

# Chronic Cough in Children with Rhinosinusitis Associated with Allergic Rhinitis and Rhinosinusitis Alone

Li-Jung Fang, Man-Tsang Ng<sup>2</sup>, Chen-Wei Wang<sup>3</sup> and Kong-Sang Wan<sup>2,4</sup>

<sup>1</sup>Department of Pediatrics, Taipei City Hospital, Mother and Child Branch, Taiwan

<sup>2</sup>Long-Jiang Pediatric Clinic, Taipei city, Taiwan

<sup>3</sup>Yuan-Yuan Pediatric Clinic, Taichung city, Taiwan

<sup>4</sup>Department of Pediatrics, Taipei City Hospital, Renai Branch, Taiwan

\*Corresponding author: Kong-Sang Wan, Department of Pediatrics, Taipei city hospital, Renai branch, No10, Sec 4, Renai Road, Da An District, Taipei City 10629, Taiwan, Fax: +886 2 27046356, Tel: +886 2 27093600, E-mail: gwan1998new@hotmail.com

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## Abstract

**Background:** Postnasal drip is one of the main causes of Upper Airway Cough Syndrome (UACS). Whether antibiotic targeted on rhinosinusitis accompanying UACS and chronic cough led to an improvement in cough is controversy.

**Methods:** Fifty-five schoolchildren, aged 4 to 14 years, were randomized into two groups: (1) Rhinosinusitis with allergic rhinitis, n = 20 (2) Rhinosinusitis alone, n = 35. The Spirometry, Forced Expiratory Volume in one second (FEV1), Forced Expiratory Flow (FEF) 25-75%, and Fractional Exhaled Nitric Oxide (FENO) were performed in all participants to rule out asthma or airway hypersensitivity. A pediatric allergist examined and recorded the clinical features, including stuffy nose, nasal discharge, postnasal drip, cough, facial, and halitosis. In addition, one senior radiologist examined and reported the results of water's view and chest plain film for all schoolchildren. Both groups were given Amoxicillin/clavulanic acid twice a day for two weeks.

**Result:** After the two-week antibiotic treatment, both groups demonstrated significant release in coughing and nasal symptoms except one participant in group 1 and two participants in group 2. We highly suspected that these three participants had retracted bacterial bronchitis; therefore, we treated them with antibiotics for two more weeks.

**Conclusion:** Taking Amoxicillin/clavulanic twice a day for two weeks is effective for treating UACS and tolerated in schoolchildren.

**Keywords:** Chronic Cough; Allergic Rhinitis; Sinusitis

## Introduction

Upper Airway Cough Syndrome (UACS) often associated with the cause of chronic cough yet it is in dispute [1]. There are numerous Rhinological findings that give rise to UACS including allergic, non-allergic, and infective Rhinosinusitis. The diagnosis of UACS-induced cough is made by reviewing symptoms, physical examination, radiological examination, and response to therapy [2]. There was a wide variation between comparing the reported incidence of UACS in America and Britain. In the United States, The range is from 26% to 87% whereas in the United Kingdom, the rates reported from 6% to 34% [3-5]. The pathogenesis of the Post infectious cough is unknown but it is thought to be caused by extensive inflammation and disruption of upper and/or lower airway epithelial integrity [6-10]. When Post infectious cough emanates from the lower airway, this is often associated with Mucus Hypersecretion and/or transient airway and cough receptor Hyperresponsiveness; which may contribute to the Subacute cough. In another study, the authors proposed that most patients with Rhinosinusitis, postnasal drip, and Pharyngolaryngitis showed laryngeal hyperresponsiveness that were consistent with an irritable larynx [2,11,12]. An irritable larynx is common in patients with chronic cough and indicated upper airway involvement, whether from rhinitis/sinusitis, gastric reflux, or idiopathic sensory neuropathy [13]. There could be more than one particular cause for cough, for instance, asthma associated findings were found in some of the patients with UACS [14]. The symptom, coughing, presented for more than 4 weeks may be due to a recognized and specific cause or non-specific and be suspected protracted bronchitis. Moreover, chronic cough is rarely caused by gastroesophageal reflux for the reason, the symptom is different one from to another [15]. Antibiotic therapy is required when Rhinosinusitis is lasts over 15-20 days in order to prevent complications and avoid turning into a chronic illness [16].

## Methods

Chronic cough defined as a cough persisting for four or more than four weeks. We included randomized controlled trials (RCT) and quasi-RCTs, which evaluated 55 children (M=33, F=22) younger than age 18 with acute Rhinosinusitis or acute Rhinosinusitis with allergic rhinitis. Acute Rhinosinusitis was defined as persistent symptoms for more than 10 days but less than 4 weeks. Patients with normal chest X-ray results and without respiratory tract infections in the preceding 4 weeks were recruited. Symptoms and examination were based on data recorded in the card at the time of the initial visit. Pulmonary function test, Fractional Exhaled Nitri Oxide (FENO), chest radiography, and water's view sinus film were performed on all participants. We also conduct further workup on whoever required further investigation. The participants had been investigated and treated with a standard protocol for the exclusion of asthma and Gastroesophageal reflux. Subjects who did not report 'mucus in the throat' was excluded, and none of the subjects were on treatment for Rhinosinusitis at the time of inclusion into the study. Other exclusion criteria included bronchiectasis, history of hypersensitivity to any of the study medications and those on prolonged courses of oral or injectable corticosteroids. This study investigated the effectiveness of the two-week Amoxicillin/clavulanic acid through analyzing the six categorized subjective symptoms and x-ray findings in pediatric patients with Rhinosinusitis with/without allergic rhinitis. The symptoms considered were stuffy nose, nasal discharge, postnasal drip, cough, facial and halitosis, using for statistical analysis multivariate logistic regression, Wald tests.

## Results

After amoxicillin/clavulanic acid treatment for two weeks, all schoolchildren's coughing and nasal symptoms were significantly released when re-evaluating the six categorized subjective symptoms. Interestingly, even though the FEV1 and FEF 25-75% were within predicted values, the FENO was increased up to 193+/-102.8 ppb, 185+/-107.3 ppb in group 1 and group 2 respectively (Table 1). However, one participant in group 1 and two participants in group 2 still presented with cough persistently after the antibiotic treatment. Retracted bacterial bronchitis was highly suspected in these three schoolchildren; as a result, antibiotic was given for two more weeks until their coughing symptom subsided.

	Rhinosiusitis plus allergic rhinitis	Rhinosinusitis alone
Age (year)	4-14	4-12
Sex	M=19 F=6	M=14 F=21
EFV1 >90% predict	yes	yes
FEF25-75>90% predict	yes	yes
FeNO≤279.0 ppb	yes	yes
Water's view	sinusitis 96% (n=24)	sinusitis 94.3% (n=33)
Chest pa	unremarkable	unremarkable
Clinical features		
Stuffy nose	n=23	n=30
Nasal discharge	n=25	n=33
Postnasal drip	n=21	n=32
Cough	n=25	n=35
Facial pain	n=2	n=3
Halitosis	n=8	n=11
Systemic corticosteroid	No	No

**Table 1:** Demographic data, clinical features & laboratory parameters of Participants

FEV1=Forced expiratory volume in one second

FEF<sub>25-75</sub>=Forced expiratory flow at 25-75%

FeNO= Fractional exhaled nitro oxide

## Discussion

The association between chronic cough and sinusitis in children is well known [17]. Rhinorrhea, postnasal drip secondary to sinusitis often lead to chronic cough and short antibiotic treatment courses are commonly prescribed [17,18]. The typical features of UACS included a history and/or symptoms of rhinitis, retropharyngeal postnasal drip, and wet cough occurred mostly during daytime. The diagnostic specificity of the above factors was more than 70% [19]. According to the literature review, there was no evidence to determine whether the use of antihistamines, decongestants or nasal irrigation was effective in children with acute sinusitis [20]. Moreover, it is unclear if the mechanism of cough was the UACS itself or direct irritation or inflammation of cough receptors locate in the upper airway. Therefore, antibiotics treatment for sinusitis might relieve the chronic cough. In this study, asthma was ruled out for participants through using the spirometer, FEV1, and FEF 25-75%. The FENO level in both groups were increased but the difference between the two groups did not show statistical significance (Table 2). The cut-off value (279.0 ppb), we used for the diagnosis of sinusitis induced prolonged cough is the same in Kim *et al.* study [21]. Sinus abnormalities

on X-ray are associated with prolonged cough in 65% of the children. The water's view sinus film is a clinically useful screening tool for clinicians in the workup of chronic cough [22]. In our research, the radiologist's reading of the water's view was positive for sinusitis in 94.5% (n = 52) children with prolonged cough while 5.45% (n=3) were negative finding. The frontal sinus was the most involved symptom, followed by the ethmoid sinus, and the maxillary sinus. The findings of chest film of all participants were negative or under the diagnosis of bronchitis only. Fifty-five children accepted amoxicillin/clavulanic acid treatment for two weeks. After treatment, 100% of patients with sinusitis were fully recovered and only three patients who without sinusitis persisted with cough. Cough with viral infection last up to two weeks in 70-80% of all children, however, the cause may be Protracted Bacterial Bronchitis (PBB) if cough present for more than 4 weeks [15,23]. Therefore, additional amoxicillin/clavulanic acid 2 weeks was given to those 3 patient and the coughing improved significantly. The results in two studies showed more than 70% of the children had aerobic bacteria in their sinuses. Besides, researchers found alpha-hemolytic streptococci 20.8%, Hemophilus influenzae 19.5%, Streptococcus pneumonia 14.0%, coagulase-negative staphylococci 13.0%, and Staphylococcus aureus 9.3% at time of sinus surgery [23]. In the bacteria diagnosis, another participant, who had chronic sinusitis with prolonged cough, showed Hemophilus influenza 35%, Streptococcus pneumoniae 30%, Maraxella catarrhalis 20%, and Staphylococcus aureus 5% [24]. Thus, amoxicillin/clavulanic acid treatment should be the choice of drug in PBB.

	Rhinosinusitis plus allergic rhinitis	Rhinosinuitis alone
<b>Clinical features</b>	subsided but cough persisted in 1 case (possible RBB)	subsided but cough persisted in 2 cases (possible RBB)
<b>FEV1 &amp; FEF25-75</b>	within predicted value	within predicted value
<b>FeNO (ppb)</b>	increased (193±102.8)	increased (185±107.3)
<b>RBB</b>	released after 2 more weeks antibiotics	released after 2 more weeks antibiotics

**Table 2:** Antibiotics treatment outcome of the participants

The clinical symptoms are using statistical analysis multivariate logistic regression, Wald tests.

FEV1= Forced expiratory volume in one second

FEF25-75= Forced expiratory flow at 25-75%

FeNO= Fractional exhaled nitro oxide

RBB= Protracted bacterial bronchitis

## Conclusion

In conclusion, children has UACS with or without allergic rhinitis, Amoxicillin/clavulanic acid is first choice for therapy.

## Conflict of Interest

The authors declared that there are no conflicts of interest that may be inherent in the submission.

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