

# A retrospective analysis of adenoidal size in children with allergic rhinitis and nonallergic idiopathic rhinitis

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## Summary

**Background:** Increased incidence of adenoidal tissue enlargement in children with allergic rhinitis (AR) when compared to non-atopic children had been reported. However, data with respect to the comparison of adenoidal size in children with AR and non-allergic idiopathic rhinitis (IR) is still lacking in the literature.

**Objective:** We aimed to compare the size of the adenoid in children with AR and with non-allergic IR.

**Methods:** Adenoid/nasopharynx ratios (ANR) of all children were calculated in both AR and IR patients and the mean ratios were compared.

**Results:** There were 52 patients in the AR group and 56 patients in the nonallergic IR group. Demographic data were similar within the two groups. The mean ANR was  $0.59 \pm 0.08$  in AR group, whereas it was  $0.77 \pm 0.12$  in nonallergic IR group. The ANR was very significantly high in the nonallergic IR patients ( $p = 0.0001$ ).

**Conclusion:** Our results suggest that there could be a cellular immune deficiency in allergic children which effects the enlargement of the pharyngeal tonsils. This might be explained with the hypothesis that allergic

patients have a deficiency in T-helper 1 cell activity and interferon-gamma production. Larger studies which compare the cytokine profiles of children with AR and with nonallergic IR, will clarify the role of recurrent respiratory infection which is a real problem in clinical practice with allergy. (*Asian Pac J Allergy Immunol* 2010;28:136-40)

**Key words:** allergic, nonallergic, idiopathic, rhinitis, radiograph, adenoidal size, adenoid/nasopharynx ratio, children.

## Introduction

Rhinitis is defined as an inflammation of the lining of the nose and is characterized by nasal symptoms including rhinorrhea, post nasal drip, nasal blockage, sneezing and/or itching of the nose. The symptoms occur for two or more consecutive days and for more than one hour on most days<sup>1</sup>. Allergic rhinitis (AR) is the most common form of non-infectious rhinitis. It is an IgE mediated condition and it is most often associated with allergy to common aero-allergens. It is diagnosed by demonstrating the presence of specific IgE to an aeroallergen which is clinically associated with the above clinical symptoms<sup>2</sup>. There is a group of patients having the above listed rhinitis symptoms without evidence of allergy. This condition is termed as “idiopathic rhinitis” (IR). Nasal inflammation is present in both AR and nonallergic IR; which leads to recurrent or chronic rhino-sinusitis<sup>2</sup>.

Hypertrophy of the tonsils is detected in 1/3 of the pediatric population and is the most frequent otorhinolaryngological indication for surgical intervention<sup>3,4</sup>. Pathological enlargement of the adenoids is assumed to be a result of antigenic stimulation associated with chronic inflammation, which is known to be predominantly T-helper 1 mediated. Inflammatory changes within the nasal and sinus mucosa may be expected to affect the adenoids, which are the most closely situated

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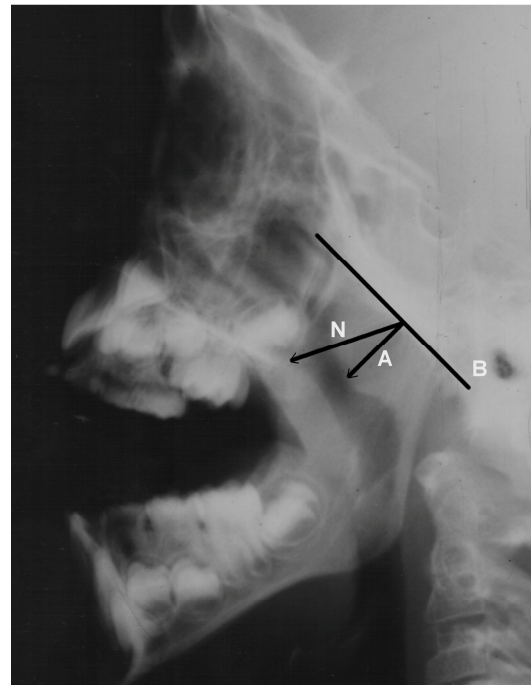
cluster of organized lymphatic tissue. There are studies showing an increased incidence of pathologic adenoid tissue enlargement in children with allergic rhinitis when compared to normal nonatopic children<sup>5,7-9</sup>. However, data with respect to the comparison of adenoidal size in children with AR and nonallergic IR is still lacking in the literature.

We aimed to compare the size of the adenoidal tissue, as an indication of TH1 cell activity, in children with allergic rhinitis and with nonallergic idiopathic rhinitis, retrospectively.

## Methods

The routine procedure in our out-patient clinic for children with complaints of nasal blockage, rhinorrhea, nasal sneezing and/or itching in the nose for two or more consecutive days, for more than one hour on most days of the last three months; which is defined as chronic rhinitis, is to investigate them with respect to allergy and other possible etiologies. Allergy prick skin test with the most common aero-allergens is performed to these patients. Skin prick test solutions by Stallergenes (Paris - France) and skin prick test multi-test applicators by Hollister-Stier (Washington - USA) are used during the procedure. Reactions with indurations more than 3 mm in diameter are accepted as positive. A possible drug associated rhinitis, food-induced rhinitis and rhinitis related to physical and chemical factors are excluded by the parental interview. The possibility of humoral immunodeficiency is excluded by the measurement of immunoglobulin (Ig) IgM and IgA. Nonallergic children with no known etiology (no history of drug-induced, food-induced or physical/chemical factor related rhinitis and no humoral immune deficiency) are classified as IR. Lateral radiographs of the nasopharynx showing the adenoid / nasopharynx ratio are found to be significantly correlated with nasal endoscopic examination findings in children in which adenoid hypertrophy is suspected<sup>10</sup>. Thus, lateral radiographs of the nasopharynx are routinely performed to these children in order to detect a possible pathological adenoidal enlargement.

The medical records of children treated in our out-patient clinic for chronic rhinitis within the last two years were evaluated retrospectively. The inclusion criteria were 1) having a diagnosis of chronic rhinitis 2) having an upper lateral



**Figure 1.** Lateral nasopharynx radiograph: The adenoidal measurement A represents the distance from the point of maximum convexity of the adenoid shadow to a line (B) drawn along the straight part of the anterior margin of the basicocciptum. The nasopharyngeal space N is measured between the posterior-superior edge of the sphenobasioccipital synchondrosis.

nasopharynx radiograph. The exclusion criteria were 1) having an upper respiratory tract infection at the time of the radiographic examination 2) having a treatment with nasal steroid at the time of the radiographic examination. Children who were included in the study were divided into two groups according to their allergy skin prick test results as “AR Group” and “Nonallergic IR Group”. The two groups were compared with respect to their adenoidal size.

In order to evaluate the adenoidal size objectively, the adenoid/nasopharynx (A/N) ratio that has been defined by Fujioka et al.<sup>6</sup> was measured on the lateral radiographs of the nasopharynx by a blinded radiologist. (Figure 1.)

The adenoidal measurement A represents the distance from the point of maximum convexity of the adenoid shadow to a line (B) drawn along the straight part of the anterior margin of the basicocciptum. The nasopharyngeal space N is measured between the posterior-superior edges of the sphenobasioccipital synchondrosis. (Figure 1.) The A/N ratio is calculated by dividing the measurement for A by the value for N.

**Table 1.** Comparison of demographic data and mean adenoid/nasopharynx ratios in AR and IR groups

	AR Group	IR Group	<i>p</i>
Age (years)	5.83 ± 1.50	5.49 ± 1.43	0.2341
Gender (girls/boys)	28/24	29/27	0.8494
Adenoid/nasopharynx ratio	0.59 ± 0.08	0.77 ± 0.12	0.0001

AR: Allergic rhinitis, IR: nonallergic idiopathic rhinitis.

Statistical analysis was carried out by using InStat 3.05 (Graphpad Software, Inc.). The statistical analysis with respect to age of the children was made by using Student's t-test, the comparison with respect to gender is made by using chi-square test and the comparison with respect to the A/N ratio is also made by using a t-test. The t-test assumes that the data are sampled from populations that follow Gaussian distributions. This assumption is tested using the method Kolmogorov and Smirnov.

## Results

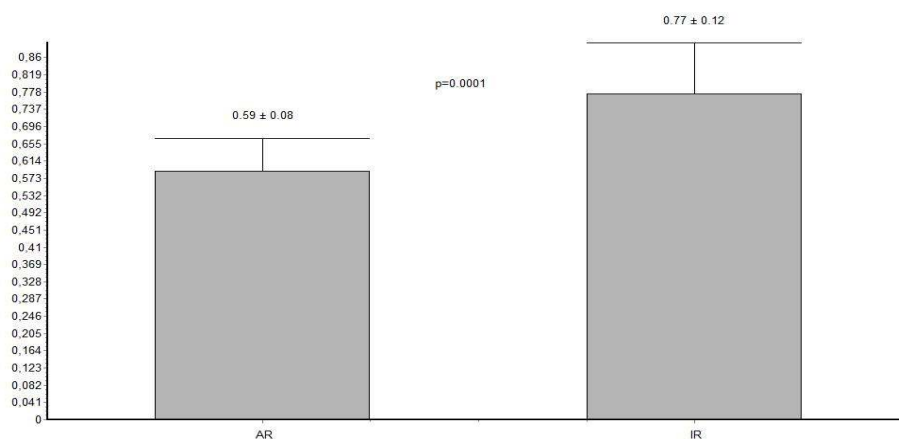
There were 52 patients in the AR group and 56 patients in the nonallergic IR group. The mean age in children with AR group is  $5.83 \pm 1.50$  years (Range: 3.00-8.83 years). The mean age in children with nonallergic IR group is  $5.49 \pm 1.43$  (Range: 3.00-7.92). There was no statistically significant difference with respect to age between the two groups ( $p = 0.2341$ ). There were 28 girls/24 boys in the AR group and 29 girls/ 27 boys in the IR group. There was no statistically significant difference with respect to gender between the two groups ( $p = 0.8494$ ) (Table 1).

The mean adenoid/nasopharynx ratio was  $0.59 \pm 0.08$  in the AR patients, whereas it was  $0.77 \pm 0.12$  in the nonallergic IR patients. The adenoid/nasopharynx ratio was very significantly high in the nonallergic IR patients ( $p= 0.0001$ ). (Figure 2.)

## Discussion

This study showed that adenoidal enlargement is more prominent in children with nonallergic idiopathic rhinitis than in children with allergic rhinitis.

Lymphoid tissue connected with mucosa, forming Waldeyer's ring in the nasopharynx, constitutes the first barrier and area of contact for antigens entering the body<sup>11-12</sup>. The lymphatic structure closest to the nasal mucosa is the nasopharyngeal tonsil (adenoids). The increased function required of the lymphatic tissue in filtering out infectious agents in the upper respiratory tract can lead to an increase in lymphoid and epithelial cell size, which results with adenoidal hypertrophy<sup>13</sup>.



**Figure 2.** Comparison of mean adenoid/nasopharynx ratios in AR and IR groups. AR: Allergic rhinitis, IR: nonallergic idiopathic rhinitis.

T cells in adenoid surface secretions possess the property of cytokine production and are mainly down regulatory or of T-helper 1 (TH1) type. Recently, Ivarsson et al. investigated the ability of these T cells to produce cytokines and their cytokine profile<sup>14</sup>. Children subjected to adenoidectomy were enrolled. Samples of adenoid surface secretion (AdSS), adenoid tissue and peripheral blood were obtained, as well as a nasopharyngeal culture. T cells obtained from AdSS, adenoid tissue and peripheral blood were then cultured and stimulated with anti-CD3 and – CD28 for 5 days. The production of interferon-gamma, tumor necrosis factor-alpha and interleukin 2, 4, 5 and 10 was analyzed using flow cytometry. As a result, they showed that all children had T cells in AdSS capable of cytokine production. T cells in AdSS, adenoid tissue and peripheral blood samples from all children produced interferon-gamma. Of the cytokines analyzed, interferon-gamma was in the highest concentrations.

The capacity to produce interferon-gamma is lower in fetal T cells than in adults; in order to protect the placenta and to prevent miscarriage<sup>15</sup>. Therefore the fetus is born with a T-helper 2 type cell predominance. In some individuals, postnatal mechanisms that limit the capacity for inducing TH1 responses may persist<sup>16</sup>. Individuals that are genetically at risk for allergies present with this condition more frequently. This suggests that there is an intrinsic defect in the T cells of atopic individuals that precedes exposure to allergens and development of clinical allergies<sup>17</sup>.

In 1997 Shirakawa et al. were first to report an inverse relationship between tuberculin sensitivity and atopic state. They had suggested that a reduction of tuberculosis could be one of the factors responsible for an increasing prevalence of atopic illnesses in recent decades<sup>18</sup>. Nevertheless, other studies revealed no correlation between tuberculin response and allergic sensitization among individuals immunized with Bacille Calmette-Guerin (BCG)<sup>19-21</sup>. It is possible that Shirakawa's results may only be a consequence, not a cause. More recently, Oliveira et al. demonstrated for the first time that blood cells from asthmatic patients with small BCG scars, including those that were nonatopic, exhibited decreased INF-gamma production after PPD stimulation<sup>22</sup>. This study suggested that asthmatic individuals exhibit a deficiency in the production

of INF-gamma, which is an indication of TH1 cell activity, probably as an intrinsic characteristic.

It is not unusual in an allergy practice to see a child with persistent rhinitis symptoms and negative skin prick tests. Pure nonallergic rhinitis is a common condition affecting approximately 20% of all patients with rhinitis<sup>23</sup> and it is more prevalent in individuals over 20 years of age. Thus, little data is present in medical literature assessing nonallergic rhinitis in children. Nonallergic rhinitis has been defined as an inflammation of the mucosal surface of the nose, not associated with IgE-mediated mechanism, generally characterized by nasal congestion, post nasal drip and rhinorrhea. Less frequently, pruritus and sneezing are also present. In this disorder, symptoms tend to be perennial<sup>24</sup>.

Both in allergic and nonallergic rhinitis, the underlying inflammation tend the child to have more upper respiratory tract infections (URTI), such as rhinosinusitis. The recurrent URTI's normally result in an increased function of local lymphatic tissue, which are the adenoids.

There are studies comparing the adenoidal size in children with allergic rhinitis with normal nonatopic controls<sup>5,7,25</sup>. Among these, in one that had been conducted by Modrzynski and Zawisza<sup>25</sup>, adenoidal size had been measured both endoscopically and by acoustic rhinometry. The results revealed that the adenoids were enlarged on endoscopy in 71.4% of children with allergic rhinitis during the pollen season. In the acoustic rhinometry measurements of almost 90 % of children adenoid size was found enlarged. Almost no changes were reported in the control group. The same investigators had conducted another study on the incidence of adenoid hypertrophy in allergic children<sup>5</sup>. In this study 436 children with allergic rhinitis were compared with 229 non-atopic controls. They had found that adenoid hypertrophy was statistically more likely only in children with allergic rhinitis. There were no statistically significant differences in adenoid hypertrophy incidence between children with other allergic diseases and the control group. The authors had reported that children with AR and adenoid hypertrophy had an increased rate of respiratory infections when compared with the ones having adenoid hypertrophy but no allergy.

Data available in the current literature is lacking with respect to the adenoidal size in children with nonallergic IR and its comparison

either with AR patients or with non-atopic controls. Our study tries to give an answer to the question “Is adenoid hypertrophy more prominent in nonallergic idiopathic rhinitis patients than in allergic rhinitis patients, although both constitutes a tendency toward more frequent URTI’s.”

In conclusion; our results show that the adenoids of nonallergic rhinitis patients have been enlarged more as a result of antigenic stimulation. This finding suggests that it could have been a result of the TH1 cell activity deficiency that has been defined in allergic individuals previously<sup>17,22</sup>. Future research, which compares the cytokine profiles of the adenoids in AR and in nonallergic IR, would help to identify the mechanisms that underlie the process which causes adenoid hypertrophy.

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