Cough in Children : *clinical approach and management*

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Definitions

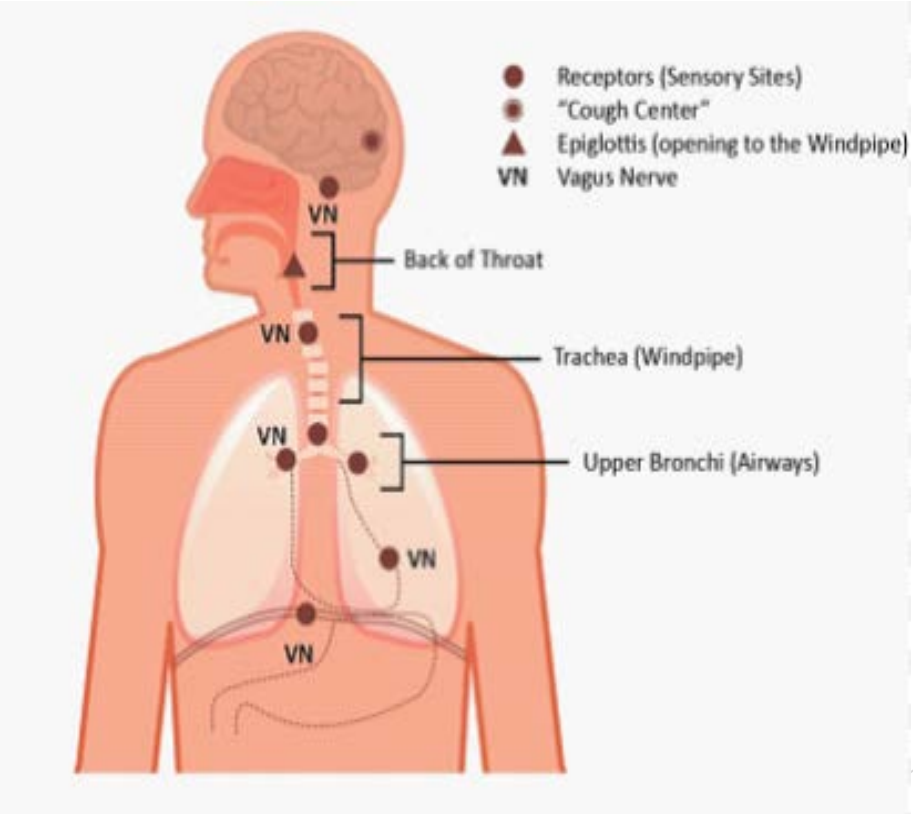
Cough :Cough is a complex physiological reflex that consists of a

violent expiration to release secretions, foreign matter, overcome

bronchospasm or relieve diseases of the airways and protect the respiratory system .

Cough receptors :located along the length of the airway from the larynx to the segmentary bronchi, are stimulated by chemical irritation, tactile stimulation and mechanical Forces.

- The cough reflex consists of an **<u>afferent pathway</u>** : impulses travel via the branches of the vagal and laryngeal nerves-→ brainstem and are modulated in the cerebral cortex →
- <u>efferent pathway (motor)</u> includes the respiratory muscles.



What provokes cough receptors ?

- Upper respiratory tract infections (URTI)
- Bronchial hyperactivity (BHR)
- Asthma
- Gastroesophageal reflux disease (GERD)
- Angiotensin converter enzyme inhibitor therapy

Epidemiology : children Vs adults

- Children are more prone to cough , Why ??
  - increased frequency of respiratory infections
  - increased cough receptor sensitivity

- Children (normally) to cough 14-21 days following a lower respiratory tract infection
- Prospective studies of acute cough post viral RTI :

  1/2 last for more than 1 week, 1/4 will persist for more than 2 weeks and approximately 5% for more than 4 weeks.
- Viral infections are very common in childhood and some normal children will have 10-12 infections per year.(adults : 2-4 viral RTI/ year)
- Some children with apparently persistent cough are likely to be suffering from sequential viral infections

Why is cough important ?

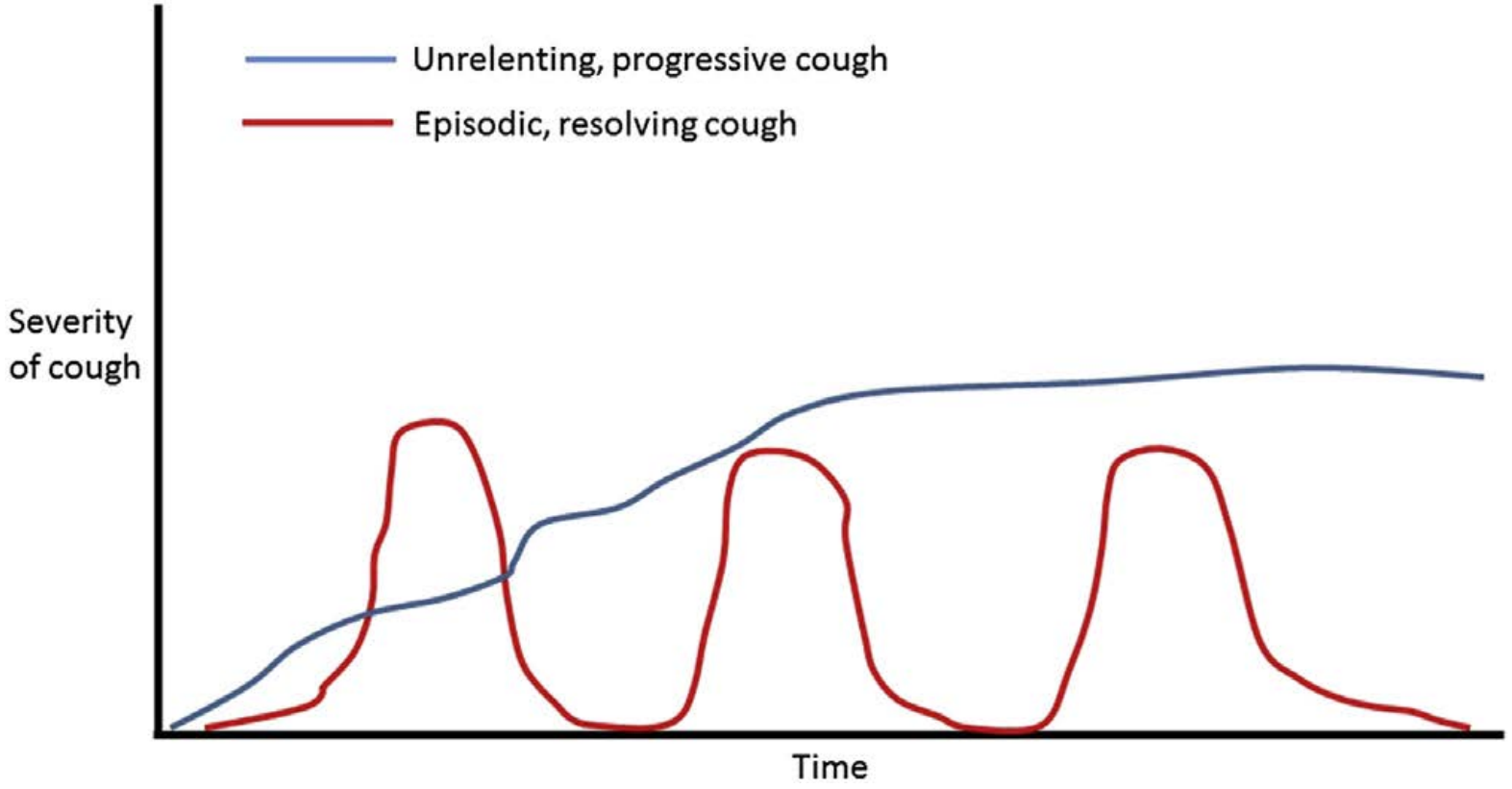
- One of the most common reasons for consultation in routine pediatric practice .
- Worrying when persists for a prolonged period
- Negative impact on sleep and daily activities and affects the quality of life of the child and the parents or caregivers.
- Management of cough in children must be in accordance with applicable pediatric guidelines, that are different from adults.
- In recent years, specific guidelines have been developed for the management of cough in children.

Approach to cough : overview

- Onset : sudden , gradual
  very early childhood → Congenital problem.
  reported by many after a single event (pneumonia) .
- Duration : acute ,subacute (prolonged) , chronic .
- Progression : episodic improving with time , or persistent and progressive
- Nature : dry ,wet
- Characteristic sounds :whoop , stridor , wheeze .

Figure 1 Difference in symptoms between viral cough and chronic cough.

SYMPOSIUM: IMMUNITY AND INFECTION



Important associated symptoms ,clues :

- Wheezing or breathing difficulties:
- Asthma, foreign body, recurrent aspirations, tracheobronchomalacia, bronchiolitis obliterans, interstitial diseases, chronic pulmonary disease in pre-term infants and heart diseases,…..etc
- Atopic dermatitis, allergic rhinitis or sensitivity to allergens, personal and family history of allergy or asthma, occurs at night and is exacerbated with exercise, cold or exposure to irritants or allergens, a diagnosis of asthma is more probable.

Important associated symptoms,clues :

- **Hemoptysis**
- Pneumonia, pulmonary abscesses, BE, CF, foreign bodies, tuberculosis, pulmonary hemosiderosis, tumors, pulmonary hypertension or pulmonary arteriovenous malformations must be excluded.
- **Nasal obstruction, mucopurulent rhinorrhea** and halitosis would suggest upper airway cough syndrome or posterior nasal drip
- **Persistent headache** may be a symptom of sinusitis.
- **Recurrent febrile syndrome**, general malaise, constitutional symptoms and a generally productive cough , contact study to rule out tuberculosis.
- **Cough associated with food-related** regurgitation and choking :Aspiration syndromes

Important associated symptoms,clues :

- **Psychogenic cough** is dry, hacking, repetitive and frequent during the day, and calms down or disappears during sleep;
- it exacerbated in the presence of parents or caregivers and diminishes with distraction and sport.
- It is diagnosed exclusively in a healthy child who does not improve with medication

Important associated symptoms, clues :

- If the patient received any type of treatment and what effect it has had on the cough,
- Environmental factors (smoking in the family, daycare attendance, animals, environmental irritants…..)
- look for alarm signs or symptoms :

(neonatal onset, cough during feeding, cough with sudden onset, suppurative cough with expectoration, nocturnal sweating, associated weight loss or signs of chronic pulmonary disease, etc.).

How long has it gone on for?

- Acute cough : symptoms that last for less than 3 weeks (acute viral URTI)

  (US and AU :2 weeks ,UK 4 weeks)

- Prolonged acute (subacute) : episode of coughing which lasts for 3-8 weeks (B pertussis ,mycoplasma)

- Chronic cough :Children with continuous symptoms for more than 8 weeks

Etiology of Cough in Children

- Acute
- Subacute (prolonged acute)
- Chronic

Acute Cough

- Cough is caused mostly by URTI that normally resolves spontaneously.
- Preschoolers may have up to 8–10 episodes of URTI a year, and coughing may last for more than2 weeks.
- Possibility of inhalation of a foreign body or bacterial infections must be taken into consideration if warning signs

Diagnostic Evaluation of Acute Cough

- Children with acute cough do not generally require any complementary examination, since progress is usually self-limiting.

- Chest X-ray indicated :

  -Clinical suspicion of pneumonia

  -Chronic respiratory disorder

  -Hemoptysis

  -Sudden onset of cough or an episode of choking that might suggest FB aspiration (ins/exp film , Bronchoscopy)

Diagnostic Evaluation of Acute Cough

- ***Cough characteristics :***

  1- wheezing : asthma

  2-hacking ,metallic cough :laryngomalacia , tracheomalacia,croup

  3-Staccato cough :Chlamydia trachomatis , Mycoplasma pneumoniae

  4-Paralytic cough with or without stridor,pertussoid syndromes

  5-croaking, strident cough, psychogenic.

Subacute Cough

- Cough lasting 4 weeks
- most cases, it is caused by prolonged or overlapping URTIs or bacterial infections.
- Recommended approach is observation
- If the cough persists more than4 weeks, a chest X-ray should be performed→ normal :child should be monitored up for 6–8 weeks.

Chronic Cough

- Cough persisting more than 4 weeks, according to the US and Australian-New Zealand guidelines, or more than 8 weeks, according to the UK guidelines.
- Cases of chronic cough in children vary depending on age.
- Frequencies of causes varies among studies :

marchant et al:(persistent bacterial bronchitis (PBB) (40%), spontaneously resolving prolonged or overlapping URTIs, asthma in 10% of cases , upper airway cough syn-drome or GERD) .

Asiloy et al. :asthma (25%), PBB (23%),upper airways syndrome (20%) and GERD (5%).

- After adolescence, the causes of chronic cough are similar to those in adults.

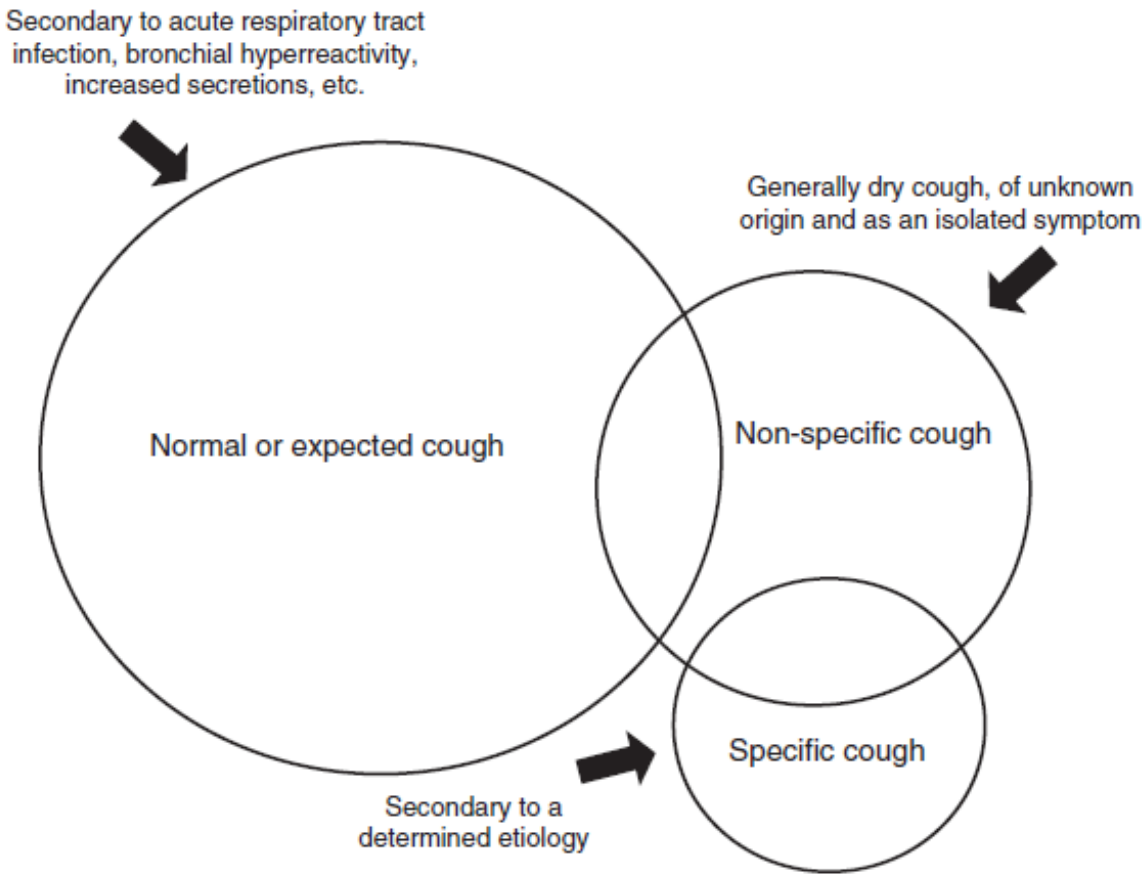
Chronic cough

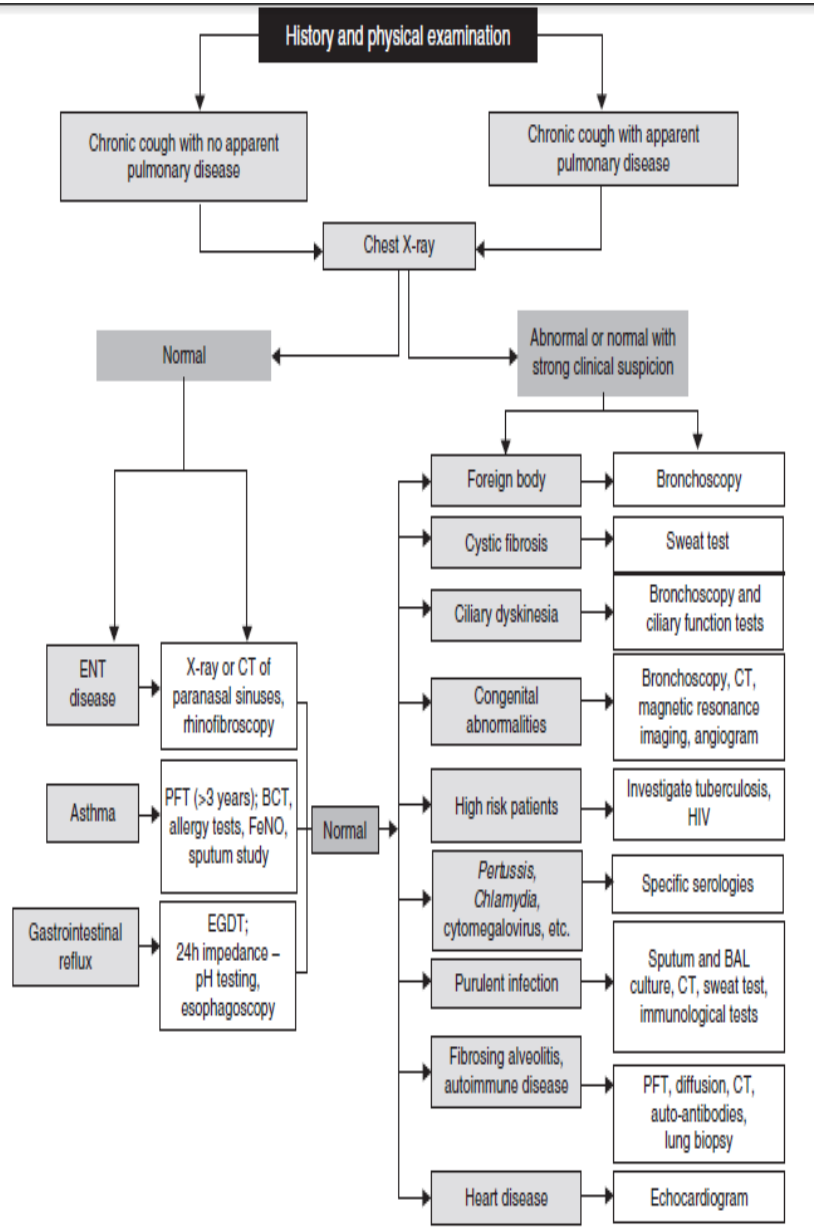
- Chronic cough in children can be classified into 3 etiological groups
- 1. Normal or expected cough: The cause is known, so the cough is considered expected and no specific studies are required.
- 2. Specific cough: This is cough that occurs with signs and symptoms suggesting a specific diagnosis that has been reached after thorough examination. (asthma, bronchiectasis(BE), cystic fibrosis (CF), aspiration of a foreign body, aspirative symptoms, atypical respiratory infections, cardiac abnormalities and pulmonary interstitial disease, among others

Chronic cough

- 3-Non-specific cough: This includes syndromes that present with predominantly dry isolated cough, with no signs or symptoms suggestive of disease in a child who feels well and in whom complementary studies (at least spirometry, if feasible, and chest X-ray) are normal.
- In most cases, it is secondary to protracted URTI, it is not serious and resolves spontaneously.
- Sometimes persistent cough is due to an increase in sensitivity of the cough receptors after a viral infection
- Environmental contamination and exposure to tobacco smoke may contribute to its persistence.
- Many of these cases are treated incorrectly with inhaled corticosteroids, having been classified as “cough variant asthma”.

A. Lamas et al. / Arch Bronconeumol. 2014;50(7):294–300





CT: computed tomography; PFT: pulmonary function tests; BCT: bronchial challenge test;
FeNO: exhaled nitric oxide; EGDT: esophageal-gastroduodenal transit; BAL: bronchoalveolar lavage.

Table 2
Key Points in the Clinical History of the Child With Chronic Cough

Table 1
Differential Diagnosis of Specific Causes of Chronic Cough in Children.

Chronic cough in healthy children	Chronic cough in children with pulmonary disease
Repeated respiratory infections	Suppurative diseases: CF, BE or PCD
Persistent bacterial bronchitis	Immunodeficiencies
Upper airway cough syndrome or post-nasal drip	Aspirative syndromes
Cough-variant asthma	Aspiration of foreign body
Psychogenic cough	Infections: *Mycoplasma pneumoniae*, *Chlamydia trachomatis*, tuberculosis, pneumonia, etc.
Irritative cough (tobacco or other irritants)	Congenital abnormalities: trachoesophageal fistula, vascular rings, airway malformations, neuromuscular diseases, etc.

BE: bronchiectasis; *C. trachomatis*: *Chlamydia trachomatis*; PCD: primary ciliary dyskinesia; CF: cystic fibrosis; *M. pneumoniae*: *Mycoplasma pneumoniae*.

Clinical history	Remarks
Nature of the cough	
Severity	Rule out potentially serious specific diseases
Time of appearance	Causes of cough vary with age
Diurnal variability	Nocturnal cough is more common with asthma or rhinitis
Sputum production	Evaluate suppurative diseases: CF, BE, PCD, PBB, etc.
Associated wheezing	Evaluate asthma
Appearance or non-appearance of cough during sleep	Psychogenic cough does not generally appear during sleep
Hemoptysis	Suppurative diseases, malformations, bronchitis
Time since onset	Allows cough to be classified as acute, subacute and chronic
Type of cough	Metallic, hacking, dry, spasmodic, staccato, paroxystic, etc.
Age at onset	Neonatal onset; congenital malformations or neuromuscular diseases
Relation with feeding or swallowing	Possible aspirative syndrome
Fever	Exclude infectious disease
Contact with TB and or HIV	Exclude these diseases
Chronic symptoms of ENT disease	Evaluate the possibility of PCD, chronic ENT diseases
Aspiration of foreign body	Consider always in case of sudden onset cough
Improvement of clinical symptoms with medication	Evaluate improvement after administration of bronchodilators or antibiotics
Exposure to tobacco smoke	Evaluate if failure to resolve or protracted resolution
Triggering factors	Cold, temperature changes, exercise, exposure to allergens
Immunological status and recurrent infectious disease	Evaluate the possibility of immunodeficiencies
Drug use	Evaluate the possibility of treatment with angiotensin converting enzyme inhibitors or others
History of atopy or chronic diseases	Possibility of asthma, CT, PCD, BE, etc.
Growth and development	Evaluate immunodeficiencies, congenital diseases.

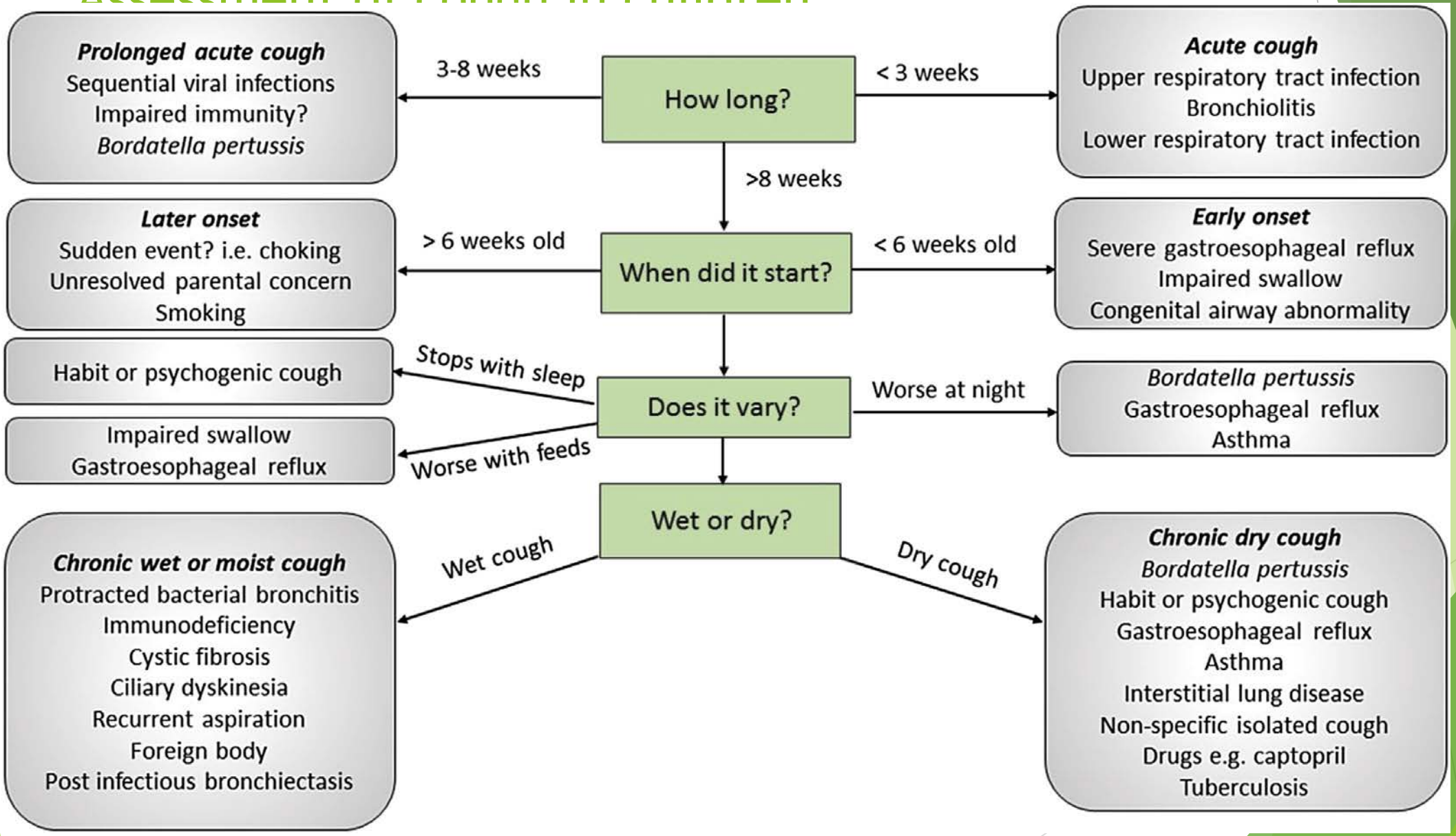
Key points in clinical hx of child with chronic cough

Table 3
Alarm Signs and Symptoms in Children With Chronic Cough.

Alarm signs and symptoms	Remarks
Abnormal auscultation	Asthma, bronchitis, foreign body, CF, congenital abnormalities
Productive cough	Suppurative diseases (CF, BE, PCD, PBB, etc.), bronchitis
Sudden onset of cough after episode of choking	Aspiration of foreign body
Cough associated with food or swallowing	Aspirative syndromes
Chronic dyspnea	Chest disease (airway or parenchyma), heart disease, etc.
Dyspnea with exercise	Asthma, pulmonary disease, etc.
Heart murmur	Heart disease
Neurological disease	Expirative syndromes, muscle weakness, etc.
Chest wall deformities	Malformations, severe chronic pulmonary disease
Hemoptysis	Suppurative disease, vascular abnormalities, malformations, etc.
Recurrent pneumonia	Asthma, foreign body, malformations, immunodeficiencies
Failure to thrive	Pulmonary or heart disease, etc.
Acropachy	Pulmonary disease, suppurative disease, heart disease, etc.
Comorbidities	Chronic diseases

PBB: persistent bacterial bronchitis; BE: bronchiectasis; PCD: primary ciliary dyskinesia; CF: cystic fibrosis.

Assessment of cough in children



Most Common Diagnoses of Chronic Cough in Children

- Asthma
- Children with asthma can begin with cough, but most children with non-specific cough do not have asthma.
- Recurrent dry cough may be due to increased sensitivity of cough receptors ,frequently caused by URTI.
- BHR is associated with wheezing but not with persistent dry cough or nocturnal cough.
- Risk factors, the characteristics of the cough, presence of wheezing and spirometry can assist in reaching a diagnosis.

Persistent Bacterial Bronchitis

- Until recently, persistent bacterial bronchitis was understudied and underdiagnosed.
- It is defined as productive chronic cough secondary to airway infection that resolves with long-term antibiotic treatment, after other diseases have been ruled out.
- The most commonly involved microorganisms are Streptococcus pneumoniae, Haemophilus influenzae and Moraxella catarrhalis, and in some cases, more than one pathogen is isolated.
- Diagnosis is carried out by bronchoscopy and BAL , but administration of antibiotics for 2–4 weeks can be tried to see if the clinical picture resolves before carrying out a bronchoscopy.
- Overlap with asthma in some children
- Should be diagnosed and treated appropriately to avoid it progressing to BE.

Upper Airway Cough Syndrome or Posterior Nasal Drip

- This is one of the main causes of chronic cough in adults, but it is less common in the pediatric population.
- It is due to mechanical stimulation of the afferent branch of the cough reflex in the upper airway by secretions that descend from the nose and/or the paranasal sinuses.
- In preschoolers, it is caused by repeated infections due to adeno-tonsillar hypertrophy and/or seromucous otitis.
- In school children, persistent rhinitis and/or turbinate hypertrophy should suggest atopy, and if nasal polyps are observed, CF should be ruled out.

Gastroesophageal Reflux Disease

- The association between GERD and non-specific chronic cough in children is widely debated
- little evidence that this disease alone causes cough.
- For the determination of acid GERD, 24-h pH testing is sensitive and specific, while impedance is required for the diagnosis of non-acid GERD.
- UGT assists in the diagnosis of vascular rings and other causes of mechanical compression.

Functional Respiratory Disorders

- It is important to recognize psychogenic cough and other functional respiratory disorders in pediatric patients, since they are difficult to diagnose and are frequently labeled as asthma or upper airway cough syndrome.
- Psychogenic cough is less common in males,
- Generally occurs in school children or teenagers who, after a URTI, begin with a dry harsh, croaking cough that occurs intermittently during the day but then disappears when the subject is distracted or sleeping.
- It is generally very alarming for parents, teachers and others to observe ,but the patient is usually surprisingly indifferent

Physical Examination

- always ask the child to cough. (Sound of a cough can be diagnostic)

  examples:
- Wet (productive or moist). A low pitched, barking cough :croup ,malacia
- marked prolonged expiratory phase : small to moderate airways obstruction. (with/out audible wheeze) ==➔ asthma.

Physical Examination

- Apart from the cough physical examination is usually normal
- Normal PE does not exclude important pathology.
- Plot Growth parameters :inadequate growth requires thorough investigation: (a basic immune function screen and sweat test)
- inflamed nose with or without markers of allergy : postnasal drip or asthma.

Physical Examination

- Check for clubbing.
- Harrison's sulci or chest wall deformities (symptoms prolonged period and associated with longstanding increase in WOB)
- Respiratory rate
- Waking oxygen saturations

Investigations : Lung function

- Lung function : performed on all children presenting with chronic cough who are able to do them.(over 5 years)
- the shape of the flow-volume loops :restriction or obstruction
- Salbutamol reversibility (an increase of 12% of FEV1) confirms a diagnosis of asthma .
- Elevated breath nitric oxide (FeNO) is less specific but may be helpful

Cough swab or sputum culture

- Most children with chronic cough do not expectorate sputum.
- Induced sputum : using hypertonic saline with assistance from respiratory physiotherapists.

Diagnostic yield close to that of BAL in children with cystic fibrosis.

- **Cough swab** : if not able to expectorate,
- Help guide antibiotic therapy.
- Cough swabs and sputum samples have a lower diagnostic yield than samples obtained at flexible bronchoscopy.

Chest X-ray

- Any child with chronic wet cough should have a chest X-ray.
- Children with chronic cough and a normal chest X-ray likely to have symptoms that spontaneously resolve.
- Chest X-ray often taken during an acute illness (an exacerbation of cough, coryzal, temperature) will show changes consistent with infection
- Wait at least 6 weeks from a significant infective episode if possible so the patient is in a “baseline” situation.

Assessment of the basic immunophenotype

- Children with chronic wet cough should have a basic assessment of their immunophenotype.
- Includes a full blood count, immunoglobulins (IgA, IgG, IgM and IgE) and functional antibodies.
- Detailed assessment if other diagnostic markers of immunodeficiency :

  Failing to thrive, severe eczema
- Neutrophil burst testing and lymphocyte subsets.

Sweat test

- Persistent wet cough
- Newborn Screening testing
- Significant number of children with cystic fibrosis diagnosed late.
- Screening is more likely to miss children with pancreatic sufficient cystic fibrosis , present late with cough and chest X-ray changes.

Flexible bronchoscopy

- Helpful when available
- BAL :Enables direct microbiological sampling of each lobe of the lung,
- Sensitive for nature of any persistent endobronchial infection.

Flexible bronchoscopy : Indications

- Suspicion of airway abnormality
- Persistent localized changes on chest X-ray,
- Aspiration lung disease.
- large airway malacia, congenital abnormalities
- Extent of secretions or large airway inflammation.
- Identifying pathogens /guide AB therapy in infectious lung disease
- Intraluminal foreign bod

CT scan of the thorax

- Gold standard for looking at small airway structure.
- Modern scanners can give detailed images with short scan time and often scans can be performed without sedation.
- The dose of radiation is significant

CT scan of the thorax

- Indicated when cough persists despite treatment and when other investigations have been completed.
- CT scans of the chest with persistent moist cough of more than 6 months duration have abnormalities.
- CT abnormalities higher with abnormal baseline chest X-ray
- Normal baseline chest X-ray does not exclude bronchiectasis.
- CT is excellent for demonstrating more subtle parenchymal changes

Video -fluoroscopy

- Children with neurodisability , increased risk of swallowing incoordination and recurrent aspiration.
- This commonly but occurs in combination with gastroesophageal reflux.
- Obtaining a high quality study requires input from an experienced paediatric radiologist and speech and language therapists

Ciliary studies

- Ciliary dyskinesias are probably underdiagnosed.
- Early onset nasal symptoms (nasal obstruction and purulent rhinorrhoea).
- Almost ½ of children have dextrocardia with situs inversus
- Definitive diagnosis requires ciliary biopsy or ciliary brushings to be examined by electron microscopy.
- Specialist center.
- Exhaled nitric oxide (FeNO) tends to be low
- Nasal nitric oxide (nNO) levels are very low

Treatment of Chronic Cough in Children

- Chronic cough should be treated after a thorough etiological study, the aim being to eliminate the causative agent, following clinical practice guidelines.

- The family must be reminded to avoid exposing the child to tobacco smoke and other environmental irritants

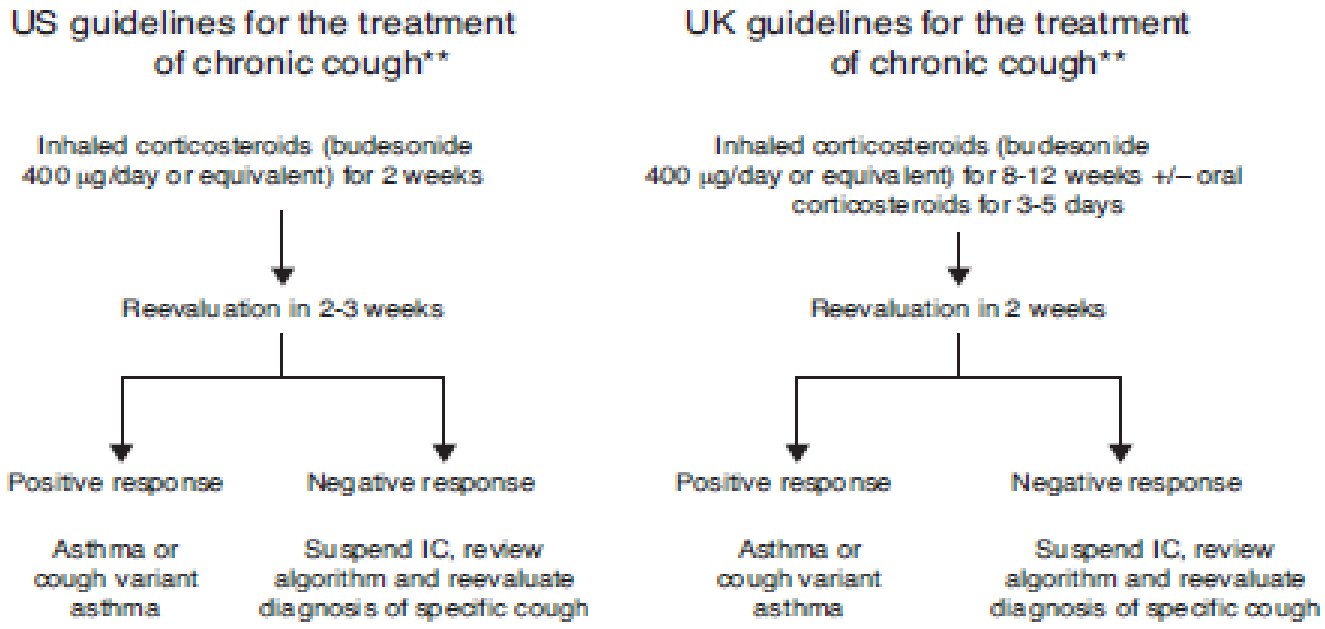
Treatment of Specific Cough.

- Chronic cough due to asthma requires treatment with bronchodilators and, depending on classification, with inhaled corticosteroids.
- In cases of allergic rhinitis, antihistamines and nasal steroids will be required.
- Sinusitis will require treatment with antibiotics.
- GERD should be treated with proton pump inhibitors and/or surgery.
- PBB needs long-term treatment (between 2 and 6 weeks) with amoxicillin–clavulanate or clarithromycin.
- Psychogenic cough requires investigation of the causes of stress or anxiety and subsequent psychological support.

Treatment of Non-specific Cough.

- There is no underlying disease and the child is healthy:
- A period of observation is recommended, with a follow-up examination of the child after 6–8 weeks.
- lack of controlled studies in the pediatric population.
- A trial treatment with inhaled cortico-steroids at half doses is recommended for predominantly dry cough (budesonide 400 mcg/day or equivalent) for 2–12 weeks, depending on the guidelines.
- The patient should be reassessed after 2–3weeks and if there has been no response to treatment , stop
- In cases of non-specific productive cough, initiating a course of antibiotics (amoxicillin–clavulanate) for 2–3weeks may be considered.

A. Lamas et al. / Arch Bronconeumol. 2014;50(7):294–300



*Chang A et al. Chest 2006; 129:260S-283S

**Shields MD; Thorax 2008:63 (Suppl) iii1-iii15

Fig. 3. Chronic non-specific cough treatment algorithm. IC: inhaled corticosteroids.

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- The use of central action antitussives, non-opiate antitussives, mucolytics or expectorants is not indicated.
- The presence of more than one cause of cough may lead to a delay in response or treatment failure if underlying conditions are not treated.

Treatment (non specific cough),

- **Honey** has been shown to be more effective than placebo in the treatment of cough associated with URTI.
- Bronchodilators are ineffective in non-asthmatic children,
- Antibiotics are recommended if bacterial infection, streptococcal tonsillitis or pneumonia is suspected.
- Educating the public and healthcare professionals about the natural history of cough associated with URTI is very important for avoiding unnecessary consultations and examinations, since in the majority of the cases, the cough will resolve two weeks after onset.


Wellness
Cough Syrup
For Kids


1 recipe
Grandma Barb's
Homemade Cough Syru
.....that really works
divascancook.com


I USED TO THINK I WAS THE ONLY ONE KIDS HATED... I DON'T KNOW WHAT I WOULD DO IF IT WEREN'T FOR YOU GUYS.
COUGH SYRUP
CARTOONSTOCK.com


1 recipe

Management of the persistent wet cough

- Three main groups of treatment for chronic symptoms:
- Antibiotics, steroids and anti-reflux treatments.
- These are augmented greatly by assistance from a large multi-disciplinary team including respiratory physiotherapists, dieticians, clinical nurse specialists and speech and language therapists.
- The approach to management does vary depending on the underlying cause and in the presence of a persistent wet cough
- Efforts should be made to arrive at a specific diagnosis.
- Guidelines available for specific diagnoses including asthma, cystic fibrosis, immunodeficiency states and ciliary dyskinesias.

Antibiotics

- Prolonged wet cough

  Most likely cause is persistent bacterial bronchitis PBB ,

  most common pathogens: Haemophilus influenza and S. pneumoniae.
- Broad spectrum antibiotics like amoxicillin-clavulanate for 2 or 6 weeks leads to resolution in approximately 50% or 70%respectively.
- No solid guidelines : Two week course amoxicillin-clavulanate with careful review following completion.
- If AB therapy fails to improve symptoms :further investigations needed
- Azithromycin (10 mg/kg three times a week) can significantly reduce symptom burden .

Inhaled corticosteroids (ICS)

- Isolated dry cough without further clues can suggest asthma .
- Children with predominantly wet cough at the outset can develop asthma symptoms with time .
- Asthma is common and an approach, assessment as per published guidelines
- Therapeutic trial of low-dose ICS for 8-12 weeks , then need for treatment is reviewed and stopped if not been helpful.

Inhaled corticosteroids (ICS)

- Perform lung function tests children able to do this (pre and post therapy)
- Patients report symptom in a diary and record any changes in symptoms.
- Persistent coughs will spontaneously resolve and it is important not to attribute any change in symptoms to ICS unless there is relapse upon withdrawal.

Anti-reflux treatment

- Insufficient evidence to suggest that patients with wet or dry cough (without clues on assessment as to an underlying cause)
- Even those with occasional gastroesophageal reflux symptoms are unlikely
- to see benefit (especially in the very young).

Conclusion

- Cough is a very common symptom and nearly all children present to a doctor with an acute episode of cough in early childhood.
- A small, but significant minority of children have persistent, recurrent or troublesome symptoms.
- It is helpful in clinical practice to determine the precise nature and pattern of symptoms.
- When cough ***is persistent*** and **wet** then an underlying diagnosis should be sought and all children should have, at the very least, a chest X-ray, baseline blood tests and a sweat test.

Conclusion

- Specific chronic cough should be treated according to the underlying disease. If diagnosis is unclear, the characteristics of the cough, whether dry or productive, can help in evaluating possible treatment: inhaled corticosteroids for dry cough or antibiotics for productive cough.
- If no improvement is observed, these treatments should be discontinued and alternative diagnoses explored, the cause of cough may be more than one disease.
- There is no evidence that the use of antitussive syrups and/or antihistamines or other cough remedies are effective, and, with the exception of honey for URTI, they may have serious adverse effects in children, so they must not be used

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Thank you

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