

## CONNECTION OF ATOPY WITH ACUTE OTITIS MEDIA

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### Abstract

This study was designed to examine whether atopy is associated with acute otitis media (AOM). Material and methods: The study was performed with the help of a questionnaire handed out to the parents of 262 children, all residents of Brno, who attended our department for adenoidectomy. The questionnaire was designed to establish any history of atopy and / or AOM in each child, as well as any family history of atopy. The information was compared to the existing data in our database of medical records. The children with one or more AOM events were used as the study group and the children with no AOM infections as a control group. The incidence of atopy in each of these two groups was then statistically analysed. The history of atopy in the family was also compared in each of these two groups. Results: No significant difference was found in the incidence of atopy when children with AOM and children without AOM episodes were compared. Furthermore, no significant difference was found in the family history of atopy, when children with AOM and children without AOM episodes were compared. Conclusion: Our data have shown no connection between AOM episodes and atopy incidence in children or their families, thus atopy or family history of atopy do not seem to play any role in the incidence of AOM.

### Key words

Atopy, Acute otitis media, Allergies, Immune problems, Otitis media with effusion

### Abbreviations used

AOM, Acute otitis media; OM, Otitis media ; OME, Otitis media with effusion ; ET, Eustachian tube

### INTRODUCTION

Allergy is thought to be one of the aetiological factors of otitis media (OM) because OM occurs frequently in allergic individuals (1). *Rylander et al.* identified allergy as a risk factor for OM (2). A review based on the existing literature and laboratory investigations at the Children's Hospital of Buffalo reported that otitis media with effusion (OME) is associated with allergy in 35–40 % of cases (3).

Research connecting the effect of allergies on the function of the Eustachian tube (ET) has been extensive (3–8), with *Bernstein et al* providing evidence that

the ET may be adversely affected by allergy (4). *Bernstein* and *Doyle* later described a pathophysiological model of OME secondary to IgE-mediated hypersensitivity, according to which the prolonged obstruction of the ET results in middle ear inflammation, mucosal metaplasia and increased glandular activities, all of which are hallmarks of chronic OME (5). Furthermore, studies at the Pittsburgh Children's Hospital involving adult volunteers demonstrated a relationship between intranasal antigen challenge, allergic rhinitis, and ET obstruction (9, 10, 11). *Charles et al* demonstrated a relationship between intranasal histamine challenge and development of acute ET dysfunction (12).

Atopy is defined as the genetic propensity to develop immunoglobulin E antibodies in response to exposure to allergens and is assessed by skin prick test responses to common allergens (13). Several studies have specifically connected atopy to OME (14-17). Others have shown that it may not be related to the development of OME in children (18).

However, epidemiological evidence examining the role of atopy and/or allergy in the pathogenesis of OME is still inconclusive (19), with any definitive proof lacking (20), and it has been suggested that their relationship will remain controversial until well-controlled clinical studies demonstrating that antiallergy therapy is effective in preventing or limiting OME in select populations are conducted (21).

Several hypotheses as to why atopic ET obstruction may eventually lead to AOM have been suggested. One explanation presented the possibility of gradual accumulation of viruses and bacteria in the ear effusion (22, 23). Another hypothesis suggested that aspiration of bacteria-laden allergic nasopharyngeal secretions in the middle-ear cavity after obstruction of ET and negative middle ear pressure development (24, 25), because of the Toynbee phenomenon (26, 27), may be responsible.

In a study examining middle ear diseases in relation to atopy, it was found that the number of episodes of AOM was higher and the duration of OME episodes longer in 13 infants with respiratory tract allergy, when compared to 14 allergic children with only skin manifestations and 25 non-atopic children (28), thus suggesting a connection of atopy both to OME and AOM. A study by *Bentdal et al* has shown a statistically significant association between AOM and reported allergic diseases (29).

We designed our study to investigate whether AOM episodes occur more frequently in atopic patients or those with a family history of atopy, compared to patients with no atopy or family history of atopy. We examine the hypothesis that obstruction of the ET due to atopy can eventually lead to AOM.

## MATERIAL AND METHODS

The collection of the data for this study was performed with the help of a standardised questionnaire handed out to the parents of children (newborns to 13 years of age), all inhabitants of Brno, that came to our department for adenoidectomy in the period between 01.02.2005 and 30.06.2006.

The parents were asked (using a standardised questionnaire) about the child's AOM history since birth, the history of atopy, as well as the history of atopy in the family. The data were double-checked, using information from our computer database where available. The children with AOM in their medical history were used as a study group and the children with no AOM infections as a control group, to determine any difference in atopy incidence between them.

The parents were asked about diagnosed atopic reactions to feathers, pollen, dust mites, animal hair, food, fungi, nickel, zinc, and others. The data were statistically analysed using chi-square tests.

## RESULTS

Out of the 262 children under study, 149 (57 %) were boys and 113 (43 %) were girls. Out of the 163 children with no history of AOM, 88 (54 %) were boys and 75 (46 %) were girls, whilst out of the 99 with a history of AOM, 61 (62 %) were boys and 38 (38 %) were girls. Out of the 60 children with atopy, 35 (58 %) were boys and 25 (42 %) were girls, whilst out of the 202 children with no atopy 114 (56 %) were males and 88 (44 %) were females. The difference between the two genders is not statistically significant, whilst the difference between the proportions of boys in the two groups is also not statistically significant (p-value 0.2268).

Out of the 262 children under study, 60 (23 %) were found to have atopy. Out of the 99 children with a history of AOM, 21 (21 %) were atopic and out of the 163 children with no AOM history, 39 (24 %) were atopic (*Table 1*). No statistically significant difference was found when children with AOM and children with no AOM episodes were compared for the incidence of atopy. No statistically significant difference was found either when children with atopy and non-atopic children were compared for the incidence of AOM. Out of the 60 children with atopy, 21 (35 %) had a history of AOM and out of the 202 children without a history of atopy 78 (39 %) had a history of AOM (*Table 1*) (p-value 0.6122).

Of the 268 families examined, 115 (43 %) had a history of atopy and 103 (38 %) had children with a history of AOM. No statistically significant difference was found in the incidence of AOM in children when families with a history and no history of atopy were compared. Out of the 115 families with a history of allergy, 49 (43 %) had children with a history of AOM. Out of the 153 families with no history of atopy 54 (35 %) had children with a history of AOM (*Table 2*). No statistically significant difference was found in the incidence of atopy in the family when children with AOM episodes and children with no episodes of AOM were compared. Of the 103 children with a history of AOM, 49 (48 %) families had a history of atopy and of the 165 children with no AOM history 66 (40 %) families had a history of atopy (*Table 2*) (p-value 0.223).

## DISCUSSION

This study was part of a survey, which was carried out to examine various risk factors for AOM and the extent of their effect on the disease.

The computer system in our hospital contains the full medical records of all the patients operated on in our clinic. For this reason, we selected our cohort among

*Table 1*  
Children with history of atopy compared to children with no atopic history for AOM incidence

Observed data				
		AOM History N°		
		No	Yes	Total
Atopy N°	No	124	78	202
	Yes	39	21	60
	Total	163	99	262

Expected data					Chi-square test statistics			P – value
		AOM History						
		No	Yes	Total				
Atopy	No	125,7	76,3	202	0.022	0.037		0.6122
	Yes	37.3	22.7	60	0.075	0.123		
	Total	163	99	262	0.097	0.160	0.257	

*Table 2*  
Families with history of atopy compared to families with no atopic history for AOM incidence in their children

Observed data				
		AOM History N°		
		No	Yes	Total
Atopy N°	No	99	54	153
	Yes	66	49	115
	Total	165	103	268

Expected data					Chi-square test statistics			P - value
		AOM History						
		No	Yes	Total				
Atopy	No	94.2	58.8	153	0.245	0.392		0.223
	Yes	70.8	44.2	115	0.326	0.522		
	Total	165	103	268	0.571	0.914	1.485	

children operated on in our department. Furthermore, all the children selected for this study were residents of the city of Brno. Since we are the only child otolaryngology clinic in the city of Brno and since the few private child otorhinolaryngologists who practice in Brno collaborate with us, the chances of the child's medical history being inaccurate or incomplete when followed through our files are, thus, negligible.

In our study, the incidence of atopy was based on the testimony of the parents (who were specifically asked to include only atopy verified by medical diagnosis), alone. However, due to the young age of the children participating in the study, many may have not yet been diagnosed with allergies. The effect of other parameters like breastfeeding duration and genetic predisposition could not be eliminated by homogenising them in the groups under study, due to the relatively small size of the sample. Furthermore, specific tests like IgE measurement, skin and RAST tests as well as clinical manifestations (hay fever, asthma, eczema or urticaria) were not evaluated.

Our results have shown no correlation between AOM episodes and atopy in children or their families and have led us to the conclusion that atopy of the patient and or genetic predisposition to atopy cannot be incriminated in the pathogenesis of AOM. The obstruction of the ET due to atopy does not seem to be enough for the induction of AOM as previously suggested (3-27).

A retrospective study following older children back for a longer period of time could give a more precise picture. We therefore suggest that further research is necessary before definite conclusions can be drawn on the effect of atopy on AOM incidence and its pathogenesis.

## CONCLUSION

Although allergy may contribute to the pathogenesis of OME through the obstruction of the ET, our data have produced no evidence connecting atopy with the incidence of AOM. Nevertheless we believe that further research is necessary to determine the exact role that atopy plays in the pathogenesis of AOM.

## REFERENCES

1. *Draper WL*. Secretory otitis media in children: a study of 540 children. *Laryngoscope* 1967; 77: 636.
2. *Rylander R, Mégevand Y*. Environmental risk factors for respiratory infections. *Arch Environ Health* 2000; 55 (5): 300-303.
3. *Bernstein JM*. The role of IgE-mediated hypersensitivity in the development of otitis media with effusion: a review. *Otolaryngol Head Neck Surg* 1993; 109 (3 Pt 2): 611-620.
4. *Bernstein JM, Lee J, Conboy K, et al*. Further observations on the role of IgE-mediated hypersensitivity in recurrent otitis media with effusion. *Otolaryngol Head Neck Surg* 1985; 93: 611.
5. *Bernstein JM, Doyle WJ*. Role of IgE-mediated hypersensitivity in otitis media with effusion: pathophysiologic considerations. *Ann Otol Rhinol Laryngol Suppl* 1994; 163: 15-19.
6. *Fireman P*. Otitis media and its relationship to allergy. *Paediatr Clin North Am* 1988; 35 (5): 1075-1090.
7. *Bernstein JM*. The role of IgE-mediated hypersensitivity in the development of otitis media with effusion. *Otolaryngol Clin North Am* 1992; 25 (1): 197-211.

8. Lazo-Sáenz JG, Galván-Aguilera AA, Martínez-Ordaz VA, et al. Eustachian tube dysfunction in allergic rhinitis. *Otolaryngol Head Neck Surg* 2005;132 (4): 626-629.
9. Friedman PA, Doyle WJ, Casselbrant ML, et al. Immunologic mediated eustachian tube obstruction: a double-blind crossover study. *J Allergy Clin Immunol* 1983; 71: 442.
10. Ackerman MN, Friedman RA, Doyle WJ, et al. Antigen-induced Eustachian tube obstruction: an intranasal provocative challenge test. *J Allergy Clin Immunol* 1984; 73: 604.
11. Doyle WJ, Friedman R, Fireman P, et al. Eustachian tube obstruction after provocative nasal antigen challenge. *Arch Otolaryngol Head Neck Surg* 1984; 110: 508.
12. Charles S, Ebert Jr, Hoke W, et al. Effect of intranasal histamine challenge on Eustachian tube function. *International Journal of Pediatric Otorhinolaryngology* 2002; 63: 189-198.
13. Arshad SH, Tariq SM, Matthews S, et al. Sensitization to common allergens and its association with allergic disorders at age 4 years: a whole population birth cohort study. *Pediatrics* 2001; 108 (2): E33.
14. Caffarelli C, Savini E, Giordano S, et al. Atopy in children with otitis media with effusion. *Clin Exp Allergy* 1998; 28 (5): 591-596.
15. Alles R, Parikh A, Hawk L, et al. The prevalence of atopic disorders in children with chronic otitis media with effusion. *Pediatr Allergy Immunol* 2001; 12 (2): 102-106.
16. Kayhan FT, Ergez E, Hatipoğlu A, et al. The incidence of allergic rhinitis in children with otitis media with effusion. *Kulak Burun Bogaz Ihtis Derg* 2002; 9 (3): 184-187.
17. Róžańska-Kudelska M, Południewska B, Biszewska J, et al. Assessment of the hearing organ in the patients with allergic perennial and seasonal allergic rhinitis. *Otolaryngol Pol* 2005; 59(1): 97-100.
18. Yeo SG, Park DC, Eun YG, et al. The role of allergic rhinitis in the development of otitis media with effusion: effect on eustachian tube function. *Am J Otolaryngol* 2007; 28 (3): 148-152.
19. Chantzi FM, Kafetzis DA, Bairamis T, et al. IgE sensitization, respiratory allergy symptoms, and heritability independently increase the risk of otitis media with effusion. *Allergy* 2006; 61 (3): 332-336.
20. Doyle WJ. The link between allergic rhinitis and otitis media. *Curr Opin Allergy Clin Immunol* 2002; 2 (1): 21-25.
21. Bernstein JM. Role of allergy in Eustachian tube blockage and otitis media with effusion: a review. *Otolaryngol Head Neck Surg* 1996; 114 (4): 562-568.
22. Bernstein JM. Immunologic aspects of otitis media. *Curr Allergy Asthma Rep* 2002; 2 (4): 309-15.
23. Ruggeri C, Barberio G, Pajno GB, et al. Relations between allergic rhinitis and otitis media with effusion. The role of the Eustachian tube. *Minerva Pediatr* 1990; 42 (11): 481-483.
24. Bluestone CD. Eustachian tube function and allergy in otitis media. *Pediatrics* 1978; 61: 753.
25. Bluestone CD, Beery QC. Concepts on the pathogenesis of middle ear effusions. *Ann Otol Rhinol Laryngol* 1976; 85 (2 Suppl 25 Pt 2): 182-186.
26. Bluestone CD, Beery QC, Andrus WS. Mechanics of the Eustachian tube as it influences susceptibility to and persistence of middle ear effusions in children. *Ann Otol Rhinol Laryngol* 1974; 83 (suppl 11): 27.
27. Bluestone CD, Klein JO. Otitis media in infants and children. 3rd ed. Philadelphia: Saunders, 2001: p. 47.
28. Irander K, Borres MP, Björkstén B. Middle ear diseases in relation to atopy and nasal metachromatic cells in infancy. *International Journal of Pediatric Otorhinolaryngology* 1993; 26 (1): 1-9.
29. Bentdal YE, Nafstad P, Karevold G, et al. Acute otitis media in schoolchildren: allergic diseases and skin prick test positivity. *Acta Otolaryngol* 2007; 127 (5): 480-485.