



The utility of nasopharyngeal culture in the management of chronic adenoiditis[☆]

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ABSTRACT

Objectives: To examine the utility of nasopharyngeal culture in the management of children with chronic adenoiditis to determine if it results in a change in antibiotic therapy.

Methods: Retrospective chart review of pediatric patients managed for chronic adenoiditis, being defined as cough, postnasal drip, and congestion for over three months with endoscopic evidence of nasopharyngeal purulence with normal anterior rhinoscopy and middle meati. Standard treatment was defined as amoxicillin clavulanate or amoxicillin clavulanate ES-600 in non-penicillin allergic patients, and cefuroxime or clarithromycin for penicillin allergic patients. Nasopharyngeal culture results and antibiotic prescriptions were reviewed to look for a change from the standard.

Results: Of 207 patients diagnosed with chronic adenoiditis, 198 had nasopharyngeal cultures (119 male, 79 female, mean age 3.7 years). The most common organisms isolated were *Streptococcus pneumoniae* sensitive to penicillin in 40 cultures (20.2%), *S. pneumoniae* intermediate or resistant to penicillin in 26 (13.1%), *Moraxella catarrhalis* in 27 (13.6%), *Haemophilus influenzae* in 57 (28.8%), and *Staphylococcus aureus* intermediate or resistant to penicillin in 26 (13.1%). 13.3% of *S. aureus* isolated was methicillin resistant. 103 (52.0%) children required different antibiotics from the standard, and 26 (13.1%) had no antibiotics prescribed based on a negative culture. Of the 87 children suspected to have upper airway reflux, 25 (28.7%) had negative cultures. Of the 135 patients with follow-up, 50 (37.0%) reported resolution and 50 (37.0%) reported improvement of their symptoms.

Conclusion: Nasopharyngeal culture has significant utility in the choice of antibiotics for children with chronic adenoiditis.

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1. Introduction

Chronic rhinosinusitis in the pediatric population is a fairly common entity within the United States causing significant impact on quality of life. Chronic adenoiditis although a different entity, is often clinically indistinguishable from chronic sinusitis and has been implicated as an etiology of chronic sinusitis in children [1–3]. The cornerstone of initial treatment for both entities is long courses of broad-spectrum beta-lactamase stable antibiotics [4,5]. When antibiotics are not successful, adenoidectomy is the initial surgical treatment for both entities [6]. Adenoiditis has also been shown as a risk factor for otitis media by Marseglia and others [7].

Chronic adenoiditis is defined as nasal discharge (often purulent), chronic cough, and nasal obstruction for a duration greater than three months. Low-grade fever and irritability may also be present to varying degrees. Chronic adenoiditis can be

distinguished from chronic sinusitis on physical examination by normal middle meati on nasal endoscopy and normal anterior rhinoscopy.

The pathogens most often implicated in chronic adenoiditis are *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Moraxella catarrhalis*, and *Staphylococcus aureus* [1–3]; all of which are covered by beta-lactamase stable antibiotics. These organisms are also implicated in pediatric chronic sinusitis. In fact, Lee and Rosenfeld found a positive correlation between sinonasal symptoms and quantitative bacteriology with the adenoid bed. However, these are not the only organisms implicated in chronic adenoiditis, as infection rate with more resistant pathogens is increasing in the pediatric population. It should also be noted that thick secretions in the adenoid bed may also be related to non-infectious entities such as reflux.

In a study by Shin et al., it was determined that the adenoid bed contains bacteria and acts as a reservoir for pathogenic bacteria. This etiology for the role of the adenoid bed in pediatric sinusitis was favored over that of being an obstructive barrier of the osteomeatal complex [1]. Lee and Rosenfeld demonstrated a positive correlation between sinonasal symptoms and quantitative bacteriology within the adenoid bed [2]. Zuliani et al. stated that biofilms within the nasopharynx may also serve as a chronic

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reservoir for bacterial pathogens in patients with chronic rhinosinusitis [3].

To date, utilization of nasopharyngeal cultures guiding antibiotic therapy is not the standard of care. Additionally, empiric broad-spectrum coverage may lead to antibiotic resistance, with no assurance of adequate coverage for patients acutely infected with resistant organisms. Our goal therefore, is effective treatment within the narrowest coverage range possible. The objective of this study is to examine the utility of nasopharyngeal culture in providing more specific antibiotic coverage for children with chronic adenoiditis and whether its results will cause any change in the choice of antibiotics.

2. Methods

After approval by our institution's Institutional Review Board, we conducted a retrospective chart review of patients treated at the Long Island College Hospital from January 2008 to January 2010. All children (age range 6 months to 12 years) undergoing treatment of chronic adenoiditis were included. Chronic adenoiditis was defined as symptoms of chronic cough, postnasal drip, and congestion for over three months with normal anterior rhinoscopy and middle meati on nasal endoscopy, but with evidence of purulence in the nasopharynx. Children with immunocompromised status including, but not limited to, immunodeficiency syndromes, diabetes mellitus, undergoing chemotherapy, or chronic steroid dependence, were excluded from the study. Children with craniofacial syndromes, history of cleft palate, prior adenoid surgery, or no prior nasopharyngeal culture were also excluded from the study.

Data collection was planned *a priori* and conducted using a standardized data collection form. Charts were reviewed by one of the authors using this form. Information was collected regarding the signs and symptoms of chronic adenoiditis, history of otitis media with effusion, history of gastroesophageal reflux disease (GERD) or current reflux symptoms, the child's daily environment (home, daycare, or school), allergies, and smoking exposure. The results of nasopharyngeal cultures (which were taken under endoscopic guidance from the adenoid bed), the type and duration of antibiotic therapy, and any changes in treatment based on the culture results were recorded.

3. Results

Of 207 patients diagnosed with chronic adenoiditis based on the above mentioned criteria, 198 had nasopharyngeal cultures (119 male, 79 female, mean age 3.7 years). Table 1 outlines the demographic data regarding the patient cohort, and Table 2 summarizes the common symptoms and historical findings. The majority of patients either had frequent cough (70.0%), while only 26.6% of patients with available data had rhinorrhea. Throat clearing and halitosis were uncommon. Reflux symptoms were reported in 29%, and only 9.7% had a history of being treated for reflux in the past. On physical examination (Table 3), most patients had a normal anterior rhinoscopy with secretions found in the nasopharynx, and 42.5% had evidence of reflux on physical examination. Middle ear effusions were recorded in 53.1% of children.

The most common organisms isolated were *S. pneumoniae* sensitive to penicillin in 40 cultures (20.2%), *S. pneumoniae* intermediate or resistant to penicillin in 26 (13.1%), *M. Catarrhalis* sensitive to penicillin in 27 (13.6%), *H. influenzae* sensitive to penicillin in 57 (28.8%), and *S. Aureus* intermediate or resistant to penicillin in 26 (13.1%). 13.3% of *S. aureus* isolated was methicillin resistant *S. Aureus* (MRSA). Table 4 summarizes the culture results.

Table 1
Patient demographics.

Characteristic	No. (%)	Mean (range)
Age, years	Mean 3.7 years	3.7 (0.3–12)
Gender		
Male	119 (60.1%)	
Female	79 (39.9%)	
Ethnicity/race		
Non-hispanic	92 (44.4%)	
Hispanic	2 (0.9%)	
White	90 (43.5%)	
African American	0	
Unknown	23 (11.2%)	

Among 198 patients, 103 (52.0%) required different antibiotics from the standard (amoxicillin clavulanate, amoxicillin clavulanate ES-600, cefuroxime, or clarithromycin in penicillin allergic patients), and 26 (13.1%) had no antibiotics prescribed based on a negative nasopharyngeal culture. The decision of whether to prescribe cefuroxime or clarithromycin to penicillin allergic patients was based on the severity of the allergic reaction (i.e. rash vs. anaphylaxis). Patients were given weaker antibiotics or switched to antibiotics to cover resistant organisms based on the sensitivities on culture. The most common incidence of this is prescribing clindamycin for MRSA. Of the 87 children suspected to have upper airway reflux, 25 had negative cultures. Of the 135 patients with follow up appointments, 50 reported resolution and

Table 2
Common symptoms and medical history.

Symptom/history	No. (%)
Rhinorrhea	
Present	17 (8.2)
Unknown	106 (51.2)
Chronic cough	125 (60.4)
Throat clearing	
Present	6 (2.9)
Unknown	10 (4.8)
Halitosis	
Present	38 (18.4)
Unknown	10 (4.8)
Bottle feeding	
Not current	171 (68.1)
Current	24 (11.6)
Unknown	12 (5.8)
Recurrent acute otitis media	
Present	50 (24.1)
Unknown	3 (1.5)
Chronic otitis media with effusion	
Present	44 (21.3)
Unknown	24 (11.6)
Obstructive sleep apnea	5 (2.4)
Current reflux symptoms	
Present	60 (29.0)
Unknown	9 (4.3)
Reflux treatment history	
Yes	20 (9.7)
Unknown	4 (1.9)
Prior adenoidectomy	2 (1.0)
History of environmental allergies	26 (12.6)
Food allergy	24 (11.6)
History of gastroesophageal reflux disease	
Present	44 (21.3)
Unknown	11 (5.3)
Daily environment	
Daycare of school	100 (48.3)
Home	69 (33.3)
Unknown	38 (18.4)
Smoking exposure	
Present	9 (4.3)
Unknown	16 (7.7)

Table 3
Common physical examination findings.

Physical examination findings	No. (%)
Anterior rhinoscopy	
Purulent	4 (11.6)
Dry	162 (78.3)
Clear secretions	18 (8.7)
Adenoid secretions	
Clear	7 (3.4)
Mucoid	53 (25.6)
Purulent	127 (61.4)
Evidence of reflux	
Present	88 (42.5)
Unknown	71 (34.3)
Middle ear effusion	110 (53.1)
Reflux therapy given at time of visit	89 (43.0)

Table 4
Nasopharyngeal culture results.

Organism isolated	No. (%)
<i>S. pneumoniae</i>	
Penicillin sensitive	40 (20.2)
Penicillin resistant	26 (13.1)
<i>H. influenzae</i> penicillin sensitive	57 (28.8)
<i>M. catarrhalis</i> penicillin sensitive	27 (13.6)
<i>S. aureus</i>	
Sensitive to penicillin	30 (15.2)
Resistant to penicillin	26 (13.1)
Methicillin resistant	4 (2.0)
Other ^a	10 (0.5)
No growth	60 (30.3)

^a Some of the other organisms include, but are not limited to other streptococcus species, pseudomonas, proteus, serratia, and yeast.

50 reported improvement of their adenoiditis symptoms. Table 5 summarizes the follow up information available for the cohort.

4. Discussion

Chronic adenoiditis remains a common problem amongst children in the United States, often indistinguishable from pediatric sinusitis. The standard initial treatment for children with chronic adenoiditis or sinusitis remains long courses of broad-spectrum beta-lactamase resistant antibiotics. In addition to the potential to over- or undertreat certain pathogens, these medications are associated with certain side effects, such as diarrhea and gastrointestinal upset. Moreover, empiric broad-spectrum coverage may lead to antibiotic resistance in the future. Therefore, the goal is to effectively treat the infection with the narrowest coverage possible.

In our retrospective review, nasopharyngeal culture was found to be of use in targeting therapy, changing the choice of antibiotics in 52% of patients. Based on this strategy, patients may have received antibiotics with better side-effect profiles along with a potentially decreased susceptibility to resistant organisms in the future. Also, patients infected with resistant organisms received adequate coverage based on sensitivities, rather than awaiting clinical response to treatment. The organisms isolated within the cohort were similar to those reported in previous studies examining the bacteriology of chronic adenoiditis/sinusitis [1–3]. With the use of targeted therapy, 74% reported resolution or improvement in adenoiditis symptoms at the 3-month follow up. Further studies are necessary to determine the effects of targeted culture on the timing of clinical improvement.

As touched upon earlier, our understanding of the significance of nasopharyngeal biofilms in the pathogenesis of adenoiditis and recurrent acute otitis media has been augmented by the contributions of Torretta et al. [8,9]. In terms of the utility of

Table 5
3 month follow-up information.

Disease	No. (%)
Adenoiditis	
Better	50 (37)
Resolved	50 (37)
No change	35 (26)
Middle ear effusion	
Better	23 (17)
Resolved	34 (25.2)
No change	78 (57.8)

nasopharyngeal swabs in detecting the presence of biofilm producing bacteria (BPB), this technique is less accurate when compared to actual tissue biopsy specimens [8]. This practical limitation in detecting BPB's should be acknowledged when considering the clinical approach to the diagnosis and treatment of pediatric adenoiditis.

Limitations of this study include the retrospective nature, along with the lack of a control group that did not receive nasopharyngeal culture and simply had no therapy or remained on the standard beta-lactamase resistant agents. Our study is however, the first to examine the use of targeted antibiotic therapy for chronic adenoiditis based on nasopharyngeal culture results. Further work needs to be done in order to examine the clinical effectiveness of targeted therapy versus the previous standard in addition to its effect on the frequency of untoward effects related to antibiotic therapy.

In summary, nasopharyngeal culture may be of use in deciding the antibiotic management of chronic adenoiditis in the pediatric population. In our retrospective study, it resulted in a change in management in 52% of patients.

Financial disclosures

None.

Conflict of interest

None.

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