

ACUTE OTITIS MEDIA IN CHILDREN: CORRELATION WITH PALATINE TONSIL SIZE, ADENOIDECTOMY AND ADENOTONSILLECTOMY

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Received: October 18, 2013

Accepted: December 26, 2013

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publish: paediatricstoday@ukctuzla.ba

Introduction

Acute otitis media represents an acute nonspecific inflammation process of the mucous membrane of the Eustachian tube, cavum tympani

Objective – The objective of the survey was to assess the role and importance of the hypertrophy of palatine tonsils and previously performed adenoidectomy and adenotonsillectomy for the incidence of the acute otitis media in children. **Materials and methods** – The prospective and controlled study was carried out among 160 patients of both genders, aged between 6 months and 7 years, with an acute otitis media, during a 12-month period. The control group consisted of 40 examinees who had not been diagnosed with this disease. Clinical assessment of the palatine tonsil size was performed according to the degree of obstruction of the isthmus faucium: hypertrophy - grade I (both palatine tonsils obstruct up to ½ of the isthmus faucium), and hypertrophy - grade II (both palatine tonsils obstruct more than ½ of the isthmus faucium). Patients were stratified by age into three groups: 3 - 11 months, 1 - 2.5 years and 2.6 - 7 years. The association between antibiotic therapy and new cases of adenotonsillar infections was evaluated. Follow-up audiological examinations were conducted. The study was carried out on the basis of a questionnaire survey. **Results** – Adenoidectomy was performed in 8.3% of examinees with acute otitis media, adenotonsillectomy in 7.5%, while 84.2% of examinees were not treated with any of the above mentioned surgical procedures. No statistically significant differences were found compared to the control group ($p=0,213$). The palatine tonsils were eutrophic in 26.8% of the examinees with the acute otitis media, 55.4% had hypertrophy - grade I, and 17.9% hypertrophy - grade II. The differences between the observed groups were statistically significant ($p=0.019$). **Conclusion** – The hypertrophy of palatine tonsils was statistically significantly more prevalent in examinees with acute otitis media compared with the control group. This kind of level of significance was not recorded regarding previously performed adenoidectomy and adenotonsillectomy.

Key words: Otitis media ■ Hypertrophy ■ Palatine tonsils ■ Adenoidectomy ■ Adenotonsillectomy.

and middle ear pneumatic space. The American Academy of Paediatrics defined this condition as a middle ear inflammation with acute symptoms and signs of inflammation, with the presence of secretion in the middle ear (1).

It is the cause of more than 24 million visits to dispensaries and 20 million prescribed antibiotics in the USA, which amounts approximately 2 to 5.3 billion US dollars on an annual level (2). Viral or bacterial infection of the adenotonsillar tissue and upper respiratory tract, in interaction with Eustachian tube dysfunction and immature immune response, form the basis of the pathogenesis of acute otitis media in children. There are numerous factors that contribute to the development of this disease: sex, age, race, hereditary, prenatal and perinatal factors, immune deficiency, anatomic variations, craniofacial malformations, syndromes, allergy, inflammatory processes and adenotonsillar tissue hypertrophy, frequent upper respiratory tract infections, socioeconomic factors.

The clinical picture depends on the degree of virulence of the pathogens, general body condition, and the age of the child and the anatomic relationships within the middle ear. Local symptomatology is characterized by pain, ear congestion, and tinnitus and impaired hearing, followed by autophony. Fever, signs of upper respiratory tract infections, excitation and the child's general weakness, vomitus, diarrhea and often dehydration are among the most significant general symptoms. It is estimated that the clinical signs and symptoms in most cases (78%) of children with acute otitis media, which were not initially treated with antibiotics, resolved within 4-7 days, while one of every 1000 children with acute otitis media develops complications (3).

Diagnosis is established on the basis of the heteroanamnesis, personal anamnesis, clinical picture, otoscopy and/or otomicroscopy or another otorhinolaryngological examination. Previous studies focused on prevention through chemoprophylaxis, vaccination programs, therapy with new types of antibiotics and improvement of surgical techniques (4). Options for surgical therapy include myringotomy and adenoidectomy.

Palatine tonsil hypertrophy is usually associated with hypertrophy of adenoid tissue. Apart from obstructive apnea, along with other complications during sleep, this may also contribute to the occurrence of acute and chronic otitis media, rhinosinusitis, malformations of the maxilla and delayed intellectual development. Symptoms that indicate adenotonsillar hypertrophy include: nutritional problems in children, open-mouth breathing, nasal voice, snoring during sleep, frequent waking at night, nocturnal enuresis and fears, behavioural changes and inadequate school performance. Tonsillectomy, with or without adenoidectomy, is one of most common interventions in children. According to some authors, adenoidectomy is a preventive surgical procedure which significantly reduces the incidence of acute and recurrent otitis media, as well as the risk of the occurrence of chronic otitis media with effusion in early childhood (5).

The objective of the survey was to assess the role and importance of palatine tonsil hypertrophy and previously performed adenoidectomy and adenotonsillectomy, for the incidence of acute otitis media in children.

Materials and methods

The paper presents a clinical epidemiological, prospective and controlled study conducted among 160 patients of both genders, aged between 6 months and 7 years. The survey was carried out at the Ear, Throat and Nose Department of the University Clinical Centre Banja Luka from June 1st 2011 to June 1st 2012. Examinees were divided into 2 groups: the experimental group, with 120 examinees diagnosed with acute otitis media, and a control group of 40 examinees who had not been diagnosed with this disease. Not all the children were involved in the study. Patients with adenotonsillar hypertrophy with obstructive sleep apnoea, recurrent infections adenotonsillar tissue, craniofacial syndromes,

recent use of any related medications, e.g. corticosteroids or antibiotics, within the past 4 weeks, anatomical abnormalities, neuromuscular diseases, acute upper respiratory infections, allergic rhinitis and asthma were excluded from the study. The diagnosis of acute otitis media was established on the basis of the personal anamnesis, heteroanamnesis, clinical picture and clinical otorhinolaryngological examination. Clinical assessment of the palatine tonsil size was performed according to the degree of obstruction of the isthmus faucium: hypertrophy - grade I (both palatine tonsils obstruct up to $\frac{1}{2}$ of the isthmus faucium), hypertrophy - grade II (both palatine tonsils obstruct more than $\frac{1}{2}$ of the isthmus faucium). Patients were stratified by age into three groups: 3-11 months, 1-2.5 years and 2.6-7 years. The association between antibiotic therapy and new cases of adenotonsillar infections was evaluated. Follow-up audiological examinations (pure tone audiometry, tympanometry) were conducted. The study was carried out on the basis of a questionnaire survey.

Statistical analysis

Parametric and nonparametric tests were used in processing statistical data to assess the significance of differences between the groups. Values below 0.05 ($p < 0.05$) were considered to be statistically significant.

Results

The incidence of acute otitis media was significantly higher in the age group of 1- 2.5 years (Table 1).

Palatine tonsil and adenoid vegetation were present in 97.5% of examinees in the control group, while the remaining 2.5% of the examinees had undergone adenoidectomy and adenotonsillectomy. In 88.3% of the examinees in the experimental group, palatine tonsils and adenoid vegetation were pres-

Table 1. Stratification by age

Age group	Group		
	Experimental	Control	Total
	n (%)	n (%)	n
3 - 11 months	19 (63.3)	11 (36.7)	30
1 - 2.5 years	38 (95.0)	2 (5.0)	40
2.6 - 7 years	63 (70.0)	27 (30.0)	90
Total	120 (75.0)	40 (25.0)	160

$\chi^2 = 11.911$; $df = 2$; $p = 0.003$.

Table 2. Clinical findings of palatine tonsils and adenoids

Clinical findings of palatine tonsils and adenoids	Group	
	Experimental	Control
	n (%)	n (%)
Palatine tonsils and adenoids present	106 (88.3)	39 (97.5)
Adenoidectomy	6 (5.0)	-
Adenoidectomy and tonsillectomy	8 (6.7)	1 (2.5)
Total	120 (100.0)	40 (100.0)

$\chi^2 = 3.204$; $df = 2$; $p = 0.201$.

ent, while the adenotonsillectomy had been performed in 6.7% and adenoidectomy in 5.0% of cases. No statistically significant differences were found in the observed groups (Table 2).

The palatine tonsils were eutrophic in 26.8% of the examinees with acute otitis media, 55.4% had hypertrophy - grade I, and 17.9% hypertrophy - grade II. In the control group, the palatine tonsils were eutrophic in 48.7% of the examinees, 46.1% had hypertrophy - grade I, and 5.1% hypertrophy - grade II. A statistically significant difference ($p = 0.005$) was found between the observed groups of examinees (Table 3).

Concerning surgical treatment of adenotonsillar tissue previously performed, adenoidectomy had been performed in 8.3% of examinees with acute otitis media, and adenotonsillectomy in 7.5%, while 84.8% of examinees had not been treated with these

Table 3. The size of the palatine tonsils

Size of the palatine tonsils	Group	
	Experimental	Control
	n (%)	n (%)
Eutrophic	30 (26.8)	19 (48.7)
Hypertrophy grade I	62 (55.4)	18 (46.1)
Hypertrophy grade II	20 (17.9)	2 (5.1)
Total	112 (100.0)	39 (100.0)

Mann-Whitney U=1587; Z=-2.813; p = 0.005; r = -0.23.

Table 4. Surgical treatment of palatine tonsils and adenoids

Surgical treatment of palatine tonsils and adenoids	Group	
	Experimental	Control
	n (%)	n (%)
Not	101 (84.2)	38 (95.0)
Adenoidectomy	10 (8.3)	1 (2.5)
Adenoidectomy and tonsillectomy	9 (7.5)	1 (2.5)
Total	120 (100.0)	40 (100.0)

$\chi^2=3.090$; df=2; p=0.213.

Table 5. Frequency of adenotonsillar infections

Number of episodes	Group	
	Experimental	Control
	n (%)	n (%)
n (%)	16 (13.3)	14 (35.0)
14 (35.0)	40 (33.3)	20 (50.0)
20 (50.0)	22 (18.3)	3 (7.5)
3 (7.5)	42 (35.0)	3 (7.5)
3 (7.5)	120 (100.0)	40 (100.0)

$\chi^2=20.053$; df=3; p< 0.001.

Table 6 Antibiotic therapy for adenotonsillar infections

Use of antibiotic therapy	Group	
	Experimental	Control
	n (%)	n (%)
Yes	107 (93.0)	27 (67.5)
No	8 (6.9)	13 (2.5)
Total	115 (100.0)	40 (100.0)

$\chi^2 = 16.532$; df = 1, p = < 0.001.

surgical treatments. There was no statistically significant difference (p=0.213) between the experimental and control groups regarding previously performed adenoidectomy and adenotonsillectomy (Table 4).

There was a statistically significantly higher prevalence and association between adenotonsillar infections and acute otitis media in the experimental group. A high percentage of patients (93.0%) in the experimental group were treated with antibiotics because of adenotonsillar infections which was statistically significantly higher than the control group (Table 5, 6).

The most common types of tympanogram were type B (31.2%) and C1 (22.5%) in one or both ears, while type A was recorded in 36.2% of cases. The average hearing threshold in one or both ears for patients (>4 years) with diagnosed acute otitis media was 18.3 dB.

Discussion

Viral or bacterial infection of the adenotonsillar tissue and upper respiratory tract in interaction with Eustachian tube dysfunction and the immature immune response, form the basis of the pathogenesis of acute otitis media in children (6). Adenoidal hypertrophy and adenotonsillar hypertrophy are common disorders in the paediatric population and may cause symptoms such as: mouth breathing, nasal congestion, hyponasal speech, snoring, and obstructive sleep apnea, as well as chronic sinusitis and recurrent otitis media.

Hypertrophy of the palatine and pharyngeal tonsils are extremely common in children, being one of the most frequent causes of visits to the Ear, Throat and Nose Department and such problems can impair the quality of the child's life. Adenotonsillectomy has a positive impact, in other words, it leads to a significant improvement in the quality of life of children with tonsil hypertrophy (7). Czyz et al. (8) emphasize that there is a significant correlation between the hypertrophy of pala-

tine tonsils and acute otitis media, rhinitis and sinusitis, as well as the symptoms of nasal obstruction and hearing impairment in children. Previous studies indicated that recurrent and chronic infection of adenotonsillar tissue without obstructive hypertrophy may cause acute otitis media, otitis media with effusion and rhinosinusitis (9). In our experience a large number of patients with AOM are treated by family physicians and pediatricians. Only a small number of patients are referred to the Ear, Throat and Nose Department. During the study period, there was a growing tendency for physicians to use the 'wait and see' approach for management of otitis media.

Boston et al. (10) indicated genetic predisposition for obstruction or chronic upper respiratory tract infection as predictors for the genesis of otitis media in children whose parents had adenoidectomy and/or tonsillectomy. Ross et al. (11) emphasised that there is no statistically significant connection between acute otitis media in children and a positive family anamnesis of upper respiratory tract infection. Sade et al. (12) stated that the size of adenoid vegetation in children is usually the largest between 2 and 4 years of age, and that adenoidectomy can reduce middle ear infections in a certain percentage, from 10% to 15%. The positive effect of adenoidectomy may be reflected in improved Eustachian tube function, whose obstruction represents one of the most important factors in the pathogenesis of this disease. In this study we found a statistically significant incidence of acute otitis media in the age group from 1- 2.5 years.

Jero et al. (13) claim that children with acute otitis media who have not been subjected to adenoidectomy have a greater risk for treatment failure in comparison to children who have undergone adenoidectomy. The positive effect of surgery is based on physiological and microbiological changes to the

nasopharyngeal space. Coyte et al. (7) came to the conclusion that adenoidectomy would be favourable in reducing the incidence of childhood otitis media, in a retrospective analysis of hospital discharge records of 37, 000 children. They found that children who had had adenoidectomy during the insertion of tympanostomy tubes had fewer hospitalizations and operations related to otitis media than children who had had tympanostomy tubes inserted alone as their first surgery.

In our research, we did not find any statistically significant difference between the experimental and control groups regarding previously performed adenoidectomy and adenotonsillectomy. Heikkinen et al. (14) stated that the positive effect of adenoidectomy, if there is one in the prevention of acute otitis media, is most efficient in children under the age of 3, while the role of adenoidectomy in prevention of recurrence of this disease is still a subject of professional and scientific debate. Tonsillectomy in acute otitis media therapy is not justified except in cases of recurrent infections and obstructive hypertrophy. All available randomised trials and non-randomised controlled studies of the efficacy of adeno/ tonsillectomy have had important limitations. In our study a statistically significantly higher incidence of palatine tonsil hypertrophy in examinees with acute otitis media (grade I - 55.4%, grade II -17.8%) was found than in examinees in the control group.

The frequency of sore throat episodes and upper respiratory infections reduces with time, whether adeno/tonsillectomy has been performed or not. Adeno/tonsillectomy leads to an additional, but small, reduction of sore throat episodes, days of sore throat associated school absence, and upper respiratory infections, compared to watchful waiting (15). This research showed that there was a highly statistically significant association between adenotonsillar infections and antibiotic therapy with acute otitis media. Four or more of adeno-

tonsillar infections were recorded in more than 50% of patients with diagnosed acute otitis media. Paradise et al. (16) found that children with adenotonsillectomy had less frequent otitis media in comparison with children who had undergone adenoidectomy alone, while other authors do not recommend adenoidectomy or adenotonsillectomy as a preventive surgical procedure for recurrent acute otitis media. The morbidity associated with these surgical procedures, although not mentioned, exceeds their limited efficacy (17).

This study is limited by a number of factors, some associated with the small number of children in the both groups. The size of the sample can be questioned, since only a very small proportion of children undergoing adenotonsillectomy was included in the trials. The small number of operated children can be explained by the fact that we excluded children who underwent adenotonsillectomy because of obstructive sleep apnoea. Although the importance of adenotonsillar hypertrophy has been studied for AOM, we were unable to find studies examining this impact sufficiently. The assessment of treatment efficacy was limited by the finding that the definitions of clinical success were usually not equivalent between the studies comparing the same treatments.

Conclusion

Hypertrophy of the palatine tonsils was statistically significantly more prevalent in examinees with acute otitis media compared with the control group. This level of significance was not recorded regarding previously performed adenoidectomy and adenotonsillectomy.

Authors' contributions: Conception and design: DV, SS; Acquisition, analysis and interpretation of data: DT, AA; Drafting the article: BB; Revising it critically for important intellectual content: DV.

Conflict of interest: The authors declare that they have no conflict of interest.

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