



Pediatric patients with chronic cough and recurrent croup: The case for a multidisciplinary approach



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ABSTRACT

Objective: To evaluate the results of our multidisciplinary approach to recurrent croup and chronic cough.

Methods: Retrospective chart review of all patients with recurrent croup and chronic cough managed at a tertiary care children's hospital by our Comprehensive Airway, Respiratory, and Esophageal (CARE) Team. Charts were reviewed for all patients who carried a diagnosis of recurrent croup or chronic cough. Patients were excluded if they did not receive a full workup, including micro-direct laryngoscopy, flexible and/or rigid bronchoscopy, bronchioalveolar lavage (BAL), and upper endoscopy with biopsies. We reviewed the records for the presence of gastrointestinal complaints, abdominal pain and failure to thrive (FTT) and compared the children with documented esophagitis to the remaining children.

Results: Forty patients met inclusion criteria. 53% had airway abnormalities; the most common was tracheomalacia, followed by enlarged adenoids. 38% had esophagitis (group 1) while 62% had normal esophageal biopsies (group 2). Among the children in group 1, 27% met criteria for eosinophilic esophagitis (>15 eosinophils per high powered field). There was no significant difference between groups 1 and 2 based on the presence of gastrointestinal complaints, abdominal pain and/or FTT ($p > 0.05$). There was no significant difference between the groups based on the location or presence of an airway abnormality ($p > 0.05$).

Conclusions: Children with recurrent croup and chronic cough may benefit from a multidisciplinary approach to management. Our CARE Team approach led to a specific diagnosis in almost 95% of patients.

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Introduction

Pediatric patients with chronic cough and recurrent croup may present a diagnostic and treatment dilemma. The etiology of chronic cough and recurrent croup may result from disease processes normally treated by pulmonologists, otolaryngologists or gastroenterologists. Our institution has created a multidisciplinary team in order to efficiently address the unique needs of these patients. We hypothesize that despite detailed history and physical exams, it is difficult to determine a priori the cause of

recurrent croup or chronic cough without a multidisciplinary evaluation.

Croup is the most common cause of stridor in the febrile child. It typically presents in children ages 6–36 months and is usually mild and self-limited. Typical infectious croup should happen no more than once or twice in child's life. Children with a prolonged course, multiple recurrent episodes, severe symptoms or age outside of the typical range (6–36 months) would be considered to have atypical or recurrent croup. Cough will often be associated with an acute upper respiratory infection and usually resolves within one to two weeks. A cough that persists beyond six weeks would be considered a chronic cough.

Several recent studies have highlighted the diverse causes of atypical croup [1,2]. These studies have highlighted the bronchoscopic findings associated with recurrent or atypical croup and even attempted to diagnose reflux disease based on a subjective

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view of the airway. Unfortunately, neither of these studies systematically evaluated their patients for reflux disease using esophagoscopy or pH probe. We know from previous studies that the subjective findings of inflammation on laryngoscopy do not correlate well with actual pathological reflux disease [3]. Interestingly, significant airway findings were identified in less than half of patients who undergo bronchoscopy for recurrent croup [1,2,4]. The remaining patients have no identifiable airway abnormality and are thus left without an explanation following bronchoscopy. Indeed, one recent study demonstrated abnormal pH probe findings indicative of GERD in 60% of children with a diagnosis of recurrent croup [5]. Others have demonstrated the association between chronic cough and reflux or eosinophilic esophagitis [6,7]. With this in mind, we set out to retrospectively review the patients with chronic cough and recurrent croup that were managed by the Comprehensive Airway, Respiratory and Esophageal (CARE) Team at the Steven and Alexandra Cohen's Children Medical Center. The CARE Team is our multidisciplinary service designed to collaboratively evaluate and manage patients with complex challenges related to the upper aerodigestive tract.

Methods

A retrospective chart review of all patients seen by our CARE Team physicians was performed between September 1, 2009 and December 31, 2011. Patients who carried a diagnosis of either chronic cough and/or recurrent croup were evaluated. Chronic cough was defined as any cough present for greater than 6 weeks. Patients with recurrent croup had three or more episodes of croup in their lifetime, with each episode characterized by either the presence of a bark-like cough or stridor. Patients were excluded if they did not receive the full CARE team workup, which included micro-direct laryngoscopy, flexible and/or rigid bronchoscopy and upper endoscopy with biopsies. Bronchioalveolar lavage (BAL) was performed at the time of bronchoscopy. If subglottic stenosis was suspected on micro-direct laryngoscopy, the airway was formally sized using the Cotton-Myer grading system.

We reviewed the charts for the presence of gastrointestinal complaints at the time of the initial history, including vomiting and spitting up ("GER"), abdominal pain and failure to thrive (FTT). We then compared the children with biopsy proven esophagitis to the remaining children to attempt to determine if physicians could determine a priori based on history and physical whether esophagitis is likely to be present on endoscopy. The two groups were compared using *T*-test for statistical significance. Statistical significance was defined as $p < 0.05$. The study was approved by the institutional review board of the North Shore Long Island Jewish Health System.

Results

We identified 40 patients who met inclusion criteria. Twenty-one patients met the criteria for recurrent croup and 19 patients had chronic cough as diagnosed by one of two pediatric pulmonologists on our team (MS or KT). Mean age was 5.76 ± 3.9 years. There were 29 males and 11 females. Twenty-one patients (53%) had 33 airway abnormalities (Table 1). Ten patients were diagnosed with two airway abnormalities and two patients had three airway abnormalities. The most common diagnosis was tracheomalacia, followed by enlarged adenoids.

We did not routinely evaluate and document tonsillar hypertrophy; however, three children underwent tonsillectomy at the time of the surgical procedure. Thus, these three children had concomitant and symptomatic tonsillar hypertrophy. There may have been other children with asymptomatic tonsillar hypertrophy. All nine children with adenoid enlargement had

Table 1
Number and percent of airway diagnoses.

Airway diagnosis	Number of abnormalities	Percent
Tracheomalacia	10	30
Adenoid enlargement	8	24
Bronchomalacia	5	15
Subglottic stenosis	2	6
Laryngomalacia	2	6
Innominate artery compression	2	6
Tracheoesophageal fistula	1	3
Unilateral vocal cord immobility	1	3
Subglottic cyst	1	3
Tracheal bronchus	1	3
Total	33	100

their adenoids removed (including the three children who also had their tonsils removed).

Fifteen patients (38%) had esophagitis noted on biopsy (group 1) while 25 (62%) had normal esophageal biopsies (group 2). Among the children with biopsy proven esophagitis (group 1), 4/15 (27%) met criteria for eosinophilic esophagitis based on the presence of greater than 15 eosinophils per high powered field.

There was no significant difference in ages between groups 1 and 2 ($p > 0.05$). There was no significant difference between groups 1 and 2 based on the presence of "GER" related complaints, abdominal pain and FTT ($p > 0.05$). There was no significant difference between the groups based on the location or presence of an airway abnormality ($p > 0.05$). Bacterial pathogens (abnormal bronchoalveolar lavage) were found in 33% of the patients we evaluated. BAL findings were also not significantly different between the 2 groups ($p > 0.05$) (Table 2). The most common pathogens were *Staphylococcus aureus* and *Streptococcus pneumoniae*. Antibiotic therapy in these patients resulted in clinical improvement of their chronic cough with decreased episodes of croup. Overall, our multidisciplinary approach to patients with recurrent croup and chronic cough led to a specific diagnosis in approximately 95% of patients evaluated

Discussion

Recurrent croup and chronic cough are challenging conditions to evaluate and manage. Pediatric patients with these complaints may be referred to either pediatric pulmonologists and/or pediatric otolaryngologists for evaluation. Interestingly, these complaints may result from a variety of causes spanning at least three different sub-specialty providers, the pediatric gastroenterologist, pulmonologist and otolaryngologist. When a pediatrician evaluates a child with recurrent croup or chronic cough, they must consider the symptoms to determine how best to manage the complaints or to whom to refer the patient. We evaluated the cause of recurrent croup and chronic cough in patients who were seen by the

Table 2
Comparison between patients with biopsy proven esophagitis (Group 1) and patients with no evidence of esophageal inflammation (Group 2). There was no statistically significant difference between the two groups for any of the metrics tested.

	Group 1		Group 2	
	Number	Percent	Number	Percent
GER complaints	7	47	7	28
Abdominal pain	1	7	4	16
Failure to thrive	1	7	2	8
Airway abnormality	7	47	14	56
Abnormal BAL	5	33	6	24

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