

The epidemiology, complications and pathogenesis of childhood
rhinosinusitis

Ph.D. Thesis

Monika Sultész M. D.

Semmelweis University
Doctoral School of Clinical Medicine



Advisor: Györgyi Mezei M.D., Ph.D.

Official opponents: Edit Kadocsa M.D., Ph.D.
Marianna Küstel M.D., Ph.D.

President of final exam committee: Prof. Ildikó Horváth M.D., D.Sc.

Members of final exam committee: László Z. Szabó M.D., Ph.D.
Julianna Tóta M.D., Ph.D.

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1 INTRODUCTION

Rhinosinusitis (RS) is the most common children's disease. Its ethiopathogenesis has been widely examined but has not been totally clarified. Infections (viral and bacterial), the child's local and general immunity and allergic factors all play a role in the development and course of the disease. The process of the disease is generally fast and simple, often not even needing therapy, while in some cases serious or even lifethreatening complications may develop.

In my study I have relied on the children visiting the allergology outpatient consultation, which I have been leading for many years, and on my experience obtained at the ORL department.

I assigned two main fields to study. One of them is the epidemiological study of allergic rhinitis (AR) among primary schoolchildren living in Budapest, the other is the complex procession of the complications of sinusitis. My scientific work wishes to provide data to a better understanding of the disease, and the planning of the treatment. My epidemiological studies have contributed to the classification of the background.

2 AIMS

About the importance of the studied diseases

The majority of the children visiting our hospital's busy ORL outpatient department have acute complaints in the background of which viral upper respiratory tract infections (URI) are the most common. Children average six to eight colds per year, approximately 5% to 10% of these cases of viral rhinosinusitis are complicated by acute bacterial rhinosinusitis (ABRS). Children being in day care in the first few years of life contributed to the increase of the frequency of RS, since they are subject to more frequent and more long lasting

respiratory illnesses, because of the superinfections.

Despite improvements in antibiotic therapies, surgical techniques and advancement in imaging studies acute bacterial sinusitis still carries a risk of serious and potentially fatal complications.

The number of ABRS cases has been increasing continuously. Therefore early diagnosis, examination and appropriate treatment are of paramount importance in the prevention of the illness from becoming chronic. In addition, it helps to prevent the development of life-threatening complications.

The major events predisposing to the development of ABRS are URI and allergic inflammation. Allergic-atopic diseases have become an endemic in the XXI. Century. Among these illnesses hay fever has become the most common chronic disease among children.

The symptoms of hay fever are of high frequency, and can be detected at an early age among the children visiting our outpatient department. This gave me the idea of setting up an ORL allergological outpatient surgery ten years ago. Nowadays a well-functioning ORL department and outpatient surgery is unimaginable without allergological consultation.

Based on clinical experience AR is a chronic disease, which, if not treated appropriately, can decrease quality of life. At the same time a diagnosed and well-treated AR will not hinder the child from studying or relaxing.

The knowledge of the prevalence, the correct examination and the treatment of AR can increase the standard of medical attendance.

We have very few data concerning the prevalence of AR in the child population living in Hungary, this is why we decided to evaluate the

incidence of AR in 6-12-year-old schoolchildren in Budapest.

I. The objective of the rhinosinusitis study was:

1. To process and analyse the most important data of the etiology, symptomatology and diagnosis of infant and childhood complications of RS and persistent ABRS among the patients of the ORL Ward of Heim Pál Hospital for Sick Children between 1997 and 2006.
2. To classify the types of ABRS, and to define the diagnostics and the treatment. To classify the persistent ABRS cases that haven't recovered following conservative therapy in the mentioned protocol.
3. To elaborate a protocol for the classification, diagnostics and the treatment of orbital complications of ABRS.
4. To elaborate the diagnostics and treatment protocol of the intracranial complications of ABRS.
5. To compare the data obtained from our retrospective analysis examining sinusitis complications with the results of similar studies from between 1955 and 1978 in our ward.
6. To compare the data obtained from our study with the results of similar studies from the ORL Ward of Texas-Southwestern Medical Center, Dallas, the USA between 1995 and 2002.
7. To discuss whether the improvement of diagnostic methods, the modern surgical techniques and application of antibiotics have brought about changes in the efficiency of medical care.

II. The objective of the AR survey was:

Among 6-12-year-old schoolchildren

1. To determine the prevalence of cumulative AR (Problems involving sneezing or a runny or blocked nose in the absence of a cold or a flu in the last 12 months were assessed as "current AR" + diagnosed AR). The AR prevalence among 6-12-year-olds have not yet been defined in Hungary. Our study is aiming to fill this gap.
2. To compare our results with the data of epidemiological surveys conducted in Budapest and Hungary earlier.

3. To compare the prevalence of current AR in our study with the similar data from the International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three study.
4. To define the prevalence of all the atopic diseases in the examined group.
5. To define the prevalence of individual types of atopic diseases.
6. To analyse the risk factors of the AR in a wider spectrum.
7. To compare our results with those of an ISAAC study carried out in another capital.

3 MATERIALS AND METHODS

I. Rhinosinusitis study

The case charts of all children admitted to our department between January 1, 1997 and December 31, 2006 with persistent acute bacterial rhinosinusitis who haven't recovered following conservative therapy or who had complications of acute sinusitis were subjected to a retrospective review. By the definition – persistent acute bacterial rhinosinusitis that does not respond to conservative therapy – we mean those cases which have not recovered within 14-26 days following the application of appropriate antimicrobial, nasal decongestant, mucolytic, antihistamine, antipyretic and analgetic therapy and thus required surgery.

My objective was, to get closer to the treatment and prevention of the above mentioned diseases by drawing conclusions from the detailed analyses of them.

In all cases, the children admitted with persistent ABRS that did not respond to conservative medical treatment were cured by direct maxillary sinus puncture and with *i.v.* ATB, decongestion and, if necessary, antihistamine.

Complications secondary to acute rhinosinusitis were diagnosed in 157 children: 150 orbital complications, 2 intracranial complications,

1 mucocele and 4 cases of osteomyelitis.

In those who presented with complications, the diagnosis was confirmed by CT scanning. MRI was superior to CT for the identification of intracranial involvement. Ophthalmological consultation was requested in cases of orbital complications as was neurological consultation when neurological symptoms developed or the findings suggested potential intracranial complications. Some cases necessitated neurosurgical consultation. The nature of the treatment in the cases involving complications is outlined in Tables 1 and 2.

Table 1

Treatment of orbital complications

Stage	Diagnosis	Number of patients		Treatment
I	Preseptal cellulitis	126	55	Highmore puncture + <i>i.v.</i> ATB
			4	FESS + <i>i.v.</i> ATB
			67	<i>i.v.</i> ATB
II	Orbital cellulitis	9	3	Highmore puncture + <i>i.v.</i> ATB
			6	FESS + <i>i.v.</i> ATB
III	Subperiosteal abscess	4		FESS + <i>i.v.</i> ATB
IV	Orbital abscess	11	5	FESS + endoscopic orbitotomy + <i>i.v.</i> ATB
			5	FESS + external orbitotomy + <i>i.v.</i> ATB
			1	Moore operation + <i>i.v.</i> ATB

Table 2

Treatment of local complications outside the orbit

Type of complication	No. of patients	Diagnosis	Treatment
Intracranial complication	1	Orbital cellulitis Pansinusitis Meningitis	FESS i.v. ATB i.v. steroid
Intracranial complication	1	Epidural abscess Pansinusitis Pott's puffy tumor	craniotomia FESS i.v. ATB
Mucocele	1	Sinusitis maxillae Ethmoiditis ac. Orbital cellulitis Mucocele maxillae	FESS i.v. ATB
Osteomyelitis	2	Ethmoiditis ac. Sinusitis frontalis Frontal abscess Osteomyelitis frontalis	FESS Incisio i.v. ATB
Osteomyelitis	2	Ethmoiditis ac. Sinusitis maxillae Abscess. subperiostalis maxillae Osteomyelitis maxillae	FESS Incisio i.v. ATB

II. Rhinitis allergica survey

The study was conducted in Budapest in September 2007. 21 primary schools in 8 districts of Budapest were chosen. At the initial teacher-parent meetings, 6335 questionnaires were distributed to the parents of the 6-12-year-old pupils. Instructions were given by the teachers before the questionnaires were completed. The questionnaires were collected immediately after the teacher-parent meetings, or at most a week later.

We chose September to perform our survey, presuming that the parents would be able to recall the symptoms of AR more vividly.

In the questionnaire parents were asked to give their children's initials and gender when answering questions about AR. We used a

modified version of the standardized core questions on AR from the ISAAC Phase I questionnaire, which had been translated into Hungarian. It was supplemented with an additional validated questionnaire which had been applied in a survey in Istanbul (Tamay et al. 2007) and with further questions relating to risk factors.

Problems involving sneezing or a runny or blocked nose in the absence of a cold or a flu in the last 12 months were assessed as “current AR”.

The prevalence of “diagnosed AR” was determined on the basis of answers to the question “Have you had allergic rhinitis diagnosed by a physician?”

The cumulative AR prevalence was taken as the sum of the current AR number and the diagnosed AR number.

The prevalence of allergic disease was determined from the responses to the question “Have you been diagnosed with an allergic disease?” (by a general practitioner, physician or natural healer). If the response was positive, the question, “What kind of allergic disease did you have?” identified those pupils who suffered from eczema, food allergy, asthma or AR.

The additional questionnaire related to the cumulative AR symptoms furnished information on the sex, a family history of atopy, frequent respiratory tract infections, frequent rhinosinusitis, a history of tonsillectomy, a history of adenoidectomy, antibiotic or paracetamol use in the first year of life, smoking at home, furry pets or birds at home, furry pets or birds at home in the first year of life, dampness at home, a dusty indoor environment, living in Budapest for between 0 and 5 years or for more than 5 years, frequent or constant heavy-vehicle traffic in a residential street, living in a green area, the quantity of

drinks consumed that contain preservatives or colourants, feather bedding, living in a house made of concrete, living not far from an air-polluting factory or mine and long-lasting disease before the appearance of the allergy.

Statistical analysis

In the retrospective analysis of the rhinosinusitis cases we supplied the number of patients. In the AR epydemilogycal study data were characterized using standard descriptive statistics:

frequencies (percentages) and means (sd) for categorical and qualitative data, respectively. The Chisquare or Fisher's exact test was used to compare frequencies, and the t-test was used to compare means of groups. Results were considered significant at $p < 0.05$. For case of categorical variables, odds ratios (OR) and 95% confidence intervals (95%CI) were calculated in order to establish how much more likely it was that someone who had the risk factor would develop allergy as compared to someone who did not have it. Missing and inconsistent responses were included in the denominator for the prevalence calculations, but excluded from subsequent bivariate analysis. Percentages were calculated by dividing the frequency by the total number of observations, and then multiplying by 100. Valid percentages were calculated by dividing the frequency by the total number of observations, excluding missing answers, and then multiplying by 100. Cumulative percentages were calculated by dividing the cumulative frequency by the total number of observations, and then multiplying by 100. The cumulative frequency was calculated by adding each frequency from a frequency distribution table to the sum of its predecessors. All analyses were performed with the SPSS 15 statistical program software.

4 RESULTS AND DISCUSSION

I. Rhinosinusitis study

Admission to hospital is necessary in those persistent cases of ABRS studied in my survey, that did not improve or got worse over 10 days, inspite of a 7-14-day antibiotic (ATB) course or repeated second ATB treatment (17-21 days). Highmore puncture was applied in the majority of the 182 cases treated for the mentioned diseases. Only in a very few cases (3 children; 1.6%) did we experience no improvement following the above mentioned therapies due to closed ostia of the sinuses. If the CT scan indicated a change in the background of the disease that justified it (for example showed mucosal changes in the ethmoidal cells due to bad ventillation), we performed FESS. The 182 patients not responding to conservative therapy recovered following hospital treatment.

Whenever a sinus infection extends beyond the confines of the sinonasal complex, there is an enchaned risk of an associated complication. *One of the main objectives of treating childhood sinusitis is to prevent complications.*

Regarding the age range of sinusitis complications we have found that, while infants and young children are particularly susceptible to orbital complications, intracranial complications tend to affect older children (preteens). A patient rarely suffers from more than one complication. In the classification of the **orbital complications** septum orbitale, which is a diaphragm- like closure of the orbit, has a major role. In 1970 Chandler et al. introduced the most recent system of classification for orbital complications (*Table 3.*).

Table 3

The pathogenesis of orbital complications in acute rhinosinusitis

Stage	Diagnosis	Clinical signs
I	Periorbital (preseptal) cellulitis	Upper eyelid swelling without extraocular or visual changes
II	Orbital (postseptal) cellulitis	Eyelid swelling, periorbital swelling, proptosis, chemosis, limited or no impairment of extraocular movement
III	Subperiosteal abscess	Displacement of the globe downward and laterally, impairment of extraocular movement, impairment of visual acuity (later finding)
IV	Orbital abscess	Severe proptosis, complete ophthalmoplegia, impairment of visual acuity that can progress to irreversible blindness
V	Cavernous sinus thrombosis	Orbital pain, chemosis, proptosis, sepsis, ophthalmoplegia. Can progress to the other eye

In such cases, it is very important that the CT scan should include coronal and axial views of all the sinuses and the orbit. MRI may be reserved for an assessment of the continued progressive neurologic changes resulting from intracranial complications.

Ophthalmologic consultation is required to determine the eye mobility, the visual acuity and the fundus. Spread of the suppurative disease to the optic nerve can result in a permanent visual deterioration, and close monitoring by an ophthalmologist is therefore necessary to determine the progression of the disease. During the endoscopic sinus procedure performed due to orbital complications an endoscopic sampling is recommended for bacteriological examination.

In our cases with post-rhinosinusitis complications, the cultivated bacterial spectrum was consistent with the results of other literature

studies. The principal bacterial pathogen was *Streptococcus pneumoniae*. Coagulase-negative Staphylococcus, which was found in 19.7% of the sample, are bacteria carried by the given anatomic region or contaminated bacteria. In the „other” category *Moraxella catarrhalis* and *Streptococcus pyogenes* occur together with other bacteria detected in small quantities.

The treatment of orbital complications depends on the Chandler classification stage. Most cases of preseptal and orbital cellulitis may be effectively managed with *i.v.* ATB. The indications for surgery in cases of orbital complications are recommended as follows:

- In stage I or II, if the patient’s condition fails to improve significantly within 24-48 hrs after appropriate ATB administration
- Immediately if the visual acuity drops
- In the event of increasing levels of proptosis and ophthalmoplegia
- If an abscess is demonstrated by the CT scan

The surgical approach includes FESS to drain the affected sinuses. The degree of the operation (middle and posterior ethmoid cells, and sphenoid sinus) depends on the extent of the disease.

When the CT scan reveals an abscess, depending on its localization (lateral, inferior or superior), FESS was supplemented with external orbitotomy. Medial subperiosteal abscesses associated with acute ethmoiditis are usually typically drained at the time of endoscopic ethmoidectomy.

Intracranial complications of paranasal sinusitis arise from both acute and subacute exacerbations of chronic rhinosinusitis in older children.

Examination of intracranial complications: 1. MRI is essential. 2. Neurologic consultation is required. 3. A spinal tap for determination of the pathogen is essential in order to identify the severity of the infection.

Treatment of intracranial complications: 1. High doses of *i.v.* broad-spectrum ATB that cross the blood-brain barrier. 2. Surgical drainage of the affected sinuses via FESS. 3. When osteomyelitis of the bone is revealed, this should be removed from an external approach. 4. Intracranial inflammation due to the spread of infection into the cranial vault is usually dealt with by a neurosurgeon.

These patients were managed by a multidisciplinary team composed of an otolaryngologist, a neurologist, a neurosurgeon, an intensive therapy specialist, an ophthalmologist, a radiologist, a pediatrician and an infectious disease specialist.

For the drug treatment of our complications we used high-dose *i.v.* ATB resistant to beta-lactamases or third-generation cephalosporins. Of the 157 children who experienced complications (Tables 1 and 2), 155 recovered without sequelae. There were no mortalities. Morbidities arose in 2 patients as the infection spread to the optic nerve and neuritis developed. One of them suffered a permanent unilateral loss of vision.

II. Rhinitis allergica survey

Of the 6335 distributed questionnaires 3933 were appropriately completed by the parents, and were processed by computer. These comprised 1976 (50.2%) boys and 1957 (49.8%) girls.

Of the 34% children reported to have been diagnosed as having an atopic disease, 3.9% had allergic conjunctivitis, 4.8% had food allergy, 6.2% had asthma, 10.2% had eczema and 15% had AR and.

The majority of the already known allergic cases (72.4%) were diagnosed by specialists (allergologist, otorhinolaryngologist, pulmonologist) and nearly a quarter of them were diagnosed by a general practitioner (26.3%). Only 15 patients turned to a natural healer, and they were all found allergic.

The results obtained from this study showed the prevalence for current AR and for physician-diagnosed AR were 14.9% (n = 530) and 11.6% (n = 413). Consequently more than one-quarter of the 6-12-year-old children in Budapest had AR (the prevalence of cumulative AR was 26.5%). The Worldwide ISAAC Phase Three study showed that the prevalence of AR ranged between 2.2% and 45.1%. Our results indicate moderate figures within this interval.

The previous surveys on childhood allergic rhinitis in Budapest have been performed with different study methods, in different ages and within different time courses. Therefore their results can only be compared to ours with reservations.

Table 4

Results of previous epidemiological surveys carried out in Budapest compared to ours

author	year	age-range	prevalence(%)
Zs.Márk et al.	1995-1996	14 -18	21
I.Móra	1998	0 -18	13.6
K.Balogh et al.	2002	5-18	17
Our survey	2007	6-12	26.5

We found that the number of children having allergic rhinitis might have increased in our capital.

We examined the development of the diseases that might lead to AR, the correlation between the effects of the environmental and lifestyle

and the prevalence of AR referring to cumulative AR pupils. We got the following results: Male gender ($p < 0.001$, OR = 0.680, 95%CI = 0.585–0.791) was more positively associated with symptoms of AR as compared with females. A positive family history of atopy ($p < 0.001$, OR = 2.247, 95%CI = 1.883–2.681), frequent upper respiratory tract infections ($p < 0.001$, OR = 2.349, 95%CI = 1.850–2.983) and sinusitis (OR = 2.547, 95%CI = 1.720–3.773) proved to be an increased risk of the development of AR in this child population.

Our results revealed that removal of the tonsils ($p < 0.01$, OR = 1.496, 95%CI = 1.176–1.902) and/or adenoids ($p < 0.001$, OR = 1.625, 95%CI = 1.377–1.919) in the young may increase the risk of the development of AR. Our data indicated that the children who received antibiotics ($p < 0.001$, OR = 1.600, 95%CI = 1.370–1.867) and paracetamol ($p < 0.001$, OR = 1.517, 95%CI = 1.293–1.780) during their first year of life had an increased risk of later AR as compared with children who did not receive antibiotics.

We found a statistically significant relation between living in a weedy green area ($p < 0.001$, OR = 1.035, 95%CI = 0.803–1.333) and the risk of AR. Our study verified that the consumption of having drinks containing preservatives or colourants ($p < 0.04$, OR = 1.175, 95%CI = 1.009–1.368) was a significant risk factor for AR. In our cohort, the incidence of AR symptoms among the children was significantly associated with living in a concrete house ($p < 0.001$, OR = 1.350, 95%CI = 1.141–1.597), living not far from an air-polluting factory ($p < 0.001$, OR = 1.455, 95%CI = 1.175–1.801) and the presence of long-lasting disease before the appearance of AR symptoms ($p < 0.001$, OR = 3.700, 95%CI = 2.641–5.185).

(OR: odds ratio; CI: confidence interval; $p < 0.05$ is considered significant)

5 CONCLUSIONS

I. Rhinosinusitis survey

- Otorhinolaryngological special examination and in most cases admission to hospital is necessary in the serious form of ABRS and in those persisting forms which do not improve following a 7-14-day ATB cure or after a second ATB treatment (17-21 days).
- The diagnosis of ABRS has to be set up in view of the case history and clinical picture. In more serious cases (suspicion of complication) low dose CT scan with coronal section is highly recommended.
- Highmore puncture suggested in the following situations: in serious cases of ABRS; in persistent forms of ABRS which do not respond to conservative treatment; in the complications of ABRS, although it can't be applied as a substitute for FESS, it can help start drainage; in order to obtain a bacteriological sample.
- If a complication of ABRS is suspected, the patient should receive prompt and high dose broad-spectrum beta-lactamase-resistant intravenous (i.v.) antibiotics or an advanced-generation cephalosporin.
- The classification of the ABRS orbital complications is essential, because correctly interpreted and applied classification determines the therapy. I introduced Chandler's stages to classify the orbital complications of rhinosinusitis, which has not been applied to children in Hungary before. I worked out a diagnostic and therapeutic protocol based on the classification and I introduced it into the clinical practice. In my study I indicated the use of the classification in the procession of 157 cases.
- In the complications of ABRS both the axial and the coronal CT scan are crucial in the setup of the diagnosis. Neurological consultation is justified if the patient's neurological state is progressing.

- In every case of orbital complications ophthalmology consultation is indicated.
- During the endoscopic sinus procedure performed due to orbital complications an endoscopic sampling is recommended for bacteriological examination.
- In case of an abscess endoscopic sinus procedures must be completed with orbitotomy unless the abscess is situated medially, in which case it can be approached endonasally.

II. Rhinitis allergica survey

Based on a questionnaire survey of 6-12-year-old schoolchildren living in Budapest I concluded the following:

- I surveyed for the first time the prevalence of cumulative AR in 6-12-year-old schoolchildren, and the assumed AR based on the symptoms in the 12 months preceding the survey.
- In my study I summarized the prevalence of all physician diagnosed atopic diseases in childhood for the first time in Hungary.
- The prevalence of cumulative AR was 26.5% (assumed AR based on the symptoms in the 12 months preceding the survey = current AR + physician-diagnosed AR), this was a quarter of the examined children.
- Compared with the results of the previous surveys on childhood AR in Budapest the number of children having AR might have increased in our capital.
- The prevalence of assumed AR based on the symptoms in the 12 months preceding the survey is 14.9%. According to comprehensive world-wide ISAAC III. Phase study (International Study of Asthma and Allergies in Childhood) our results are in the middle of their interval.
- 34% of the examined schoolchildren had some kind of atopic illness. In our survey the prevalence of these illnesses is distributed in the following way: allergic conjunctivitis 3.9%, food allergy 4.8%, asthma 6.2%, eczema 10.2%, allergic rhinitis 15%.
- Of all the risk factors detected in our study I highlight the ones, that can be avoided, and the elimination of which can reduce the

appearance of AR. It is worth informing doctors, parents and children about it, following risk factors: antibiotics and paracetamol given in the first year of life; living not far from an air-polluting factory or mine; living in a weedy green area; consumption of drinks containing preservatives or colourants and living in a house made of concrete.

- All pediatricians and allergologists should be familiar with the risk factors detected in my study and the other presumed risk factors in order to be able to record a precise case history to help establish a diagnosis and to weigh the prognosis. Male gender; a positive family history of atopy; frequent upper respiratory tract infections; sinusitis and presence of long-lasting disease before the appearance of AR symptoms.
- The Hungarian risk factors differ slightly from those in other European countries, as we have a special building system (concrete apartment buildings) and the air in the Carpathian Basin is the most highly polluted with ragweed pollen in Europe.

NEW RESULTS OF THE THESIS

In our department I introduced Chandler's stages to classify the orbital complications of rhinosinusitis, which has not been applied to children in Hungary before. I worked out diagnostic and therapeutic protocol based on the classification and I introduced it into the clinical practice. In my study I indicated the use of the classification in the procession of 157 cases.

The classification of the ABRS orbital complications is essential, because correctly interpreted and applied classification determines the therapy.

I was the first to survey the prevalence of AR among 6-12-year-olds. I concluded that the cumulative prevalence of AR is 26.5%. This result is the sum of diagnosed AR cases (11.6%) and the assumed AR cases based on the symptoms in the 12 months preceding the survey (14.9%).

In my study I give a summary of the prevalence of all atopic diseases diagnosed by a physician in Hungary for the first time.

It has not yet been detected in connection with children's epidemiological examinations that positive family history of atopy; frequent upper respiratory tract infections; sinusitis; antibiotics and paracetamol given in the first year of life, consumption of drinks containing preservatives or colourants; presence of long-lasting disease before the appearance of AR symptoms proved to be an increased risk of the development of AR.

6 LIST OF PUBLICATIONS RELATED TO THE SUBJECT OF THE THESIS

Papers:

1. Tímár A., Katona G., Farkas Zs., Bognár L., Sultész M. (2003) A Pott-féle homlokduzzanat diagnosztikai jelentősége gyermekkorban. *Fül-orr-gégegyógy.* 49: (4), 196-200.
2. Sultész M., Csákányi Zs., Majoros T., Farkas Zs., Katona G. (2008) Az orrmelléküreg-gyulladások és szövődményeik előfordulása osztályunk tízéves beteganyagában (1997-2006). *Fül-orr-gégegyógy,* 54 (4): 175-181.
3. M. Sultész, Zs. Csákányi, T. Majoros, Zs. Farkas, G. Katona (2009) Acute bacterial rhinosinusitis and its complications in our pediatric otolaryngological department between 1997 and 2006. *Int J Pediatr Otorhinolaryngol,* 73: 1507–1512.
4. M. Sultész, G. Katona, A. Hirschberg, G. Gálffy (2010) Prevalence and risk factors for allergic rhinitis in primary school children in Budapest. *Int J Pediatr Otorhinolaryngol,* 74: 503-509.
5. M. Sultész, G. Katona, A. Hirschberg, G. Gálffy (2010) Reply to the Comment by Robert Siebers on "Prevalence and risk factors for allergic rhinitis in primary school children in Budapest" by Monika Sultész et al. [*Int. J. Pediatr. Otorhinolaryngol.* 74 (2010) 503-509]. *Int J Pediatr Otorhinolaryngol* 74: 1341

Presentations:

1. Magyar Fül-, Orr-, Gégeorvosok Egyesülete Gyermek-Fül-Orr-Gégészeti Szekciójának XVII. Kongresszusa, Siófok, 2007. március 29-31. Sultész Monika, Csákányi Zsuzsanna, Majoros Tatjana, Farkas Zsolt, Katona Gábor: A heveny orrmelléküreggyulladások és szövődményeik előfordulása osztályunk tízéves beteganyagában (1997-2006)
2. Magyar Fül-, Orr-, Gége és Fej-, Nyaksebész Orvosok Egyesülete 40. Jubileumi Kongresszusa, nemzetközi részvétellel, Siófok, 2008. október 15-18. Sultész Monika-Katona Gábor: Az akut sinusitisek szövődményei gyermekkorban – 20 perces referátum
3. Magyar Fül-, Orr-, Gége és Fej-, Nyaksebész Orvosok Egyesülete Gyermek Fül-Orr-Gége Szekciójának XVIII. Vándorgyűlése, Balatonalmádi, 2009. március 26-28. Sultész Monika, Bojszko Ágnes, Stéger Gabriella, Katona Gábor, Gálffy Gabriella: Az allergiás nátha előfordulási gyakorisága és rizikó tényezői 6-12 éves budapesti általános iskolások körében
4. A Magyar Allergológiai és Klinikai Immunológiai Társaság XXXVII. Kongresszusa, Balatonalmádi, 2009. május 14-16. Sultész Monika, Bojszko Ágnes, Stéger Gabriella, Katona Gábor, Gálffy Gabriella: Az allergiás nátha prevalenciája és rizikó tényezői 6-12 éves budapesti általános iskolások körében
5. 10th International Congress of the European Society of Paediatric Otorhinolaryngology, Pamplona, Spain, 5-8 June 2010. Monika Sultész, Gábor Katona, Andor Hirschberg, Gabriella Gálffy: Prevalence and risk factors for allergic rhinitis in primary schoolchildren in Budapest
6. Magyar Fül-, Orr-, Gége és Fej-, Nyaksebész Orvosok Egyesülete 41. Kongresszusa, nemzetközi részvétellel, Budapest, 2010. október 13-16. Sultész Monika, Katona Gábor, Hirschberg Andor, Gálffy Gabriella: Az allergiás nátha előfordulási gyakorisága és rizikó tényezői 6-12 éves budapesti általános iskolások körében.