

Evaluation of Chronic Cough in Pediatrics: Clinical and Diagnostic Spectrum and Outcome of Specific Therapy

Sandeep Shyamrao Mogre^{1,*}, Sunil Deshmukh², N.L. Fuljhele³, Kavita Lall⁴

^{1,2,4}Assistant Professor, ³Professor, Department of Pediatrics, CCM Medical College & Hospital, Chhattisgarh

***Corresponding Author:**

Email: mogre91@gmail.com

ABSTRACT

A Cough is a sudden and often repetitively occurring reflex which helps to clear the large breathing passages from secretions, irritants, foreign particles and microbes. Chronic cough is defined as a cough lasting for three weeks or more. This is because most acute.

Respiratory infections in children resolve within this interval.

Chronic cough needs to be evaluated for the underlying disease in a systematic manner regarding the nature of cough, timing of cough, onset of cough, site of pathology, associated clinical features, response to previous medications, seriousness of problem, the differential diagnosis and investigations. Therapy should be based on physiologic derangement and etiology.

Key word: *Chronic cough in children, Bronchoscopy*

INTRODUCTION

Cough is a sudden and often repetitively occurring reflex which helps to clear the large breathing passages from secretions, irritants, foreign particles and microbes.

Cough may be voluntary or involuntary, infrequent and hardly noticeable or painful, disruptive and debilitating. Cough may be viewed as a continuum of health through disease and is a useful host defense mechanism. Cough gives protection to the tracheobronchial tree from potentially injurious substances and by removal of endogenous secretions and other materials, such as pus, necrotic tissue and foreign bodies(1).

Chronic cough needs to be evaluated for the underlying disease in a systematic manner regarding the nature of cough, timing of cough, onset of cough, site of pathology, associated clinical features, response to previous medications, seriousness of problem, the differential diagnosis and investigations. Therapy should be based on physiologic derangement and etiology. In this clinical study, we have attempted to evaluate the varied clinical presentation and response to specific therapy in children with chronic cough.

SUBJECTS AND METHODS

The study was carried out between June 2014 to June 2015 in the Department of Pediatrics, C.M. Medical College and Hospital, Kachandure, Durg(C.G.). A prospective study of 104 consecutive, unselected, immunocompetent patients, aged between 1 to 12 years was designed for the children with chronic cough, with the duration of at least 3 weeks or more of unknown etiology at the time of enrolment. Patients with congenital or acquired heart diseases were excluded. Informed consent from the parents was obtained.

We worked on the following diagnostic protocol (day =D); (i) D1: History and physical examination; (ii) D2:

Sequential incorporation of routine investigations; e.g., complete blood count with differential count, erythrocyte sedimentation rate, Mantoux test, sputum examination, throat swab for microscopy, culture and sensitivity and X-ray chest; and (iii) D3: Special investigations done were broncho-scopy, sweat chloride, HIV, CT scan chest and barium swallow whenever indicated.

Pretreatment and post-treatment diagnostic criteria.

Prospective criteria were established for the presumptive diagnosis of following diseases. Final diagnosis required fulfillment of criteria plus disappearance of cough with specific therapy.

1. Bronchial asthma: Recurring episodes of non-productive cough, breathlessness and wheezing, having family history in some cases(2-4), with reversibility of airway obstruction when treated with broncho-dilators alone or with corticosteroids(5,6).
2. Cough variant asthma: Cough variant asthma has chronic cough as the sole manifestation, these patients do not wheeze and respond to therapeutic trial of bronchodilator in 3-5 days. There should be no other etiological factor(3,7,8).
3. Tuberculosis: Patients complained of cough associated with low grade fever, loss of appetite and weight or had protein energy malnutrition. X-ray chest was suggestive of tuberculosis. Mantoux test was more than 10 mm with 5 TU PPD(9-11).
4. Pulmonary eosinophilia: Chronic cough with absolute eosinophil count more than 1500/cumm which responded to diethyl-carbamazine for 21 days and deworming the patient with mebendazole for 3 days(12).
5. Sinusitis: Patients with sinusitis described the sensation of having something drop down into their throats and/or the need to frequently clear their

- throats. They had history of headache and sinus point tenderness. Physical examination of the nasopharynx and oropharynx revealed mucoid or mucopurulent secretions and/or cobblestone appearance of the mucosa. Radiology was suggestive of asymmetry of sinuses. Sinusitis was treated with combination of antibiotics for 2 to 3 weeks and chlorpheniramine maleate. Allergic rhinitis with post-nasal drip was treated with antihistamine and decongestant preparation(13,14).
6. Bronchiectasis: Patients presented with chronic cough with copious mucopurulent sputum during acute respiratory infections. Moist or musical creptitations were heard or elicited by cough. X-ray chest and CT scan chest confirmed the diagnosis. Bronchiectasis was treated with broad-spectrum antibiotics for 2-3 weeks, along with steam inhalation for ten minutes before chest physiotherapy and postural drainage(15).
 7. Bronchopneumonia: The patients had fever, dyspnea, creptitations in chest or bronchial breathing and X-ray chest suggestive of bronchopneumonia. They were treated with intravenous antibiotics, steam inhalation, mucolytic agent and postural drainage.
 8. Pertussis: Children were unimmunized or partially immunized for pertussis, having dry whoopy cough with absolute lymphocytosis (lymphocytes 70-80% of TLC). Pertussis was treated with oral erythromycin in a dose of 40 mg/kg for 21 days(16).
 9. Gastroesophageal reflux: The patients presented with symptoms of upper abdominal pain, vomiting followed by coughing and wheezing. Barium swallow study demons-trated reflux of barium. Sensitive investiga-tions such as 24 hours esophageal pH monitoring, upper GI endoscopy, esophageal biopsy, radionucleide scan could not be done in our set up. Gastroesophageal reflux was treated with high protein low fat diet and eating frequent small meals, not eating or drinking prior to sleep except for taking medications, elevated head end of bed, metoclopramide (prokinetics) and H2 blockers(17,18).
 10. Foreign body inhalation: Patients had history of sudden onset with gagging while eating or playing. Paroxysmal cough may have been associated with blood in sputum. Patients may have had wheeze. Respiratory distress in the form of contraction of neck muscles, pulsus paradoxus and nasal flaring may have been present. X-ray chest could be suggestive of collapse, emphysema, bronchi-ectasis or the foreign body. Patients were subjected to diagnostic and therapeutic bronchoscopy with foreign body removal(19).
 11. Table I summarizes the diagnosis made in the study children. The commonest cause was bronchial asthma plus cough variant asthma in 39.4% (n = 41) while tuberculosis was found in 24% (n = 25) and pertussis in 4.2%(n = 4). Sixty eight per cent (n = 64) patients had cough of 3-4 weeks duration followed by 10.6% (n = 10) having cough of 4-5 weeks duration. Maximum number of patients, presented with non-spasmodic cough (69.1%), non-seasonal cough (62.7%) and dry cough (72.3%). The cough occurred more frequently any time (57.4%) as opposed to nocturnal (39.3%)
 12. Other presenting symptoms and signs are summarized in Table II. Maximum number of patients presented with breathlessness (62.7%), rhonchi in chest (60%), creptitations (51%) and fever (45.7%).

Table 1: Diagnostic Spectrum in 104 Cases with Chronic Cough

Diagnosis	Number	Percentage
Bronchial asthma	26	25.0
Cough variant asthma	15	14.4
Tuberculosis	25	24.0
Pulmonary eosinophilia	09	9.5
Sinusitis	09	9.5
Bronchiectasis	05	5.3
Bronchopneumonia	05	5.3
Pertussis	04	4.2
Gastro-esophageal reflux	02	2.2
Foreign body aspiration	02	2.2
Others	02	2.2
Total	104	100

A positive family history of bronchial asthma was present in 17 patients out of total 104 study subjects (Table 3). Out of 26 patients of asthma, 10 patients (39%) had family history of bronchial asthma. Out of 13 patients of cough variant asthma, 6 patients (46%) had family history of bronchial asthma.

Sixty nine (73.4%) patients were living in urban slums; 10 (10.6%) were from urban non-slum background and 15 (16.1%) resided in rural areas. Eighteen (19.1%) patients were living close to industries or mills.

Seventy three (77.6%) patients had history of receiving antibiotics before being enrolled in the study. However, only 46.8% had infective etiology, this includes tuberculosis in 22.3%. Thus, only 24.5% patients needed antibiotics.

In the present study cough was due to one cause in 91.4% of patients and due to two causes in 8.6% of patients.

Table 2: Symptoms and Signs

Symptoms and Signs	Number	Percentage
Breathlessness	59	62.7
Fever	44	45.7
Nasal discharge	35	37.2
Post nasal drip	8	8.5
Cervical lymphadenopathy	25	26.5
Tonsillitis	15	16
Clubbing	5	5.3
Rhonchi	57	60
Crepitations	48	51

Table 3: Positive Family History in Study Subjects (n=104)

Positive Family History	Number	Percentage
Asthma	15	15.0
Rhinitis	40	42.5
Skin atopy	11	11.7
Smoking	22	23.4
Tuberculosis	13	13.8

Diagnosis by careful history and physical examination was done in 39.4% (n = 37) patients. Diagnosis by history and physical examination and routine investigations was done in 87% (n = 82) patients. In 12.7% (n = 12) of patients the diagnosis was not possible by history, physical examination and routine investigations and hence special investigations were conducted.

Bronchoscopy was done in 12 patients, out of which therapeutic foreign body removal was done in 2 patients. In other patients, bronchoalveolar lavage was simultaneously done. Bronchoscopy result was positive in 10 out of 12 patients which included foreign body removal (n = 2), mucus plug removal (n = 2), diagnosis of endo-bronchial tuberculosis (n = 2), and diagnosis of bronchiectasis (n = 4) with removal of thick tenacious secretions (n = 4).

DISCUSSION

Bronchial asthma along with cough variant asthma was found to be the commonest cause of chronic cough followed by tuberculosis in this study from Central India at Durg (C.G.), having dry and hot weather (humidity ranges between 10 to 40% in different seasons, except in rainy seasons).

We found asthma in 25% of patients and cough variant asthma in 14.4% as etiological cause of chronic cough. Two studies from Mumbai, Western Maharashtra have reported asthma in 39% and 29% of patients of chronic cough, respectively. However, cough variant asthma has not been mentioned as a separate group in both these studies(20,21).

Non spasmodic and non-seasonal cough was more prevalent than spasmodic and seasonal cough, as 63% patients had etiology other than asthma. Seasonal and spasmodic cough during winter and rainy season is suggestive of an allergic hyper reactive airway disease, and was found in 37% children having asthma.

Family history of asthma was present in 41% patients of asthma while 46% patients of cough variant asthma had positive family history of asthma. Family history of asthma, rhinitis and skin atopy reflects the same pattern and such a history helps in alerting the physician, though it may not always be present(22).

Family history of smoking was present in 23% (n = 22) of children. Out of 35 patients of asthma, 40% (n = 15) had passive cigarette smoke as a triggering factor for their symptoms. This is in accordance with earlier studies which have shown strong association of childhood respiratory symptoms with passive smoking(23).

Cough variant asthma was found in 14.4% patients as a cause of chronic cough. These patients do not wheeze. They have dry hacking cough which is more irritating at night. Cough may occur at any time of the day. Pulmonary function tests with methacholine challenge test confirm the diagnosis. A therapeutic trial of bronchodilator shows a response in 3 to 5 days(3).

Tuberculosis was found in 22.3% of the patients in our study. Positive family history of tuberculosis was present in 60% of these patients. Other studies have documented similar findings(20,21).

Sinusitis was found in 9.5% patients. Paramesh(24) from Bangalore found a similar prevalence while Nadkarni and Lahiri(21) found it in 16% of the patients in Mumbai. A lower frequency of sinusitis in our series could be due to dry weather and less humidity in Central India(14). The patients describe the sensation of having something drop down into their throat and/or the need to frequently clear their throat. They have positive history of headache. Sinus points show tenderness and nasopharynx and oropharynx reveal post nasal drip and/or cobblestone appearance of mucosa. They have chronic night and early morning cough. Radiology of sinuses is not a good modality of diagnosis. CT scan may be needed for diagnosis. Nasal secretions may be stained for eosinophils or neutrophils to differentiate the cause as allergy or infection(13). The incidence of sinusitis is less in dry weather as there is less mucosal edema, thus less stagnation of sinus secretions which causes sinus blockade and sinusitis(14).

Pertussis was found in 4.2% patients as a cause of chronic cough. In India, the present immunization coverage is 82%. Proper implementation of universal immunization program with 100% coverage can eliminate this preventable cause.

Gastroesophageal reflux was seen in 2.2% of the patients in our study. Gastroesophageal reflux leads to esophagitis, vomiting and may lead to pulmonary aspiration. A relationship between bronchospasm and reflux has also been proposed. Positive abdominal pressure caused by forced expiration during coughing and wheezing can lead to gastro-esophageal reflux. The drugs used for the treatment of bronchial asthma like β -adrenergic agonists and xanthine derivatives lead to relaxation of esophageal sphincter which may be an aggravating factor for reflux. There should be high index of suspicion, otherwise these cases could be missed.

Infective etiology (other than tuberculosis) was present in 24.5% patients. History of receiving antibiotics, prior to enrollment in the study, was present in 77.3% cases. Therefore, it suggests that antibiotics should be used in appropriate cases only and their misuse should be avoided.

In 87.3% of patients, a diagnosis could be made with thorough history, physical examination, and routine investigations. Special investigations were required for only 12.7% of patients. Bronchoscopy is very useful

diagnostic and therapeutic tool. Out of 12 patients subjected to bronchoscopy positive results were present in 10 patients. Removal of foreign body was the only treatment available for the patients having foreign body in bronchus. Bronchoalveolar lavage was helpful for the removal of mucus plug causing chronic cough in younger children and removal of thick tenacious secretions in bronchiectasis, which were difficult to expectorate out by children in spite of the usual measures of steam inhalation, physiotherapy and postural drainage. The bronchoalveolar lavage fluid microscopy, Gram staining and culture helped to start appropriate antibiotics for these patients and helped in diagnosing endobronchial tuberculosis.

Contributors: SS Mogre coordinated the study, particularly its design and interpretation; and drafted the paper. He will act as the guarantor of the paper. S Deshmukh participated in data collection and DBalpande helped in drafting the paper. S Mukerji helped in pathological testing.

Funding: None

Competing interests: None stated

REFERENCES

1. Black P. Evaluation of chronic or recurrent cough. *In: Pediatric Respiratory Disease: Diagnosis and Treatment*. Ed. Hilman BC, Philadelphia, W.B. Saunders Company, 1993; p 143-153.
2. Paramesh H. Scenario of respiratory ailments in children with particular references to asthma in Bangalore. *In: Recent Trends in Aerobiology, Allergy and Immunology*. Ed Aghashe SM. Bangalore, Oxford and IBH publishing, 1994; pp 43-82.
3. Cloutier MM, Lughlin GM. Chronic cough in children. A manifestation of airway hyper-activity. *Pediatrics* 1981; 67: 6-12.
4. YJ Kelly, BJ Braabin, PJM Milligan, JA Reid, Heaf D, Pearson MG. Clinical significance of cough and wheeze in the diagnosis of asthma. *Arch Dis Child* 1996; 75: 489-493.
5. International Pediatric Asthma Consensus Group. Asthma: A follow statement from an International Pediatric Asthma Consensus Group. *Arch Dis Child* 1992; 67: 240-247.
6. Hatch RT, Carpenter GB, Smith LJ. Treatment options in the child with a chronic cough. *Drugs* 1993; 45: 367-373.
7. Hanna way PJ, Hopper DK. Cough variant asthma in children *JAMA* 1982; 247: 206-208.
8. Annotation Cough - but is it asthma? *Arch Dis Child* 1994; 70: 1-2.
9. Seth V, Singh U. Clinical spectrum of tuberculosis in children: An outcome of host's immunity in relation to nutritional status. *Indian Pediatr* 1986; 23: 831-834.
10. Udani PM. Tuberculosis massive pneumonia in infancy and early childhood: Varieties of clinical presentation. *Pediatr Clin India* 1983; 18: 126-142.
11. Vallego JG, Ong LT, Starke JR. Clinical features, diagnosis and treatment of tuberculosis in infants and children. *Pediatrics* 1994; 94: 1-6.
12. Stern RC. Loeffler syndrome (eosinophilic pneumonia). *In: Nelson's Textbook of Pediatrics*, 15th edn. Eds. Nelson WE, Behrman RE, Kliegman RM, Arvin AM. Philadelphia. W.B. Saunders Company 1996; pp 1219-1220.

13. Rachelefsky GS, Katz RM, Siegel SC. Chronic sinusitis in the allergic child. *Pediatr Clin North Am* 1988; 35: 1091-1101.
14. Mackey IS, Bull TR. Infective rhinitis and sinusitis. *In: Scot-Brown Otolaryngology*, 6th edn. Mumabi, K.M. Varghese Co, 1997; pp 1-25.
15. Stern R. Bronchiectasis. *In: Nelson's Textbook of Pediatrics*, 15th edn. Eds. Nelson WE, Behrman RE, Klickman RM, Arvin AM. Philadelphia. W.B. Saunders Company, 1996; pp1232-1233.
16. Sutter RW, Cochi SL. Pertussis hospitalizations and mortality in the United States; 1985-88: Evaluation of the completeness of national reporting. *JAMA* 1992; 267: 386-390.
17. Hillmeier AC. Gastroesophageal reflux: Diagnostic and therapeutic approaches. *Pediatr Clin North Am* 1996; 43: 197-212.
18. Orenstein SR, Orenstein DM. Gastroesophageal reflux and respiratory diseases in children. *J Pediatr* 1988; 112: 847-855.
19. Puhakka H, Suedstorom E, Penttikero. Tracheobronchial foreign bodies: A persistent problem in pediatric patients. *Am J Dis Child* 1989; 143: 543-545.
20. Lahiri K. Chronic cough in children: Evaluation and management. *Asian Pediatr Prac* 1997; 1: 85-88.
21. Nadkarni UB, Lahiri K, Naik M. Spectrum of chronic cough in children. Abstract XXXVII National Conference of Indian Academy of Pediatrics, Hyderabad 2000.
22. Sears MR, Holdaway MD, Flannery EM, Herbinson GP, Silva PA. Parental and neo-natal risk factors for atopy, airway hyper-responsiveness and asthma. *Arch Dis Child* 1996; 75: 392-398.
23. Charlton A. Children's coughs related to parental smoking. *BMJ* 1984; 288: 1647-1649.
24. Paramesh H. Clinical profile of chronic cough in children. Abstract of 9th Asian Congress of Pediatrics, Hongkong.