            | Primary      | 92               | 61.3 | 79                  | 52.7 | 0.130    |
|                   | Secondary    | 26               | 17.3 | 28                  | 18.7 | 0.764    |
|                   | University   | 12               | 8.1  | 25                  | 16.6 | 0.022    |
|                   | Others       | 20               | 13.3 | 18                  | 12.0 | 0.728    |
| <b>Occupation</b> |              |                  |      |                     |      |          |
| Father            | Employer     | 35               | 23.3 | 45                  | 30.0 | 0.728    |
|                   | Retired      | 7                | 4.7  | 11                  | 7.3  | 0.331    |
|                   | Earner       | 108              | 72.0 | 94                  | 62.7 | 0.085    |
| Mother            | Employer     | 10               | 6.7  | 17                  | 11.4 | 0.158    |
|                   | Retired      | 0                | 0.0  | 0                   | 0.0  | 1.000    |
|                   | Non Employer | 18               | 12.0 | 23                  | 15.3 | 0.401    |
|                   | housewife    | 122              | 81.3 | 110                 | 73.3 | 0.098    |

\*  $\chi^2$ -test was used.

## DISCUSSION

The present study used case control design in order to accomplish its objectives. The limitations of such design are selection bias, recall bias, and confounding. In this study, the maximum frequency of AOM was observed in the age group 1-2 years (26%), the lowest frequency was at the age group 4-5 years (8%). These values are close to the results obtained by other researchers, Alho O P *et al*, in their study of 2512 children in Finland 1991, found that children up to 24 months formed 50% of all attacks of AOM.<sup>16</sup>

Serhan N, in his study of 250 cases of AOM in Baghdad city 1997, found that the percentage of children up to 24 months formed (48, 4%).<sup>17</sup>

In the present study males formed (56.7%) of cases of AOM while females formed (43.3%). This result is comparable to other studies, Serhan N, found that male account for (51.6%) of the patients, while female account for (48.4%).<sup>17</sup>

Jack L *et al* in USA 1997, found that the males consistently had higher incidence of AOM attacks than females.<sup>18</sup>

Serhan N, found otalgia (or excessive crying, head rollings, irritability) was present in (89.2%) of patients, fever in (62.8%), discharge in (37.2%) and vomiting in (29.9%).<sup>17</sup>

In the present study fever was present in (82%) of children of AOM, Otalgia in (66%), irritability (54%), and vomiting in (16%). Symptoms

frequencies of the present study are comparable to some extent to the results of the above mentioned studies.

Alho O.P *et al* 1991, found that the development of AOM higher in children attend daycare centers when compared with care in their homes.<sup>16</sup>

In the meta-analysis of Uhari *et al* in Finland 1996, the risk of AOM also increased with child care outside the home (daycare).<sup>19,20</sup>

The present study, found that there is a strong relationship between the occurrence of AOM and day care attendance ( $P=0.005$ ), which is similar to what is found in the above mentioned studies.

The present study shows that there is strong association between the occurrence of AOM and bottle feeding for the 1<sup>st</sup> six months of life ( $P=0.004$ ).

Jack L.*et al*, found in a study conducted in USA, 1997 a significant protective relationship between breast feeding only during the 1<sup>st</sup> year of life.<sup>18</sup>

Serhan N, found in (121) child below two years with AOM, (69.42%) were bottle fed, while (30.58%) were breast fed.<sup>17</sup>

A meta analysis conducted by Uhari *et al*, concluded that breast feeding in the first 3 months of life reduce the risk of AOM by (13%).<sup>19</sup>

The present study showed that the supine bottle feeding was significantly associated with the occurrence of AOM. ( $95\%CI=1.67-7.00$ ,  $P=0,001$ ). This result was similar to that found by other studies.

Jose F *et al* (2006), found that one of the mechanisms involved in the association between bottle feeding and OM is "positional OM", according to which children bottle fed in an unsuitable position (lying down) are great risk for AOM, as shown in a cohort with (698) children followed up from birth to two years of age demonstrated that the supine bottle feeding position was associated with earlier onset of AOM.<sup>21</sup> This might be due to aspiration of milk during supine feeding.

The present study, demonstrates a significant association between occurrence of AOM and the use of pacifier in the 2<sup>nd</sup> 6 months of life. ( $95\%CI=1.58-7.46$ ,  $P=0.001$ ).

Niemela *et al* in his study in Finland, demonstrated that those used pacifiers had a greater risk of presenting with four or more

episodes of AOM than those who did not use them.<sup>22,23</sup>

Uhari *et al*, found that the use of a pacifier increase the risk for AOM by (24%).<sup>19</sup> Warren *et al* (2001) in his study in USA, demonstrated that pacifier sucking was significantly associated with AOM from the 6th to the 9th months and presented a strong trend towards statistical significant in the period from 9-12 months.<sup>24</sup> This is probably due to eustachian tube dysfunction associated with pacifier sucking.

The present study, parental tobacco smoking significantly associated with the occurrence of AOM. ( $95\%CI=1.54-3.92$ ,  $P=0.0001$ ), this result found to be similar to many other studies which are conducted in Iraq and other countries. Serhan N, reported that children of smoking families had higher incidence of AOM (53.2%) compared to (46.8%) in those of non-smoking families.<sup>17,25</sup> Uhari *et al*, found that the parental smoking increased the risk of AOM.<sup>19</sup>

On the other hand Jose F.*et al* (2006), concluded that passive smoking does not increase the chance of non-recurrent AOM, with regard to recurrent AOM, passive smoking was classified as a probable risk factor.<sup>21</sup>

The present study, observed that there is significant association between pre maturity and the occurrence of AOM, this result found to be similar to the result of Becken *et al* (2001), in his study in USA, found that very preterm birth (< 33 weeks of gestation ) and very low birth (< 1500g ) increase risk of AOM.<sup>26</sup> This is probably due to altered immunity in this group.

A study conducted by Boston M *et al* (2003) in USA, demonstrated that the presence of craniofacial anomaly increased the chance of the child requiring multiple interventions for ventilation tube placement, so higher incidence of AOM occurred among children with un corrected cleft palate than in normal children , and when the cleft is corrected, AOM recurrence is reduced.<sup>27</sup>

Nevertheless the present study demonstrate no association between craniofacial anomaly and the occurrence of AOM, this result most probably attributed to small sample size and the little number of cases of craniofacial anomalies which are included in the study population.

The present study found there is significant association between allergy and the occurrence of

AOM (95%CI=1.30-4.02, P=0.004), this result found to be comparable with another study conducted by Bernstein JM (2002), New York, USA, found that atopic Eustachian tube obstruction may eventually lead to AOM by gradual accumulation of viruses and bacteria in ear effusion.<sup>28,29</sup>

In the other hand Jose F *et al* (2006), found that although there is epidemiologic, mechanical and therapeutic evidence showing that allergic rhinitis contributes to the pathogenesis of AOM it needs further study before more definitive conclusions can be drawn.<sup>21</sup>

## CONCLUSIONS

From the results of the present study the following conclusions can be obtained:

The highest frequency of acute otitis media occurred in the age group 1-2 years. The significant risk factors for AOM were day care attendance, bottle feeding for the 1<sup>st</sup> 6 months of life, supine bottle feeding, pacifier use in the second 6 months of life, parental tobacco smoking, preterm baby, and allergy.

## RECOMMENDATIONS

1. Supplementary studies on probable measures to prevent AOM through the reduction of risk factors are needed.
2. The main health care priorities in distant communities be supposed to: carry strategies that decrease the transmission of bacterial infections to infants and toddlers, support sensible vaccination, counsel on effective communication strategies for hearing impaired offspring, provide recurrent and precise assessment of middle ear disease in the first 18 months of life.

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