Tonsillectomy and Adenoidectomy

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No practice involving health care for children has excited more heated controversy among health professionals than has surgical removal of the tonsils and adenoids. Long the most common major operation carried out on children, tonsillectomy and adenoidectomy (T&A) continues to draw professional, legislative, and lay attention as a treatment for which benefits in relation to costs and risks have never been adequately assessed, and for which indications remain largely ill-defined. Nonetheless, the continuing high rate of performance of T&A, despite some recent decline, attests to its strong hold on the minds of many physicians and parents as a treatment of importance and value. Annual expenditures for tonsil and adenoid surgery in the USA probably exceed one-half billion dollars.

Although T&A is often thought of and carried out as a single, combined operation, each of the two components - tonsillectomy and adenoidectomy - requires individual attention when considering indications for operation. As of present writing, convincing evidence is lacking that T&A, in the conditions for which they are usually undertaken, either are or are not superior in efficiency to conservative management. Unfortunately, the few reported trials of T&A have as a group been inadequate and inconclusive. In order to arrive at rational indications for tonsil and adenoid surgery, groups of children must first be defined who have particular symptom complexes severe enough to justify particular operations; in those groups the efficacy of the operations must then be tested by means of an integrated group of randomized, controlled trials; and finally, if the operations prove efficacious, their overall impact must be assessed as critically as possible in relation to their risks and costs. It was with this frame of reference that the current Children's Hospital of Pittsburgh study was designed and undertaken.

The Children's Hospital of Pittsburgh Study

Goals, Design, and Methodology

The Children's Hospital of Pittsburgh study, instituted on a pilot basis in 1971, supported since 1973 by the National Institute of Child Health and Human Development, and still in progress, addresses a number of questions involving both the natural history of presumably tonsil- and adenoid-related problems and the results of tonsil and adenoid surgery. In particular, the study focuses on the efficacy of tonsillectomy in reducing the frequency and severity of episodes of pharyngitis, the efficacy of adenoidectomy in reducing the frequency and severity of episodes of otitis media, and the effect of adenoidectomy on the course of nasal obstruction that is caused by large adenoids.

Salient characteristics of the study include the following:

1. A team of individuals is employed specifically for the work of the study; virtually all historical accounts are obtained and virtually all examinations conducted by study personnel.

2. On entry, each subject receives independent evaluations by a pediatrician and an otolaryngologist.

3. Tonsillectomy and adenoidectomy are treated as separate procedures.

4. Criteria for entering the clinical trials of tonsillectomy and of adenoidectomy are specified (Tables 1 and 2).

5. Criteria are specified (Table 3) for exclusion from randomization (ie, when indications for operation appear compelling).

6. Standardized systems are used for quantifying or rating relevant clinical findings and diagnoses.

7. A continuing process of testing the inter-observer reliability of study staff members is maintained.

8. Assessment of middle ear status is based on combined otoscopic, tympanometric, and audiometric examinations.

9. Standardized cephalometric radiographs are used in assessing adenoid size.

10. Each subject receives a screening allergy/immunology evaluation that includes both skin tests and determination of serum immunoglobulin levels.

11. Standardized dental and orthodontic observations concerning each subject are recorded by a pedodontist.

12. Follow-up of each subject is carried out by direct clinical examination at six-week intervals and also at the time of intercurrent respiratory illness, and is supplemented by bi-weekly, standardized telephone inquiries.

Preliminary Findings

Limitations of Undocumented Histories of Recurrent Throat Infection. Many of the children referred to the study as potential candidates for the tonsillectomy trial have histories of recurrent episodes of throat infection that appear to meet all the entry standards listed in Table 1 except documentation. These children are admitted to the study and followed prospectively; if at least two observed episodes of throat infection then develop with patterns of frequency and clinical features that match or exceed those described in their presenting histories, they become eligible for the tonsillectomy trial. To date, a large majority of such children have failed to develop frequent or severe episodes of throat infection. From this experience it is reasonable to conclude that *undocumented* histories of recurrent throat infection do not validly forecast subsequent experience and hence do not constitute an adequate basis for subjecting children to tonsillectom.

Table 1. *Children's Hospital of Pittsburgh T&A Study: Criteria for Entering Controlled, Randomized Trial of Tonsillectomy*

1. Recurrent throat infection

a. At least three episodes in each of three years, or five episodes in each of two years, or seven episodes in one year; and

b. Each episode must have been characterized by one or more of the following:

Oral temperature 38.3°C or higher

Enlarged (> 2 cm) or tender, anterior cervical lymph nodes

Tonsillar exudate

Positive culture for group A beta-hemolytic streptococcus

c. Apparently adequate antibiotic therapy must have been administered for proven or suspected streptococcal episodes; and

d. Each episode must have been confirmed by examination and its qualifying features described in a clinical record at the time of occurrence

or, 2. Peritonsillar abscess

or, 3. Chronic (minimum 6 months) tonsillitis, persisting despite appropriate antimicrobial therapy

or, 4. Nonurgent obstructive symptoms if tonsils very large, including

a. stertorous or mouth breathing, with or without episodes of obstructive sleep apnea

b. muffled, "hot potato" voice if child is at least 6 years old

or, 5. Chronic (minimum 6 months) enlargement (> 2 cm) or tenderness of anterior cervical lymph nodes, persisting despite appropriate antibiotic therapy.

Table 2. *Children's Hospital of Pittsburgh T&A Study: Criteria for Entering Controlled, Randomized Trial of Adenoidectomy*

1. Recurrent suppurative or nonsuppurative otitis media, if myringotomy and insertion of tympanostomy tube have been performed at least once previously

or, 2. Persistent nasal obstruction

a. manifested by stertorous or mouth breathing, with or without episodes of obstructive sleep apnea, and by hyponasal speech, and

b. accompanied by roentgenographic evidence of adenoid hypertrophy, and

c. apparently not due to allergy

or, 3. Chronic sinusitis or nasopharyngitis

a. accompanied by both clinical and roentgenographic evidence of adenoid hypertrophy, and

b. apparently not due to allergy, and

c. persisting despite appropriate antimicrobial and other medical therapy.

Table 3. *Children's Hospital of Pittsburgh T&A Study: Criteria for Exclusion from Controlled, Randomized Trial and for Prompt Surgical Intervention*

Indication	Tonsillectomy	Adenoidectomy
Upper airway obstruction apparently due to large tonsils or adenoids or both, and accompanied by evidence of alveolar hypoventilation or cor pulmonale	X	X
Consisten interference with swallowing apparently due to tonsilar enlargement	X	
Severe nasal obstruction due to adenoid enlargement, resulting in apparent discomfort in breathing		X

The Clinical Trial of Tonsillectomy. Preliminary findings to date indicate that in children with recurrent episodes of throat infection that meet the entry criteria shown in Table 1, tonsillectomy is indeed effective in reducing morbidity from throat infection over a period of at least two years. On the other hand, it is noteworthy that the absolute morbidity from throat infection experienced by control subjects has in general not been extreme: about half the control subjects have thus far each experienced fewer than three episodes of throat infection per year, and almost two-thirds of these episodes have been rated clinically as mild.

With the regard to the efficacy of tonsillectomy for peritonsillar abscess, chronic (as distinct from recurrent acute) tonsillitis, and chronic isolated cervical lymphadenitis, the number of patients with these conditions admitted to the study have been too few to warrant drawing conclusions.

Tonsillectomy, when carried out for obstructive symptoms unequivocally attributable to large tonsils, has consistently afforded complete relief; in children not operated on, data currently available are insufficient to indicate the extent to which such symptoms - and the underlying tonsillar hypertrophy - may subside spontaneously.

The Clinical Trial of Adenoidectomy for Otitis Media. In order to define a population at high risk for development of otitis media, the protocol of the current study specifies that, as a prerequisite to entering the trial of adenoidectomy on the basis of recurrent otitis media, a child must have received myringotomy and tympanostomy tube insertion in the past and must subsequently have experienced at least one episode of either suppurative or non-suppurative otitis media (Table 2).

Preliminary data show that adenoidectomy by no means eliminates the problem of recurrent otitis media in such children, but it mreains uncertain whether adenoidectomy somewhat reduces the rate, severity, or duration of recurrent episodes. The question is particularly complex because of the large number of variables that may potentially influence outcome. A large number of study subjects will be required in order to reach firm conclusions.

The Clinical Trial of Adenoidectomy for Nasal Obstruction. Children are admitted to the clinical trial of adenoidectomy for nasal obstruction only if the obstruction is appreciable (Table 2) and can be shown with reasonable certainty to be caused wholly or mainly by large adenoids. Such children who have received adenoidectomy appear to be experiencing almost uniformly excellent results persisting for at least two years. In the control group, some spontaneous improvement has developed within the first year or two in some of the patients, but complete resolution of nasal obstruction has developed in relatively few. The children providing these data have been mainly five and six years old, and information regarding children either younger or older is as yet inadequate for analysis.

It is important to consider whether the significantly greater relief of nasal obstruction achieved in the operated group resulted in benefits to the children (Table 4) that offset the cost and risks of the operation. In an effort to test the development of one such benefit - improved nasal function - we assessed olfaction in a group of study children using varying concentrations of phenylethyl alcohol, a rose-like odorant. We found that children rated as having no nasal obstruction showed almost uniformly good olfactory function, whereas most of those with severe obstruction showed poor function.

Other hoped-for outcomes of adenoidectomy remain to be evaluated. For example, certain orthodontists have attributed presumably abnormal growth patterns (long and narrow faces, low tongue placement, narrow upper jaws, steep mandibles, and open anterior bites) to large adenoids and have advocated surgery to prevent or ameliorate the so-called adenoid facies. One study claimed improvement in dentofacial measurements following adenoidectomy but failed to include unoperated control subjects. Comparative analysis of the standardized cephalometric roentgenographs obtained periodically from adenoidectomy and control subjects in the Pittsburgh study may help to clarify this question. Outcomes of adenoidectomy such as an increased sense of comfort in breathing and improved facial appearance are essentially subjective and not readily measurable.

Table 4. *Costs and Potential Benefits of Tonsillectomy or Adenoidectomy or Both*

Costs

1. Currently (September, 1981) $ 1500 at Children's Hospital of Pittsburgh
2. Risk of anesthetic accidents:
    malignant hyperthermia
    cardiac arrhythmia
    vocal cord trauma
    aspiration with resulting bronchopulmonary obstruction or infection
3. Risk of miscellaneous surgical or postoperative complications:
hemorrhage
    airway obstruction due to edema of tongue, palate, or nasopharynx, or to retropharyngeal insufficiency
    otitis media
    emotional upset
4. Unknown risks

Potential Benefits If Efficacious

1. Reduction in frequency of ENT illness:
    - discomfort
    - inconvenience
    - school absence
    - parental anxiety
    - work missed by parents
    - costs of doctor visits and drugs
2. Reduction in nasal obstruction, with improved:
    - respiratory function
    - morbidity
    - comfort
    - sleep
    - craniofacial growth and development
    - appearance
3. Reduction in hearing impairment
4. Improved growth and overall well-being
5. Reduction in long-term parental anxiety.

Currently Acceptable Surgical Indications and Surgical Decision Making

Notwithstanding the large remaining areas of uncertainty about the efficacy of tonsillectomy and of adenoidectomy, decisions about surgery must currently be made on the basis of information now available. Operation is clearly indicated in a small number of severely affected children and clearly not indicated in the great majority of children in whom the degree of tonsil- or adenoid-related illness or disability is insubstantial. Between these extremes lies an intermediate group concerning whom there is room for legitimate controversy. The uncertainty regarding these latter children is of two general categories: (1) the tonsil or adenoid surgery is of uncertain efficacy, as in the case of recurrent otitis media; or (2) efficacy appears to be reasonably well established, as in the case of adenoidectomy for nasal obstruction secondary to large adenoids, but in the patient at hand clinical severity, prognosis, or both may be in doubt. For example, it may not be possible to determine satisfactorily whether (a) a child is affected severely enough to justify an operation; (b) a child is so severely affected as to make surgery mandatory rather than optional; or (c) a child is so likely to soon "outgrow" the condition as to render operation of only short-term value.

Definite Surgical Indications

Operation is clearly indicated in unusal circumstances in which massive hypertrophy of tonsils, adenoids, or both results in unquestioned dysphagia, in extreme discomfort in breathing, or, even more extremely, in alveolar hypoventilation or cor pulmonale (Table 3).

Alveolar hypoventilation is a difficult diagnosis to confirm, short of the development of clinical, roentgenographic, or electrocardiographic evidence of cor pulmonale. The measurement of blood pO_2 and pCO_2 both when awake and during sleep, a procedure that currently cannot be accomplished non-invasively, is required. Extremely stertorous breathing when awake and frequent episodes of obstructive apnea during sleep should lead to a high

index of suspicion of the presence of alveolar hypoventilation. It appears likely that the condition, while unusual, may be more common than is generally appreciated.

On the other hand, even in children with symptoms or signs of appreciable obstruction, surgery should not be an immediate and automatic alternative. Seemingly dramatic obstructive manifestations, even when long-standing, may be caused by edema that accompanies relatively inapparent infection, rather than to fixed structural changes. Such obstructive symptoms may sometimes lessen considerably with vigorous antimicrobial treatment. Accordingly, a trial of an appropriate antimicrobial agent is often advisable before deciding whether surgery is mandatory or even reasonably indicated.

Uncertain but Reasonable Surgical Indications

Although the conditions in Tables 1 and 2 are still being tested, they appear to constitute reasonable indications for tonsillectomy and adenoidectomy, respectively. For all of these conditions the common denominator is an arbitrarily defined minimum degree of severity, frequency, or duration. Equally reasonable, however, might be modifications *within the spirit* of these minimum standards. For example, in the case of frequently recurring or persistent episodes of recurrent otitis media, it appears acceptable (1) not to require prior tympanostomy tube placement before considering adenoidectomy, or (2) to include tonsillectomy if adenoidectomy were being embarked upon as a treatment option.

However, the fact that a child meets the above criteria should not necessarily lead to a decision in favor of surgery. Each decision should be individualized. For example, in a child with recurrent tonsillopharyngitis, additional factors that might influence the decision include accessibility of health care, school achievement and progress, parental tolerance of illness, other family stresses, and the relative out-of-pocket costs to the family of medical and surgical management. One study argues in favor of tonsillectomy for the patient with rheumatic heart disease who has large tonsils and in whom antistreptococcall prophylaxis cannot be maintained with confidence.

Regarding the question of using surgical criteria less stringent that those listed in Tables 1 and 2 (for example, the criteria listed by a committee of the American Academy of Pediatrics), the purpose of these criteria is to define a *minimally acceptable* rather than an *optimal* standard of care. Recognizing that these criteria are arbitrary, it nonetheless appears that relaxing them would rarely achieve appreciable benefit, whereas without them many children might undergo unnecessary operations. The Pittsburgh study should eventually provide information regarding the expected illness experience of the children who fall just short of meeting these criteria, since such children also are followed in the study prospectively. Should their prognosis prove in general to be benign, relaxing the criteria would hardly appear to be appropriate. If, on the other hand, these children are found to experience appreciable tonsil- or adenoid-related illness, further study of the efficacy of surgery should be done.

Halitosis caused by the accumulation of debris in tonsillar crypts may justify tonsillectomy in those unusual circumstances in which more conservative measures, such as gargling or pharyngeal douche, prove ineffective.

Contraindications to Tonsil and Adenoid Surgery

Contraindications to surgery include velopharyngeal, hematologic, immunologic, and infectional conditions.

A number of abnormal conditions that result in velopharyngeal insufficiency, such as overt cleft of the palate, submucous or covert cleft of the palate, neurologic or neuromuscular abnormalities leading to impaired palatal function, and an unusually capacious pharynx, are contraindications to adenoidectomy. In each of these conditions the presenting complaint is likely to be *hyper*nasality, a symptom that the unwary observer may fail to distinguish from *hypo*nasality. If adenoidectomy is undertaken to improve the "nasal" speech of such children, the symptoms may worsen markedly, since the adenoids had been serving to help fill the relative velopharyngeal void and thus to facilitate normal speech production. Suspicion of a submucous cleft of the palate should be aroused by observing a bifid uvula or widening and attenuation of the median raphe of the soft palate. The diagnosis may be further ascertained by palpating along the junction of the hard and soft palates, where a V-shaped midline notch, rather than the normal rounded curve, is strongly suggestive of a submucous cleft. This examination should be performed on all children, with or without hypernasality, for whom adenoidectomy is being considered. Irrespective of the findings, if hypernasality secondary to velopharyngeal insufficiency is suspected, it is advisable to refer the patient to an individual or a team skilled in the evaluation and management of cleft palate.

Hematologic contraindications to tonsil or adenoid surgery consist of anemia and disorders of hemostasis. Surgery should not be undertaken if the hemoglobin concentration is less than 10 gm per dL or the hematocrit less than 30 per cent. When surgery is being considered, careful inquiry should always be made about a family or past history of unusual bleeding or bruising, as certain rare hemostatic disorders may not be detectable with readily available tests. Routine preoperative studies should include measurements of the hemoglobin or hematocrit, prothrombin time, and partial thromboplastin time, and an estimate of the platelets, usually from a stained blood smear.

Inthe view of some clinicians, the existence of frank respiratory allergy that has not been treated for at least six months constitutes a contraindication to tonsil or adenoid surgery unless urgent, obstructive symptoms are present. The opinion that tonsil or adenoid surgery in allergic children may precipitate the development of asthma has not been tested in clinical studies. Certainly in children without urgent obstructive symptoms who have both upper respiratory allergy and large tonsils or adenoids, a reasonable trial of anti-allergic management as a precursor to considering surgery appears to be prudent.

Tonsillectomy or adenoidectomy should not be undertaken in patients with local infection unless urgent obstructive symptoms are present, appropriate, prolonged antimicrobial treatment has been maintained unsuccessfully, or, in the view of some, a peritonsillar abscess is present. Ordinarily, an interval of at least three weeks following an episode of acute infection will allow for general recuperation and reduce the risk of operative hemorrhage.

Adverse Effects of Tonsil and Adenoid Surgery: Real and Potential

Physicians who recommend tonsil or adenoid surgery must weigh the possibility of adverse consequences ranging from death, to nonfatal direct and indirect anesthetic and surgical complications, to hypothetical interference with immunologic defense mechanisms. Unfortunately, accurate statistics regarding mortality and morbidity in large patient populations are not available.

The death of a child as a consequence of tonsil or adenoid surgery is especially tragic if, as is usually the case, the operation was elective. Fatality rates have been variously reported during the past 25 years as ranging from 1 per 1000 to 1 per 27.000 patients, but the validity of these reports is open to question. Except for a probably irreducible minimum of anesthesia-related deaths (the anesthesia-related mortality rate unadjusted for age was recently reported to be 1 per 14.000 patients), death as a result of tonsil or adenoid surgery should be entirely preventable.

The possible nonfatal complications of tonsil or adenoid surgery are summarized in Table 4; velopharyngeal insufficiency and emotional upsets are discussed in detail above and below, respectively. The risk of hemorrhage can be minimized by avoiding operation during or immediately following episodes of infection, by careful attention to surgical technique, and by avoiding the use of aspirin for relief of postoperative pain. Nonetheless, either primary or secondary hemorrhage is bound to occur in some cases, and transfusion will occasionally be required. Data reported from a large number of hospitals surveyed during 1965 indicate a transfusion rate of 0.4 per cent. Otitis media has been reported as a not infrequent postoperative complication, but it is not clear that the risk is higher than in comparable patients not operated upon.

Whether tonsil or adenoid surgery imposes immunologic risks of any practical consequence remains uncertain. The heightened risk of poliomyelitis that was an important deterrent to surgery before the advent of an effective vaccine, and for which an immunologic basis has more recently been elucidated, is no longer of practical concern. The concern that tonsillectomy might predispose to the development of Hodgkin's disease has apparently been dispelled by more recent epidemiologic investigations. It is possible that removal of the immunologically active tonsils and adenoids will later undermine the patient's resistance to disease of some sort, but the likelihood appears to be small.

Preparation for Hospitalization and Surgery, and Care in the Hospital

Children who are to undergo surgery should be prepared for the experience well in advance. Parents should describe the expected course of events in as much detail and as frankly as possible, commensurate with the child's ability to comprehend. Children should be told that they will experience a certain amount of discomfort but that every effort will be made by hospital personnel to minimize it. Many hospitals permit advance visits so that children may see the facilities and equipment to be used and become acquainted with some of the personnel. Coloring or story books can also be helpful in the familiarization process. Once admitted to the hospital, children should have free and unlimited access to parents or parent surrogates, and parental rooming-in should be encouraged, especially for children younger than school age. One or both parents should remain with the child during the period

immediately preceding the trip to the operating room and should be at the bedside when the child returns. Careful preparation and kind, thoughtful management of the entire process of hospitalization and surgery should virtually eliminate the risk of untoward psychological consequences in previously well-adjusted children. For the child who is emotionally disturbed, the same general principles apply but, in addition, specialized professional advice may be appropriate to minimize the risk of neurotic misinterpretation of theoperative event by the child.