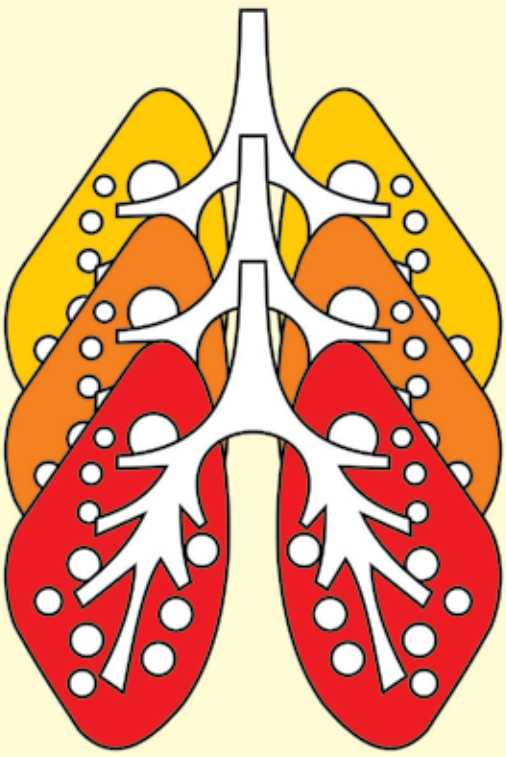
COUGHOLOGY

The art & science of navigating cough

IN PAEDIATRIC PRACTICE



DR. PRAMOD JOG

Glenmark

COUGHOLOGY

The art & science of navigating cough

IN PAEDIATRIC PRACTICE

by

Dr. Pramod Jog

COUGHOLOGY

The art & science of navigating cough

IN PAEDIATRIC PRACTICE

Educational grant by

Glenmark
A new way for a new world

Glenmark Pharmaceuticals Limited (GPL),
Corporate Enclave, B. D. Sawant Marg,
Chakala, Andheri (E), Mumbai – 99.

Published by:

201, Kalpataru Plaza, Chincholi Bunder Road,
Nadiyawala Colony 2, Malad West, Mumbai - 400 064

Website: www.docmode.org

LET'S LISTEN TO THE VOICES OF THE RESPIRATORY SYSTEM

Let's look at a common case-scenario. A two-year-old presents with recurrent episodes of fever, cold, cough and wheezing since the age of 6 months. Each time, the episode begins with high fever that lasts for 2 to 3 days, accompanied with cold and progressively worsening cough, followed by wheezing. Wheezing settles down within a short time but the cough continues for two weeks. Routine investigations are normal. The child remains well in-between episodes, and maintains good growth and development. No one in the family has history suggestive of asthma or atopy. The child receives repeated courses of antibiotics and inhaled steroids for 3 months, but there is no change in frequency of episodes. Each and every time the paediatrician's *'mann ki baat'* rotates around questions like...Is it viral?...Is it bacterial?...Can I label it as asthma?...*Kahin ye 'woh' toh nahin?* (Tuberculosis!)... finally realising that it is Wheeze Associated Lower Respiratory Infection (WALRI)!

Respiratory complaints are the commonest reason for visits by our young patients to us (barring well baby visits of course). The disease pattern presenting to the paediatricians ranges from self-limiting upper respiratory tract infection (URTI) to severe complicated pneumonia; and with acute, sub-acute, recurring, relapsing, or chronic presentations. Paediatricians face problems and difficulties in diagnosing, investigating, and treating a wide range of respiratory illnesses. It's necessary to clear our concepts and revise, refresh and review the knowledge about the conditions (common as well as not so common) affecting a child's respiratory system.

Recurring respiratory symptoms is a common problem that a paediatrician faces in a clinic. Do all such children warrant a battery of investigations and treatment, including antibiotics? A paediatrician needs to be aware that 6-8 episodes of acute respiratory infection (most of which are simple cold and cough) are a normal phenomenon in pre-school and school-age and one needs to counsel the anxious

parents that there is nothing wrong with the child's immunity. They must be clearly told that there are no drugs which 'build' or enhance immunity. At the same time, the conditions which are likely to increase the frequency of these episodes need to be borne in the mind. Conditions like allergic rhinitis and obstructive sleep apnoea need to be picked up in time. Subtle clues to identify rare disorders like immunodeficiencies or ciliary dysfunction are also important in such situations. Parental counselling forms the main stay of approach in the management of majority of URTI as the episodes tend to recur in the first five years of life. Recurring URTI may be benign in nature, while recurring lower respiratory tract infections (LRTI) may have significant underlying diseases. Evaluation of a patient with respiratory tract infection calls for a detailed history encompassing the source of infection (for example, another child in the family), onset of the disease (for example; sudden onset of high grade fever in the viral URTI, disappearance of fever followed by troublesome cough as in acute viral URTI), detailed information on host factors including nutrition, growth, and immunisation status, or valuable information about the environmental factors such as parental smoking, day-care admissions, bottle feeding and hand-hygiene practices.

Under-five children presenting with a wheeze is a conundrum that we commonly find ourselves in. We need to remember that almost 50% of children wheeze in the first three years while only 20% will experience continued wheezing. The common and often asked questions which one has to answer are 'Is it asthma?; Does he/she need a controller?; What is the long-term outlook?' For answering these, we need to find out if the child is a transient wheezer, or is going to have a persistent wheezing. From the days of residency, we have been listening to the dictum – All that wheezes is not asthma. History of a forgotten episode of choking (foreign body aspiration), and a close contact with patient of pulmonary tuberculosis needs to be elicited. One has to really be a '**W**heezard' while dealing with a child with wheeze, and have the knowledge as to **W**hat age did it begin…**W**ay it took forward…**W**hether it is **W**ALRI…Is there **W**eight gain…Are there any **W**eird findings like clubbing…**W**hether the wheeze is generalized or localised, and **W**aiting till getting enough proof before putting a child with recurrent respiratory

symptoms on anti-tubercular therapy. One must remember that any recurrent wheeze that is not getting controlled warrants search for alternate diagnosis.

A sizeable number of our patients have problems ranging from leaky nostrils to itchy rashes, and from sneeze to wheeze. The prevalence of allergic diseases is increasing worldwide, in both developing and developed countries. Allergic rhinitis (AR) is an important co-morbidity with asthma; 30% of patients with AR have asthma, and 80% of those with asthma have AR. The four major cardinal symptoms of AR are sneezing, nasal itching, rhinorrhoea and congestion. AR and asthma share common allergens. Proper treatment of AR along with allergen control improves control of asthma.

The approach and management of asthma is a dynamic science. This is best illustrated by updates in the recent Global Initiative for Asthma (GINA) guidelines, which now emphasize on individualizing patient management not only by using genomics or proteomics, but also with 'humanomics', taking into account the behavioural, social and cultural factors that shape outcomes. When we have a child with asthma, we are inflicting five shocks to the family – the child has *asthma*, we will treat with *inhalers*, the preventers are *steroids*, the treatment is *long-term*, and we can at the best control as there is *no cure*. Time is what parents need second to our expertise, and the time spent is directly proportional to the success in therapy and disease outcome. For each of the shock, we have five shock absorbers! We get them to **Accept** the diagnosis of asthma, we get them to **Agree** to the line of treatment, we get them to **Adhere** to the treatment planned, we get them to recognise an **Acute** attack and home management, and we teach them to identify and **Avoid** triggers. One must remember these five '**A**'s of counselling in Asthma.

The itch to prescribe an antibiotic for a child (or more commonly a parent) is one that needs to be avoided. In this era of antibiotic resistance, and when hardly any new antibiotic has been discovered in the last many years, rational antibiotic therapy is definitely the need of the hour. Understanding that only a few upper respiratory conditions like acute bacterial tonsillitis or sinusitis warrant antibiotic

treatment, is of utmost importance. Once the need for antibiotic is confirmed, the choice, route and appropriate dosage is of paramount importance. A haphazardly chosen antibiotic like cefixime for bacterial tonsillitis will not only contribute to the emergence of resistant strains but the child will also not improve, resulting in the parents losing faith in the doctor. A simple drug like amoxicillin may be sufficient in most of the respiratory infections in our day-to-day practice. Also, if the appropriately chosen antibiotic does not seem to be working, rather than changing the antibiotic at the drop of the hat, possibility of wrong diagnosis and/or complication needs to be considered.

There is a Japanese proverb which says, 'When the character of a person is not known to you, look at his friends.' Similarly, you have to judge the cough by its accompaniments like wheezing, upper airway symptoms ± snoring, rhinitis, sinusitis, symptoms from first day of life, sudden onset of symptoms, chronic wet cough/sputum, worse wheeze or irritable after feed, worse lying down, vomiting, choking on feeds, features of immunodeficiency and findings like clubbing, weight loss or failure to thrive etc. A large number of formulations are available to alleviate symptoms like cough and cold and it's necessary to understand the pharmacology of individual components before prescribing them.

To alleviate symptoms of cough, a large number of formulations are available and the paediatrician is often tempted to prescribe one or the other of these, many a times just for the satisfaction of the anxious parents. There is nothing like a cough-and-cold-remedy for children below six years of age. There is no true suppressant or expectorant. There is a general consensus amongst experts that these medicines have hardly any role in improving the symptoms, and may in fact have many undesirable effects, especially in young children. In rare situations, when a child becomes exhausted, or has insomnia or repeated vomiting due to cough, a safe cough suppressant may be justified. Many a times, simple demulcent syrups (not containing alcohol) soothe the throat and may provide some relief from cough.

Childhood tuberculosis (TB), in spite of all efforts remains difficult to diagnose and confirm. Some clinicians tend to overdiagnose it in any child with recurrent respiratory symptoms. At the same time, an over-enthusiastic newbie may completely miss a case with atypical presentation in his overzealous effort to isolate the *Mycobacterium tuberculosis*. The lack of an accurate diagnostic test for TB in young children is a major challenge, and adds to the potential for both under-diagnosis and over-diagnosis. With these practical problems in mind, a relatively easy to follow algorithm for diagnosis of childhood TB can be followed.

Respiratory emergencies are the commonest emergencies faced by a paediatrician. When to call it respiratory distress or respiratory failure – is a common question in the minds of many. Rapid assessment of respiratory distress and triaging is the need of the hour. Even upper airway emergencies like croup, or laryngospasm due to anaphylaxis can be life threatening, and identifying them goes a long way in early and appropriate management. The do's and don'ts in acute severe asthma and other non-respiratory conditions presenting as respiratory emergencies are crucial, and can make a difference between life and death.

The knowledge of inhalation therapy and oxygen administration still needs to be upgraded for many of us, as errors can result in failure of therapy and can prove very costly. It has become a common practice to offer nebulisation (like a welcome drink) for any respiratory disease, including URTI! Nebulisation is to be used for an acute episode of asthma. Even in asthma, it is recommended in a hospital setting for severe exacerbation. In mild-to-moderate exacerbations, a spacer with a mask is as effective as nebuliser, and should be preferred. Indoor children with respiratory distress due to aetiology other than asthma are also commonly nebulised for prolonged period without any justification. We also have to be rational in using the medications for nebulisation therapy, and have to be specially vigilant about doses and schedule while using preparations with a combination of drugs. The cleanliness and sterility of devices used for nebulisation and oxygen therapy also warrants attention. Ideally a new mask should be used for each patient to avoid cross-infection. Nebulisation without oxygen may increase hypoxia in a sick child.

Nebulising solution should always be diluted with normal saline, and never with distilled water, as is practiced many times, particularly at home. Many a times wrong dose is administered because of confusion between respule and 'nebulising solution.' Nebulising with saline for common cold or a blocked nose is irrational.

I am sure that the book will 'clear the airways' of knowledge while dealing with congested and irritated respiratory tracts of children and remove the 'hypoxia' of ignorance.

Dr. Pramod Jog
MD (Paed), DNB (Paed), FIAP, FICMCH,
Prof. of Paediatrics, D.Y. Patil Medical College, Pune,
President, Indian Academy of Pediatrics (IAP) 2016,
Former Standing Committee Member, International Paediatric Association (IPA),
Former Steering Committee Member GAVI, (CSO), (SC),
Consultant Paediatrician @ Ankura, Jupiter, Deenanath, Medipoint Hospital, Pune

Source: Jog P. 'Clearing' pediatric airways. *Indian Pediatr.* 2016 Nov;53(11):957-9.

COUGHFEE WITH PRAMOD

"*Love and cough cannot be hidden*"

Cough is a common reason for paediatric outpatient visits. Cough as a manifestation of respiratory disease can range from minor upper respiratory tract infections (URTIs) to serious conditions such as bronchiectasis. Acute cough in children is mostly caused by URTIs. Chronic cough, defined as daily cough of at least 4 weeks in duration, can be associated with an underlying serious disorder and, hence, requires systematic and thorough clinical evaluation. There is high-quality evidence that a systematic approach to the management of chronic cough in children using paediatric-specific cough algorithms improves clinical outcomes. Treatment of cough should be based on the aetiology. Because cough is a common presenting complaint, practitioners must become familiar with the initial evaluation and management of children with cough to establish a diagnosis and determine appropriate therapy.

As a paediatrician, I have encountered numerous young patients and their parents who have struggled with the distressing and persistent symptom of cough. It is a condition that not only affects the child's physical well-being but also disrupts their daily activities, school performance, and overall quality of life. Through years of clinical experience, I have come to realise the complexity and unique challenges associated with diagnosing and managing cough in children.

This book serves as a comprehensive guide dedicated to cough in paediatric practice. Its purpose is to provide healthcare professionals, parents, and caregivers with a deeper understanding of this often-perplexing condition. By exploring the underlying causes, diagnostic approaches, and evidence-based treatment options, we aim to empower those involved in the care of children with cough.

A wealth of knowledge and expertise from the published literature in the field of paediatric respiratory medicine has been included in this book. Each chapter delves into different aspects of cough, covering topics such as guidelines, algorithms, and clinical evidence providing practical strategies for management. Additionally, there are case scenarios to illustrate various clinical presentations. Moreover, a section on important drugs in cough management will serve as a ready reckoner for clinicians.

It is my sincere hope that this book serves as a valuable resource for healthcare professionals seeking to enhance their knowledge and refine their clinical skills in managing cough in the paediatric age group. Furthermore, I hope it provides clinicians with a guide to those who are seeking answers and effective solutions for their patients.

I extend my deepest gratitude to the patients and families who have placed their trust in me for my clinical judgement and provided their invaluable support throughout my journey in writing this book and sharing their clinical experiences.

Together, we can work towards a future where cough in children is better understood, and effectively treated, and ultimately its impact on young lives is minimised.

Dr. Pramod Jog

ABOUT THE AUTHOR

Dr. Pramod Jog is a renowned paediatrician hailing from Pune, India. With an immense experience of over 40 years, he has dedicated his life to providing compassionate and comprehensive healthcare to children and adolescents. Dr. Jog's commitment to the well-being of his young patients, coupled with his expertise and passion for paediatric medicine, has made him a trusted and respected figure in the field.

Dr. Pramod Jog's journey in medicine began with his pursuit of a Bachelor of Medicine and Bachelor of Surgery (MBBS) degree from a prestigious medical college in India. Driven by his fascination with child health, he further specialised in Paediatrics and obtained a Doctor of Medicine (MD) degree in Paediatrics. His rigorous training equipped him with a deep understanding of the unique medical needs and developmental milestones of children.

Throughout his illustrious career, Dr. Jog has achieved numerous milestones and made significant contributions to the field of paediatrics. His expertise spans a wide range of paediatric subspecialties, including growth and development, nutrition, immunisation, infectious diseases, pulmonology, adolescents and practice management.

As a compassionate caregiver, Dr. Pramod Jog believes in the holistic approach to healthcare. He emphasizes the importance of building strong doctor-patient relationships and fosters an environment of trust, where parents and caregivers can openly discuss their concerns and receive personalized guidance.

Dr. Jog has actively participated in various medical conferences, workshops, and seminars, both in India and internationally. His thirst for knowledge and dedication

to staying up to date with the latest advancements in paediatric medicine has helped him provide the best possible care to his patients.

Dr. Pramod Jog is not only committed to his individual patients but also strives to make a positive impact on child health on a larger scale. He has been involved in several community outreach programmes and awareness campaigns to educate parents and caregivers about preventive care, immunisation, and early intervention for childhood illnesses.

Dr. Jog is a firm believer in the power of education. He has conducted numerous educational sessions for parents, teachers, and healthcare professionals in his unique, inimitable style, sharing his expertise and empowering them to become advocates for children's health and well-being.

Beyond his clinical practice, Dr. Pramod Jog has also contributed to medical literature through his research and publications. His work has been featured in reputed medical journals, further establishing his credibility as a thought leader in the field of paediatrics.

Dr. Pramod Jog's passion for paediatric medicine, his commitment to excellence, and his unwavering dedication to the health and well-being of children have made him a respected authority in the field. Through his expertise, compassionate care, and educational initiatives, he continues to touch the lives of countless children and families, leaving a lasting impact on their journey toward good health.

CONTENTS

SECTION 1

Approach to Acute and Chronic Cough in Children

- How much cough can be called normal?
- Aetiology of cough in children
- Causes of acute cough
- Differential diagnosis of acute cough
- Pertussis (whooping cough)
- Protracted bacterial bronchitis
- Chronic cough in children
- Differential diagnosis of chronic cough
- Management of chronic cough
- Psychogenic cough
- A practical approach to investigating a child with cough
- Red flags for cough in children
- Primary ciliary dyskinesia in children – A rare disorder presenting with cough
- Cystic fibrosis
- GERD and cough in children
- Children with persistent cough
- Recurrent cough

Cough is considered as the most common complaint in children with diseases of the respiratory tract. In many children, cough can be a bothersome symptom and can impact feeding. It may sometimes create an emergency, for instance when there is a foreign body aspiration.[1]

In the paediatric population, non-specific cough is more commonly observed, and the treatment is based on a watch, wait, and review approach, along with the exploration of parental expectations and concerns.[2]

Cough may also represent serious underlying clinical conditions, like cystic fibrosis due to which parents are often worried about their children's cough and often seek medical advice.[2] Cough can be acute or chronic, specific or non-specific.[3]

Many children diagnosed with acute cough have an uncomplicated viral acute respiratory tract infection (RTI). The likelihood of a serious condition causing cough, such as foreign body aspiration, must be ruled out.[3]

Cough performs a protective function and maintains respiratory health. There is forceful expiration when there is pressure build-up due to contraction of expiratory muscles over a closed glottis.[2]

In the paediatric population, numerous types of coughs are defined, such as acute cough, which is a mere symptom associated with RTI. A prolonged acute cough is mostly correlated with protracted bacterial bronchitis (PBB).[4] Chronic cough lasts more than 3 weeks in children.[5]

The aetiology of cough varies according to age and exposure to tobacco, smoke, and environmental contaminants and these are common causes of cough or the failure of cough resolution in all ages.[6]

Several factors need to be evaluated when approaching a child with cough. Onset of cough is an important point to consider. Cough that starts suddenly can indicate foreign body aspiration.[5]

URTI is frequent in children, and they suffer from 7 to 10 episodes in a year and can cough up to 140 days per year. Children are nearly 4-fold more susceptible to URTI-associated acute cough and it is more common in females compared to males. Acute cough correlated with URTI is intense and results in discomfort in children.[7]

It is quite rare to witness cough in early infancy, however, if it presents at this age, serious underlying conditions must be considered, including aspiration due to a birth defect, congenital heart disease, reflux, or cystic fibrosis.[5]

Cough during the night, especially immediately after lying down, suggests postnasal drip. One that occurs later during the night points to reactive airway disease.[5]

Furthermore, there can be dry cough or wet cough. Dry cough indicates upper airway involvement while wet cough suggests lower airway disease.[5] Of note, young children are unable to expectorate sputum.[3]

How the cough progresses is also an important part of evaluation, where episodic cough may point to asthma while progressive worsening of cough can suggest pertussis.[5]

The type of cough can provide valuable information about the cause of cough. For instance, a loud honking cough can be due to psychogenic cough while a barking cough suggests croup or tracheomalacia. Paroxysmal cough with an inspiratory whoop is characteristic of pertussis.[3]

Approaching a child with cough is not a child's play. Attention needs to be paid to every detail to appropriately manage a child with cough.

How much cough can be called normal?

While all children cough, most of them are normal. Normal children can cough about 1-30 times a day. Cough beyond 3 weeks is considered as chronic cough.[5]

A study by Munyard and Bush evaluated cough frequency in normal children and noted it to be 11.3 cough episodes (ranging from 1 to 34) per day.[8] Although this study noted that cough frequency was not affected by passive smoking or the presence of pets in the household, attention to detail is important to identify "red flags" in cough. Additionally, attention to environmental factors, such as active and passive smoking, and exposure to dust and pets is important.

Clinical classification of cough

When evaluating a child with cough in clinical practice, it could be categorised as follows:

- Cough in a normal child – As mentioned earlier, normal children can cough about 11 times in a day
- Cough with a non-serious cause, such as acute viral infection
- Cough in the presence of a serious underlying cause, such as aspiration
- Cough due to asthma
- Cough with no known underlying cause, such as psychogenic cough.

Aetiology of cough in children

Defining cough: Cough can be characterised by its duration, the suggested underlying cause, and the nature of sound.[9]

- **Normal or expected cough:** The infrequent daily cough, or a mild cough with a clear reason (such as following a URTI) with no need for additional treatment.[9]

Acute URTIs occur often in healthy children each year, produce acute coughs that are self-limiting and simply need supportive care, such as antipyretics for fever (to soothe the child), and proper fluid intake.[9]

- Acute cough refers to cough of recent onset that lasts for <3 weeks.[5,10]

Causes of acute cough[11]

Common cold	Asthma
Influenza	Laryngotracheobronchitis
Bronchitis/bronchiolitis	Pertussis
Foreign body aspiration	GERD*
Pneumonia	Inhalation of irritants such as smoke

*GERD - Gastro-oesophageal reflux disease

- A prospective cohort study noted that 10% of children continue to cough for 25 days.[12] This is the general basis for the classification of chronic cough.

- Cough is a crucial defensive reflex and considerably strengthens the respiratory system's innate immunity by promoting mucociliary clearance.[9] A normal child can experience 11 coughing episodes a day when unwell. However, the frequency and severity can increase during the winter season when URTIs are more prevalent.[8,9] Coughing can affect the child's daily activities and quality of sleep. It is frequently a cause of anxiety for parents.[9]

Level of activity

Sound sleep

Play or attend school

Differential diagnosis of acute cough

- Acute viral infections are the main cause of coughs, and asthma accounts for 7-12% of coughs.[11]

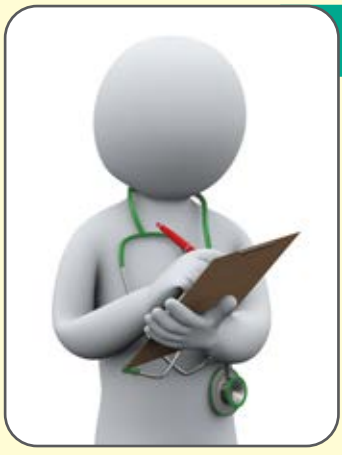
Questions for clinical management[5]

Question	Analysis
Is cough a main symptom?	It can be airway disease
Is the cough dry or wet?	• Dry—Upper airway disease • Wet—Lower airway disease
Any history of recurrent cough?	It can be a reactive airway disease
Any personal or family history of atopy?	Points to atopic disease
Is there worsening at night?	
• Immediately after lying down	• Postnasal drip
• Later during the night or early morning	• Reactive airway disease
Onset?	
• Sudden	• Foreign body inhalation
• Over a few hours	• Reactive airway disease
Progress?	
• Recurrent/episodic	• Asthma
• Progressive worsening	• Pertussis, compression of airway by a mediastinal mass

Question	Analysis
What is the order of appearance of signs and symptoms?	
• Cold and cough after high fever	• Viral infection
• High fever after cold and cough of 1-2 days' duration	• Viral infection after prodrome
• Mild fever after cold and cough	• Reactive airway disease
• Cough subsiding after resolution of fever	• Viral infection
• After resolution of fever, cough takes 5-7 days to subside	• Viral infection with a background of reactive airway disease
Cold, fever, breathlessness, chest pain, vomiting, palpitation, swallowing disorder	Based on the symptoms

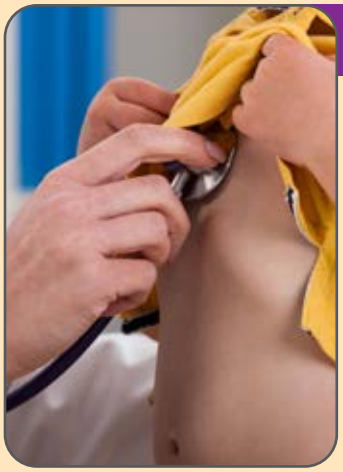
Assessment of cough in children

A thorough history and physical examination are the pillars of evaluating cough in children.[9]



Clinical history

- Duration, nature, causes, progression, and seasonal/diurnal variations of cough
- Neonatal history, family history
- Environmental exposures (passive smoking, exposure to wood smoke, etc.)
- Medication use
- History of allergy.



Physical examination

- Child's overall health, vital signs and growth parameters
- An in-depth examination of the respiratory system [including the ear-nose-throat (ENT) examination]
- Assessment of nutritional status
- Specific physical signs (such as noisy breathing, clubbing).

Differential diagnosis of cough may be guided by the distinction between dry and wet cough.[9]

- The pattern of a cough's sound can assist in identifying the cause beneath it.
- A dry cough implies an underlying cause of airway irritation or inflammation, whereas a wet cough indicates mucus hypersecretion or reduced mucociliary clearance.
- A detailed study is necessary when a wet cough persists for a long time or is linked to other symptoms, such as clubbing.[9]

Table: Cough characteristics and the probable causes[13]

Cough characteristic	Probable cause
Dry, staccato	Chlamydophila
Wet (with or without sputum)	PBB, sinusitis, pneumonia
Barking/brassy	Croup, tracheomalacia, other abnormalities of the respiratory or gastrointestinal (GI) tract
Paroxysmal/spasmodic/whoop	Pertussis or pertussis-like syndrome
Honking	Psychogenic

Let's look at some cases of acute cough—

CASE SCENARIO

Acute cough in a child

A 5-year-old boy presented to the clinic with fever for the past 4 days and a runny nose, and wet cough for 3 days. The cough was severe enough to wake the child up from his sleep. He had clear watery discharge from the nose.

History

The child's parents revealed that 4 days ago after coming from school, the child was feeling unwell and was found to have fever (101°F). The next day, he developed cough and a runny nose. The cough was initially dry but then became wet.

There was no history of frequent infections or allergies. The patient's family history was also not significant.

The child was given paracetamol at home which reduced the temperature for a few hours.

Examination

While the child did not look very unwell, he was visibly uncomfortable due to nasal discharge and cough. The temperature was 101°F. His respiratory rate (RR), blood pressure (BP), and pulse rate were normal. There was clear watery discharge from the nose. Auscultation findings were normal.

This looked like an acute viral infection.

CASE SCENARIO

Management

The patient was prescribed paracetamol syrup.

He came for follow-up to the clinic after 3 days and had no fever for the past 24 hours. He still had a cold and mild cough, which improved over the next 3-4 days.

Viral infections are usually self-limiting within 7 days. Viral infections are contagious and spread quickly among contacts. Therefore, the presence of a similar illness in any other family member or community can suggest a possible viral infection.

CASE SCENARIO

Sudden onset cough with breathlessness

An 18-month-old child presented with cough and breathlessness since 5 days.

History

The child had sudden onset of cough and breathlessness with respiratory distress for the past 5 days. She was on nebulisation therapy. However, there was no improvement.

There was no associated fever.

There was a history of one prior episode of fever and breathlessness 6 months ago. There was also a history of eczema in the child.

There was a positive family history of asthma in the child's mother.

Examination and investigations

Rhonchi were heard on the right side with decreased air entry.

Chest X-ray of the child:

CASE SCENARIO

Diagnosis

The child was found to have foreign body aspiration.

Red flags in such cases – Sudden onset of symptoms; localised signs and symptoms; history of choking or aspiration may be present; finding of recurrent pneumonia at the same site.

Let's look at a case of asthma—

CASE SCENARIO

A child with acute cough, particularly at night

A 4-year-old boy presented with cough for the past 10 days.

History

The child developed mild fever and dry cough 10 days ago. The fever responded to antipyretic medication and subsided in 3 days. However, the cough persisted despite treatment with cough syrup.

There was history of coughing episodes at night. The child also had nasal congestion.

There was a history of similar illness at the age of 3 years after exposure to smoke. There was no known history of allergy. However, the family history was positive for asthma in the child's father.

Examination and investigations

The child looked well with normal oral temperature. His pulse was 90/min, RR was 20/min, and SpO_2 was 98% on room air. Nasal congestion was noted with watery nasal discharge. There was no lymph node enlargement.

Auscultation revealed occasional wheezes.

CASE SCENARIO

Management

This looked like a case of asthma. After ruling out signs and symptoms of GERD and foreign body aspiration, the child was treated with bronchodilator. The child responded well to the treatment and reported after 2 weeks with marked improvement in cough and wheeze.

Asthma – Key characteristics

- Recurrence of cough (non-productive), breathlessness and wheezing
- Seasonal worsening
- Cough or dyspnoea triggered by an allergen or exercise
- History of atopy in the child or their family
- Nocturnal cough
- Symptoms often not linked to fever
- Cough variant asthma—Chronic cough being the only presentation, no wheeze, response to bronchodilator therapy.

However, before labelling any cough as asthma, consider the following:

- Asthma is a diagnosis of exclusion in infancy
- Rule out aspiration syndromes—GERD, upper GI anomalies, palato-pharyngeal incoordination
- Hyperactive airway disease—In preterm babies and those who had lung damage in the neonatal period
- Foreign body, congenital heart defects.

There may be instances when a child has asthma but is not responding to treatment. Let us look at some cases—

CASE SCENARIO

A child with recurrent cough and allergic rhinitis

A 7-year-old boy presented with recurrent cough for the past 3 weeks. He also complained of headache, sore throat, and nasal congestion for about 3 weeks. His mother reported that he also snored on some nights and had to breathe through the mouth while sleeping.

Over the past 3-4 days, the episodes of wet, productive cough had increased during the night. Additionally, he was having occasional attacks of sneezing over the past few days usually after coming back from school.

History

The child was a known case of asthma but was not responding to inhaled corticosteroids.

The parents reported that he had been having frequent episodes of nasal congestion and colds since the age of 4 years. He also had two episodes of hives over the past year which subsided on their own without any medication.

Family history revealed a positive history of pollen allergy in the mother and asthma in his elder brother. On further questioning, the parents revealed that they had brought a puppy home around 3 years ago and recalled that the patient's symptoms had been appearing off and on since that time.

CASE SCENARIO

Examination and investigations

The patient appeared well and comfortable with no pallor or cyanosis. His temperature, RR, BP, and pulse were normal.

On physical examination, allergic shiners were evident, and the turbinates were enlarged and swollen. There was white postnasal discharge and cobblestone posterior pharynx mucosa. Nothing abnormal was found on auscultation. Nasal endoscopic examination did not reveal any abnormality. Eye and ear examination was normal.

Complete blood count (CBC) was normal and the patient did not get the swab test done. The patient was found to be allergic to animal dander and house dust mites on skin prick testing.

The patient was diagnosed with allergic rhinitis.

Management

The parents were advised to avoid the patient's exposure to the pet dog and the patient was prescribed a non-sedating antihistamine and intranasal corticosteroid.

The patient returned after 3 weeks with marked improvement in his condition. His snoring and mouth breathing had reduced considerably. The patient and his parents reported significant relief in cough and there had been no sneezing attack over the week.

CASE SCENARIO

In a patient not responding to treatment for asthma, the clinician must look for comorbidities. It is common for children with asthma to have allergic disease. Around 80% of asthmatics have allergic rhinitis as a comorbidity.

Let's look at another case where a child with asthma did not respond to usual treatment—

CASE SCENARIO

A child with asthma and foreign body obstruction

An 8-year-old boy, with a history of asthma for the past 4 years, presented with a dry cough, breathing difficulty, and wheezing for the last 3 days. There was no fever, cold, or any other complaint.

The parents brought him to the clinic thinking this was another exacerbation.

History

Asthma was diagnosed 4 years ago and the patient had asthma exacerbations almost every month for the past 1 year. His usual medications given by his parents did not help. He was also allergic to animal dander and pollen.

His family history was positive for asthma in his father.

Examination and investigations

The child appeared well and had slight difficulty breathing. His RR was 26/min and his pulse rate was 85/min.

On auscultation, rhonchi were noted over the right side.

Before proceeding with labelling it as asthma exacerbation and doing further investigations, the child was enquired about the onset of cough. He recalled that he had a bout of severe cough 3 days ago while eating at his friend's birthday party. He felt that something might have slipped in his throat while eating.

CASE SCENARIO

His friend's parents rubbed his back and soon he was fine, and the coughing stopped. However, he had been having recurrent episodes of cough and slight breathing difficulty since then. The parents were not aware of this episode.

The child had raised white blood cells (WBCs) and C-reactive protein (CRP) and an X-ray chest showed hyperinflation on the right side.

Management

A flexible bronchoscopy was immediately ordered under general anaesthesia and a piece of peanut was removed from the right main bronchus. The child was kept under observation for one day and was then discharged as the post-procedure course was uneventful.

A follow-up evaluation revealed relief from cough and breathing difficulty and normal chest examination findings.

One must not hurry in labelling cough, wheezing, and difficulty breathing in an asthmatic child as an exacerbation. A thorough history of the onset of cough is important and can help differentiate an exacerbation from another cause, such as an allergic reaction or a foreign body obstruction.

Let's look at a set of some different cases—

CASE SCENARIO

An infant with worsening cough

A 1-month-old baby was brought by his parents with mild cough for the past 3-4 days. There was no other complaint.

History

The baby was breastfed and was growing well. There was no history of fever, vomiting, or choking on feeding.

There was positive history of cough in 5-year-old elder sibling.

Examination

The baby's vitals were normal and chest was clear on auscultation. Saturation was maintained on room air.

The baby was treated as a case of viral RTI.

However, after 1 week, the baby was brought with persistent and worsening cough. The baby's mother stated that there was a funny noise while the baby was coughing and would almost stop breathing while coughing. The baby had a bout of cough while examination which was characteristic of whooping cough.

CASE SCENARIO

Points to consider here:

- Pertussis should be suspected in younger infants, particularly in those who have not yet been vaccinated and there is a history of contact at home.
- CBC shows leucocytosis or normal white cell counts with lymphocytosis.
- The child has apnoea or bradycardia or cough with or without whoop.

Red flag—Neonatal onset or onset in early infancy

Differential diagnosis of neonatal-onset cough—congenital anomalies: tracheobronchomalacia, vascular ring; aspiration: GERD, laryngomalacia, tracheo-oesophageal fistula, laryngeal cleft; mucociliary disorders like primary ciliary dyskinesia (PCD) or cystic fibrosis, particularly when the child has persistent rhinitis since birth; infection of lungs in utero or during the perinatal period; cytomegalovirus, respiratory syncytial virus, chlamydia, pertussis; brief resolved unexplained event (BRUE).

CASE SCENARIO

Worsening dry cough in a child with marked paroxysms at night

A 3-year-old girl presented with dry cough for 6 days. The complaint started with low-grade fever and mild cough. Though the fever subsided in 3 days, the cough kept worsening with marked paroxysmal cough at night.

History

There was no history of a similar illness and no history of recurrent RTIs or allergies. The family history was positive for a similar illness in the patient's grandfather.

The patient had also lost some weight over the past 1 month.

The patient was given paracetamol and a cough syrup at home during this period and no doctor was consulted.

Examination

The patient's temperature, BP, heart rate, and RR were normal, with SpO_2 of 98% on room air. On auscultation, there were diffuse crackles.

The child had a violent bout of cough while examination which made her breathless and she felt like vomiting afterwards. There was an inspiratory whoop.

CASE SCENARIO

A chest X-ray revealed bilateral infiltrates and the blood work showed raised WBCs with lymphocytosis.

A nasopharyngeal swab was sent for polymerase chain reaction (PCR) analysis which returned positive for *Bordetella pertussis*.

The child was diagnosed with pertussis and the parents were advised to consult a doctor for the child's grandfather as well.

Management

The child was prescribed azithromycin and improved within a week of starting treatment.

When there is no suggestive family history or no personal history of recurrent cough, pertussis can be suspected when there is evidence of bouts of cough that are worsening in severity and duration.

CASE SCENARIO

Persistent cough in a child with an uncertain immunisation history

A 2-year-old boy was brought with the complaint of worsening dry cough for the past 3 weeks. He also had mild fever and sore throat.

History

The child had developed high fever, sore throat and cough and was taken to a doctor who told the parents that it was a viral infection. He was prescribed an antipyretic and a cough syrup. By the end of one week, the fever started reducing; however, the sore throat persisted and the cough started deteriorating.

There was no history of recurrent infections or allergies in the child and in any family member. There was no history of weight loss.

The parents could not describe any specific cough characteristic but stated that it was loud and occurred at regular intervals. There was no history of post-tussive vomiting. On further questioning, the parents stated that the child became breathless after coughing.

The family belonged to the lower socio-economic class and 7 members lived in a small room. The parents were not sure about the vaccinations that the child had received and stated that they were not regular with his immunisation.

CASE SCENARIO

Examination and investigations

At the time of presentation, the child's oral temperature was 99°F. He looked distressed and fatigued.

His RR was 40/min and heart rate was 140/min. The SpO_2 was 95% at room air.

Chest auscultation was normal except for expiratory wheeze and a chest X-ray was done but did not reveal anything abnormal.

A Mantoux test was done and simultaneously a nasal swab was sent for culture and PCR analysis. CBC was ordered which revealed leucocytosis with lymphocytosis. The Mantoux test came out to be negative while the PCR analysis was positive for *B. pertussis*.

Management

The child was put on treatment with azithromycin. He started improving within 6 days of treatment. There was a marked relief in cough by the 7th week of illness.

The parents were told about the infectious nature of the disease and were advised to follow necessary precautions. They were also advised to observe all the family members for any similar signs and symptoms.

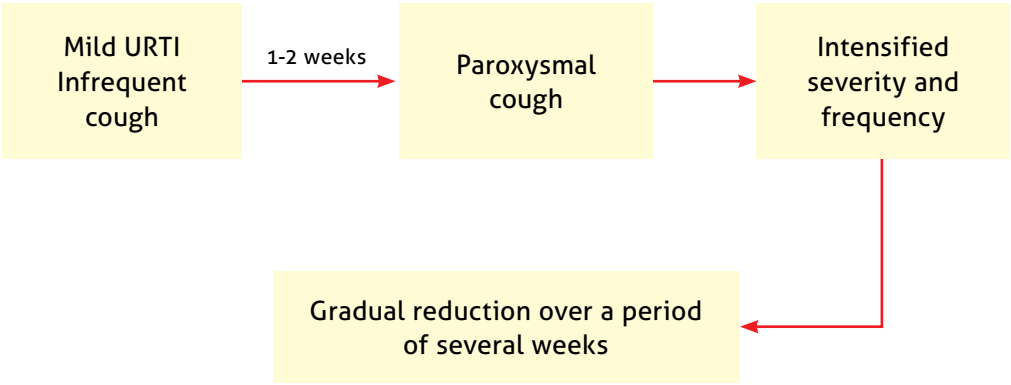
CASE SCENARIO

In cases where the characteristic features of cough are absent or not recognised well, history and physical examination play an important role. The child's living conditions and uncertain immunisation history led to the suspicion of TB and pertussis.

Pertussis (whooping cough)

Pertussis is an RTI of a highly communicable nature. Known to be caused by *B. pertussis*, this illness largely affects infants and young children. However, it can afflict people of all ages. Some other species of Bordetella can also cause Bordetella-like illness, such as *B. parapertussis*, *B. holmesii*, and *B. bronchiseptica*. The latter two are known to affect those with a compromised immune response while *B. parapertussis* tends to cause a mild pertussis-like condition.[14-16]

Presentation and progression of whooping cough[14-16]



Catarrhal phase	Paroxysmal phase	Convalescence
Duration — 1-2 weeks Rhinorrhoea, mild cough (dry), low-grade fever, congestion of the conjunctiva, fatigue	Duration 4-6 weeks Fever subsides Paroxysms of dry, staccato cough, post-tussive vomiting, forceful inspiration after cough giving rise to the distinctive inspiratory whoop Paroxysms usually at night	Gradual resolution over 1–2 weeks

Paroxysms of cough can be triggered by laughing, crying, eating, etc., and can occur several times in quick succession within a short span. The patient appears well in between the paroxysms.[16]

Diagnosing pertussis may be a little challenging as culture from a nasopharyngeal sample usually takes 3-7 days to show a positive result. Moreover, specialised media are needed considering the slow-growing nature of Bordetella. Furthermore, the potential to detect the pathogen diminishes early in the course of the disease. Frequently, this happens even before the suspicion of pertussis arises.[15,16] Culture is most useful during the catarrhal phase.[14] A PCR test appears to be more helpful than culture and can detect the infection up to several weeks.[15,16] Its sensitivity may reduce 4 weeks following the the onset of illness. Serology may help in the convalescent phase.[14]

Treatment involves supportive measures such as hydration and airway maintenance, and the use of macrolide antibiotics. If started early, antibiotic therapy can eliminate the organism from the nasopharynx within a span of 5 days.[14]

Considering the highly infectious nature of the disease, isolation is crucial. People in close contact with the patient should also be given erythromycin or azithromycin.[15]

Vaccination is the appropriate approach to prevent pertussis[14]

Characteristic distinguishing features of pertussis – 3 phases of progression, persistent cough in the absence of fever[15]

Key takeaways in pertussis

- An infant with pertussis may present with apnoea.
- Older children may present with typical cough like pertussis.
- However, an adolescent may have a cough like whooping cough but the clinician may miss it and wrongly label it as hyperreactive airway disease.

Cough in the neonatal period

Cough that begins in the neonatal period points to several probable diagnoses:[17]

- Aspiration syndromes, such as tracheo-oesophageal fistula, laryngeal cleft.
- GERD.
- Congenital anomalies like tracheobronchomalacia, mucociliary defects, like PCD or cystic fibrosis.
- Lung infection during the perinatal period or *in utero*.

Neonatal pertussis also poses a huge burden and can affect non-immunised and incompletely immunised infants.[18]

Let's look at some cases of persistent wet cough in children—

CASE SCENARIO

Persistent wet cough in a child

A 3-year-old boy presented with persistent cough and mild fever for the past 4 weeks.

History

The child was treated with bronchodilators and cough syrups but the cough persisted.

There was no history of Koch's contact, asthma or atopy or any other systemic involvement.

The child's mother felt that the cough was chesty.

Examination and investigations

The boy appeared well at the time of presentation with normal growth and development. There was no clubbing. His RR was 20/min. There was no intercostal or subcostal recession. SpO_2 was 98% on room air.

On auscultation, scattered crepitations and rhonchi were heard and there was equal air entry on both sides.

CASE SCENARIO

Examination of other systems yielded normal findings.

CBC, chest X-ray, Mantoux test, and erythrocyte sedimentation rate (ESR) were normal.

Red flags in this case – Persistent cough; wet cough

Differential diagnosis: TB; suppurative lung disease; PBB; mucociliary disorders; immune deficiency; recurrent pulmonary aspiration; retained foreign body.

Bronchoscopy was done and bronchoalveolar lavage (BAL) evaluation was suggestive of *Moraxella catarrhalis*.

A trial of antibiotic therapy was started. The child was prescribed amoxicillin/clavulanic acid for 1 week and following improvement, it was continued for 4 weeks.

Based on the clinical presentation and response to antibiotic therapy, it was diagnosed as PBB.

Let's look at another case—

CASE SCENARIO

Chronic persistent wet cough in a 5-year-old boy

A 5-year-old boy was brought by his parents with the complaint of persistent cough of 5 weeks' duration. There were no other concerning symptoms. The cough worsened with a change in position.

History

The complaint started with mild fever and cough 5 weeks ago. While the fever subsided in 3 days with antipyretics given at home, the cough persisted.

There was no personal or family history of an allergic disease and the parents also denied the possibility of foreign body aspiration. There was no history of recurrent RTIs.

The child's parents were working and after school, the child used to stay in a day care centre till evening.

Examination and investigations

The child looked well; there was no clubbing, cyanosis, or respiratory distress.

He had a spontaneous, wet cough with a rattling sound. Chest X-ray did not reveal anything abnormal.

Bronchoscopy revealed mucosal inflammation with purulent secretions. BAL was sent for culture which showed infection with *Streptococcus pneumoniae*.

CASE SCENARIO

Management

With a diagnosis of PBB, treatment was started with amoxicillin/clavulanic acid for a duration of 2 weeks.

The patient came after 2 weeks and the parents reported that the cough had completely resolved.

In patients with chronic wet cough, in the absence of any specific pointers for cough, PBB should be considered. It may be differentiated from chronic cough of asthma through the nature of cough, which is dry in the case of asthma. History can also help differentiate between the causes of chronic cough.

Protracted bacterial bronchitis

The diagnostic criteria for PBB include:[19]

- Clinical criteria – Wet cough >4 weeks; no symptoms or signs of any other disease that may cause wet cough; cough resolution after a 2-week course of a suitable treatment
- Microbiological criteria – Wet cough >4 weeks; identification of bacteria ≥10^4 CFU/ml in BAL; resolution of cough after a 2-week course of suitable antibiotic
- Recurrent PBB – More than 3 episodes in a year.

Typical causative pathogens include *Haemophilus influenzae*, *S. pneumoniae*, and *M. catarrhalis*.[19]

PBB can be suspected in the presence of the following:

- Persistent wet cough
- No rhinorrhoea
- Normal ENT system examination
- No relation to allergy
- Isolated wet cough
- Well child
- No other likely diagnosis
- Resolution of cough after prolonged antibiotic therapy (2 to 4 weeks).

Chronic cough in children

- It is a prevalent cause for medical consultations, known to affect nearly 5-10% children.[20]
- Chronic cough in children is defined as one that persists for more than 3 weeks.[5]
- Cough in children is categorized into specific and non-specific cough.
- Specific pointers of cough suggest the underlying cause of chronic cough.[21]

1. SPECIFIC COUGH: A cough accompanied by additional symptoms and warning signals that point to an underlying condition. Signs of specific cough:[9]

Sudden onset of cough with a choking episode	Noisy breathing; abnormality on lung auscultation
Progressive cough	History of recurrent pneumonia
Shortness of breath	Cough onset in neonatal period
Hypoxaemia	Difficulty in swallowing
Presence of constitutional symptoms	Craniofacial abnormality
Digital clubbing	Neuromuscular disorder
Haemoptysis	Wet cough for over 3-4 weeks
Abnormality of the chest wall	Failure to thrive

2. NON-SPECIFIC COUGH: A dry cough without a clearly defined respiratory illness. Most cases have a non-serious cause and may recover on their own.[9]

Common causes of chronic cough, depending on the age of the child, are summarised below:[9]

Below 5 years	Above 5 years
■ Infection	■ Infection
■ Asthma	■ Asthma
■ Congenital abnormality	■ Postnasal drip
■ Gastro-oesophageal reflux (GER)	■ PBB
■ PBB	■ Passive smoking
■ Passive smoking, pollutants	■ Bronchiectasis
■ Foreign body inhalation	■ Psychogenic cough

- Causes of chronic cough vary depending on the age of the children.[9]
- Children with chronic cough must be thoroughly examined to understand the underlying cause.[20]
- Detailed history and physical examinations, with chest X-ray and spirometry (if possible) can help.[20]

Upper airway cough syndrome

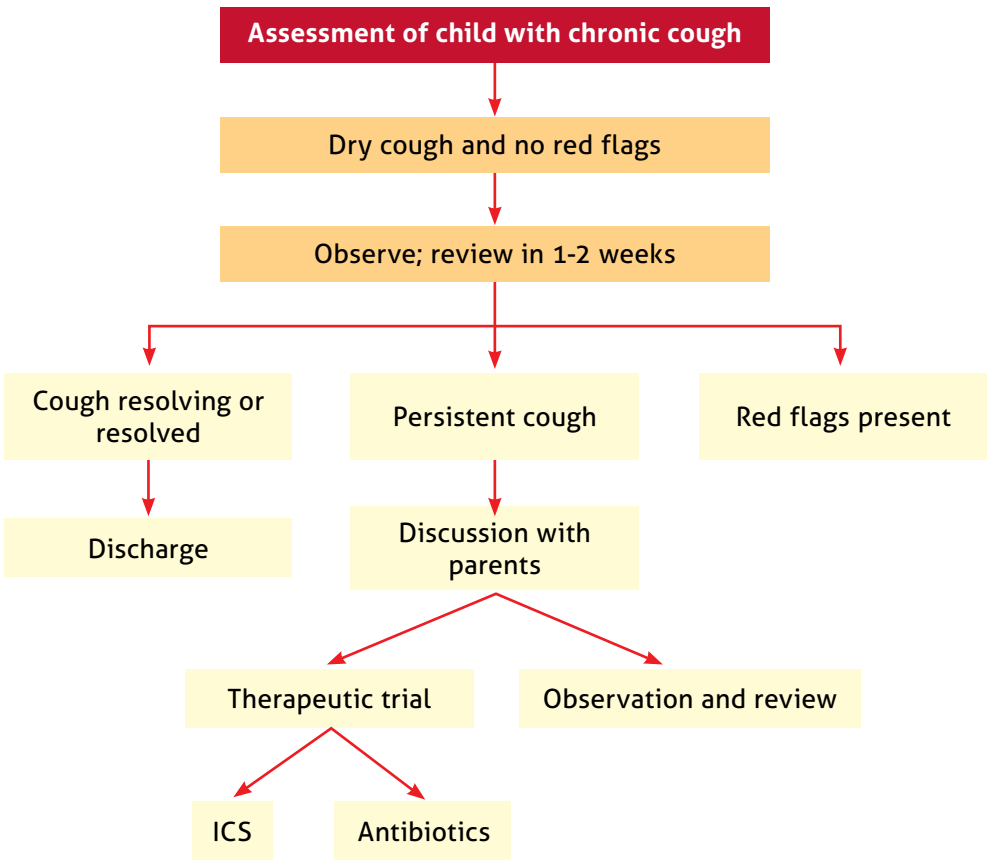
- It was previously referred to as postnasal drip syndrome
- The condition is comorbid with allergic rhinitis
- Persistent thick nasal discharge suggests sinusitis
- There is a sensation of something dropping down into the throat and the patient has to frequently clear the throat
- There may be a history of headache and sinus tenderness
- On examination, there may be mucopurulent secretions in the nasopharynx or oropharynx; cobblestone appearance
- One can have sinusitis even in the absence of fever.

Differential diagnosis of chronic cough

Assessment of children with chronic cough[20]

- Initial assessment of cough first needs a detailed clinical history as well as a physical examination.

- Detailed description of features of chronic cough comprises of the age of onset of symptoms, wet or dry cough, cough triggers, frequency, and timing as well as the associated features.



ICS: Inhaled corticosteroids.

History in chronic cough[22]

- Precise history taking can be helpful in the identification of the reasons for cough.
- The diagnostic yield of a thorough history surpasses that of traditional testing.

What are the useful ways to take successful history in patients with chronic cough?[22]

Being careful and taking enough time with the patient

Calm and relaxed environment

Paying attention to both the patient as well as family members

Exceptional communication abilities, maintaining objectivity, unbiased approach, demonstrate empathy

Order of evaluation after obtaining a clinical history and physical examination:[23]

Common and unusual causes of cough can be determined by employing a systematic method for differential diagnosis. The most frequent:

Cough for 3 months, particularly spasmodic, indicates pertussis syndrome

Infant feeding-related cough needs a textured swallow study

PCD is suggested if there has been persistent cough since the neonatal period, history of transient tachypnoea, and chronic otitis media

Cough stops following a brief course of oral corticosteroids—indicates asthma

Absence of cough while sleeping suggests habit cough syndrome

- Additional testing can help decide the best course of action
  - Chest X-ray
    - Inflammation of the airways or bronchiectasis calls for sweat chloride testing for cystic fibrosis
    - Situs inversus totalis points to PCD
  - Flexible fibreoptic bronchoscopy with BAL can help check for airway malacia or PBB.

A study conducted in children with chronic cough noted the most common diagnoses as PBB, asthma, bronchiectasis, natural resolution, and tracheomalacia.[23]

Salient features of the chronic cough history[22]

AGE OF ONSET

- **Neonatal onset cough—**Chronic cough that starts in the neonatal period and continues thereafter indicates the need for identification of specific underlying conditions such as—
  - Dysfunctional swallowing
  - Airway anomalies
  - PCD.

Healthcare professionals need to evaluate for neonatal respiratory distress syndrome or neonatal pneumonia, meconium aspiration, bronchopulmonary dysplasia, treatment interventions, corticosteroids, surfactants, and advanced respiratory care.

- **Preschool children—**

  Let's have a look at a case of a preschool child with cough—

CASE SCENARIO

Persistent dry cough in a preschooler

A 3-year-old child presented with dry cough for the past 2 weeks. Sometimes the cough was severe enough to wake him up from sleep at night. There was no fever, nasal congestion, or sore throat.

History

The parents revealed that before the cough started, the child had developed mild fever, rhinorrhoea, sore throat, and sneezing. The fever resolved in 3 days and the rest of the complaints resolved by 2 weeks. However, this was followed a day later by the onset of cough which has been persistent, dry and occurred anytime during the day.

The parents had given him cough suppressants but they had not been of much use.

There was no trigger for cough and no specific cough pointers. There was no history of any allergic disease or recurrent infections in the past.

The family history did not suggest anything significant either.

Examination

The child's physical examination revealed no abnormal findings. He was afebrile and looked well.

There was no nasal congestion or discharge.

CASE SCENARIO

This looked like a post-infectious cough in a child following a viral infection.

No medication was prescribed and the parents were asked to report after a week.

At the next visit, the parents reported that there had been some improvement in cough without any medication.

They were reassured that the cough would resolve completely in a few days.

- Cough in the preschool age group is usually caused by post-infectious airway infections, airway anomalies, or asthma.

Post-viral cough

- Cough persists even after the viral infection is over
- Three patterns (Figure, Page 50)
- Keeps coming till the cough completely resolves.

- School children and adolescents—

  Chronic coughs among older children and adolescents are like those of adults, with asthma, GER, and upper airway associations taking over.

MODE OF ONSET[22]

Abrupt onset

- It is a red flag for the healthcare professionals to consider the chance of an inhaled foreign body
- Identification of the onset of cough is important for all children, irrespective of the duration of cough.

Gradual onset

- When the onset of cough is progressive, it is difficult to categorise it
- History of cough onset may help determine the cause.

COUGH TRAJECTORY[22]

Continuous or static but on-going

- Presence of cough daily that may be aggravated in the presence of a new RTI.

Recurrent acute cough

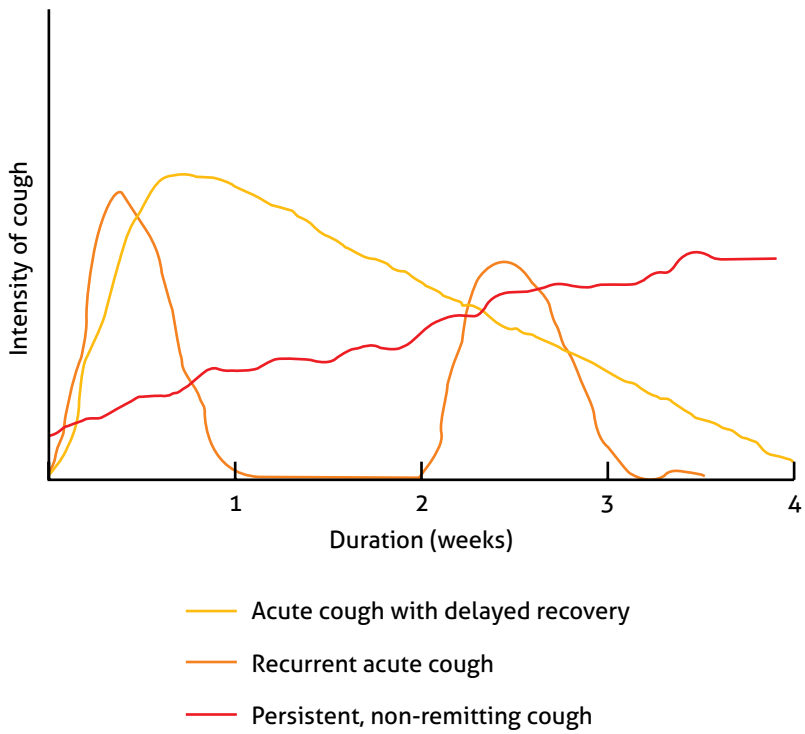
- There is recurrent coughing when children have URTI
- Differentiating recurrent acute cough caused by repeated infections is crucial to historical details and depends on detailed history, to outline the pattern of chronic cough.

- When the cough seems to be subsiding, the clinician must monitor to make sure that there is complete resolution.

- When the cough persists for a prolonged period and shows progressive worsening, it calls for additional testing and management. This could be due to a pertussis infection, retained foreign body, an airway lesion or a progressive infection.

The figure below shows different cough patterns.

Figure. Cough patterns based on intensity and duration



Source: *Marais BJ, Gie RP, Obihara CC, et al. Well defined symptoms are of value in the diagnosis of childhood pulmonary tuberculosis. Arch Dis Child. 2005 Nov;90(11):1162-5.*

Cough accompaniments to look for in children

As mentioned above, there is a wide range of causes that may cause acute and chronic cough in children. Moreover, there are various cough pointers which can help a clinician determine the aetiology and devise an appropriate diagnostic and management approach. To summarise, mentioned below are some cough accompaniments that a clinician must look for while evaluating a child with cough.[5,17,21,24,25]

Examination findings	Signs/ symptoms	Comorbid conditions/ additional features
• Wheezing present—Is it monophonic or polyphonic? Is it unilateral?	• Sudden onset	• Features pointing to immunodeficiency
• Adenoid/tonsillar enlargement	• Chronic wet cough/ sputum production	• Growth failure
• Presence of rhinosinusitis	• Presence of snoring	• Signs of cardiac disease
• Clubbing	• Symptoms with onset in the neonatal period	• Weight loss
• Chest deformity	• Difficulty in feeding, cough with feeding, irritability following feeding, choking on feeding	• Absence of cough while sleeping
• Presence of stridor	• Presence of vomiting	
• Presence of nasal polyps	• Cough worse after lying down	
	• Unremitting/ worsening cough	

Furthermore, symptoms accompanying cough, such as fever, breathlessness, or cold, may help determine the cause. The presence of cough and these accompanying symptoms can point to the following conditions:[26]

Cough	Cold	Fever	Breathlessness	Breath sounds	Condition
YYY	Y	N	YY	Wheeze	**Asthma**
YYY (wet)	Y/N	Y	N	-	**Bronchitis**
Y/N	Y	Y/N	YY	-	**Bronchiolitis**
Y (barking)	N	YY	Y/N	Stridor	**Laryngitis**
YY (hacking)	N	YY	N	-	**Pharyngitis**
Y/N	N	YY	Y/N	Grunt	**Pneumonia**

Y: Yes (present); N: No (absent)

Considering the table above, let's look at a case of pneumonia—

CASE SCENARIO

A child with high-grade fever and mild cough

A 3-year-old boy presented with a fever, mild cough and difficulty in breathing. Fever had developed 5 days ago and was high-grade, followed by cough and breathing difficulty from the next day.

History

There was no history of recurrent infections of the respiratory tract or any allergies. The child's family history was also non-contributory.

There were no GI symptoms.

The child would have a temperature of 102-103°F and would come down with paracetamol syrup given by the parents at home. However, it would reappear in about 5-6 hours. He was also given a cough syrup at home but there was no improvement in cough.

He had received all the vaccinations.

Examination and investigations

The child looked very sick. His oral temperature was 100°F at presentation. His heart rate was 90 beats/min and RR was 35/min. He looked slightly distressed and had some difficulty in breathing. His SpO_2 was 93% on room air.

CASE SCENARIO

On inspection, the chest looked normal, however, on auscultation, there were reduced breath sounds on the left side. There were crackles localised on the left lower lung.

Examination of the eyes, ears and nose was normal. Nothing abnormal was detected in rest of the systemic examination.

A CBC revealed raised WBCs with elevated neutrophils. Chest X-ray showed left lower lobe infiltrates.

Based on the localised findings and the examination and investigation results, a diagnosis of bacterial community-acquired pneumonia was made.

Management

The patient was started on amoxicillin with clavulanic acid for a week.

He started showing improvement within 2 days when the fever subsided. The cough also improved over the next few days.

Key takeaways

- The aetiology of cough, using red flags, must be taken into consideration while managing children with a chronic cough.[20]
- In children with red flags having chronic cough, chest X-ray and spirometry can be helpful.[20]
- Paediatric-specific management protocols or algorithms must be used for children with chronic cough.[21]
- Children with chronic cough can be appropriately managed by following appropriate pathways of recognising the underlying aetiology based on history and physical examination, conducting specific tests, determining the diagnosis, and evidence-based management.
- For a patient, family, and doctor, chronic cough can be frustrating.
- Parents' and the child's expectations and worries are frequently explored to better manage children's coughs because coughs frequently affect both parents' and children's quality of life.[21]

Management of chronic cough[9]

- It is important to identify the underlying aetiological factor of chronic cough in children in order to implement a targeted management plan.
- Standardised algorithm for the management of children having chronic cough helps enhance clinical outcomes.
- Management of specific causes of chronic cough in children must be based on evidence-based recommendations.

Guidelines for the management of chronic cough in children aged ≤14 years[21]

Management algorithms must take into consideration the specific cough features and the history, which involves specific cough pointers

Chest radiograph and spirometry (depending on the child's age) should be done

When there is a clinical suspicion of pertussis, it is advisable to consider conducting tests to assess recent *B. pertussis* infection

Aggravating factors, like exposure to smoke, need to be examined and intervention options to stop such exposure should be initiated

For children with chronic wet/productive cough not related to any disease and without any cough pointers, it is recommended to use 2 weeks of antibiotic therapy for common respiratory bacteria targeting local antibiotic sensitivities

For children with chronic cough in the absence of any underlying lung disease, having GI symptoms of GER, management of GERD is advised as per evidence-based GERD-specific guidelines for 4-8 weeks and their response needs to be reassessed.

Let's look at some cases—

CASE SCENARIO

A child with persistent, dry, loud cough

A 10-year-old boy presented with persistent dry cough for the past 1 year. The cough started suddenly, was loud, and the bouts continued for roughly 2 minutes every time. The child had no other complaint.

History

The child had been subjected to various investigations and was given several over-the-counter (OTC) cough syrups, antihistamines, and antibiotics over the past 1 year but to no avail.

The parents and the child denied any episode of choking or foreign body inhalation.

The patient's mother, however, reported that there was no cough while the child slept, whether during the day or at night.

His family history did not reveal anything significant.

Examination and investigations

Nothing abnormal was detected on physical examination.

His chest X-ray was normal.

Considering the history and normal examination and investigation results, the child was diagnosed with a possible habit cough.

He was referred for psychiatric evaluation.

CASE SCENARIO

An illness or symptom, that continues for a long time, tends to impact the overall well-being of the patient and can be recognised by altered sleep, eating patterns, activity, etc. However, when there is no such change in a patient with a chronic symptom, a functional disorder must be considered. A thorough history can help prevent a delay in diagnosis and avoid medications that are not required.

CASE SCENARIO

Persistent bouts of cough in a school-going child

An 11-year-old girl was brought to the clinic with the complaint of cough off and on for the past 2 weeks.

History

The complaint had started 6 months back and had a sudden onset. There were very short expiratory bouts.

The child did not have any fever, upper airway symptoms, breathlessness, or wheeze.

The child had not come in contact with any sick individuals.

It was also reported by the mother that there was no cough when the child was deeply engrossed in some activity and while sleeping.

The child had been treated with bronchodilators in the past, but they did not help.

The child's family history was not significant for any similar illness.

On questioning about the events that had occurred at the time when the cough had suddenly started, the girl's mother stated that her close friend had left the school around the same time.

CASE SCENARIO

Examination

The child looked well and healthy but had several bouts of loud, non-productive cough during the consultation.

There was no fever and her vitals were normal. Chest auscultation did not reveal anything abnormal.

Based on the child's presentation and history, there was a suspicion of habit cough.

Red flags—No cough during activity or while sleeping; honking, repetitive cough several times in a minute continuing for hours with long inspiration and short expiration.

The parents were advised to take the child for psychiatric evaluation. The parents were anxious for a cure for their child and were counselled that giving unnecessary medications would not help their child.

Psychogenic cough

Habit cough or psychogenic cough is characterised by a honking cough.[13] The key feature in such a cough is absence of cough while sleeping or during activity.[13]

A practical approach to investigating a child with cough[10]

Respiratory diseases in children are different as compared to the adult population.

Children have less developed airways, chest wall, respiratory muscles, sleep-related characteristics, as well as respiratory reflexes.

What are the effects of pre-existing illnesses on cough aetiology?

Chronic cough in a healthy child	Chronic cough with an underlying condition
Post-infectious cough	PBB
Recurrent viral bronchitis	Immune deficiency
Pertussis-like condition	PCD
Allergic rhinitis, postnasal drip, sinusitis	Cystic fibrosis
Cough variant asthma	Recurrent pulmonary aspiration
Psychogenic cough	TB
Bizarre honking cough	Retained foreign body
GERD	Anatomical disorders
	Tracheo-oesophageal fistula, hiatal hernia
	GER
	Interstitial lung disease

Evaluation of a child with cough

- Different types of coughs need further investigation based on the specific pointers identified in the history and clinical examination.
- History comprises of time of onset, nature and quality of cough, triggering and relieving factors, and the presence or absence of haemoptysis.
- Clinical examination involves evaluation of clubbing and asymmetrical findings on auscultation.

Presence of cough in the neonatal period suggests—

Feeding difficulty or pulmonary aspiration due to a congenital defect	Cystic fibrosis	Airway abnormality
	PCD	Chronic viral pneumonia

Investigations in a child with cough

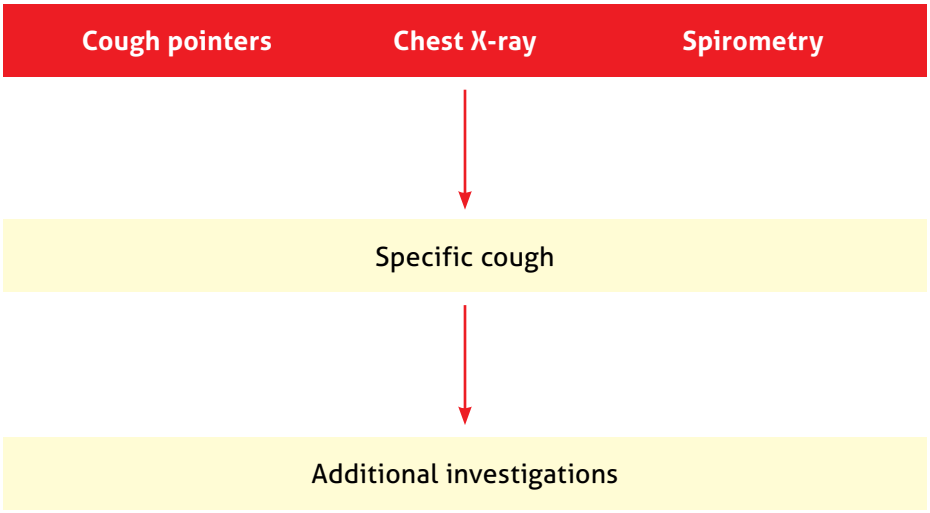
- Most children with a chronic cough require a chest X-ray as part of their diagnostic evaluation.
- Spirometry can be considered, particularly in children aged >5 years.
- Unless asthma is the primary cause, additional tests may be required in children with a specific cough.

Indication for chest X-ray—Suspicion of foreign body inhalation, signs of a chronic respiratory illness, presence of haemoptysis, uncertain diagnosis of pneumonia, and an unusual course of illness.

Use of computed tomography (CT) scan in children

- It needs to be carefully evaluated with radiation effects.
- Children have greater susceptibility to the effects of radiation and face a higher risk of cancer-related mortality over the lifetime.
- Non-contiguous, high-resolution CT (HRCT) should be done in children with a suspicion of diffuse interstitial lung disease at the time of diagnosis and at follow-up of airways or diffuse infiltrative lung disease.

INVESTIGATION IN CHRONIC COUGH



- A meticulous and sytematic assessment is required in children experiencing chronic cough to identify specific diagnostic markers and a chest X-ray and spirometry must be perfomed.

- Those having chronic productive purulent cough must undergo investigations to determine if bronchiectasis is present, as well as to identify any underlying causes that can be treated.

- Chronic cough with onset in the neonatal stage, particularly in the initial few days or weeks, points to significant disease.

Clues from examination that can help in diagnosis

- BCG scar
- Growth chart
- Presence of clubbing
- ENT evaluation
- Allergic markers
- Sputum examination (purulent, viscid)
- Respiratory and cardiovascular systems examination
- Examination at each follow-up visit.

Considering the utility of CT scan in certain situations, let's look at a unique case—

CASE SCENARIO

A teenager with persistent cough and weight loss

A 15-year-old boy presented with productive cough for 15 days and fever for about 4 days.

History

The boy developed cough about 15 days ago and there had been fever for the past 4 days. He also had a history of weight loss over the past 6 months.

There was no history of Koch's contact.

Examination and investigations

On examination, the boy had a normal BP, pulse rate, and RR. The child was mildly febrile at the time of presentation.

Auscultation revealed equal air entry bilaterally and occasional crepitations in the left upper zone.

Nothing abnormal was found on the examination of other systems.

CASE SCENARIO

Antibiotic treatment was started for 7 days. Chest X-ray before and after treatment is shown below.

Before treatment

After treatment with antibiotics for 7 days

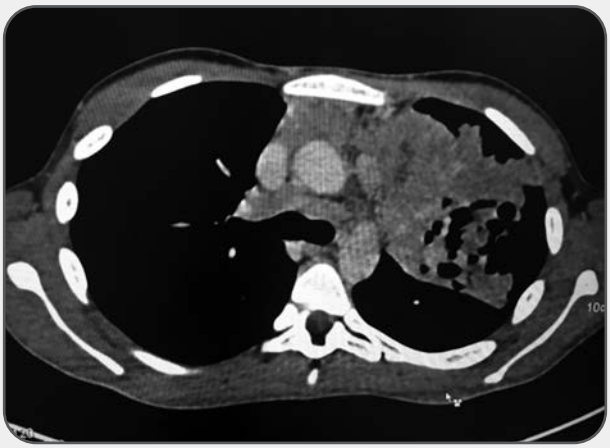
Further investigations

CBC—WBC total count was 12,400; N 56, L 32; ESR was 110 mm/h.

Sputum smear was negative for acid-fast bacilli (AFB) and Gene Xpert test was also negative.

CASE SCENARIO

A CT scan revealed lymphadenopathy with no central necrosis.



This case had some red flags – Persistent cough; non-responsive to treatment; weight loss; CT scan not pointing to TB.

A CT-guided biopsy was done which showed the presence of Reed-Sternberg cells confirming the diagnosis of Hodgkin's lymphoma.

CHARACTERISTICS OF SOME CONDITIONS KNOWN TO CAUSE CHRONIC COUGH

Chronic sinusitis

Let's look at a case—

CASE SCENARIO

Cough in a child with acute bacterial rhinosinusitis and allergy

An 8-year-old girl presented with fever, nasal congestion, cough, sore throat, headache, and sneezing for the past 6 days.

History

Her past history was positive for frequent episodes of cold and cough over the past 6 years. She also had tonsillitis at the age of 6 years and was treated with antibiotic therapy.

She developed a cold on day 1 and started sneezing by the evening. The next day, she had a runny nose and developed fever and cough. This was followed by a sore throat and headache on the third day. The rhinorrhoea had reduced by this time and the patient started complaining of a stuffy nose.

She had received all the vaccinations. Her family history was positive for pollen allergy in her mother and asthma in her elder brother. The parents denied any history of allergy in the patient.

CASE SCENARIO

Examination

The patient was visibly unwell and had a temperature of 103°F. Her RR was 16/min and heart rate was 100 beats/min. Ear examination was normal and the chest was clear on auscultation.

There was mucopurulent, yellowish nasal discharge; no adenoid hypertrophy. Tonsils were slightly enlarged and inflamed. Facial tenderness on the sinuses was present.

The patient was diagnosed with acute bacterial rhinosinusitis. The parents were, however, informed that the aspect of allergy cannot be ignored in the patient.

Management

The patient was prescribed amoxicillin/clavulanic acid syrup for 14 days. She was also prescribed paracetamol for fever.

The fever subsided within 2 days and the patient returned after 5 days with considerable improvement in her condition.

The possibility of an allergic disease was discussed with the parents (considering the patient's past history and family history of allergic disease) and an allergy test was advised for the patient. The test was done and came out positive for pollen and house dust mite.

The patient was prescribed an antihistamine and was completely relieved of her symptoms.

- It is characterised by:

Nasal obstruction

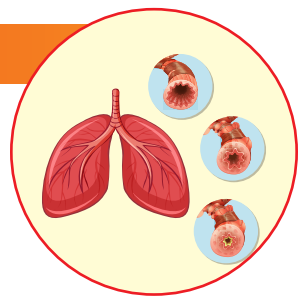
Nasal discharge

Halitosis

Headache

- A study demonstrated that children with chronic cough exhibited a 52% prevalence of moderate to severe opacification of the paranasal sinus on CT. The maxillary sinuses were involved in 90% of cases.

Congenital airway disorders



- Anatomical airway anomalies may lead to chronic cough.
- Tracheomalacia and cough are commonly observed in children after undergoing surgery for tracheo-oesophageal fistula or oesophageal atresia.
- A barking cough is noted among children with airway compression or stenosis due to any cause.

- When children present with relevant symptoms, it is important to consider the possibility of mediastinal masses, including bronchogenic cysts (Look at the case below).

CASE SCENARIO

An infant with persistent cough and breathlessness

An 8-month-old infant was brought by the parents with severe breathlessness for the past 2 days.

History

There was a history of low-grade fever for about 7 days with mild breathlessness. The breathlessness became worse a day before presentation.

Following a positive Mantoux test (14 mm), the baby had been on anti-tubercular therapy since a week. He was also being nebulised, receiving oxygen support and steroid therapy.

There was a history of recurrent wheezing for the past 2 months for which the baby was nebulised and given antibiotic treatment.

There was no history of feeding difficulties. The baby's family history was not positive for asthma or atopy. There was no history of diarrhoea, otitis media, or pyoderma.

CASE SCENARIO

Examination and investigations

The child weighed 7.2 kg and was mildly febrile on presentation. His SpO_2 was 82% on room air. He had tachypnoea with an RR of 90/min.

There were bilateral wheezes on auscultation with equal air entry on both sides.

CBC revealed a white cell count of 15,000, N 70, E 2, L 23.

A gastric lavage was negative for AFB and a repeat Mantoux test (2 tuberculin units) was 14mm.

X-ray chest is shown below.

CASE SCENARIO

Management

The child was treated with amoxicillin/clavulanic acid, antiviral agent oseltamivir, steroids, nebulisation, and oxygen support.

Breathlessness continued for about 7 days and the child was discharged after 14 days on anti-tubercular therapy and bronchodilator therapy.

Follow-up

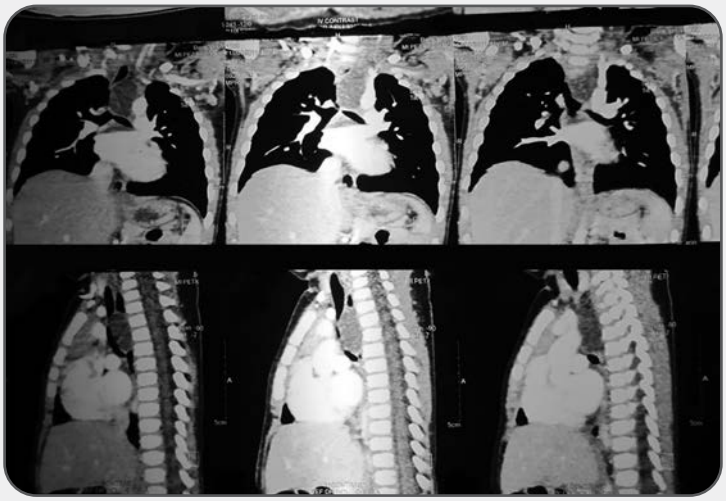
The child presented after 4 weeks with persistent wheeze and partial response to the medication.

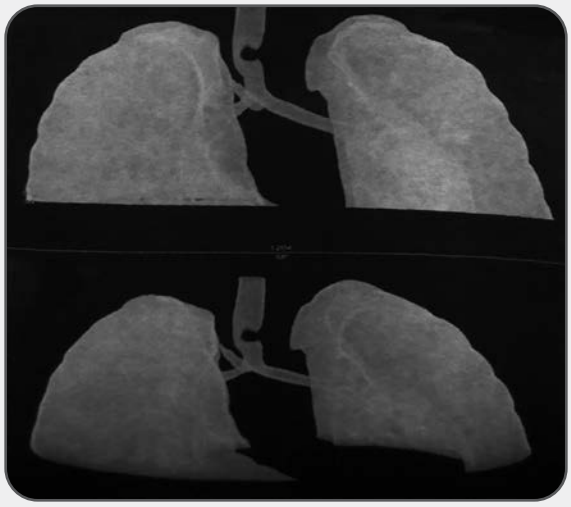
Some red flags in this case—Infant; persistent wheeze or cough or tachypnoea; inadequate response to bronchodilator therapy.

Investigations in this case may include bronchoscopy, HRCT chest, sweat chloride test, nasal brush biopsy, and immune workup.

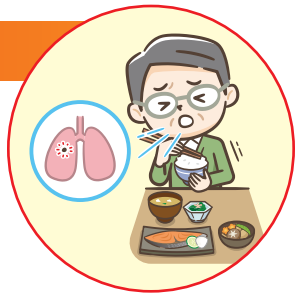
CASE SCENARIO

A contrast-enhanced CT (CECT) chest was ordered which showed a mass above carina consistent with a diagnosis of a bronchogenic cyst.





Foreign body aspiration



Let's look at a case of missed foreign body—

CASE SCENARIO

Recurrent cough in a child—Missed foreign body obstruction

A 4-year-old boy was brought to the clinic by his parents with the chief complaint of a recurrent cough for the past 6 weeks. He also had occasional wheeze after playing for some time.

History

The patient's parents gave him an OTC cough syrup for about 5-6 days after he developed cough 6 weeks ago. However, when the cough did not resolve they took him to a paediatrician. A chest X-ray was ordered twice during the past 6 weeks which did not show any abnormality except for bilateral hyperinflation.

CBC had revealed raised WBC count and ESR. The rest of the results were normal and the test for TB was also negative. There was no significant family history except for a history of asthma in the patient's father.

CASE SCENARIO

The patient was treated over this period with cough syrups, antibiotics, and inhaled bronchodilator therapy with suspicion of conditions like allergy, laryngitis, pharyngitis, and asthma. The treatments used to improve cough slightly but the cough and occasional wheeze on exertion continued throughout the treatment.

One week ago, the paediatrician suggested treatment with corticosteroids. That is when the parents got worried and started looking for second opinion and presented to our clinic.

Evaluation at current presentation

The child appeared well and comfortable. General physical examination did not reveal anything remarkable. SpO_2 at room air was 97%.

The parents were asked about a history of choking or foreign body aspiration but they denied any such episode. However, the child's elder brother, aged 10 years, recalled an incident when the patient was playing with a pen while he was doing his homework. He reported that his younger brother had suddenly started coughing and that he rubbed his back for a few minutes and then the coughing stopped. The parents were not home when this happened.

When asked about the pen, he said that he noted in school the next day that the pen did not have a small upper part but he did not pay any heed to it and threw the pen away.

A CT scan of neck and chest was immediately ordered which showed a foreign body lodged in the lower portion of the trachea.

CASE SCENARIO

Management

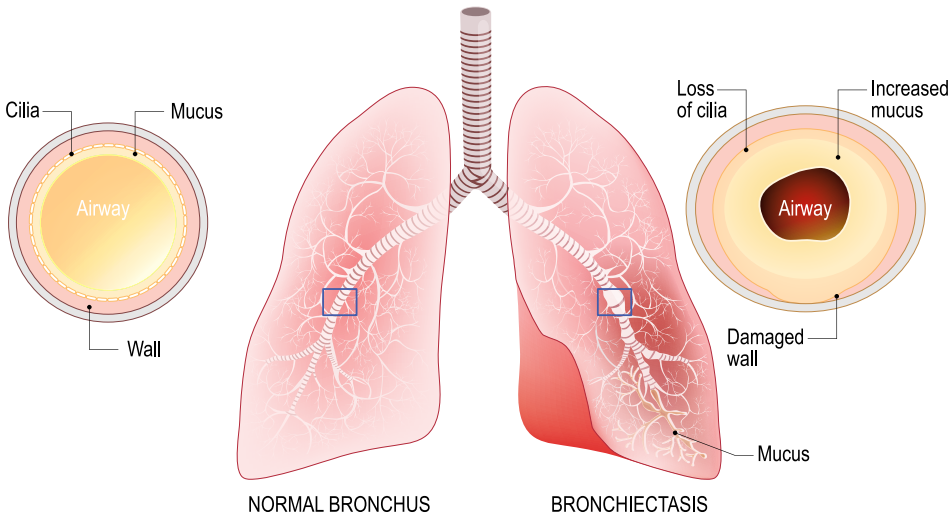
The patient was subjected to rigid bronchoscopy under general anaesthesia to remove the foreign body and a small part of a pen made of plastic (about 1 cm long hollow piece) was retrieved with some mucopurulent secretion. The eventual course was uneventful and after observation for one day at our facility, the patient was discharged.

He came for follow-up after 3 days and did not have any cough or wheeze.

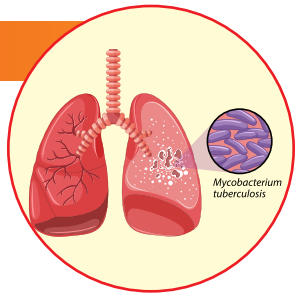
- Foreign body aspiration is more frequently observed in boys compared to girls, being more frequent below the age of 4 years.
- It is an acute condition, however, if the initial diagnosis is missed, the problem may remain unrecognised for extended periods.
- In such cases, there may be history of haemoptysis, wheeze, cast production, along with repeated episodes of pneumonia and infiltrates.

Bronchiectasis

- It is an abnormal dilatation of airways with thickened walls and leads to chronic productive cough.
- When there is no clear aetiology of bronchiectasis, patients should undergo diagnostic evaluation to determine the underlying disorders.
- It may occur due to cystic fibrosis, PCD, retained foreign body, post-infectious condition, immune deficiency, aspiration, etc.



Tuberculosis



Let's have a look at some cases first—

CASE SCENARIO

Worsening cough in a child with low-grade fever

A 12-year-old boy presented with low-grade fever, usually in the evening, for the past 10 days and cough for 2 weeks. There was no other complaint.

History

There was no past history of a similar illness or recurrent infections. The patient reported that the cough had been worsening over the weeks while the fever continued to be low-grade.

The patient lived in a hostel and had come home during vacation. On further questioning, he revealed that one of his friends in his hostel also had similar symptoms.

Family history did not reveal anything remarkable.

The patient's parents reported that the boy had lost around 2 kg of weight since he last visited them 5 months ago.

CASE SCENARIO

Examination and investigations

The child looked well. His temperature was 98.6°F, BP was 120/80 mmHg, pulse rate was 74/min and RR was 16/min.

There was cervical lymphadenopathy and crackles were heard over the left side.

A chest X-ray and nucleic acid amplification testing (NAAT) were ordered. The chest X-ray showed left lower lobe infiltrates. NAAT confirmed the diagnosis of pulmonary TB.

Management

Treatment was started with anti-tubercular treatment which was continued for 6 months.

The patient started showing improvement within a month of starting therapy.

Low-grade fever may point to a mild viral infection. However, the continuation of low-grade fever beyond 3-4 days should prompt the consideration of infections like TB or fungal infection.

CASE SCENARIO

A child with progressive cough and weight loss

A 10-year-old girl presented with progressive cough for the past 3 weeks. There were no other associated symptoms.

History

There was no history of fever. The girl had progressive cough with tachypnoea and the girl's mother stated that she had also lost weight over the past few months.

Examination and investigations

Physical examination was normal while sputum test for cartridge based NAAT (CB-NAAT) returned positive for rifampicin-sensitive *M. tuberculosis*.

The patient's chest X-ray is shown below.

CASE SCENARIO

Red flags in this case – Persistent cough; progressive symptoms; weight loss

When there is persistent cough for 2 weeks with fever and weight loss, one must screen for TB. Enlarged mediastinal nodes pressing on trachea should also raise the suspicion.

When a child has persistent productive cough, TB should be taken into account, especially in the presence of symptoms like fever, loss of weight, or malaise.

With a majority of TB infections spread through inhalation, more than 95% of children who are infected have primary lesions in the lungs.

Chest X-ray is the primary imaging tool to assess pulmonary TB in children. CT can offer valuable insights for the diagnosis and treatment in certain cases.

Red flags for cough in children

Over 80% of children with chronic cough visit the doctor five or more times in a year, and 53% visit the doctor more than ten times, indicating a significant burden of the condition in young patients.[27]

History[22]

- Chronic cough in children is indicative of an underlying condition
- A detailed history taking can assist determine the reason for cough
- Cough-specific guidelines advocate the consideration of specific pointers to help clinicians determine a strategy for investigations
- The specific indicators and red flags in chronic cough can be recognised while taking a comprehensive history and play a crucial role in diagnosis.

Key red flags in history and physical examination[20,21]

When evaluating a child with chronic cough, it is critical to consider the order of events and ascertain if there are any red flags:

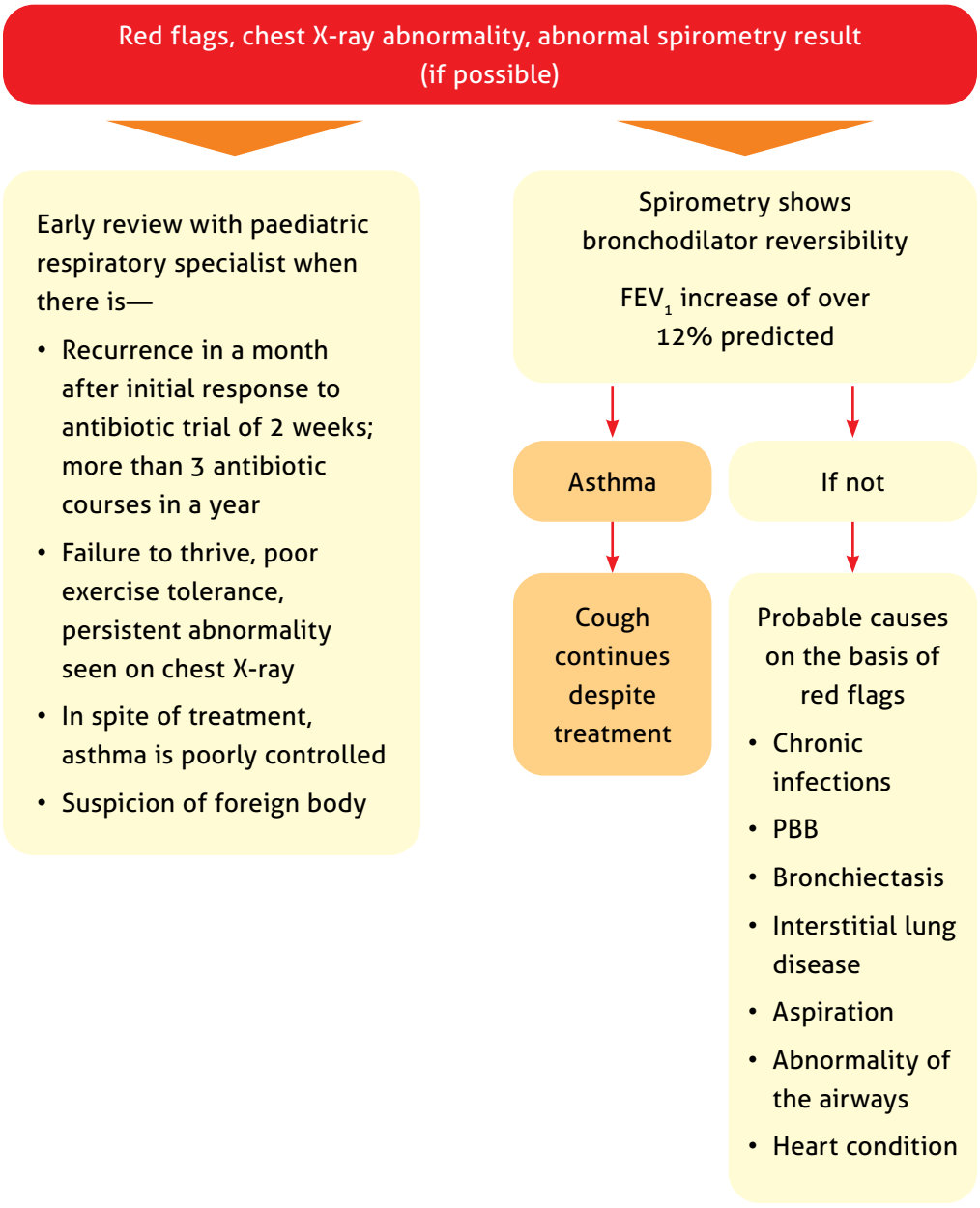
History

Red flags	Probable cause
Choking	Foreign body
Pain in chest	Asthma, arrhythmia
Daily wet/productive cough	TB, PBB, suppurative lung disease, atypical infections, recurring episodes of aspiration
Dyspnoea/tachypnoea	Chronic lung or heart disease
Exertional dyspnoea	Airway/parenchymal disease
Pain in face or purulent discharge from nose	Chronic sinusitis (PBB), PCD
Hoarseness or stridor	Laryngeal cleft, airway abnormalities
Feeding difficulties, feeding followed by arching	Serious systemic or pulmonary disease, aspiration
Recurrence of infections	Immunodeficiency
Haemoptysis	Suppurative lung disease, vascular abnormalities
History of chronic lung/oesophageal disease	Numerous causes—Second H-type fistula, bronchiectasis, asthma

Physical examination

Red flags	Probable cause
Hypoxia/cyanosis	Airway/parenchymal disease, heart disease
Chest wall deformity	Airway or parenchymal disease
Clubbing	Suppurative lung disease
Growth failure	Serious systemic or pulmonary disease
Abnormal neurodevelopment	Aspiration lung disease
Wheeze	Asthma, bronchiolitis obliterans, bronchiolitis, foreign body aspiration, malacia, stenosis, lymphadenopathy, vascular rings, mediastinal tumours, TB
Crepitations	Airway disease, parenchymal disease

Approaching a child with chronic cough with red flags[20]



FEV_1: Forced expiratory volume in 1 sec

- Chest X-ray and spirometry are the two primary tests that can be done.[20]
- If the child is five years of age or older, spirometry can be done. Uncontrolled asthma is indicated if bronchodilator response is seen, as indicated by an increase in FEV_1 of >12% predicted.[20]
- Following a specialist referral, some tests aimed at specific diagnoses could be done:[20]

Skin prick tests	Determine atopy
Flexible bronchoscopy	To assess the airways
BAL	For microbiological diagnosis
CT of the thorax	For assessing lung parenchymal changes

Key takeaway

- Identifying the key red flags from the child's history and physical examination can assist in determining the potential cause of chronic cough.
- Once a thorough history is taken, physical examination and investigations like chest X-ray and spirometry help improve diagnostic accuracy.

Primary ciliary dyskinesia in children – A rare disorder presenting with cough

Let's look at a case—

CASE SCENARIO

A child with wet cough and fever with h/o recurrent infections

A 10-year-old boy presented with wet cough, nasal congestion, fever, and headache for the past 8 days. He also complained of breathing difficulty and mild chest pain.

History

There was a history of recurrent rhinosinusitis and ear infections since the age of 1 year. The parents stated that they felt that the child's nose was almost always congested. The child had 3-4 episodes of pneumonia over the past 3 years.

The mother's pregnancy was uneventful and the child was a term baby with no neonatal respiratory distress. The parents said that the boy has been unwell with some or the other symptoms on most days since around 6 or 7 months of age.

The child had been fully vaccinated.

CASE SCENARIO

Examination and investigations

At presentation, the child had an oral temperature of 101°F. He was having difficulty breathing and complained of chest discomfort. There was no clubbing.

His BP was 122/80 mmHg, heart rate was 98/min, and RR was 30/min. His SpO_2 was 95% on room air. Chest auscultation revealed crackles and wheeze. Heart sounds were normal but were heard towards the right side.

The child's nose was congested and had thick discharge. Ear examination was normal.

CBC showed elevated WBC count and raised ESR.

Chest X-ray showed bilateral infiltrates and dextrocardia.

Management

The child was admitted and antibiotic treatment was started for pneumonia. However, there also seemed to be a possible diagnosis of PCD in this patient.

The patient underwent a nasal nitric oxide (nNO) test which showed low levels.

The child was discharged on the 8th day after his condition showed marked improvement.

CASE SCENARIO

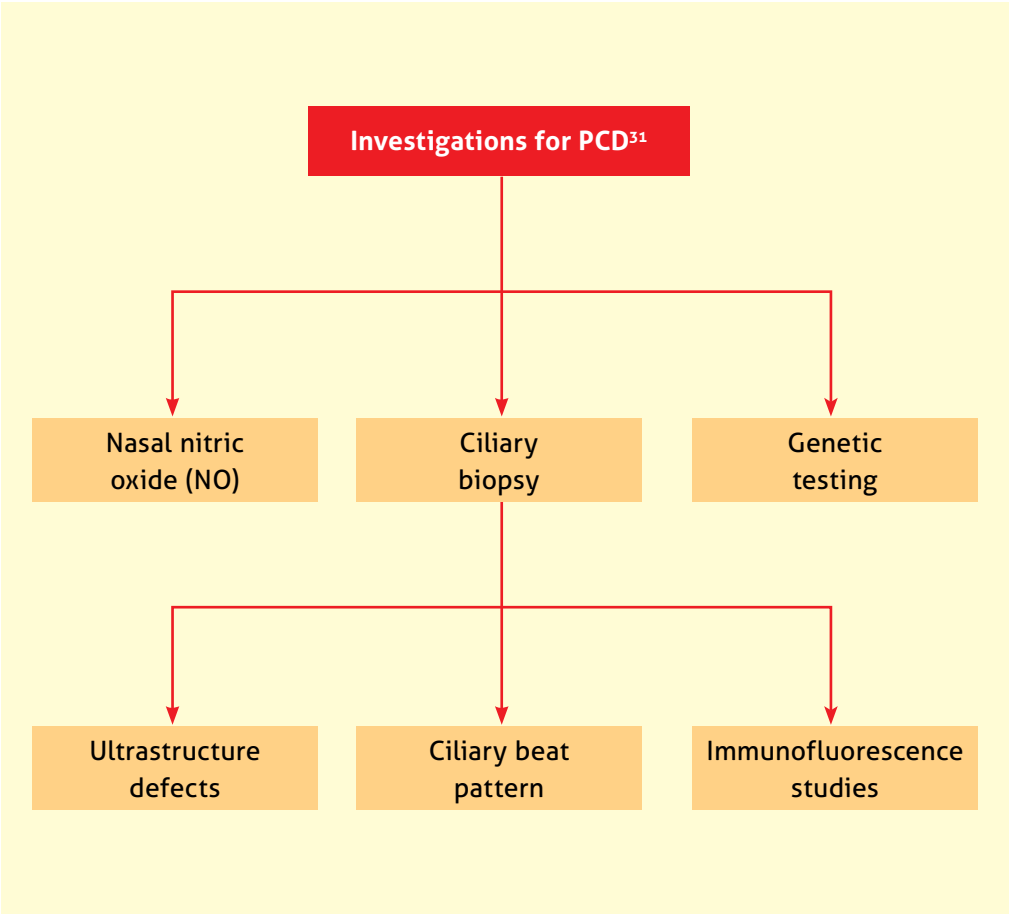
The parents were counselled about the possibility of PCD in their child and the child was referred to a specialised PCD clinic for a thorough evaluation, diagnosis, and treatment.

Primary ciliary dyskinesia, an autosomal recessive inherited disease, encompasses a heterogeneous group of disorders of the motile cilia.[28,29] This rare lung disorder can lead to chronic oto-sino-pulmonary disease, irreversible lung damage, and the possibility of eventual progression to respiratory failure.[30]

Prevalence of PCD is reported to range from 1:2200 to 1:40000, owing to varying analysis methods.[29]

Neonatal distress in children with PCD[30]

- Respiratory distress is seen in around 80% of full-term neonates with PCD.
- Respiratory distress develops about 12-24 hours after birth.



Management of PCD

Goal of PCD management[31]

- Maintenance or recovery of lung function
- Diminish bronchiectasis progression by means of airway clearance and treating infections.

There is a lack of treatment options specific to PCD and the management is guided by the data available for cystic fibrosis and non-cystic fibrosis bronchiectasis.[28,31]

Primary ciliary dyskinesia

- Recurrent infections of ears or sinuses
- Neonatal respiratory distress
- Persistent nasal discharge
- Situs inversus in around 50% of the cases.

Cystic fibrosis

Let's look at a case first—

CASE SCENARIO

A child with recurrent pulmonary infections and loose stools

A 2-year-old boy was brought to the clinic with complaints of cough, fever, runny nose for the past 1 week. He also had loose, smelly stools for the past 3 days with slight discomfort in the abdomen.

History

The child had a history of recurrent wet cough with difficulty in breathing, recurrent RTIs, and rhinosinusitis. He had developed a cough and respiratory distress 1 month after birth and was admitted to the hospital. A similar episode occurred at the age of 14 months and he was again admitted and needed oxygen support for a day.

He had been diagnosed with asthma at 1 year of age and was treated for the same but there was no improvement in recurrent cough or frequency of respiratory infections. He was also admitted at the age of 7 months with pneumonia.

According to the parents, the child had been having loose, foul-smelling stools for quite a few months. The child's mother reported that she felt her son was weak and was not gaining enough weight and that he did not eat well.

The child had been tested for allergies and was not found to be allergic. His family history was not positive for any similar illness or allergic disease.

CASE SCENARIO

On questioning further, it was found that there was no history of meconium ileus at birth, however, when asked specifically about the child's sweat, the mother revealed that it felt salty.

Immediately, this last finding in history raised suspicion of cystic fibrosis. However, we chose to examine the patient and investigate to be sure.

Examination and investigations

The child looked well and was in no distress. There was no clubbing or cyanosis. His oral temperature was 99°F, pulse rate was 100/min, and RR was 30/min. SpO_2 was 98% on room air. His weight was between the 10th and 15th percentile for his age.

His ear examination was normal. There was watery nasal discharge with no polyps or adenoid hypertrophy. His tonsils were slightly enlarged, and he had postnasal drip. Abdominal examination did not reveal anything abnormal.

On auscultation, there was wheezing and diffuse rhonchi. Bowel sounds were normal.

His blood work showed raised WBCs. Mantoux test and sputum culture were negative for TB. However, the sputum culture showed *Klebsiella pneumoniae*. Stool examination revealed steatorrhoea.

A chest CT revealed bronchiectasis. Chloride level was elevated on sweat test.

A probable diagnosis of cystic fibrosis was made.

CASE SCENARIO

Management

Antibiotic therapy was started for an RTI. He was also prescribed paracetamol to manage fever. Nutritional supplementation was also advised.

The parents were counselled about the likely diagnosis of cystic fibrosis in the child and were advised to get genetic testing done which confirmed the diagnosis of cystic fibrosis. The child was referred to a specialised cystic fibrosis clinic.

Let's look at another case in an infant—

CASE SCENARIO

An infant with cough and wheeze

A 4-month-old baby was brought with complaints of wet cough and wheezing for the past 2 months. The child also had loose stools.

History

There was a history of loose stools since the age of 2 weeks. He had been admitted to a hospital and was treated with antibiotics and bronchodilators, however, there was only a partial response to therapy.

There was no other relevant past medical history or family history.

Examination and investigations

The baby's weight and height were below the 3rd centile (failure to thrive).

Clubbing and cyanosis—Negative

The child had tachypnoea with bilateral chest signs.

SpO_2—86% on room air.

CBC—Haemoglobin 9.5 g/dL, total leucocyte count 25,400/mm^3 (P-76, L-18, M-6), platelet count 4,65,000/mL

CRP—86 mg/dL

Electrolytes—Na: 131 mmol/L, K: 3.5 mEq/L, Cl: 96 mEq/L

CASE SCENARIO

Stool for fat—++

Sweat conductivity test—122 mmol/L

X-ray chest is shown below:

Bronchoscopy was done which showed copious amounts of purulent mucoid secretions in all major airways.

There was no sign of any anatomical abnormality. BAL did not show any lipid-laden macrophages and culture showed Pseudomonas with a colony count of $>10^5$.

With a suspicion of cystic fibrosis based on the findings, an exome analysis was ordered which showed heterozygous pathogenic variants in the cystic fibrosis transmembrane conductance regulator (CFTR) gene, confirming the diagnosis of cystic fibrosis.

Red flags in this case—Persistent symptoms with poor response to treatment; wet cough; failure to thrive; multisystem involvement.

- Cystic fibrosis is a heterogeneous genetically-inherited, autosomal recessive disorder characterised by CFTR gene mutations.[32,33]
- This condition is marked by chronic bacterial airway and sinus infection, impaired fat digestion owing to insufficient pancreatic exocrine function, male infertility because of obstructive azoospermia, and increased chloride in sweat.[32]
- It is estimated that 162,428 individuals are living with cystic fibrosis in 94 countries, out of which around 65% are diagnosed, with 12% being treated with triple combination therapy; 57,076 patients are estimated to be undiagnosed.[34]

Diagnosis of cystic fibrosis

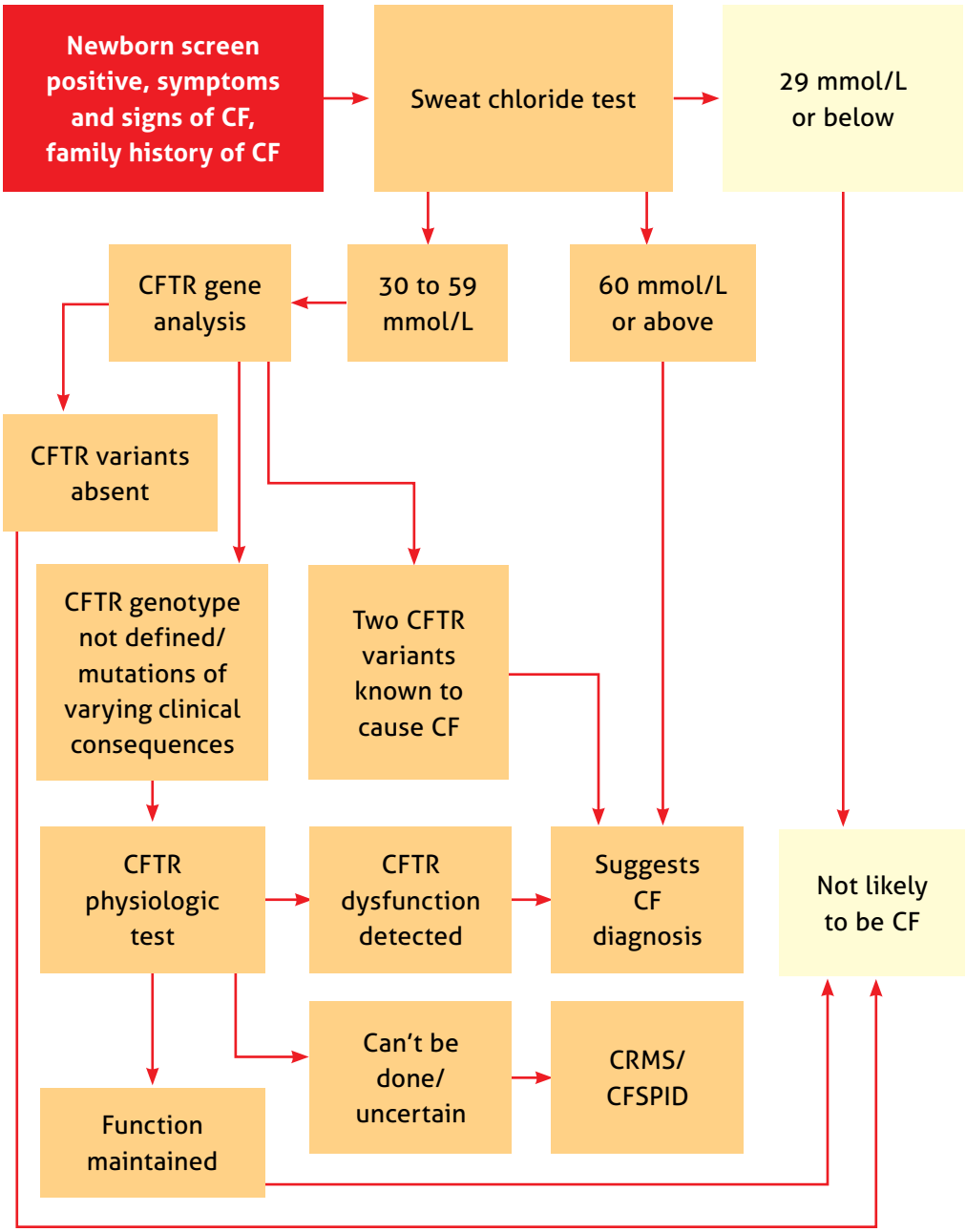
Diagnosis can be established on the basis of:[35]

Positive test findings in patients not exhibiting any symptoms, such as screening the infant through blood spot immunoreactive trypsin test; confirmation with sweat and genetic tests, OR

Clinical signs and symptoms, along with sweat or genetic testing to confirm cystic fibrosis, OR

Only clinical presentation, in patients exhibiting symptoms but normal results on sweat or genetic testing.

Approach to investigations to diagnose cystic fibrosis[33]



CF: Cystic fibrosis; CRMS: CFTR-related metabolic syndrome; CFSPID: CF screen positive, inconclusive diagnosis

Management of cystic fibrosis[33,35]

PULMONARY MONITORING

- Assessment—History, physical examination, weight and height measurement
- Oxygen saturation
- Microbiological evaluation of sputum sample/cough swab/nasopharyngeal aspirate
- Spirometry
- Chest X-ray; chest CT to identify features missed by other investigations
- Blood tests, such as white cell count, Aspergillus serology, serum immunoglobulin E (IgE).

AIRWAY CLEARANCE

- Airway clearance technique should be discussed with children with cystic fibrosis not having signs of lung disease and their parents. Patients with cystic fibrosis having signs of lung disease should be trained to use airway clearance methods.

MUCOACTIVE DRUGS

- Dornase alfa (recombinant human deoxyribonuclease [rhDNase]) is the preferred drug.
- If there is insufficient response to rhDNase, both rhDNase and hypertonic sodium chloride or hypertonic sodium chloride alone can be considered.

- Mannitol dry powder for inhalation can be thought of in children and young patients unable to use rhDNase and hypertonic sodium chloride.

ANTIBIOTICS

- Antibiotic prophylaxis to prevent recurrent respiratory infections.

PANCREATIC ENZYME REPLACEMENT

- Pancreatic enzyme replacement therapy to manage pancreatic insufficiency.

Targeted therapies in cystic fibrosis have also been developed which include potentiators, correctors, and production correctors

GERD and cough in children

Let's look at a case—

CASE SCENARIO

Chronic cough in an otherwise healthy boy

A 12-year-old boy was brought by his parents for a recent increase in coughing for the past 3 days. The parents reported that the boy had a dry cough for the past 8 months. There was no other associated complaint.

History

The child had a history of persistent isolated non-productive cough with no other associated symptoms.

The parents had consulted two other doctors previously and he had been treated with cough suppressants, bronchodilators, and corticosteroids, but they had not helped at all.

He had no known allergies and allergy tests done previously at other centres were negative.

There was no history of recurrent respiratory infections. A thorough history revealed that cough used to worsen during or after eating.

CASE SCENARIO

Examination and investigations

The child was non-febrile and appeared healthy. His BP, pulse and RR were all normal.

Chest auscultation revealed normal findings.

X-ray of the paranasal sinuses and chest were normal. Chest CT scan was also normal. The child also had normal findings on spirometry.

Further questioning revealed that there was no heartburn or any other symptoms, but the mother revealed that the boy burped a lot.

Oesophageal endoscopy was done which showed reflux oesophagitis. 24-hour oesophageal pH monitoring also showed reflux.

The child was diagnosed with GERD.

Management

The child was started on proton pump inhibitor (PPI) therapy once daily and reported with complete relief in cough within 6 weeks of starting treatment.

GERD could be a cause of chronic cough in children. Instead of starting medications like bronchodilators and steroids, in the absence of any specific signs, a thorough evaluation must be done, and investigations must be performed in order to determine the cause of isolated cough.

- Among children, asthma, RTIs, and GERD seem to be the most frequent causes of chronic cough.[36]
- When a child who is otherwise healthy experiences chronic isolated cough without wheeze, the following conditions should be considered:[36]
  - Postinfectious cough
  - Recurrent viral bronchitis
  - Pertussis-like illness
  - Cough variant asthma
  - Psychogenic cough
  - Upper airway cough syndrome
  - GERD.

Mechanism[37]

- The exact cause of cough due to GERD is unknown.
- It is usually believed to be associated with microaspiration of the contents from the stomach that reflux into the airways.

Reasons for not being able to show a cause-and-effect relationship:[38]

- No standard diagnostic method for GERD in infants and children
- A range of possible interventions for GERD
- More harm than benefit with certain interventions such as surgery and PPIs.

Diagnosis and treatment

- In the absence of clinical signs of GERD, including chest pain or epigastric pain, repeated episodes of regurgitation, or heartburn, it is not advised to utilise GERD therapy for chronic cough.[37]

- When the diagnosis is uncertain, investigations like oesophagogastroduodenoscopy (EGD) with biopsy or a combination of oesophageal multichannel intraluminal impedance with pH monitoring (pH-MII) can be considered.[37]

- GERD treatment based on age and symptoms:

  - Formula-fed babies – Decrease in feed volumes, feed thickeners for 1-2 weeks, or hydrolysed milk formula for 2-4 weeks' duration[38]

  - Breastfed babies – May give alginates[38]

  - Acid suppression using PPIs or H_2 receptor antagonists can be considered in older children for a short-term trial[37]

  - These agents should be used for a limited duration, generally not exceeding 4-8 weeks, when assessing treatment efficacy.[38]

- It is crucial to weigh the potential benefits against the potential adverse effects associated with long-term use of PPIs.[37]

Recommendations/suggestions from the CHEST guideline and expert panel report on chronic cough and GER[38]

S.No.	Category of patients	Recommendation/suggestion
1.	Children ≤14 years of age having chronic cough with no underlying lung condition	GERD treatment not to be used in the absence of clinical signs of GER (infants—recurrent regurgitation, dystonic neck posture; older children—heartburn or epigastric pain)
2.	Children 14 years of age or below having chronic cough with no underlying lung condition, having features or tests consistent with pathological GER	Treatment for GERD according to evidence-based GERD guidelines
3.	Children 14 years of age or below with chronic cough with no underlying lung disease having features or tests compatible with gastro-oesophageal pathological reflux	Acid suppressive therapy not to be used only for chronic cough
4.	Children with chronic cough with no underlying lung condition, having GI GER symptoms	It is suggested to treat for GERD according to evidence-based GERD guidelines for a period of 4-8 weeks; response to be reassessed
5.	Children with chronic cough and with no underlying condition	If there is a suspicion, on the basis of GER symptoms, that GERD may be the cause, it is suggested to investigate the child suspected to have GERD using GERD guidelines

Role of triple endoscopy

- Triple endoscopy is typically carried out by otolaryngologists, pulmonologists, and gastroenterologists in case of a child with dysphagia and recalcitrant chronic cough to provide comprehensive care involving multiple fields of medicine.[37]

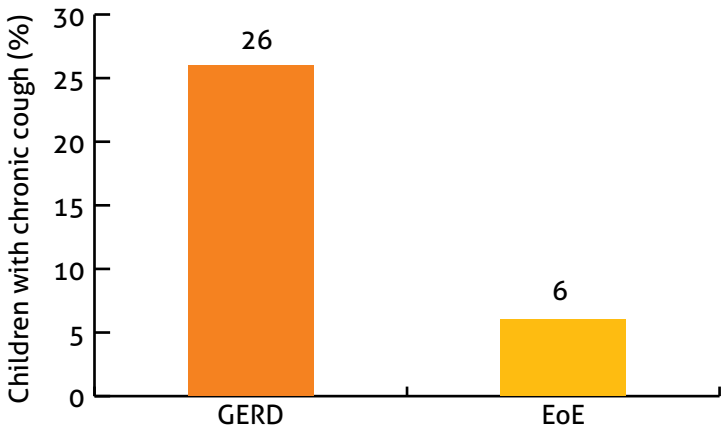
- Triple endoscopy results in an accurate diagnosis and a favourable prognosis after focused therapy and lowers expenditures and dangers related to repeated anaesthesia.[37]

A study by Fracchia *et al.* showed that in children undergoing triple endoscopy for chronic cough

About 42% of the children had diagnoses in more than one specialty

Around 26% of the children had GERD and 6% had eosinophilic oesophagitis (EoE) (Figure).[39]

Figure. Children undergoing triple endoscopy diagnosed with GERD and EoE



Children with persistent cough

- Persistent cough is a common complaint in practice and has a wide variety of possible diagnoses.[40]
- School-age children and young adults have a high incidence of pertussis correlated with a persistent cough.[40]

In a child with persistent cough, the difference has to be ascertained between dry and a moist or rattly cough.[41]

In some cases, persistent cough can occur as a result of persistent atelectasis, or congenital airway narrowing.[41]

If there is a concern of foreign body aspiration or suppurative lung disease, or if the cause of persistent cough is uncertain, the child must be referred for further assessment.[41]

- In children having persistent dry cough, that lacks an easily identifiable cause, a chest X-ray should be obtained.[41]
- In children with cough persisting for more than 3 weeks, a chest X-ray is indicated.[17]

A persistent cough is hypothesised to occur due to repeated activation of sensory nerves in the bronchial mucosa.[42]

It has often been considered as the symptom of childhood asthma and has been categorised as cough variant asthma.[42]

Corticosteroids can be effective for the management of persistent cough in children, as observed in many trials.[42]

Recurrent cough

The most frequent causes of recurrent cough are asthma, viral infections, and upper airway bacterial infections.[43]

A thorough medical history aids in determining the underlying cause of a cough and has a greater diagnostic value compared to standard testing methods.[22]

Viral infections occur more commonly during the winter season. As these infections can occur one after the other, the child may be perceived to have chronic persistent cough.[44]

In cases of viral infections, the child usually also has a fever and cold. Cough can be present all through the day and night.[5] On the other hand, cough during the later part of the night suggests reactive airway disease, like asthma.[5] If there is cough immediately after lying down, it could be due to a bacterial infection owing to postnasal drip.[5,43]

Wheezing and dyspnoea are common in asthma.[24] Asthma is also associated with a personal or family history of atopic condition.

The cough in viral infections may be dry or wet. A dry hacking cough accompanied by irritation in the throat is suggestive of viral pharyngitis. However, when such a cough is accompanied by pain on swallowing, it could be a sign of bacterial infection.[5]

Fever usually responds to antipyretics in viral infections. Bacterial infections give rise to a hectic fever, while fever may occasionally be observed in asthma.[43] Cough and cold after a high fever suggest a viral infection. A reactive airway disease, on the other hand, may be characterised by cold and cough followed by mild fever.[5]

Asthma can be associated with cold all through the year with nose itching. In viral infections, there is intermittent watery discharge and fever. Bacterial infections present with thick and purulent discharge.[43]

Acute pharyngotonsillitis presents with fever, redness of the pharynx and tonsils, tonsillar exudate, enlargement of cervical lymph nodes with tenderness, dysphagia, and headache. The presence of simultaneous respiratory symptoms such as coughing or a runny nose suggests a viral infection.[45]

References

1. Shendurnikar N, Thakkar PA. Approach to Practical Paediatrics. [Internet] Available at: https://books.google.co.in/books?id=ujnvDwAAQBAJ&printsec=frontcover#v=onepage&q&f=false. [cited June 16, 2023].

2. Chang AB, Asher MI. A review of cough in children. J Asthma. 2001 Jun;38(4):299-309.

3. Chang AB, Landau LI, Van Asperen PP, et al; Thoracic Society of Australia and New Zealand. Cough in children: definitions and clinical evaluation. Med J Aust. 2006 Apr 17;184(8):398-403.

4. Ioan I, Poussel M, Coutier L, et al. What is chronic cough in children? Front Physiol. 2014 Aug 28;5:322.

5. Amdekar Y, Chokhani R, Palaniraman R. IAP Standard Treatment Guidelines 2022. Management of Cough in Office Practice. [Internet]. Available from: https://iapindia.org/pdf/Ch-150-Management-of-Cough-in-Office-Practice.pdf. [cited May 22, 2023].

6. Lamas A, Ruiz de Valbuena M, Máiz L. Cough in children. Arch Bronconeumol. 2014 Jul; 50(7):294-300.

7. Murgia V, Manti S, Licari A, et al. Upper respiratory tract infection-associated acute cough and the urge to cough: New insights for clinical practice. Pediatr Allergy Immunol Pulmonol. 2020 Mar;33(1):3-11.

8. Munyard P, Bush A. How much coughing is normal? Arch Dis Child. 1996 Jun;74(6):531-4.

9. Alsubaie H, Al-Shamrani A, Alharbi AS, Alhaider S. Clinical practice guidelines: Approach to cough in children: The official statement endorsed by the Saudi Pediatric Pulmonology Association (SPPA). Int J Pediatr Adolesc Med. 2015 Mar;2(1):38-43.

10. do Rosario Matos M, Taylor GA, Owens CM. Investigating a Child with a "Cough": A Pragmatic Approach. In: Hodler J, von Schulthess GK, Kubik-Huch RA, Zollikofer CL. (eds) Diseases of the Chest and Heart 2015–2018:37-45.

11. Worrall G. Acute cough in children. Can Fam Physician. 2011 Mar;57(3):315-8.

12. Hay AD, Wilson A, Fahey T, Peters TJ. The duration of acute cough in pre-school children presenting to primary care: a prospective cohort study. Fam Pract. 2003 Dec;20(6):696-705.

13. Goldsobel AB, Chipps BE. Cough in the pediatric population. J Pediatr. 2010 Mar;156(3):352-8.

14. Joshi JG, Manglik A, Durgappa H. IAP Standard Treatment Guidelines 2022. Pertussis in children. [Internet] Available from: https://iapindia.org/pdf/Ch-113-Pertusis-in-Children.pdf. pdf. [cited May 22, 2023].

15. Lauria AM, Zabbo CP. Pertussis. [Updated 2022 Oct 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK519008/ [cited June 15, 2023].

16. Decker MD, Edwards KM. Pertussis (Whooping Cough). J Infect Dis. 2021 Sep 30;224(12 Suppl 2):S310-S320.

17. Shields MD, Bush A, Everard ML, et al; British Thoracic Society Cough Guideline Group. BTS guidelines: Recommendations for the assessment and management of cough in children. Thorax. 2008 Apr;63 Suppl 3:iii1-iii15.

18. Agrawal A, Singh S, Kolhapure S, et al. Neonatal Pertussis, an Under-Recognised Health Burden and Rationale for Maternal Immunization: A Systematic Review of South and South-East Asian Countries. Infect Dis Ther. 2019 Jun;8(2):139-53.

19. Gallucci M, Pedretti M, Giannetti A, et al. When the Cough Does Not Improve: A Review on Protracted Bacterial Bronchitis in Children. Front Pediatr. 2020 Aug 7;8:433.

20. Cheng ZR, Chua YX, How CH, Tan YH. Approach to chronic cough in children. Singapore Med J. 2021 Oct;62(10):513-9.

21. Chang AB, Oppenheimer JJ, Irwin RS; CHEST Expert Cough Panel. Managing chronic cough as a symptom in children and management algorithms: CHEST guideline and expert panel report. Chest. 2020 Jul 1;158(1):303-29.

22. Kantar A, Marchant JM, Song WJ, et al. History Taking as a Diagnostic Tool in Children With Chronic Cough. Front Pediatr. 2022 Apr 15;10:850912.

23. Weinberger M, Fischer A. Differential diagnosis of chronic cough in children. Allergy Asthma Proc. 2014 Mar-Apr;35(2):95-103.

24. Chang AB, Oppenheimer JJ, Dunlap W, et al. Yardstick for managing cough, part 2: In children. Ann Allergy Asthma Immunol. 2023 May;130(5):681-9.

25. Weber SA, Ferrari GF. Incidence and evolution of nasal polyps in children and adolescents with cystic fibrosis. Braz J Otorhinolaryngol. 2008 Jan-Feb;74(1):16-20.

26. Subramanya NK. Handbook On Cough And Wheezing In Children. 2020;Noble Vision.

27. Marchant JM, Newcombe PA, Juniper EF, et al. What is the burden of chronic cough for families? Chest. 2008 Aug;134(2):303-9.

28. Machogu E, Gaston B. Respiratory Distress in the Newborn with Primary Ciliary Dyskinesia. Children (Basel). 2021 Feb 18;8(2):153.

29. Mirra V, Werner C, Santamaria F. Primary Ciliary Dyskinesia: An Update on Clinical Aspects, Genetics, Diagnosis, and Future Treatment Strategies. Front Pediatr. 2017 Jun 9;5:135.

30. Shapiro AJ, Zariwala MA, Ferkol T, et al. Diagnosis, monitoring, and treatment of primary ciliary dyskinesia: PCD foundation consensus recommendations based on state of the art review. Pediatr Pulmonol. 2016 Feb;51:115-32.

31. Leigh MW, Horani A, Kinghorn BreAnna, et al. Primary ciliary dyskinesia (PCD): A genetic disorder of motile cilia. Transl Sci Rare Dis. 2019 Jan 1;4(1-2):51-75.

32. Knowles MR, Durie PR. What is cystic fibrosis? N Engl J Med. 2002 Aug 8;347(6):439-42.

33. Wiencek JR, Lo SF. Advances in the Diagnosis and Management of Cystic Fibrosis in the Genomic Era. Clin Chem. 2018 Jun;64(6):898-908.

34. Guo J, Garratt A, Hill A. Worldwide rates of diagnosis and effective treatment for cystic fibrosis. J Cyst Fibros. 2022 May;21(3):456-62.

35. Cystic fibrosis: diagnosis and management. [Internet] Available at: https://www.nice.org.uk/guidance/ng78/resources/cystic-fibrosis-diagnosis-and-management-pdf-1837640946373. [cited May 22, 2023].

36. Benich JJ 3rd, Carek PJ. Evaluation of the patient with chronic cough. Am Fam Physician. 2011 Oct 15;84(8):887-92.

37. Mukerji SS, Yenduri NJS, Chiou E, et al. A multi-disciplinary approach to chronic cough in children. Laryngoscope Investig Otolaryngol. 2022 Mar 23;7(2):409-16.

38. Chang AB, Oppenheimer JJ, Kahrilas PJ, et al; CHEST Expert Cough Panel. Chronic Cough and Gastroesophageal Reflux in Children: CHEST Guideline and Expert Panel Report. Chest. 2019 Jul;156(1):131-40.

39. Fracchia MS, Diercks G, Cook A, et al. The diagnostic role of triple endoscopy in pediatric patients with chronic cough. Int J Pediatr Otorhinolaryngol. 2019 Jan;116:58-61.

40. Philipson K, Goodyear-Smith F, Grant CC, et al. When is acute persistent cough in school-age children and adults whooping cough? A prospective case series study. Br J Gen Pract. 2013 Aug;63(613):e573-9.

41. Pattemore PK. Persistent cough in children. NZFP. 2007;34(6):432-6. [Internet]. Available from: https://www.researchgate.net/publication/228684160_Persistent_cough_in_children. [cited April 17, 2023].

42. Chan PW, Debruyne JA. Inhaled nedocromil sodium for persistent cough in children. Med J Malaysia. 2001 Dec;56(4):408-13.

43. Amdekar YK, Khare RD, Chokhani RR. Lessons from the grand rounds 2. Options in rational management. [Internet] Available at: https://books.google.co.in/books?id=hVd9BAAAQBAJ&printsec=frontcover#v=onepage&q&f=false. [cited June 15, 2023].

44. de Jongste JC, Shields MD. Cough . 2: Chronic cough in children. Thorax. 2003 Nov; 58(11):998-1003.

45. Stjernquist-Desatnik A, Orrling A. Pharyngotonsillitis. Periodontol 2000. 2009 Feb; 49(1):140-50.

SECTION 2

An Algorithmic Approach to Diagnosis and Management of Cough in Children

- Acute cough in children
- Chronic cough in children
- Evaluation and management of pulmonary TB in children (absence of risk factors for drug resistance)
- Treatment of drug-resistant TB in children

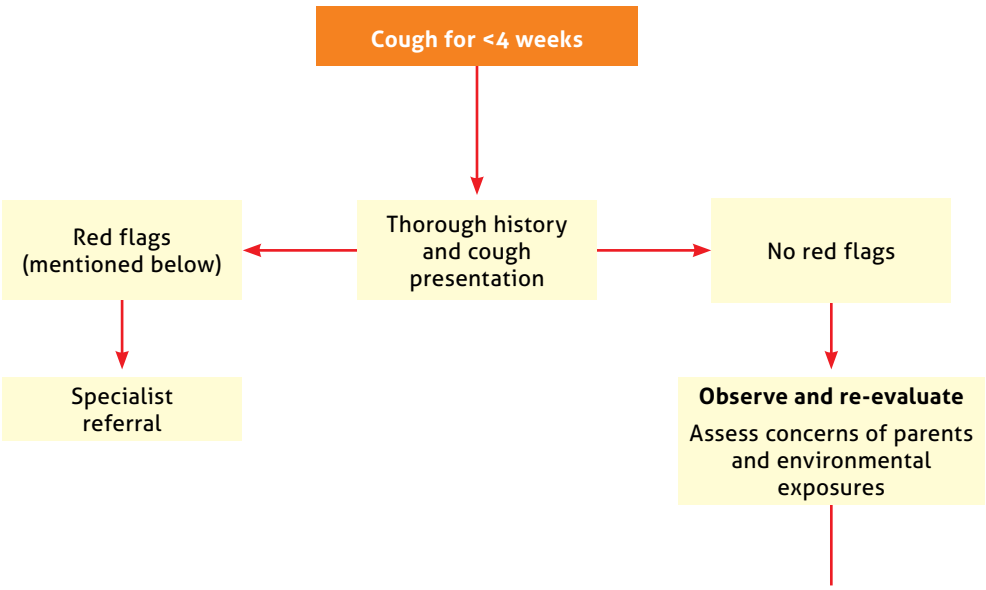
An Algorithmic Approach to Diagnosis and Management of Cough in Children

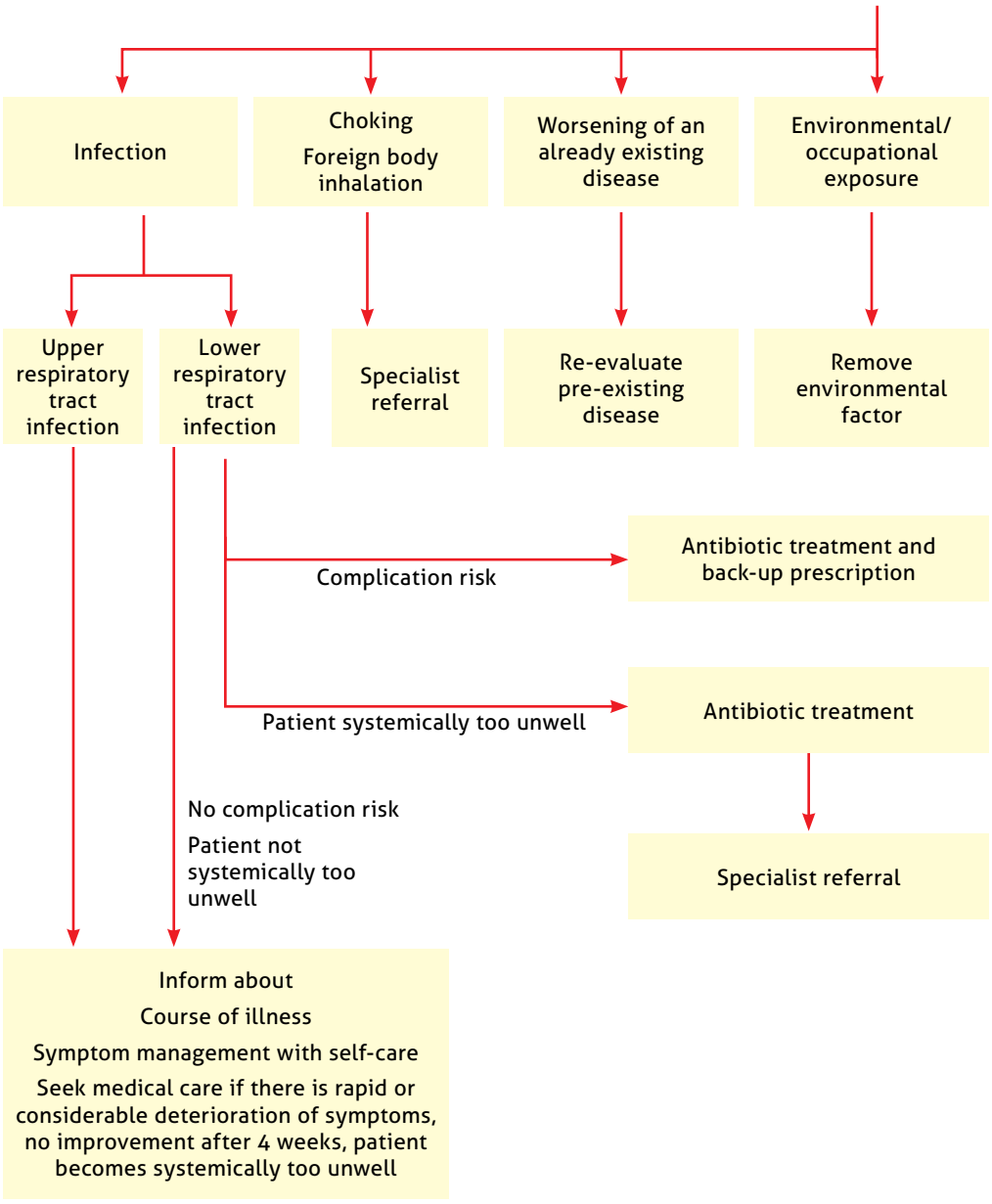
On the basis of duration, cough can be categorized as:[1]

Acute **Chronic**

Acute cough in children

***Evaluation and management*[1]**





Red flag signs

Neonatal cough onset; failure to thrive; digital clubbing; drug use; fever; pallor; sweating; dehydration; palatal abnormality; signs of immunodeficiency; pain in chest; moist cough daily; haemoptysis; abnormal features of cough; cyanosis or hypoxia; tachycardia; prior lung disease or a predisposing aetiology; respiratory distress/dyspnoea/tachypnoea; deformity of chest wall; adventitious lung sounds

General approach for cough management in children[2]

OTC antitussive agents, decongestants, and antihistamines not to be used in children below 2 years of age

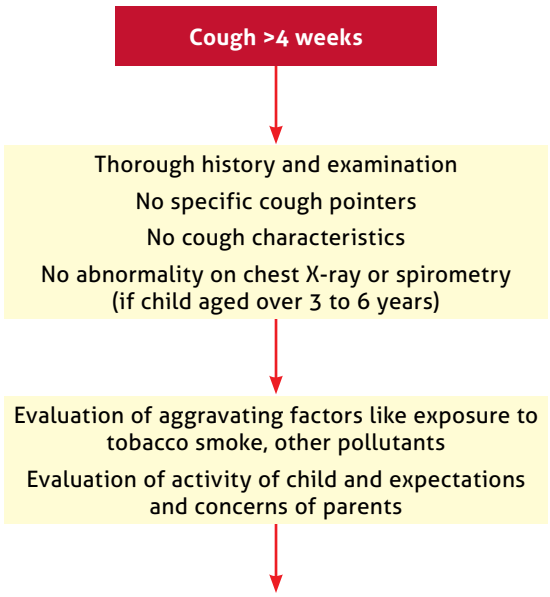
Antibiotic treatment not to be given to children having acute cough due to URTI of viral aetiology

In case of pertussis, macrolide antibiotics to be given by 1 to 2 weeks

Products with honey can be considered in case of an acute cough after URTI among children aged above 2 years.

Chronic cough in children

Evaluation and management of a child aged 14 years or below with chronic cough with non-specific cough (no pointers, dry cough)[3]

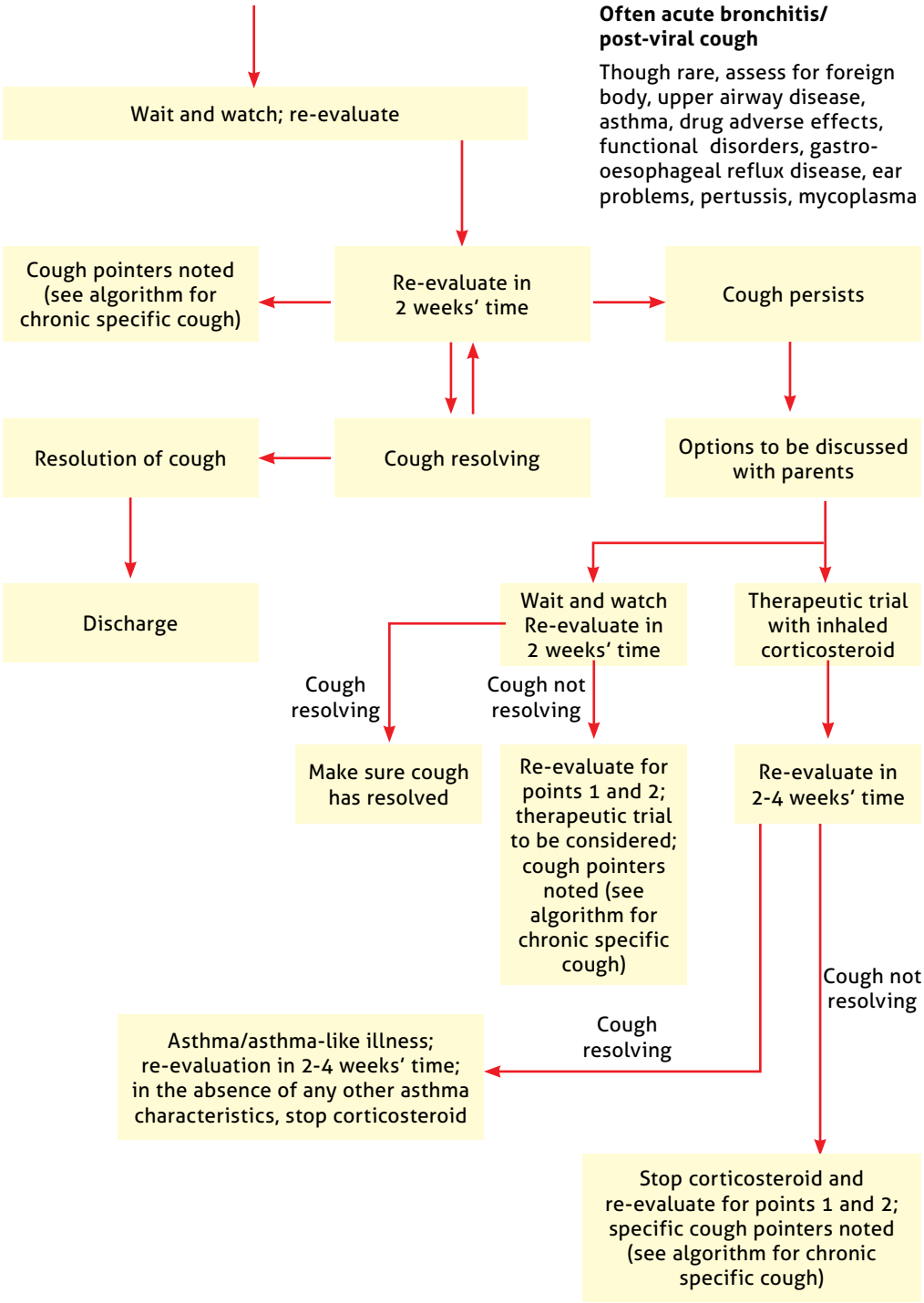


1. Specific cough pointers

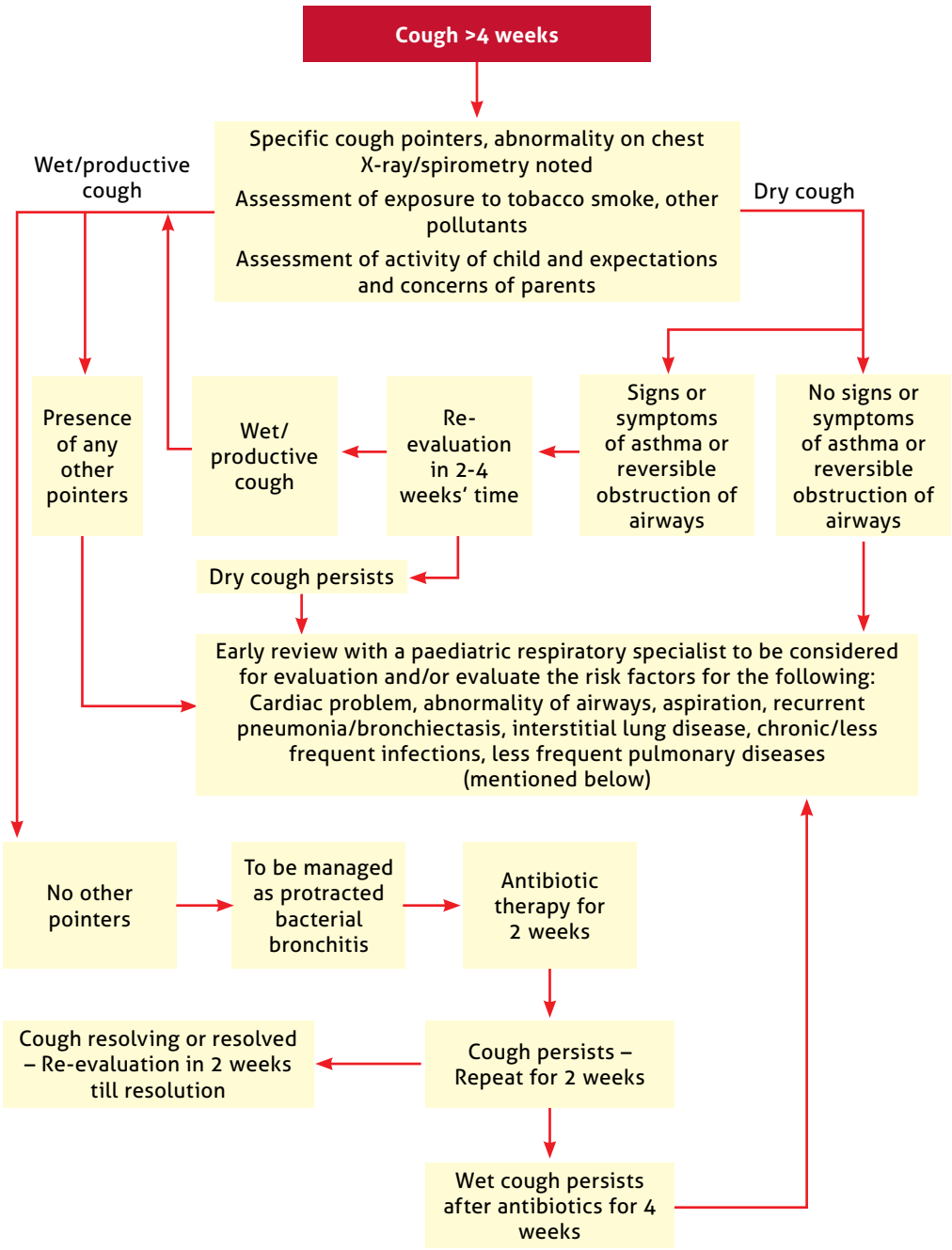
Findings on auscultation (wheeze, crepitations), cardiac abnormality, pain in chest, choking, tachypnoea/ dyspnoea, clubbing, daily wet cough, deformity of chest wall, trouble in feeding, facial pain, purulent discharge from nose, growth failure, haemoptysis, hoarseness of voice/stridor, cyanosis or hypoxia, recurring pneumonia/infections, neurodevelopmental disorder, history of chronic oesophageal/ lung disease, abnormal chest X-ray/ spirometry

2. Cough characteristics

Honking, barking/brassy, cast production, paroxysmal, staccato

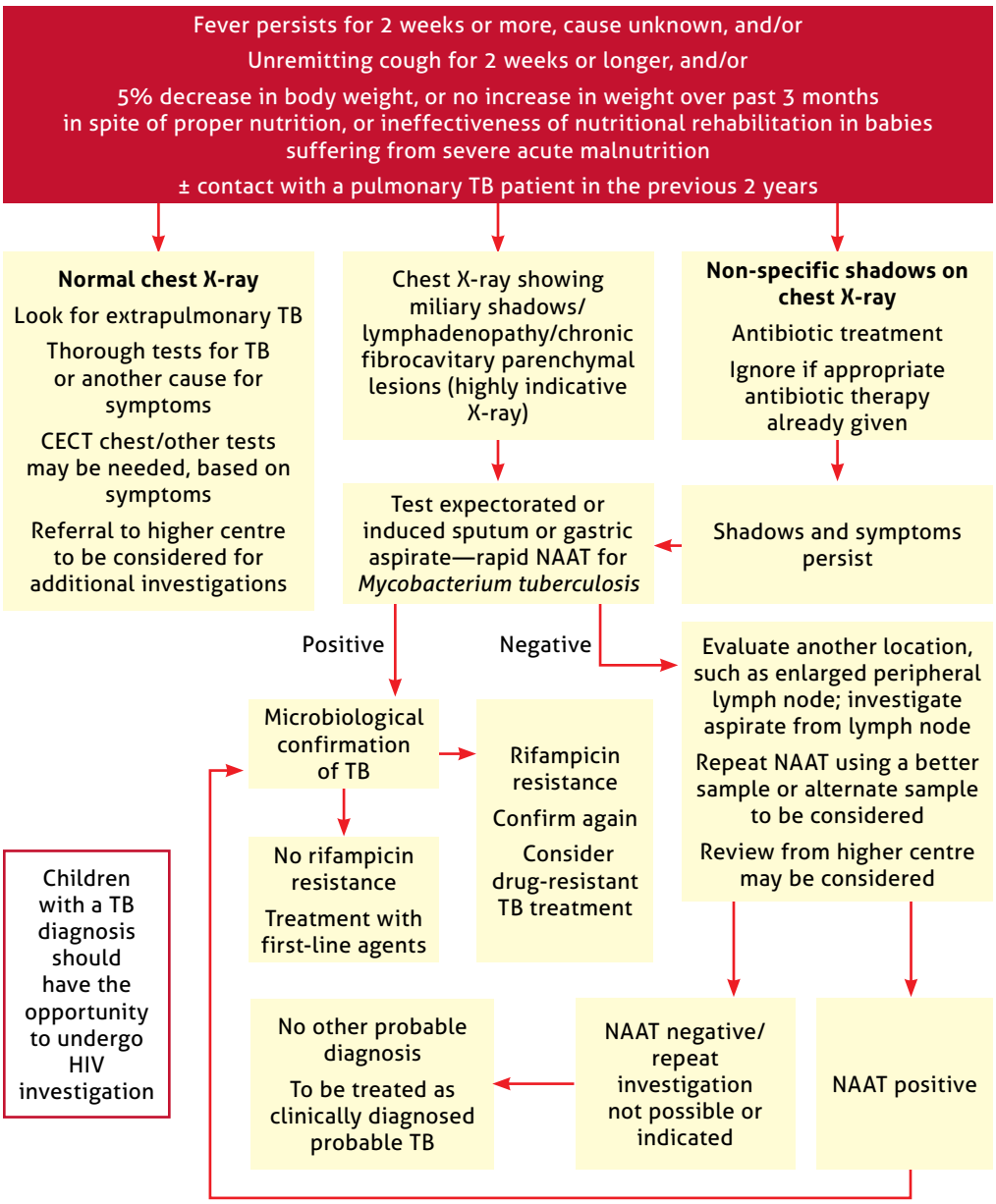

Wait and watch; re-evaluate
Often acute bronchitis/ post-viral cough
Though rare, assess for foreign body, upper airway disease, asthma, drug adverse effects, functional disorders, gastro-oesophageal reflux disease, ear problems, pertussis, mycoplasma
Cough pointers noted (see algorithm for chronic specific cough)
Re-evaluate in 2 weeks' time
Cough persists
Resolution of cough
Cough resolving
Options to be discussed with parents
Discharge
Wait and watch Re-evaluate in 2 weeks' time
Therapeutic trial with inhaled corticosteroid
Cough resolving
Cough not resolving
Make sure cough has resolved
Re-evaluate for points 1 and 2; therapeutic trial to be considered; cough pointers noted (see algorithm for chronic specific cough)
Re-evaluate in 2-4 weeks' time
Cough not resolving
Cough resolving
Asthma/asthma-like illness; re-evaluation in 2-4 weeks' time; in the absence of any other asthma characteristics, stop corticosteroid
Stop corticosteroid and re-evaluate for points 1 and 2; specific cough pointers noted (see algorithm for chronic specific cough)

Evaluation and management of a child aged 14 years or below with chronic specific cough[3]



Cardiac problem Pulmonary hypertension, cardiac oedema	Consultation with a paediatric cardiologist	**Investigations:** ECG, echocardiography, cardiac catheter
Aspiration Primary and secondary, neurologically abnormal, weak cough reflex, altered swallow, neuromuscular disorder, abnormalities of larynx, tonsil adenoid hypertrophy, tracheo-oesophageal fistula/H-fistula, severe gastro-oesophageal reflux disease		**Investigations:** Barium swallow, video fluoroscopy, bronchoscopy and lavage, pH metry, salivagram
Recurrent pneumonia/bronchiectasis Cystic fibrosis, history of severe pneumonia, ciliary dyskinesia, immunodeficiency, structural lesions in the airways, congenital lung lesions, tracheo-oesophageal fistula/H-fistula, missed foreign body		**Investigations:** Bronchoscopy, sweat test, immune tests, CT chest, barium swallow, genetic test
Interstitial lung disease Rheumatic diseases, cytotoxic agents, radiation, drugs, etc.		**Investigations:** Autoimmune markers, lung biopsy, HRCT chest, gene markers
Chronic/less frequent infections Tuberculosis, non-tuberculous mycobacterial infection, mycoses, parasitic		**Investigations:** Blood workup, bronchoscopy and lavage, chest CT, sputum test
Abnormality of airways Tracheobronchomalacia, other intraluminal lesions, extrinsic compressive lesions		**Investigations:** Bronchoscopy and lavage, chest MRI and CT

Evaluation and management of pulmonary TB in children (absence of risk factors for drug resistance)[4,5]



CECT: Contrast-enhanced computed tomography; NAAT: Nucleic acid amplification test; HIV: Human immunodeficiency virus

***Treatment of rifampicin-sensitive TB cases*[5]**

2HRZE + 4HRE

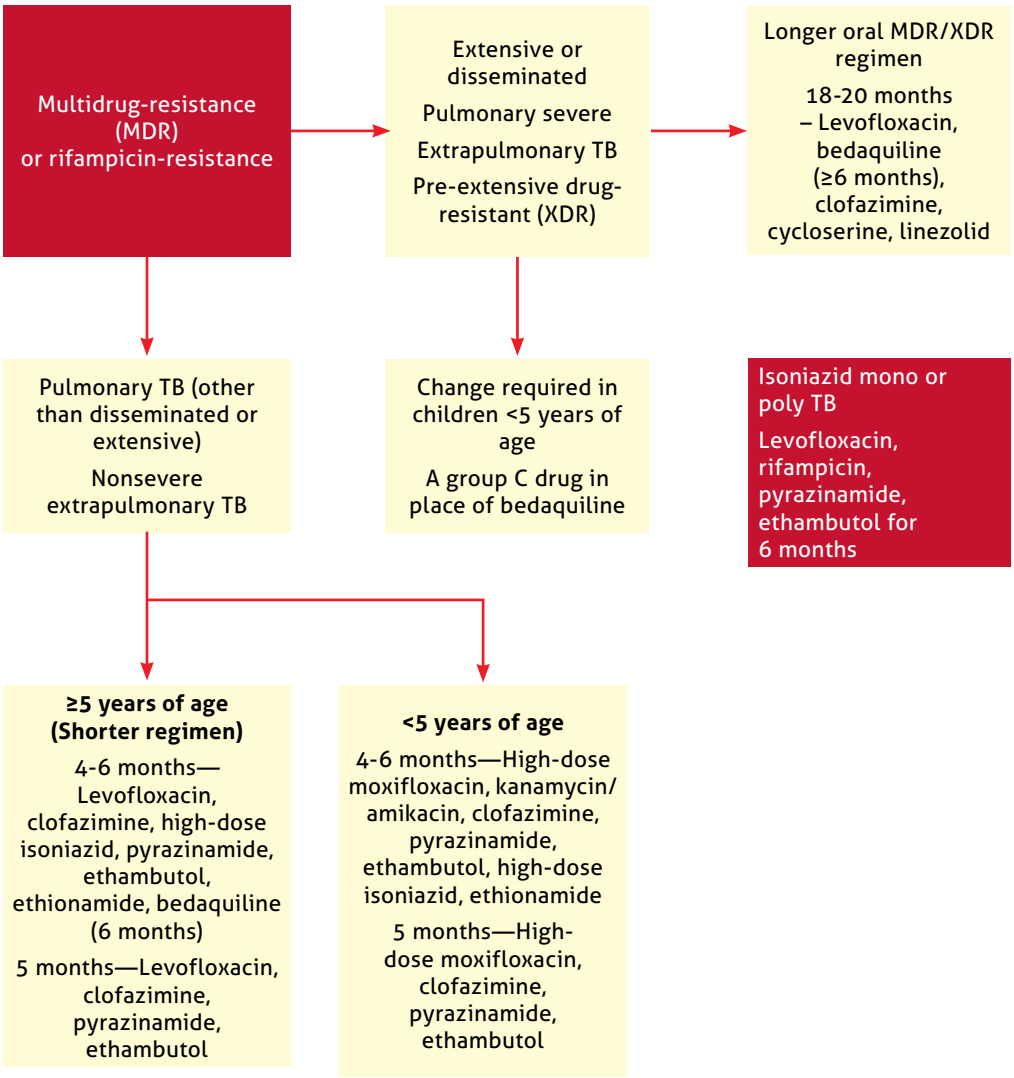
- This applies to patients with new rifampicin-sensitive pulmonary and extrapulmonary TB with microbiological confirmation, new clinically diagnosed pulmonary and extrapulmonary TB i.e., probable rifampicin-sensitive TB, and drug-sensitive TB cases that have been treated in the past.

R: Rifampicin; H: Isoniazid; Z: Pyrazinamide; E: Ethambutol

Concomitant therapy in TB[5]

- Steroids – Clear indications: TB meningitis, Addison's disease, pericarditis, miliary TB with alveolo-capillary block, TB uveitis.
- Pyridoxine.

Treatment of drug-resistant TB in children[4,5]



Group A – Moxifloxacin/levofloxacin, bedaquiline, linezolid

Group B – Clofazimine, cycloserine/terizidone

Group C – Ethambutol, delamanid, pyrazinamide, imipenem-cilastatin/meropenem, amikacin/streptomycin, prothionamide/ethionamide, p-aminosalicylic acid

References

1. Marseglia GL, Manti S, Chiappini E, et al. Acute cough in children and adolescents: A systematic review and a practical algorithm by the Italian Society of Pediatric Allergy and Immunology. Allergol Immunopathol (Madr). 2021 Mar 1;49(2):155-69.

2. Alsubaie H, Al-Shamrani A, Alharbi AS, Alhaider S. Clinical practice guidelines: Approach to cough in children: The official statement endorsed by the Saudi Pediatric Pulmonology Association (SPPA). Int J Pediatr Adolesc Med. 2015 Mar;2(1):38-43.

3. Chang AB, Oppenheimer JJ, Irwin RS; CHEST Expert Cough Panel. Managing Chronic Cough as a Symptom in Children and Management Algorithms: CHEST Guideline and Expert Panel Report. Chest. 2020 Jul;158(1):303-29.

4. Singh V, Parakh A, Mane S. IAP Standard Treatment Guidelines 2022. Diagnosis and Management of Childhood Tuberculosis. [Internet] Available from: https://iapindia.org/pdf/Ch-149-Diagnosis-and-Management-of-Childhood-Tuberculosis.pdf. [cited June 15, 2023].

5. National Tuberculosis Elimination Programme. Paediatric TB Management Guideline 2022. [Internet] Available from: https://tbcindia.gov.in/showfile.php?lid=3668. [cited June 15, 2023].

SECTION 3

Guideline Recommendations for the Management of Cough in Children

- Guidelines from the Indian Academy of Pediatrics (IAP) for cough management
- Guidelines from the European Respiratory Society (ERS) for diagnosis and management of chronic cough among adults and children
- CHEST guideline for the management of chronic cough in children
- Asthma treatment steps in paediatric population
  Global Initiative for Asthma (GINA)

Introduction

Children and adults are not alike and applying the evidence obtained from studies in adults to children could be associated with adverse outcomes.[1,2] There are various similarities in cough between children and adults, however, there are several differences too. Besides physiological and clinical differences, there are aetiological differences in cough between adults and the paediatric population. Additionally, children may not have the same response to certain medications as adults do.[2]

Various guidelines have been published over the years for the diagnosis and management of cough in children. Key recommendations from some of these guidelines are summarised here.

Guidelines from the Indian Academy of Pediatrics (IAP) for cough management[3]

Important points from the IAP standard treatment guidelines 2022 on the management of cough in office practice are summarised below.

Cough continuing for over 3 weeks is categorized as chronic cough

Symptomatic and supportive management is required in most conditions that present with cough

Acute cough – supportive management

Antitussive agents, expectorants, mucolytics, antihistamines, antihistamines combined with decongestants, demulcents (honey)

OTC antitussives

- Effectiveness not better vs. placebo to decrease viral URTI-related cough in children
- Not to be given to children <6 years of age

Honey

- Moderate improvement in frequency and severity of cough vs. placebo for treatment of nocturnal cough in children

Peripheral antitussives

- Levodropropizine—associated with enhanced cough elimination on the 6th day of a presumed viral disease, compared to antibiotics

Bronchodilators

- Help only in cough associated with wheeze, such as bronchiolitis, asthma, wheeze-associated lower respiratory infection (WALRI)
- Inhaled agents are preferable

Education and awareness

- Educate people and healthcare professionals about natural history of URTI-related cough-In most patients, there is resolution of cough within a span of 2 weeks.
- Educate parents about the red flags.
- Inform them about when to return to the paediatrician.
- Cough that lasts more than 2 weeks requires a thorough assessment.
- Use cough remedies cautiously; solely to alleviate the discomfort, not with the aim of curing cough.

Home remedies can be helpful – open ventilation, sipping hot water, honey with some lime, staying hydrated, being in a propped-up or elevated position, or gargling with hot water.

Cough suppressants can be used only for dry cough, but cautiously. It may be preferable to use dextromethorphan or pholcodine. It is safe to use a local demulcent.

An expectorant, such as guaifenesin, can be used for productive loose cough only.

Mucolytics can help in conditions like cystic fibrosis and bronchiectasis.

Antihistamines can be used for mild sedation, but cautiously. These are not helpful in patients with asthma.

For bronchospasm, an inhaled bronchodilator is the ideal option.

In addition to honey, dextromethorphan can be prescribed to children aged >4 years as a single dose at night (0.5 mg/kg) or levodropropizine 1-2 mg/kg dose can be prescribed once or twice

Guidelines from the European Respiratory Society (ERS) for diagnosis and management of chronic cough among adults and children[4]

The ERS guideline, published in 2020, was aimed at enhancing the precision of diagnosis and encouraging a treatment approach based on evidence, for both children and adults. Key recommendations from the guideline are summarised below.

- The guideline suggested that a chest CT should not be done as a routine in chronic cough patients exhibiting normal findings on physical examination and chest radiography.
- It suggested conducting a short-term trial of ICS therapy of 2 to 4 weeks among paediatric patients having chronic dry cough.
- It suggested conducting an antibiotic trial in children having chronic wet cough who have normal findings on chest radiography and spirometry and present with no alarm signs.

CHEST guideline for the management of chronic cough in children[5]

A recent CHEST guideline and report from an expert panel put forward several recommendations and suggestions on the management of chronic cough in children. Some of the key recommendations and suggestions are mentioned here.

Definition of chronic cough in the paediatric population

- It suggested that chronic cough be defined as daily cough of over 4 weeks' duration among children aged 14 years or below.

In comparison with the previous guideline, the age has been changed from below 15 years to less than or equal to 14 years.

Evaluation of a child with chronic cough

- Among children ≤14 years of age, it was recommended that a clinician must not assume that the common causes of chronic cough in adults are also the common aetiologies among children. Additionally, one must consider the child's age and clinical settings at the time of evaluation and management.

- Among children aged up to 14 years having chronic cough, use of paediatric-specific protocols or algorithms for management has been recommended.

- Among children aged up to 14 years with chronic cough, it was recommended that the management or testing algorithm must be established considering the features of cough and the clinical history, like specific cough pointers.

- It has been recommended that among children having chronic cough, aged ≤14 years, chest radiography and spirometry (if appropriate for the child's age; before and after β2 agonist) should be done.

- Among children above 6 years of age and up to 14 years experiencing chronic cough and clinically suspected asthma, considering a test for airway hyper-responsiveness has been suggested.

- In children ≤14 years of age having chronic cough, it was recommended that added investigations, such as Mantoux test, skin prick test, bronchoscopy, and chest CT, should not be done as a routine. These tests should be tailored to the clinical setting and the child's presentation.

- When there is a suspicion of pertussis in children aged 14 years or below having a chronic cough based on clinical presentation, investigations to assess if they have been recently infected with *B. pertussis* have been suggested.

Treatment of a child with chronic cough

- Among children aged ≤14 years having chronic cough, it has been recommended that the management be based on the cause. One must not adopt an empirical approach to treat upper airway cough syndrome from a rhinosinus disease, GERD, and/or asthma, if there are no other signs indicative of these conditions.

- It has been suggested that factors that worsen the condition, like exposure to tobacco smoke, must be identified in children aged up to 14 years with chronic cough. Additionally, it is advised to provide guidance or start interventions to stop such exposure.

- In children with chronic productive/wet cough, aged ≤14 years, where the cough does not seem to be associated with an underlying disease and there is an absence of any specific pointers of cough, such as clubbing, cough while feeding, etc., antibiotic therapy targeting common respiratory bacteria has been recommended for a period of 2 weeks, targeted to local antibiotic sensitivity.

- It has been recommended that in these patients, when such cough resolves with antibiotic therapy for 2 weeks, targeted to local antibiotic sensitivities, a

diagnosis of PBB should be made. If the wet cough continues despite suitable antibiotic therapy for 2 weeks, 2 more weeks of therapy with the appropriate antibiotic agent has been recommended. If the wet cough continues despite 4-week therapy with suitable antibiotics, investigations like flexible bronchoscopy with quantitative cultures and sensitivities ± chest CT scan are suggested.

- Additional investigations, such as flexible bronchoscopy and/or chest CT scan, evaluation for aspiration and/or assessment of any immunologic causes, have been recommended to determine whether there is an underlying condition in children up to 14 years of age with a chronic cough that is wet/productive, not associated with any underlying disease, but exhibiting specific pointers.

- Among paediatric patients 14 years of age or below, having chronic cough with no underlying lung disease, treatment for GERD is not recommended in the absence of GI features of GER, including heartburn, or pain in the epigastric region in older children or frequent regurgitation and dystonic neck posturing in infants.

- In children aged ≤14 years with chronic cough and no underlying lung disease, having signs/symptoms or tests conforming with gastro-oesophageal pathological reflux, treatment for GERD has been recommended in line with evidence-based guidelines specific to GERD. It is not recommended to use acid suppressive therapy only for chronic cough.

- It has been suggested to treat children up to 14 years of age having chronic cough with no underlying lung disease, having GI symptoms of GER, for GERD based on evidence-based guidelines specific to GERD, for a period of 4-8 weeks. The response to treatment should be reassessed.

- In case of children with chronic cough following acute viral bronchiolitis, cough management has been suggested in accordance with the CHEST paediatric chronic cough guidelines. Asthma drugs must not be used for cough unless there is additional evidence of asthma and inhaled osmotic agents should not be administered.

- It has been recommended to diagnose children with tic cough who have chronic cough that could not be explained medically following a thorough assessment according to the latest evidence-based guideline, when there are key features of tics, such as suggestibility, distractibility, suppressibility, variability, and premonitory sensation, whether the cough is solitary or one among multiple tics.

- A trial of hypnosis or suggestion therapy or combined reassurance, counselling, or referral to a psychologist or a psychiatrist have been suggested for children having chronic cough and a diagnosis of somatic cough disorder.

- It has been suggested that in countries with a high prevalence of TB, sputum microscopic evaluation be replaced by XpertMTB/RIF* test, if available, as an initial diagnostic test for patients having cough, who have a risk of pulmonary TB but a low risk of drug-resistant TB. However, when possible and if resources permit, chest X-ray must also be performed in patients with a suspicion of pulmonary TB.

- It has been suggested to prioritise the use of XpertMTB/RIF over sputum microscopy, when available, in patients with cough with a suspicion of pulmonary TB and a high risk of drug-resistant TB. However, wherever possible and permitted by the resources, sputum mycobacterial cultures, drug susceptibility testing and chest X-rays must be done.

*nucleic acid amplification test to detect TB and rifampin resistance

- In countries with a high prevalence of TB, a chest X-ray has been suggested, when resources permit, in patients with cough with or without fever, haemoptysis, night sweats, and/or loss of weight, having a risk of pulmonary TB.

- In children up to 14 years of age having non-specific cough, if there is no resolution in 2 to 4 weeks' time, it has been suggested to assess the child again for specific pointers.

- In the presence of asthma risk factors among children aged 14 years or below with non-specific cough, it has been suggested that a short trial of 400 µg/day of beclomethasone equivalent for 2 to 4 weeks may be appropriate. The children must be evaluated again in 2 to 4 weeks.

In children having an acute cough, it has been suggested to avoid OTC cough and cold medications unless it has been established that they can reduce the severity of cough or hasten the resolution.

It has been suggested that honey may provide greater symptom relief in children having an acute cough compared to no treatment, diphenhydramine, or placebo, however, it is not superior to dextromethorphan.

In children having acute cough, it has been suggested not to use medications having codeine due to the risk of serious adverse effects, such as respiratory distress.

Asthma treatment steps in paediatric population Global Initiative for Asthma (GINA)[6]

Treatment steps in children 6–11 years

Track 1 (Preferred treatment)	Track 2 (Alternative treatment)
Step 1	
Treatment options for children (6-11 years) with infrequent asthma symptoms (less than twice a month): - Taking ICS whenever SABA is taken with separate inhalers. - Regular ICS plus as-needed SABA is also a possible option. - Consider poor adherence in children with infrequent symptoms when choosing treatment. - No studies on as-needed-only ICS-formoterol in children (6-11 years). - Concerns about SABA-only treatment apply to children and should be considered when initiating Step 1 treatment.	GINA no longer recommends SABA-only treatment of asthma in adults, adolescents, or children 6–11 years.
Step 2	
Regular low-dose ICS plus as-needed SABA.	Low-dose ICS whenever they use SABA medication. Not recommended: Sustained-release theophylline, LAMA without concomitant ICS and chromones.

Step 3	
- Increase ICS to medium dose plus as-needed SABA reliever. - Change to combination low-dose ICS-LABA plus as-needed SABA reliever. - Switch to MART with a very low dose of ICS-formoterol.	Not recommended: Addition of LTRA to low-dose ICS.
Step 4	
- If low-dose ICS-LABA with as-needed SABA doesn't control asthma, consider medium-dose ICS-LABA. - For MART with budesonide-formoterol, if control isn't achieved, increase the maintenance dose to 100/6 µg twice daily (metered dose; 80/4.5 µg delivered dose) while still low dose. - If asthma remains poorly controlled on medium-dose ICS, refer the child for expert assessment and advice.	- Increase to a high paediatric dose of ICS-LABA, but potential adverse effects should be considered. - Tiotropium mist inhaler can be used as add-on therapy in children aged 6 years and older to improve lung function and reduce exacerbations. - LTRA may be added if not previously tried but the FDA warning about montelukast should be noted. Not recommended: Theophylline

ICS: Inhaled corticosteroids, SABA: Short-acting beta-agonists, LABA: Long-acting beta-agonists, LTRA: Leukotriene receptor antagonists, LAMA: Long-acting muscarinic antagonists, MART: Maintenance-and-reliever therapy, FDA: Food and Drug Administration

Treatment steps in children aged 5 years and younger

Track 1 (Preferred treatment)	Track 2 (Alternative treatment)
Step 1	
As-needed inhaled SABA: - Wheezing episodes in children should be treated with inhaled SABAs for symptom relief. - Not all children may respond effectively to SABAs. - If a child requires SABA treatment more than twice a week on average for one month, consider a trial of low-dose ICS treatment. - Initial wheezing episodes in children under 1 year are often associated with infectious bronchiolitis, which should be managed according to local guidelines. - SABAs are generally ineffective for bronchiolitis.	- Avoid oral bronchodilators due to slower onset and higher side effects compared to inhaled SABAs. - Intermittent high-dose ICS may be considered for children with intermittent viral-induced wheeze and no interval symptoms, particularly those with underlying atopy. - This approach should only be used if the physician is confident in its appropriate use, as there is a risk of side effects.
Step 2	
Regular daily low-dose ICS plus as-needed SABA: - Regular daily, low-dose ICS is the recommended initial treatment to control asthma. - Give this treatment for at least 3 months to evaluate its effectiveness in achieving good asthma control.	- Regular treatment with an LTRA modestly reduces symptoms and the need for OCS in young children with persistent asthma. - LTRA does not reduce OCS-requiring exacerbations in young children with recurrent viral-induced wheezing.

	- Daily low-dose ICS is more effective than regular LTRA monotherapy to improve symptom control and reduce exacerbations in preschool children with asthma or recurrent wheezing. - For preschool children with frequent viral-induced wheezing and interval asthma symptoms, consider as-needed or episodic ICS, but a trial of regular daily low-dose ICS should be attempted first. - If good asthma control is not achieved with specific therapy, try alternative Step 2 treatments before moving to Step 3.
Step 3	
Additional controller treatment with as-needed SABA and consider specialist referral. - Doubling the initial low dose of ICS may be the recommended approach. - Evaluate the response after 3 months of treatment. - If symptom control remains poor and/or flare-ups persist, or if side effects of treatment are observed or suspected, refer the child for expert assessment.	- Consider adding an LTRA to low-dose ICS based on evidence from older children. - Consider the relative cost of treatment options when choosing controllers for children. - Be aware of the FDA warning for montelukast (LTRA) regarding potential side effects.

Step 4	
Continue the controller treatment and consider referring for expert assessment. If doubling the initial dose of ICS does not achieve and maintain good asthma control: - Reassess inhaler technique and medication adherence. - Evaluate and address control of environmental factors, if applicable. - Consider re-evaluating the asthma diagnosis.	Treatment options to consider, with specialist advice, for children with confirmed asthma diagnosis: - Increase the ICS dose for a few weeks until asthma control improves, monitoring for side effects. - Add LTRA considering the benefits and risks of side effects. - Add LABA in combination with ICS. - Add a short course of low-dose OCS until asthma control improves, monitoring for side effects. - Consider adding intermittent high-dose ICS at the onset of respiratory illnesses if exacerbations are the main issue. - Re-evaluate the need for additional controller treatment at each visit, aiming for the shortest duration possible while considering risks and benefits. - Discuss and reconsider treatment goals and feasibility with the child's family or caregiver.

ICS: Inhaled corticosteroids, OCS: Oral corticosteroids, SABA: Short-acting beta-agonists, LABA: Long-acting beta-agonists, LTRA: Leukotriene receptor antagonists, FDA: Food and Drug Administration

References

1. Chang AB. Cough: are children really different to adults? Cough. 2005 Sep 20;1:7.
2. Chang AB, Glomb WB. Guidelines for evaluating chronic cough in pediatrics: ACCP evidence-based clinical practice guidelines. Chest. 2006 Jan;129(1 Suppl):260S-283S.
3. Amdekar Y, Chokhani R, Palaniraman R. IAP Standard Treatment Guidelines 2022 Management of cough in office practice. [Internet]. Available from: https://iapindia.org/pdf/Ch-150-Management-of-Cough-in-Office-Practice.pdf. [cited May 11, 2023].
4. Morice AH, Millqvist E, Bieksiene K, et al. ERS guidelines on the diagnosis and treatment of chronic cough in adults and children. Eur Respir J. 2020 Jan 2;55(1):1901136.
5. Chang AB, Oppenheimer JJ, Irwin RS; CHEST Expert Cough Panel. Managing Chronic Cough as a Symptom in Children and Management Algorithms: CHEST Guideline and Expert Panel Report. Chest. 2020 Jul;158(1):303-29.
6. Global Initiative for Asthma (GINA). Global Strategy for Asthma Management and Prevention, 2023. Updated July 2023. [Internet] Available from: www.ginasthma.org. [cited July 11, 2023].

Drugs for Cough Management in Paediatric Population

RESPIRATORY DRUGS

- Antihistamines
- Antitussives
- Bronchodilators
- Expectorants
- Mucolytics

Respiratory Drugs

Antihistamines

Second-generation antihistamines

Agent	Age (years)	Dosage
Cetirizine	1-2	250 µg/kg twice a day
	2-6	2.5 mg twice a day
	6-12	5 mg twice a day
	12-18	10 mg once a day
Levocetirizine	2-6	1.25 mg twice a day
	6-18	5 mg once a day
Loratadine	2-12	Weight <30 kg: 5 mg once a day; weight >30 kg: 10 mg once a day
	12-18	10 mg once a day
Fexofenadine	6-12	30 mg twice a day
	12-18	120 mg once a day
Desloratadine	1-6	1.25 mg once a day
	6-12	2.5 mg once a day
	12-18	5 mg once a day
Ebastine	2-5	2.5 mg once a day
	6-11	5 mg once a day
	>11	10 mg once a day
Bilastine	<6	Not recommended
	6-11	10 mg once a day

CHLORPHENIRAMINE MALEATE

Indications: A histamine-1 (H_1) receptor antagonist, indicated for relief of cough and symptoms associated with upper respiratory allergies or a common cold.

Mechanism of action: Chlorpheniramine maleate is a potent antihistamine (H_1-receptor antagonist). Antihistamines diminish or abolish the actions of histamine in the body by competitive reversible blockade of histamine-1 receptor sites on tissues. Chlorpheniramine also has anticholinergic activity.

Dosage: *6 - 12 years:* 5 ml (2 mg) every 4 to 6 hourly. *2 - 6 years:* 2.5 ml (1 mg) every 4 to 6 hourly.

Drug interactions: Additive effect when used concurrently with hypnotics and anxiolytics causing potentiation of drowsiness.

Adverse effects: Sedation, nausea, vomiting, diarrhoea, dry mouth. Children are more likely to experience the neurological anticholinergic effects. Paradoxical excitation (agitation) in children can occur.

Contraindications: Hypersensitivity to the active substance or to any of the excipients.

Special precautions: Chlorpheniramine should be used with caution in epilepsy, prostatic hypertrophy, glaucoma, hepatic disease, bronchitis, bronchiectasis, thyrotoxicosis, raised intra-ocular pressure, severe hypertension or cardiovascular disease and bronchial asthma. Children are more likely to experience the neurological anticholinergic effects.

DIPHENHYDRAMINE

Indication: Diphenhydramine, a first-generation antihistamine is used in various therapeutic indications, including the management and prevention of dystonias, insomnia, pruritus, urticaria, vertigo, and motion sickness. It is also used to relieve cough caused due to minor throat or airway irritation.

Mechanism of action: Diphenhydramine works as an inverse agonist at the H_1 receptor, reversing the effects of histamine on capillaries, resulting in a reduction of symptoms associated with allergic reactions.

Dosage: **For mild allergy symptoms:** *2-5 years:* 6.25 mg by mouth/IM/IV* every 4 to 6 hours as required; max 37.5 mg/day; *6-11 years:* 12.5 to 25 mg by mouth/IM/IV every 4 to 6 hours as required; max 150 mg/day; *>12 years:* Use adult dosing.

For severe allergy symptoms: *2-11 years:* 1-2 mg/kg by mouth/IM/IV every 2 to 4 hours as required; max: 300 mg/day by mouth; 100 mg/dose up to 400 mg/day IM/IV; *>12 years:* Use adult dosing.

Adverse effects: Drowsiness, dizziness, impaired coordination, headache, epigastric discomfort, constipation.

Contraindications: Documented hypersensitivity to diphenhydramine, premature infants and neonates, breastfeeding mothers.

Drug interactions: Abrocitinib, Acebutolol, Acenocoumarol: ↓ metabolism of these drugs.

Special precautions: Allergy to diphenhydramine, or to any other medications.

* IM: Intramuscular; IV: Intravenous

Antitussives

Act in the central nervous system to raise the threshold of cough centre.

DEXTROMETHORPHAN

A synthetic central NMDA (N-methyl D-aspartate) receptor antagonist, dextromethorphan does not depress mucociliary function of the airway mucosa and is practically devoid of constipating action.

Indication: Cough suppressant.

Dosage: *>4 years:* 0.5 mg/kg single dose. It is a common ingredient of many proprietary cough formulations.

Adverse effects: Nausea and GI discomfort, drowsiness and dizziness.

Contraindications: Known or established hypersensitivity.

LEVODROPROPIZINE

Indication: An antitussive, prescribed as a cough suppressant.

Mechanism of action: Levodropropizine is a non-opioid agent that acts as an antitussive agent by modulating the levels of sensory neuropeptide in the respiratory tract. It exerts its antitussive effect by inhibiting airway sensory nerves and has been demonstrated to be able to inhibit the release of neuropeptides from C-fibers *in vitro*.

Dosage: *>2-12 years:* 1 mg/kg PO TID; *>12 years*: 60 mg PO TID; duration: not more than 7 days.

Side effects: Nausea, vomiting, heartburn, dizziness, palpitations and drowsiness (less compared to central).

CODEINE

Indication: Cough suppressant.

Dosage: *2–6 years:* 2.5–5 mg, *6–12 years:* 5–10 mg, frequently used as syrup codeine phos. 4–8 ml.

Adverse effects: Constipation, nausea or vomiting, clouded mentation or sedation.

Contraindications: Hypersensitivity reaction to codeine or any component of the formulation.

Special precautions: The Food and Drug Administration (FDA) advises prescription cough and cold medicines containing the opioid medicines codeine or hydrocodone to limit their use to adults 18 years and older because the risks of these medicines for cough outweigh their benefits in children younger than 18.

Bronchodilators

LEVOSALBUTAMOL (LEVALBUTEROL)

Levosalbutamol (Levalbuterol) is an enantiomerically pure (R)-salbutamol formulation.

Indication: Prevention or relief of wheezing, shortness of breath, coughing, and chest tightness caused due to lung diseases like asthma and chronic obstructive pulmonary disease (COPD).

Mechanism of action: It works by relaxing the smooth muscles in the bronchial tubes to elevate air flow.

Dosage: **For inhalation aerosol dosage form:** *<4 years of age:* Use and dose should be determined by doctor; *>4 years of age:* Two puffs every 4 to 6 hours. One puff every 4 hours may be sufficient in some patients.

For inhalation solution dosage form (used with a nebuliser): *<6 years of age:* Use and dose should be determined by doctor; *6-11 years of age:* 0.31 mg in the nebuliser 3 times a day, max dose not more than 0.63 mg 3 times a day; *>12 years of age:* Initially, 0.63 mg in the nebuliser 3 times a day, every 6 to 8 hours per day. For some patients, an initial dose of 1.25 mg in the nebuliser 3 times a day.

Adverse effects: Fast heartbeat, chest pain or tightness, dizziness, lightheadedness, troubled breathing.

Drug interactions: Risk or severity of hypertension can be increased when combined with aceclofenac, aminophenazone, benzthiazide.

Special precautions: Allergy to levosalbutamol, albuterol or any other medications.

SALBUTAMOL (ALBUTEROL)

Indication: Prevention and treatment of wheezing, difficulty in breathing, chest tightness, and coughing resulting from lung diseases like asthma and COPD.

Mechanism of action: A bronchodilator that works by relaxing and opening the air passages to the lungs, making breathing easier.

Dosage: **For bronchospasm:** For oral dosage form (syrup, tablets): *>2 years:* Use and dose should be determined by doctor; *2-6 years:* The usual dose is 0.1 mg per kg of body weight per dose, 3 times a day, each dose not more than 2 mg, maximum dose of 12 mg a day, divided and given 3 times a day; *6-12 years:* 2 mg taken 3 or 4 times per day, maximum dose of 24 mg per day, divided and given 4 times per day.

For inhalation aerosol dosage form (inhaler): *<4 years:* Use and dose should be determined by doctor; *>4 years:* Two puffs every 4 to 6 hours as required.

Adverse effects: Nervousness, dizziness, headache, uncontrollable shaking of a body part, muscle cramps, excessive motion or activity, sudden mood changes.

Drug interactions: Acebutolol: Decrease in therapeutic efficacy of salbutamol, Aceclofenac, Acemetacin: Risk of hypertension increased.

Special precautions: Allergy to albuterol, any other medications, history of irregular heartbeat, heart disease, high BP, hyperthyroidism, diabetes, or seizures.

TERBUTALINE

Indication: Prevention and reversal of bronchospasm in patients at least 12 years old, with asthma, bronchitis, emphysema, and other lung diseases.

Mechanism of action: It is a selective β-2 adrenergic receptor agonist that acts by relaxing the smooth muscle in the bronchiole.

Dosage: **For oral dosage form (tablets):** *<12 years of age:* Use is not recommended. *12-15 years of age:* 2.5 mg thrice a day; max dose not more than 7.5 mg per 24 hours.

Inhalation aerosol: 0.5 mg/dose.

Adverse effects: Uncontrollable shaking of body part, nervousness, dizziness, drowsiness, difficulty falling asleep or staying asleep, weakness, headache, nausea, sweating, dry mouth.

Drug interactions: Therapeutic efficacy of terbutaline can be reduced when used in combination with acebutolol, increased risk of severity of adverse events when combined with acetylcholine, almotriptan, aminophylline.

Special precautions: Allergy to terbutaline or any other medications.

Expectorants

AMBROXOL

A metabolite of bromhexine having similar mucolytic action. Bromhexine improves mucociliary clearance and enhancement of fluid secretion which facilitates expectoration and eases cough.

Indication: Cough expectorant.

Dosage: 30 mg/5 ml liquid, 7.5 mg/ml drops.

As 7.5 mg/mL drops: *<2 years:* 7.5 mg BID; *2-5 years:* 7.5 mg TID.

30 mg/5 mL syr: *<2 years:* 7.5 mg BID; *2-5 years:* 7.5 mg TID; *6-11 years:* 15 mg BID or TID.

Adverse effects: Nausea, vomiting, diarrhoea, dyspepsia, dry mouth or throat, abdominal pain, heartburn, oral or pharyngeal hypoaesthesia, dysgeusia.

Drug interactions: May increase the concentrations of antibiotics (e.g., cefuroxime, doxycycline, erythromycin, amoxicillin) in the lung tissue.

Contraindications: Known or established hypersensitivity.

Special precaution: Patient with stomach or duodenal ulcers, ciliary dyskinesia, and bronchial conditions; renal and hepatic impairment.

BROMHEXINE

Indication: Cough expectorant.

Dosage: *1–5 years:* 4 mg BID; *5–10 years:* 4 mg TID.

Drug interactions: Enhances the penetration of antibiotic agents (e.g., amoxicillin, erythromycin, cefuroxime) into bronchial secretions.

Adverse effects: Diarrhoea, nausea, vomiting, upper abdominal pain.

Contraindications: Known or established hypersensitivity.

Special precaution: Patient with existing or history of gastric ulceration; asthma. Severe renal and hepatic impairment.

GUAIFENESIN

Indication: Guaifenesin, an expectorant, is indicated for the temporary relief of symptoms associated with congested chests and coughs caused by respiratory conditions such as the common cold, bronchitis, and other pulmonary disorders.

Mechanism of action: It acts by facilitating the loosening of phlegm (mucus) and thinning of bronchial secretions, thus clearing the bronchial passageways from excessive mucus and making coughs more productive.

Dosage: For regular (short-acting) oral dosage forms (capsules, oral solution, syrup, or tablets)

For cough in children: *Up to 4 years:* Use is not recommended; *4-6 years:* 50 to 100 mg every four hours; *6-12 year:* 100 to 200 mg every four hours.

For long-acting oral dosage forms (extended-release capsules or tablets).

For cough in children: *Up to 4 years:* Use is not recommended; *4-6 years:* 300 mg every twelve hours; *6-12 years:* 600 mg every twelve hours.

Adverse effects: Headache, nausea, vomiting.

Special precautions: Allergy to guaifenesin, any other medications.

Mucolytics

ACETYLCYSTEINE

Indication: Mucolytic therapy.

Dosage: *Nebulisation by a face mask, mouth piece, or tracheostomy:* 3-5 mL of 20% solution, or 6 to 10 mL of 10% solution, 3 to 4 times a day.

Adverse effects: Nausea, vomiting, fever, runny nose, swelling of the inside of the mouth, throat irritation, drowsiness.

Drug interaction: Ambrisentan, asunaprevir, atorvastatin, benzylpenicillin, bosentan: Excretion of these drugs can be decreased when combined with acetylcysteine.

Special precautions: Allergy to acetylcysteine, or any other medications.

Suggested Reading

1. Fitzsimons R, van der Poel LA, Thornhill W, et al. Antihistamine use in children. Arch Dis Child Educ Pract Ed. 2015 Jun;100(3):122-31.
2. Pecoraro L, Paiola G, Pietrobelli A. Ebastine overdose in a child. Clin Case Rep. 2017 Feb 22;5(4):403-5.
3. Church MK, Tiongco-Recto M, Ridolo E, Novák Z. Bilastine: a lifetime companion for the treatment of allergies. Curr Med Res Opin. 2020 Mar;36(3):445-54.
4. Parisi GF, Leonardi S, Ciprandi G, et al. Antihistamines in children and adolescents: A practical update. Allergol Immunopathol (Madr). 2020 Nov-Dec;48(6):753-62.
5. Ritter JM, Flower R, Henderson G, et al. Rang and Dales's Pharmacology. Ninth Edition, Elsevier; 2020.
6. Tripathi KD. Essentials of Medical Pharmacology, Eighth Edition. Jaypee Brothers Medical Publishers; 2019.
7. Drugs@FDA: FDA-Approved Drugs accessed at: https://www.accessdata.fda.gov/scripts/cder/daf/index.cfm.
8. Diphenhydramine [Internet] [Updated Jul 11, 2022]. Available at: https://www.ncbi.nlm.nih.gov/books/NBK526010/#article-20535.s4.
9. Diphenhydramine [Internet] [Updated Jan 15, 2022]. Available at: https://medlineplus.gov/druginfo/meds/a682539.html.
10. Diphenhydramine [Internet]. Available at: https://go.drugbank.com/drugs/DB01075.
11. Amdekar Y, Chokhani R, Palaniraman R. IAP Standard Treatment Guidelines 2022. Management of Cough in Office Practice. [Internet]. Available at: https://iapindia.org/pdf/Ch-150-Management-of-Cough-in-Office-Practice.pdf.
12. Zanasi A, Lanata L, Fontana G, et al. Levodropropizine for treating cough in adult and children: a meta-analysis of published studies. Multidiscip Respir Med. 2015 May 31;10(1):19.
13. Levalbuterol Oral Inhalation [Internet] [Updated Mar 15, 2016]. Available at: https://medlineplus.gov/druginfo/meds/a603025.html#.
14. Levosalbutamol [Internet]. Available at: https://go.drugbank.com/drugs/DB13139.
15. Levalbuterol (Inhalation Route) [Internet] [Updated Feb 01, 2023]. Available at: https://www.mayoclinic.org/drugs-supplements/levalbuterol-inhalation-route/proper-use/drg-20067232.

16. Albuterol [Internet] [Updated Jul 15, 2016]. Available at: https://medlineplus.gov/druginfo/meds/a607004.html#.

17. Albuterol (Oral Route) [Internet] [Updated Mar 01, 2023]. Available at: https://www.mayoclinic.org/drugs-supplements/albuterol-oral-route/proper-use/drg-20073510.

18. Albuterol (Inhalation Route) [Internet] [Updated Mar 01, 2023]. Available at: https://www.mayoclinic.org/drugs-supplements/albuterol-inhalation-route/proper-use/drg-20073536.

19. Salbutamol [Internet]. Available at: https://go.drugbank.com/drugs/DB01001.

20. Terbutaline [Internet] [Updated May 15, 2017]. Available at: https://medlineplus.gov/druginfo/meds/a682144.html.

21. Terbutaline [Internet]. Available at: https://go.drugbank.com/drugs/DB00871.

22. Terbutaline (Oral Route) [Internet] [Updated Feb 01, 2023]. Available at: https://www.mayoclinic.org/drugs-supplements/terbutaline-oral-route/proper-use/drg-20073569.

23. Guaifenesin [Internet] [Updated Jan 15, 2022]. Available at: https://medlineplus.gov/druginfo/meds/a682494.html#.

24. Guaifenesin [Internet]. Available at: https://go.drugbank.com/drugs/DB00874.

25. Guaifenesin (Oral Route) [Internet] [Updated Feb 01, 2023]. Available at: https://www.mayoclinic.org/drugs-supplements/guaifenesin-oral-route/proper-use/drg-20068720.

26. Acetylcysteine Oral Inhalation [Internet] [Updated Mar 15, 2017]. Available at: https://medlineplus.gov/druginfo/meds/a615021.html#.

27. Acetylcysteine [Internet]. Available at: https://go.drugbank.com/drugs/DB06151.

28. Acetylcysteine (Inhalation Route) [Internet] [Updated Feb 01, 2023]. Available at: https://www.mayoclinic.org/drugs-supplements/acetylcysteine-inhalation-route/proper-use/drg-20061456.

Table 1: Medications for cough

Suppressants with examples	Adverse effects	Dosage
Dry Cough		
Central		
1. Codeine and opiate derivates such as noscapine, hydrocodone, pholcodine	• Nausea, vomiting, palpitations, constipation, and dizziness • For higher doses: Somnolence, rash, miosis, vomiting, ataxia, swelling of the skin and rarely respiratory failure	• <12 years: Safety and efficacy not established for codeine • ≥12 years: 7.5-30 mg PO every 4-6 hours
2. Dextromethorphan	• Dizziness and GI disturbances • For higher doses: Central nervous system depression	• Dosage not established for children <4 years • 4-6 years: 2.5-7.5 mg PO every 4-8 hours; maximum dose 30 mg/day • 7-12 years: 5-10 mg PO every 4 hours OR 15 mg every 6-8 hours; maximum dose 60 mg/day • ≥12 years: 10-30 mg PO every 4-8 hours; maximum dose 120 mg/day

Suppressants with examples	Adverse effects	Dosage
Peripheral		
1. Levodropropizine (Non-opioid)	• Nausea, vomiting, heartburn, dizziness, palpitations, and drowsiness (less compared to central)	• >2-12 years: 1 mg/kg PO TID • >12 years: 60 mg PO TID; duration not >7 days
Soothing remedies		
1. Honey	• Excess may sometimes lead to osmotic diarrhoea	• No specific dosage
Wet Cough		
Mucolytic		
1. Bromhexine	• GI side effects, headache, dizziness, sweating, skin rashes	• Not recommended in children <2 years of age (US FDA) • 6-12 years: 4 mg PO TID
Expectorant		
1. Guaifenesin	• Rash, vomiting, nausea, nephrolithiasis	• 6 months-2 years: 25-50 mg PO every 4 hours; maximum dose 300 mg/day • 2-6 years: 50-100 mg PO every 4 hours; maximum dose 600 mg/day • 6-12 years: 100-200 mg PO every 4 hours; maximum dose 1.2 g/day • >12 years: 100-400 mg PO every 4 hours; maximum dose 2.4 g/day

Summary of Recommendations from the CHEST Guideline and Expert Panel Report

1. Definition of chronic cough in children aged ≤14 years: daily cough lasting more than 4 weeks.

2. Consider the age and clinical setting when evaluating and managing chronic cough in children aged ≤14 years, as common causes in adults may not be applicable.

3. Use paediatric-specific cough management protocols/ algorithms for children aged ≤14 years with chronic cough.

4. Take a systematic approach, using validated guidelines, to determine the cause of chronic cough in children aged ≤14 years.

5 Base management or testing algorithm for chronic cough in children aged ≤14 years on cough characteristics and associated clinical history, such as specific cough pointers.

6 Conduct chest radiography and spirometry, if suitable for age, (pre- and post-bronchodilator) for children aged ≤14 years with chronic cough.

7 Consider testing for airway hyper-responsiveness in children aged >6 years and ≤14 years with clinically suspected asthma and chronic cough.

8 Do not routinely perform additional tests (skin prick test, Mantoux, bronchoscopy, chest CT) for children aged ≤14 years with chronic cough. Undertake them based on the child's clinical presentation.

9 When there is a clinical suspicion, evaluate recent *B. pertussis* infection in children aged ≤14 years with chronic cough.

10 Management in children aged 14 years or below having chronic cough should be based on the underlying cause. Empirical treatment for upper airway cough syndrome, GERD, and/or asthma should not be used unless other signs indicative of these conditions are present.

11 While employing an empirical trial on the basis of features that align with a presumed diagnosis, it should be for a limited period to ascertain whether the presumed diagnosis is accurate or not.

12 Clinical studies for evaluating cough causes in children aged ≤14 years should use validated cough outcomes, a-prior-defined response, and diagnosis, consider the period effect, and incorporate a follow-up period.

13 Exacerbating factors such as exposure to environmental tobacco smoke should be identified, and intervention options for cessation should be advised or initiated in children aged ≤14 years with chronic cough.

14 Parents' (and child's, when suitable) expectations should be assessed, and their specific concerns must be inquired and addressed while dealing with children aged ≤14 years with chronic cough.

15

Children aged ≤14 years with chronic wet or productive cough not associated with an underlying disease and in the absence of additional specific cough pointers (such as coughing with feeding, clubbing) should be treated with 2 weeks of antibiotics targeting common respiratory bacteria (*S. pneumoniae, M. catarrhalis, H. influenzae*) targeted to local antibiotic sensitivities.

16

The diagnosis of PBB should be considered if children aged ≤14 years with chronic wet or productive cough without any specific pointers, and not related to an underlying disease, show resolution of cough within 2 weeks of treatment with antibiotics based on local antibiotic sensitivities.

17

For children aged ≤14 years with a chronic wet or productive cough that is not related to an underlying disease and without specific cough pointers, if the wet cough persists after 2 weeks of suitable antibiotic therapy, treatment with an additional 2 weeks of an appropriate antibiotic(s) is recommended.

18

In cases where children aged ≤14 years have chronic wet or productive cough without any specific cough pointers and not related to an underlying disease, further investigations should be carried out if the cough persists after 4 weeks of appropriate antibiotics. The investigations could include flexible bronchoscopy with quantitative cultures and sensitivities, with or without chest CT.

19

For children aged up to 14 years with PBB having lower airway (BAL or sputum) confirmation of clinically important respiratory bacteria density ($\geq 10^4$ cfu/mL), the term 'microbiologically-based-PBB' must be employed to distinguish it from clinically-based-PBB, which means PBB in the absence of confirmation of lower airway bacteria.

20

Children aged 14 years or younger who have a chronic wet or productive cough with specific cough pointers and no underlying disease should undergo further investigations, such as assessment for aspiration and/or evaluation of immunologic competency, flexible bronchoscopy and/or chest CT, to determine the presence of an underlying disease.

21

For children aged 14 years or below with a chronic cough that is not associated with an underlying lung disease, treatment for GERD should not be employed in the absence of GI features of GER, including repeated regurgitation, dystonic neck posture in infants, or heartburn or epigastric pain in older children.

22

In children ≤14 years of age with a chronic cough that is not related to an underlying lung disease but have symptoms and signs or tests consistent with gastro-oesophageal pathological reflux, treating them for GERD following evidence-based GERD-specific guidelines is recommended and acid-suppressive therapy should not be used solely for chronic cough.

23

Children aged ≤14 years with chronic cough, with no underlying lung disease, having GI symptoms of GER, should be treated for GERD according to evidence-based GERD-specific guidelines for a period of 4-8 weeks, and the response must be reassessed.

24

For children aged ≤14 years with chronic cough with no underlying lung disease, and suspected GERD based on GI symptoms, the GERD guidelines should be followed for investigating children suspected of GERD.

25 In children with chronic cough following acute viral bronchiolitis, management has been suggested in accordance with the CHEST paediatric chronic cough guidelines. Asthma medications should not be used unless there is other evidence of asthma and inhaled osmotic agents should not be used.

26 For diagnosing or ruling out psychogenic or habit cough, using the presence or absence of night-time cough or a barking or honking cough is not advised in children with chronic cough.

27 The diagnosis of tic cough should be made for children with a chronic cough that could not be explained medically after a comprehensive evaluation, based on the presence of core clinical features of tics, regardless of the cough being single or one of many tics.

28 The diagnostic terms habit cough and psychogenic cough should not be used for children with chronic cough. Instead, tic cough should be used for habit cough to be consistent with the DSM-5* classification of diseases, and somatic cough disorder should be used instead of psychogenic cough.

* DSM-5: Diagnostic Statistical Manual of Mental Disorders, 5th edition

29 The diagnosis of somatic cough disorder for children with chronic cough should only be made after ruling out tic disorders and uncommon causes and meeting the DSM-5 criteria for a somatic symptom disorder.

30 For children with chronic cough due to somatic cough disorder, non-pharmacological trials of hypnosis, suggestion therapy, combined reassurance, counselling, or referral to a psychologist and/or psychiatrist should be considered.

31 In high TB prevalence countries or settings, patients with a cough should be screened for TB irrespective of duration of cough. In addition, the use of active case finding along with passive finding may improve outcomes in patients with pulmonary TB.

32 In countries with a high prevalence of TB, it is suggested that sputum microscopic evaluation be replaced by XpertMTB/RIF test, if available, as an initial diagnostic test for patients having cough, who have a risk of pulmonary TB but a low risk of drug-resistant TB. However, when possible and if resources permit, chest X-ray must also be performed in patients with a suspicion of pulmonary TB.

33 When managing patients with cough and suspected pulmonary TB who are at high risk of drug-resistant TB, the XpertMTB/RIF assay should be used instead of sputum microscopy, if available. However, if feasible and resources permit, additional diagnostic tests such as sputum mycobacterial cultures, drug susceptibility testing, and chest X-rays should also be performed.

34 For patients at risk of pulmonary TB in countries with a high prevalence of TB, presenting with cough, with or without fever, night sweats, haemoptysis, and/or weight loss, a chest X-ray should be done if resources are available.

35 Children ≤14 years of age with chronic cough and suspected obstructive sleep apnoea should be managed according to sleep guidelines.

36 Children aged 14 years or younger with a non-specific cough should be re-evaluated for the emergence of specific underlying causes if the cough persists beyond 2 to 4 weeks.

37 In children aged 14 years or younger with non-specific cough and risk factors for asthma, a short trial (2-4 weeks) of 400 µg/day of beclomethasone equivalent may be justified. A follow-up evaluation within 2 to 4 weeks is recommended.

38 It is recommended that OTC cough and cold medications should not be used for children with acute cough until they have been proven effective in reducing the severity or hastening cough resolution.

39 Honey may provide more relief for cough symptoms than no treatment, diphenhydramine, or placebo, but it is not superior to dextromethorphan for children with acute cough.

40 The use of codeine-containing medications should be avoided in children with acute cough due to the potential for serious adverse effects including respiratory distress.

Reference: Chang AB, Oppenheimer JJ, Irwin RS; CHEST Expert Cough Panel. Managing Chronic Cough as a Symptom in Children and Management Algorithms: CHEST Guideline and Expert Panel Report. Chest. 2020 Jul;158(1):303-29.

NOTES

NOTES

NOTES

NOTES

Educational grant by

Glenmark Pharmaceuticals Limited (GPL),
Corporate Enclave, B. D. Sawant Marg,
Chakala, Andheri (E), Mumbai – 99.

Published by