

# Improvement in allergic and nonallergic rhinitis: A secondary benefit of adenoidectomy in children

Meir Warman, MD; Esther Granot, MD; Doron Halperin, MD, MHA

## Abstract

*Chronic rhinitis (CR) is a common disorder in children. Allergic rhinitis (AR) is a risk factor for CR, and children with AR tend to suffer more from hypertrophic adenoids than do patients with nonallergic rhinitis (NAR). Few studies have addressed the issue of alleviating symptoms of pediatric CR or AR following adenoidectomy alone. We conducted a retrospective chart review to determine whether CR in children improves after adenoidectomy and whether children with AR will benefit more than those with NAR. Charts of 47 children who had undergone adenoidectomy for nasal obstruction and chronic middle ear effusion were reviewed. AR and NAR subgroups were classified based on symptoms, signs, blood IgE, and nasal smear (allergic criteria). Hypertrophic adenoids were graded using the adenoid-to-nasopharyngeal ratio (ANr >0.8). A questionnaire was used to assess the change in chronic rhinitis postoperatively. Improvement in CR was reported in 37 of 47 (79%) children. Patients with AR improved to a higher extent than those with NAR (12 of 14 [86%] vs. 25 of 33 [76%], respectively), but the difference was not statistically significant. A total of 41 lateral postoperative nasopharyngeal x-rays were obtained. The x-rays revealed that 20 of 26 (77%) of patients with ANr >0.8 had complete and 4 of 26 (15%) had partial resolution of symptoms of CR for a total resolution rate of 92%, compared to only a 53% resolution in the ANr <0.8 subgroup (6 of 15 and 2 of 15 patients, respectively [ $p < 0.05$ ]). The correlation between adenoid size and resolution of CR was not related to any of the AR/NAR*

*subgroups. We conclude that symptoms of CR may improve after adenoidectomy in children who are experiencing nasal obstruction and chronic otitis media with effusion. Clinical improvement did not differ between AR and NAR patients, and was more prominent in children with hypertrophic adenoids (ANr >0.8).*

## Introduction

Adenoidectomy is useful in relieving nasal obstruction in patients with hypertrophic, obstructing adenoids. In patients with small, chronically infected adenoids, adenoidectomy may be beneficial in otitis media with effusion by decreasing the efflux via the eustachian tube. Although adenoidectomy is one of the most common procedures performed in young children, it is not an absolute indication for pediatric chronic rhinitis, either allergic or nonallergic.

Although chronic rhinitis (CR) is common in children, it is associated with some controversy. For example, some object to referring to this symptom as pathologic, stating that a child might have as many as 10 upper respiratory tract infections a year, each lasting up to 10 days, and that this might reflect a normal development of the child's secondary lymphoid organs of the immune system.<sup>1</sup> On the other hand, the existence of bacterial pathogens in the nasopharyngeal tissue in children suffering from CR, and more so in children with hypertrophic adenoids, has driven clinicians to maximize treatment in those children, either medically or surgically.<sup>2,3</sup>

Recent studies have supported adenoidectomy as an effective treatment for pediatric CR and chronic rhinosinusitis (CRS) in uncomplicated cases that are refractory to medical treatment.<sup>2,4,5</sup> In this study, we chose children scheduled for adenoidectomy because of nasal obstruction or chronic otitis media with effusion (COME) and questioned whether their CR symptoms would resolve following surgery.

From the Department of Otolaryngology, Head and Neck Surgery (Dr. Warman and Dr. Halperin) and the Department of Pediatrics (Dr. Granot), Kaplan Medical Center, Rehovot, Israel; and Hebrew University Hadassah Medical School, Jerusalem (Dr. Warman, Dr. Granot, and Dr. Halperin).

Corresponding author: Warman Meir, MD, Department of Otolaryngology Head and Neck Surgery, Kaplan Medical Center, POB 1, Rehovot 76100, Israel. Email: warman\_m@yahoo.com

Some studies show that children with allergic rhinitis (AR) tend to develop hypertrophic adenoids more often than do patients with nonallergic rhinitis (NAR). Moreover, the presence of obstructing adenoids, more so than nonobstructing adenoids, has a well-reported association with CR.<sup>1</sup> However only a few studies address the improvement of rhinitis symptoms in patients with AR following adenoidectomy alone.<sup>4,6</sup>

The aim of our study was to determine whether CR symptoms improved after surgery in patients with AR and NAR who underwent adenoidectomy for nasal obstruction and COME.

### Patients and methods

This is a retrospective case study. We reviewed the case files of children who underwent adenoidectomy at Kaplan Medical Center between March 2007 and March 2008.

**Inclusion and exclusion criteria.** Patients who underwent adenoidectomy for nasal obstruction or adenoidectomy with ventilation tubes for COME during the study period were included. CR was defined as having symptoms and signs related to rhinitis lasting more than 12 weeks.<sup>7</sup>

The following patients were excluded from the study: post-tonsillectomy patients, patients with cleft palate or other craniofacial abnormalities, patients who were treated with immunomodulation before and after surgery (4 weeks before surgery with steroids, and 10 days before surgery with antihistamines), and those undergoing revision adenoidectomy.

**Adenoid hypertrophy grading.** Lateral nasopharyngeal x-rays that assessed adenoid hypertrophy were collected. Adenoid-to-nasopharyngeal ratio (ANr) value  $>0.8$  was used as an indication for hypertrophic adenoids, as was shown before<sup>8,9</sup> and depicted in the figure. The adenoid diameter (line A) is measured by a perpendicular line from point A' to the intersection with the straight line of the basiocciput (line B), which can be identified in a lateral nasopharynx x-ray. The most anteroinferior bulging (A') represents the adenoid hypertrophy, although to some extent it includes the nasopharyngeal soft tissue (figure, A). The nasopharynx diameter (line N) is measured from the sphenobasioccipital synchondrosis (D') to the posterosuperior part of the hard palate (C') and in practice represents the anteroposterior diameter of the nasopharyngeal space (figure, B).

**Allergy workup.** A patient was considered allergic if 2 of 4 of the following criteria were present:

- history of allergic symptoms (asthma, dermatitis, conjunctivitis);<sup>7</sup>

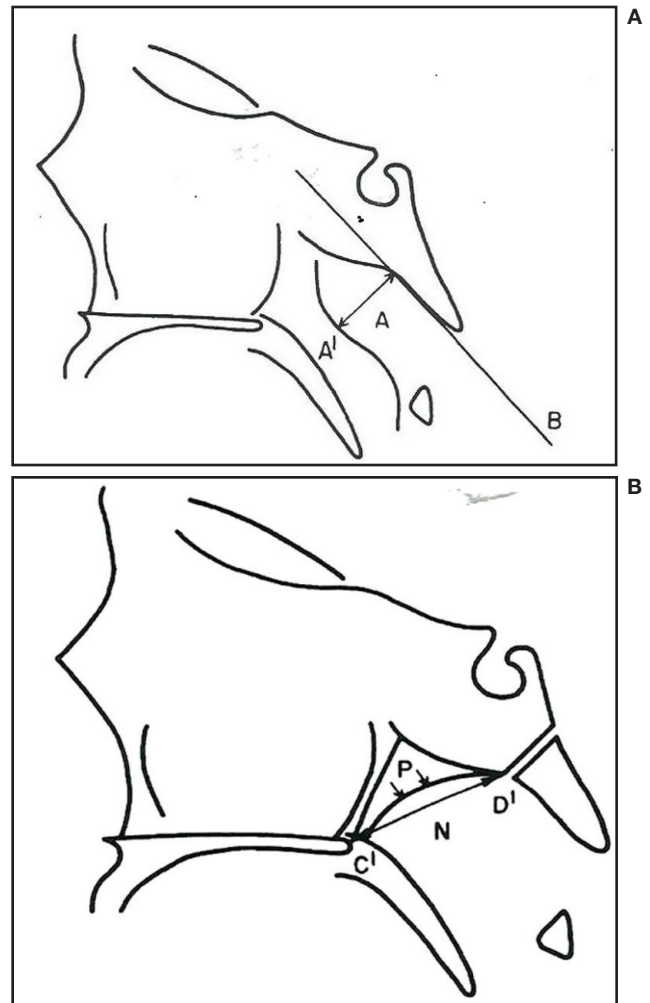


Figure. A: The adenoid diameter (line A) is measured by a perpendicular line from point A' to the intersection with the straight line of the basiocciput (line B), which can be identified in a lateral nasopharynx x-ray. The most anteroinferior bulging (A') represents the adenoid hypertrophy. B: The nasopharynx diameter (line N) is measured from the sphenobasioccipital synchondrosis (D') to the posterosuperior part of the hard palate (C') and represents the anteroposterior diameter of the nasopharyngeal space. Reprinted with permission from Fujioka M, Young LW, Girdany BR. *AJR Am J Roentgenol* 1979;133(3):401-4.

- atopic signs ("allergic salute," watery rhinorrhea, "allergic" nasal mucosa (i.e., pale nasal mucosa));<sup>7</sup>
- increased total blood IgE, increased total eosinophil count;<sup>10</sup> and
- eosinophils in nasal smear;  $>10$  eosinophils per HPF (high-power field) was considered positive. This is correlated with a high IgE level in the blood, and with the diagnosis of allergic rhinitis.<sup>11,12</sup>

The patients were classified into either an AR or NAR group based on this workup.

**Adenoidectomy.** Adenoids were resected via curettage, as is the standard practice in our department.

**Questionnaire.** We used a questionnaire to evaluate the subjective impression of the patients' caregivers concerning the degree and characteristics of the CR (complete, partial, or no resolution and suppurative or watery rhinitis), with an emphasis on comparing symptoms before and after surgery. The patients were followed for 1, 3, and 12 months after surgery.

**Statistical analysis.** Statistical analysis was performed using the Statistical Package for Social Sciences, version 12.0 for Windows (SPSS, Inc.; Chicago). Average mean and standard deviation were used for comparison of data and parametric tests (independent *t* tests) and nonparametric tests (chi-square test) when applicable. *P* values <0.05 with a confidence interval of 95% were considered statistically significant.

## Results

Table 1 presents the patients' clinical characteristics in the AR and NAR subgroups. The subgroups were not statistically different with regard to sex, age, indication for surgery, adenoid hypertrophy, and time of follow-up. Resolution of patients' CR after adenoidectomy is demonstrated in table 2. Rhinitis improved in 37 of 47 (79%) children with CR who underwent adenoidectomy. In one-third of the children, the rhinitis changed from "suppurative" to a watery secretion, whereas in 60% it

did not change at all. The question was not answered for the remaining 7%.

Patients with AR improved to a higher extent than those with NAR (12 of 14 [86%] vs. 25 of 33 [76%], respectively), but the difference was not statistically significant. Based on 41 available lateral nasopharyngeal x-rays, complete resolution of CR symptoms was reported for 20 of 26 (77%) patients and partial resolution in 4 of 26 (15%) patients with adenoid hypertrophy (ANr >0.8), for an overall rate of improvement of 92%. This improvement was significantly better than the improvement observed in the nonadenoid hypertrophy subgroup (*p* <0.05), in which 6 of 15 (40%) patients reported complete resolution and 2 of 15 (13%) patients reported partial resolution of symptoms, for an overall rate of improvement of 53%. The correlation between adenoid size and resolution of CR was not related to any of the AR/NAR subgroups. No correlation was found between the specific indication for surgery and the improvement in CR.

## Discussion

The definitions of CR and CRS in children are controversial. The consensus states that CRS is "a sinus infection with low-grade symptoms and signs persisting longer than 12 weeks."<sup>7</sup> The diagnosis of CR or CRS in children is based on clinical grounds. Imaging studies to confirm the diagnosis or evaluate the extent of the disease are

unnecessary unless complications are suspected, symptoms and signs are intractable to adequate antibiotic therapy, or in the presence of toxic, progressive disease.<sup>13</sup>

AR is known to be a major risk factor for CR and CRS in children, and it is difficult to distinguish between AR and CR or between AR and CRS based on clinical manifestations alone.<sup>1,7,14</sup> Moreover, the statement that children with AR have a higher tendency than children with NAR to suffer from obstructive adenoids has been based on the assumption that inhaled allergens—such as molds, house dust mites, or even food allergens—are transported to immunocompetent nasopharyngeal cells and thus may promote adenoid hypertrophy.<sup>1,4,15</sup> Although the gold standard test for detection of hypersensitivity to allergens

**Table 1. Patient characteristics (N = 47)**

|                                   | AR (n = 14) | NAR (n = 33) | <i>p</i> Value |
|-----------------------------------|-------------|--------------|----------------|
| <b>Sex*</b>                       |             |              |                |
| Male, n (%)                       | 10 (71)     | 18 (55)      | NS             |
| Female, n (%)                     | 4 (29)      | 15 (45)      |                |
| <b>Age (years)†</b>               | 4.8 ± 2.9   | 4.99 ± 2.8   | NS             |
| <b>Indication*</b>                |             |              |                |
| OSA/snoring, n (%)                | 9 (64)      | 18 (55)      | NS             |
| COME, n (%)                       | 5 (36)      | 15 (45)      |                |
| <b>Adenoid hypertrophy</b>        |             |              |                |
| ANr >0.8                          | 12 (86)     | 14 (42)      | NS             |
| ANr <0.8                          | 2 (14)      | 13 (39)      |                |
| <b>Postop follow-up (months)†</b> | 6.43 ± 3.0  | 4.55 ± 2.7   | NS             |

\*Based on chi-square approximation.

†Analysis using independent-samples *t* test.

Key: AR = allergic rhinitis; NAR = nonallergic rhinitis; NS = not significant; OSA = obstructive sleep apnea; COME = chronic otitis media with effusion; ANr = adenoid/nasopharyngeal ratio.

**Table 2. Resolution of chronic rhinitis symptoms after adenoidectomy**

|                 | All patients<br>(N = 47) | Subgroups   |              | ANr >0.8<br>(n = 26) | ANr <0.8<br>(n = 15) |
|-----------------|--------------------------|-------------|--------------|----------------------|----------------------|
|                 |                          | AR (n = 14) | NAR (n = 33) |                      |                      |
| Complete, n (%) | 24 (51)                  | 7 (50)      | 17 (52)      | 20 (77)*             | 6 (40)               |
| Partial, n (%)  | 13 (28)                  | 5 (36)      | 8 (24)       | 4 (15)*              | 2 (13)               |
| None, n (%)     | 10 (21)                  | 2 (14)      | 8(24)        | 2 (8)                | 7 (47)               |

\*p &lt;0.05.

Key: AR = allergic rhinitis; NAR = nonallergic rhinitis; ANr = adenoid/nasopharyngeal ratio.

is the skin prick test, nasal smear eosinophilia has been shown to be of high sensitivity in the diagnosis of AR.<sup>11,12</sup>

Recent publications justify adenoidectomy in children with CR or CRS either in enlarged adenoids, which can cause stasis of secretions and obstruction of sinus ostia, or in smaller adenoids, which may act as a reservoir for pathogenic bacteria and interfere with mucociliary clearance.<sup>2,16</sup>

Objective estimation of improvement in CR is also

controversial. In adults, the visual analogue scale (VAS) stands as the chosen scoring system for the severity of CRS, but this system cannot be used in children. Therefore, some studies use the number of physician visits for a new episode as a measure of severity while others use the parents' impression as a mean of rhinitis evaluation, as was done in our study.<sup>3,16,17,18</sup>

Methods for assessing adenoid hypertrophy differ in the various published studies. We used the ANr (figure).

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**Table 3. Comparison with previous studies assessing pediatric allergic rhinitis and chronic rhinitis improvement after adenoidectomy**

| Author/yr                                    | Study design                                                           | No. pts | Mean age (years) |
|----------------------------------------------|------------------------------------------------------------------------|---------|------------------|
| Sanderson and Warner, <sup>6</sup> 1987      | Retrospective                                                          | 104     | 9.9              |
| Saito et al, <sup>15</sup> 1996              | Retrospective analysis of postop changes in asthmatic patients         | 25      | 7.0              |
| Don et al, <sup>3</sup> 2001                 | Retrospective analysis of pediatric patients w/ chronic rhinosinusitis | 70      | 6.4              |
| Ungkanont and Damrong-sak, <sup>4</sup> 2004 | Prospective study of pediatric rhinosinusitis                          | 37      | 6.0              |
| Warman et al, <sup>‡</sup> 2015              | Retrospective study of postop AR vs. NAR patients                      | 47      | 4.9              |

\* Based on caregivers' report.

† Based on reduction of rhinosinusitis infection symptoms per year.

‡ Present study.

Key: AR = allergic rhinitis; NAR = nonallergic rhinitis

Despite the problematic evaluation of the nasopharynx space in two dimensions only, this method is accepted as a relatively accurate and objective estimation of adenoid hypertrophy.<sup>8,9</sup>

Favored treatment options for CR and CRS vary greatly among pediatricians, allergists, and rhinologists. The conservative approach recommends follow-up only for watery or suppurative rhinitis, especially if it is of short duration and uncomplicated.<sup>1</sup> Others claim that a chronic runny nose in a child with adenoid hypertrophy most probably involves the sinuses, as well; therefore, they are in favor of systemic antibiotic therapy to eradicate the common pathogens of CRS.<sup>3,19</sup> The surgical approach suggests adenoidectomy and/or endoscopic sinus surgery (ESS) as the preferred definitive treatment for CR/CRS.<sup>16</sup>

The main manifestations in our patients were either nasal obstruction from clinical hypertrophic adenoids or COME, diagnosed clinically as hearing loss, based on audiometry. Our study group was unique in that the patients were not treated with an intravenous antibiotic protocol and, therefore, received no medical treatment for rhinitis. In this respect, improvement in their CR symptoms may represent a secondary benefit of the surgical procedure they had undergone.

Support for the conservative approach states that as a child grows, mainly after the age of 8 to 9 years, there is a self-resolution of rhinitis. This is approximately the same age at which decreased involvement of adenoid tissue in inflammation and infectious processes of the upper respiratory tract is seen.<sup>1</sup> Thus, measuring the benefit of surgical treatment for CR in older children in noncontrolled studies is problematic because of selection bias.<sup>16</sup> In younger children, like those who participated in our study (table 3), this bias influences the results to a lesser extent. Studies examining the best treatment for the young age group are scarce.

For some children with chronic suppurative rhinitis, medical treatment is not sufficient and surgical therapy is needed. Although the common surgical procedure for CRS in children is adenoidectomy, recent reports regarding ESS have raised some doubts considering this previously common and efficient therapy.<sup>16</sup> However, ESS has risks and complications that cause greater morbidity than adenoidectomy.

As shown in table 3, we compared our study group to those of previously published studies addressing adenoidectomy as part of the treatment of CR or CRS in children. Our study included children younger than

| Treatment                                                               | Results                                                                                 |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Tonsillectomy, adenoidectomy, sinus washout, ventilation tubes inserted | 40% had improvement in perennial AR after surgery; 90% improved after medical treatment |
| Adenoidectomy, tonsillectomy                                            | 18% improvement in nasal symptoms*                                                      |
| IV cefuroxime, selective adenoidectomy (part of a stepwise protocol)    | 89% complete resolution of rhinosinusitis symptoms                                      |
| Adenoidectomy                                                           | Reduction of rhinosinusitis symptoms after surgery†                                     |
| Adenoidectomy                                                           | 79% complete and partial resolution of symptoms*                                        |

those included in previous studies, thus diminishing the above-mentioned selection bias. Moreover, only two publications<sup>6,15</sup> questioned whether adenoidectomy would influence the AR obstructed subgroup more than the NAR subgroup.

In the paper by Sanderson and Warner,<sup>6</sup> the patient population lacked uniformity, and the surgical methods included a variety of operations, such as adenoidectomy, tonsillectomy, tube insertion, and sinus lavage. Furthermore, the medical treatment was not standardized for all cases reviewed.

Saito et al included mainly patients with bronchial asthma who had undergone tonsillectomy in addition to adenoidectomy as the chosen procedure for AR.<sup>15</sup> In the current study, we described an improvement in CR in the majority of the children after adenoidectomy alone. Although the rate of improvement in our allergic subgroup was slightly higher than that observed in our nonallergic subgroup, differences did not reach statistical significance.

A study including a larger number of patients may be needed to determine whether patients with AR stand to benefit more from adenoidectomy than those with NAR.

We conclude that adenoidectomy alone improves symptoms of CR in a significant number of children with nasal obstruction or with COME. Rhinitis improves to a higher degree in children with hypertrophic adenoids (ANR >0.8); the rate of improvement does not differ significantly between AR and NAR patients.

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