Adenoidectomy vs Endoscopic Sinus Surgery for the Treatment of Pediatric Sinusitis

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**Objective:** To compare endoscopic sinus surgery with adenoidectomy for the treatment of refractory chronic sinusitis in children.

**Study Design:** Prospective nonrandomized study in a pediatric otolaryngology service of a university teaching hospital.

**Patients and Methods:** Sixty-six children consecutively referred to the pediatric otolaryngology service between 1994 and 1997 with computed tomographic documentation of sinusitis subsequently underwent endoscopic sinus surgery or adenoidectomy. Their ages ranged from 2 to 14 years. Sixty-one children received follow-up. Two main outcomes were documented: (1) symptom status at least 6 months after the intervention and (2) requirement of the alternate procedure or a revision procedure.

**Results:** Twenty-four (77%) of 31 children who underwent endoscopic sinus surgery had improved symptoms, compared with 14 (47%) of 30 children who underwent adenoidectomy (odds ratio [OR], 3.9; \( P = .01 \)). Multivariable analysis demonstrated that endoscopic sinus surgery was significantly better than adenoidectomy after age, sex, allergy, asthma, day care attendance, and computed tomographic stage were adjusted for (OR, 5.2; \( P = .03 \)). The diagnosis of asthma also appeared to be an independent predictor of success (OR, 4.37; \( P = .03 \)).

**Conclusion:** Endoscopic sinus surgery is better than adenoidectomy for the treatment of refractory chronic sinusitis in a select group of children.


The success of endoscopic sinus surgery (ESS) for the treatment of chronic sinusitis has been remarkable; as a result, ESS has become one of the most common procedures performed by otolaryngologists.\(^1\) Even though ESS has been widely accepted for use in adults, enthusiasm for ESS is much less when children are involved.\(^1\) Some authors argue that there is no need for surgery in children.\(^2\) Recently, some reports have suggested that ESS may cause retardation of the growth of the midface of children.\(^3\) These reports are based on animal studies in which ESS was performed on one side of the face and the other side was used as a control. Follow-up of the animals revealed that the side that was operated on showed growth retardation compared with the control side.\(^3\) Because of these findings, some surgeons question whether ESS should still be considered as the treatment of choice in children with sinusitis.\(^4,5\) Endoscopic sinus surgery has similar success rates in children and adults, but, fortunately, it has no impact on the growth of the face in the adult population.

The fact remains that some children with chronic sinusitis who do not respond to medical treatment will be referred to the otolaryngologist for advice. The otolaryngologist is then faced with the dilemma of what to recommend. There is an agreement that some type of surgical intervention is necessary to control the disease and to prevent complications. The parents or caregivers also expect something to be done to improve the quality of life of these children.

Recently, adenoidectomy instead of ESS was recommended as a treatment option for refractory chronic sinusitis in children.\(^6,7\) The adenoids may act as a reservoir for bacteria and may thus cause recurrent sinus infections.\(^8,9\) Removing the adenoid pad may allow better drainage and eliminate the source of organisms from the nasopharynx. The success rate of adenoidectomy in the treatment of chronic sinusitis is really unknown. Also, to my knowledge, there are no adequate reports in the literature that compare ESS with adenoidectomy in the treatment of chronic sinusitis. The purpose of this study was to evaluate and compare the success of ESS and...
PATIENTS AND METHODS

PATIENT SELECTION

A prospective evaluation of patients who were referred to the pediatric otolaryngology service at a tertiary referral hospital setting between March 1994 and March 1997 was carried out. All patients were referred by the pediatrician allergy service to seek an opinion regarding surgery because of refractory chronic sinusitis that had been treated for at least 6 months. Medical treatment included antibiotics, nasal steroids, decongestants, systemic steroids, and allergy management. All children had undergone an allergy evaluation, an immunoglobulin deficiency workup, and a sweat chloride test. The children ranged in age from 2 to 14 years. Those who met all of the following criteria were included in this study:

1. Sinusitis documented by history and by findings of physical examination and computed tomography (CT).
2. No response to at least 24 weeks of treatment with an appropriate oral antibiotic as well as topical or oral decongestants.
3. Continuous symptoms despite allergy evaluation and treatment or 6 or more episodes of sinusitis that were adequately treated by the referring physician. The episodes had to have been separated by at least 3 weeks of complete resolution of symptoms so that patients who had residual sinusitis rather than recurrent sinusitis would not be included.
4. Computed tomographic documentation of sinusitis at the end of maximal medical therapy. Staging was reported according to the Lund-Mackay system.10

Children were excluded if they had predisposing factors of sinusitis, such as cystic fibrosis, immunoglobulin deficiency, or ciliary dysfunctions, or if they had previously undergone surgery on the sinuses or an adenoidectomy.

RESULTS

Sixty-nine patients were enrolled in the study. Data were missing on 5 patients, and outcomes were missing on an additional 2 patients who did not show up for follow-up and could not be reached by mail or telephone. The age range of the remaining patients was 2 to 14 years (mean [SD] age, 7.2 [3.1] years). The mean (SD) CT stage was 9.3 (4.1). The rest of the characteristics of the population are summarized below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (% of Patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>42/64 (66)</td>
</tr>
<tr>
<td>Allergy</td>
<td>20/64 (31)</td>
</tr>
<tr>
<td>History of smoking in household</td>
<td>16/53 (30)</td>
</tr>
<tr>
<td>Asthma</td>
<td>32/64 (50)</td>
</tr>
<tr>
<td>Resident surgeon</td>
<td>52/64 (83)</td>
</tr>
<tr>
<td>Day care attendance</td>
<td>23/51 (45)</td>
</tr>
</tbody>
</table>

The 2 surgical groups (ESS and adenoidectomy) were comparable with regard to age, sex, presence of allergies, and smoking in the household (Table 1). The ESS group, however, had more severe disease, as evidenced by a mean CT score of 10.8 compared with 7.5 for the adenoidectomy group ($P = .001$). The ESS group also had a higher prevalence of asthma (58%) than the adenoidectomy group (42%) and was slightly older ($P = .003$). Twenty-three patients (45%) were receiving day care, with almost equal numbers in both groups.

Nasal congestion was the most frequent preoperative complaint (84%), followed by nasal discharge (77%), cough (75%), and headache (70%). The preoperative symptom distribution for both groups is shown in Figure 1.

After surgery, there was more improvement of all symptoms in the ESS group than in the adenoidectomy group, although improvement in nasal congestion and cough was similar in both groups (Figure 2). Nasal discharge and headache were markedly improved in the ESS group compared with the adenoidectomy group.

Twenty-four (77%) of 31 patients who underwent ESS demonstrated improvement of their symptoms at the 6-month follow-up visit, compared with 14 (47%) of 30 patients who underwent adenoidectomy (odds ratio [OR], 3.9; $P = .01$ (Table 2). Only 1 patient (3%) in the ESS group required an adenoidectomy because of persistent symptoms during follow-up, compared with 12 patients (40%) in the adenoidectomy group who underwent ESS because of

OUTCOME ASSESSMENT

All children were followed up after surgery at 3, 6, 9, and 12 months. A questionnaire was administered at least 6 months (range, 6-12 months) after surgery. The questionnaire was used to assess the status of the preoperative symptoms of each child and the degree to which these symptoms had changed since surgery. The questionnaire was administered by a nurse or mailed to the caregivers. The parents or caregivers ranked each preoperative symptom (ie, nasal obstruction/stuffiness, rhinorrhea, cough, and headache) as cured, better, same, or worse. They were also asked about how satisfied they were with the surgery. Success was defined as improvement (cured or better) in one or more of the symptoms. Any child who needed the alternate procedure or a revision performed was considered as “a failure.”

Univariate statistical analysis was performed using χ² and Fisher exact tests in the analysis of binary outcomes. For continuous variables, a t test was performed. Multivariable analyses were performed using a logistic regression model, with age and CT stage (Lund-Mackay system)10 as continuous variables. To measure the influence of type of surgery after the other variables were adjusted for, a propensity score analysis was also performed. This analysis involved the development of a second logistic regression model to predict success. The fitted model was then used as a propensity score in a third logistic model to predict the chances of success as a function of surgery type and the score.

After evaluation of the CT scans, either an adenoidectomy or ESS was performed on the patients in a nonrandomized fashion. Allocation to treatment was made after discussion with the parents and was based on the surgeon’s and the parents’ preferences. All children in the ESS group underwent an anterior ethmoidectomy with a middle meatal antrostomy. Only 9 (28%) underwent a posterior ethmoidectomy and 4 (12%) underwent a sphenoidotomy.

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persistent symptoms. Six parents (19%) of children who underwent ESS but who did not require a revision were not satisfied with the procedure, compared with 4 parents (13%) of comparable children in the adenoidectomy group.

Multivariable analysis using logistic regression analysis after age, sex, asthma, allergy, CT stage, and day care attendance were adjusted for revealed that the success of ESS compared with adenoidectomy remained significant (OR = 5.2; P = .03). Asthma was the only other predictor of success (OR = 4.37; P = .03) (Table 3). An alternative analysis based on a propensity score developed from the covariates listed in Table 3 gave very similar results for the effect of type of surgery. This outcome suggests that despite the lack of randomization, the results are valid.

This study revealed that the success rate was 77% in the ESS group and 47% in the adenoidectomy group. The presence of asthma was the only other predictor of success: the success rate was 74% in the patients with asthma and 50% in those without asthma.

Although there is a consensus favoring surgical intervention in children with refractory chronic sinusitis, there is still disagreement about which type of surgical intervention is appropriate.2,4-9,11 Adenoidectomy4-6 and ESS7,8,11 have both been recommended as initial surgical option.4-6 Some authors, however, suggest that antral washes through a middle meatal antrostomy should be the first step, but this course has not been substantiated by any studies. Other authors recommend proceeding with ESS for the treatment of refractory chronic sinusitis.7,8,11

This tightly controlled study involved patients in whom at least 6 months of medical treatment had failed and who were referred by the pediatric allergy service. It is important that allergy testing and immunology workup be performed on children with refractory chronic sinusitis before surgery is considered. All study patients had undergone testing for allergies and immunodeficiency and cystic fibrosis workup and had been treated...
for their allergies (if any) for at least 6 months. A CT scan showing persistent evidence of sinusitis was obtained in all children at the end of at least 24 weeks of treatment. Once the decision was made for surgery, and after adequate discussion with the family, patients underwent either an adenoidectomy or ESS. Those children who underwent an adenoidectomy initially and then ESS were considered failures of the adenoidectomy group. Those children who underwent ESS initially but required an adenoidectomy or revision ESS with or without an adenoidectomy were considered failures of the ESS group. The rest of the patients who did not require further surgery were evaluated with a questionnaire at least 6 months after surgery. The results revealed a success rate of 77% for ESS and 47% for adenoidectomy at least 6 months after surgery.

Stating that adenoidectomy or antral washes should be the initial step in the treatment of all children with chronic sinusitis is misleading and confusing. Adenoidectomy may not be the treatment of choice for children with cystic fibrosis, immunodeficiency, or pansinusitis. Recommending antral washes, a procedure that requires general anesthesia, may be inefficient, since it is possible to perform ESS at that time. Previous studies that evaluated adenoidectomy as a treatment for chronic sinusitis were retrospective in nature and did not use CT scans to document sinusitis but instead relied only on symptoms and used only univariate analysis of the data without adjusting for risks.

Limitations of this study include the fact that a questionnaire was used to measure outcomes of those patients who did not require further surgery. As with all questionnaires about symptoms, the responses are subjective and the parents may have been biased at the time by other factors. Allocation of the children to 1 of the 2 surgical groups was not randomized and was based on the surgeon's and the parents' preferences. However, a multivariable analysis, as well as an alternate analysis based on the propensity score, was performed to control for the presurgical differences between the 2 groups.

The sample population consisted of children who were referred from the allergy service because of failure of at least 6 months of medical treatment. Thus, the sample may not be representative of the true population because of the tertiary referral nature of the patients involved. The results, then, should be interpreted in that context. A mean CT score of 9.3, an asthma incidence of 50%, and an allergy incidence of 30% reflect the fact that the study sample was skewed toward children with severe disease.

Parents, caregivers, and referring physicians are seeking our help for those children who require therapy with multiple antibiotics, frequent office and emergency department visits, and treatment with systemic steroids. Some parents/caregivers expect more from us than just continuation of the medical treatment that their children have been receiving for at least 6 months to 1 year. Since surgical intervention also seems to be an alternative that is used by some physicians, the questions are, “Which procedure is more effective for these children?” “Should an adenoidectomy be performed first?” “Should we reserve ESS for patients in whom other treatment has failed or for those with more severe disease?”

This study revealed that ESS had a better success rate than adenoidectomy alone in a select group of children. When ESS was used as the initial treatment modality, the need for further surgery was reduced, especially in children with asthma, a high CT score, and allergy for which aggressive medical treatment consisting of multiple antibiotics, topical nasal steroids, systemic decongestants, and allergy management had failed and whose parents wanted an alternative treatment.

Accepted for publication July 16, 1999.
Presented at the Annual Eastern Section Meeting of the American Laryngological, Rhinological, and Otological Society, Providence, RI, January 31, 1999.
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