

# UPPER AND LOWER RESPIRATORY SYSTEM DISEASES AND ENVIRONMENTAL FACTORS IN CHILDREN

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The most prevalent illnesses among pediatric patients are those affecting the respiratory system. In general, these conditions can be classified into three main categories: infections, wheezing in infants, and allergic diseases. Acute infections are a common occurrence during the school years. Such illnesses may be bacterial or viral in origin. Tuberculosis as a chronic infection persists as a significant public health concern. Wheezing in infants may be indicative of a straightforward viral infection. If the condition persists, it may be indicative of an underlying anatomical disorder or a precursor to future asthma. Allergic respiratory diseases tend to have a chronic course. They are often classified as allergic rhinitis affecting the upper respiratory tract and asthma affecting the lower respiratory tract. These conditions frequently co-occur. Treatment is tailored to the severity of the disease. Treating the concomitant disease in a manner that aligns with the family's preferences can enhance the likelihood of successful treatment outcomes.

## A-Infections

**Colds or nasopharyngitis:** The common cold is an acute, self-limiting viral infection of the upper respiratory tract that causes varying degrees of sneezing, nasal congestion and discharge (rhinorrhoea), sore throat, cough, low-grade fever, headache and malaise. It is the most common disease in children between the ages of 3 and 8. It is most common in spring and autumn. It can be caused by members of several families of viruses; the most common are the more than 100 serotypes of rhinoviruses. The main predisposing factors are exposure to cigarette smoke, an overcrowded family and a low standard of living.

- **Etiology:** The symptoms of the common cold are caused by a variety of viruses. Rhinoviruses, which encompass over 100 serotypes, are the causative agents of up to 50% of colds in children and adults (1). Other factors that play a role in the

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aetiology of colds include: Common cold coronaviruses, influenza viruses, respiratory syncytial virus (RSV), parainfluenza viruses, adenoviruses, coxsackievirus A (2). The average incubation period is 2-5 days.

- **Transmission:** The majority of colds are transmitted via hand contact; cold-inducing viruses have been demonstrated to remain viable on human skin for a minimum of two hours and on inanimate surfaces for up to 24 hours. A small number of cold viruses, including influenza and SARS-CoV-2, can be transmitted via aerosols (2).

- **Pathophysiology:** The symptoms of the common cold are primarily the result of the innate immune response to infection, rather than being caused by direct viral damage to the respiratory tract (3). The virus gains entry to the epithelial cells, where it releases inflammatory mediators that increase vascular permeability. This leads to the development of oedema and nasal congestion, as well as the stimulation of cholinergic nerves, which in turn cause mucus production and nasal discharge. Cellular damage ensues, which results in a sore throat. Damage to the cilia results in impaired excretion of nasal secretions (2).

- **Clinical findings:** The symptom profile of the common cold is subject to variation between patients, with age and the causative virus being two contributing factors. The most prevalent symptoms are nasal congestion, nasal discharge, and cough. In infants, fever and nasal discharge are common presenting symptoms. Additional symptoms may include irritability, difficulty feeding, decreased appetite, and difficulty sleeping.

- **Complications:** Complications of the common cold may include acute otitis media, acute bacterial sinusitis, asthma exacerbation, and lower respiratory tract disease. Complications associated with SARS-CoV-2 include multisystem inflammatory syndrome in children, myocarditis, and pericarditis (4).

- **Diagnosis:** The diagnosis of the common cold is made on the basis of clinical findings, including an individual's history and examination results. These findings may include exposure to someone with a cold, nasal congestion, nasal discharge, sore throat, fever (in young children), anterior cervical adenopathy, and erythema of nasal mucosa and oropharynx.

- **Treatment:** A symptomatic treatment plan is initiated. The patient is administered acetaminophen (10-15 mg/kg/dose) and ibuprofen (10 mg/kg/dose). It is also important to ensure that the child remains well hydrated. An attempt is made to open the nose with saline. Additionally, the administration of water vapour, maintenance of the head in an elevated position, and avoidance of cigarette smoke have been demonstrated to be beneficial. The use of decongestant drugs is an additional option. The administration of antihistamine-expectorants has been demonstrated to have no effect. Cough suppressant syrups have been associated with adverse effects and are therefore not recommended. The administration of antibiotics does not result in a reduction in the duration of symptoms or an acceleration of the recovery process.

**Rhinosinusitis:** Rhinosinusitis is defined as inflammation of the mucosal lining of one or more of the paranasal sinuses. Such inflammation is a common occurrence during viral upper respiratory infections, but typically resolves spontaneously. Predisposing factors: Allergic rhinitis, cigarette smoke exposure, immune deficiency, cystic fibrosis, ciliary dysfunction, phagocyte dysfunction, gastroesophageal reflux, anatomical defects (cleft palate, etc.), nasal polyp, nasal foreign body (including gastric tube)(5).

- **Etiology:** *Streptococcus pneumoniae*, *Moraxella catarrhalis*, *Haemophilus influenzae*, *α-haemolytic streptococci*, *Staphylococcus aureus*, anaerobes.

- **Pathophysiology:** The paranasal sinuses are typically sterile. However, contamination with bacteria that colonise the nasal mucosa and nasopharynx may occur due to the continuity of the membranes that line the nose with those that line the sinus cavities. The contaminating bacteria are typically removed by mucociliary clearance. However, when this process is compromised, the sinus may become susceptible to infection due to the inoculation of large numbers of microorganisms. The alteration of mucociliary clearance can be attributed to a number of factors, including damage to the ciliary epithelium, changes in the number or function of cilia, alterations in the production or viscosity of mucous, and changes in the patency of the ostia. Examples of conditions that may lead to such alterations include upper respiratory infections and allergic rhinitis.

- **Clinical findings:** The clinical manifestations of rhinosinusitis encompass cough, nasal congestion/discharge, fever, postnasal drip, halitosis, headaches, facial pain and swelling and sore throat.

- **Complications:** Complications of the may include rhinosinusitis preseptal cellulitis, orbital cellulitis, septic cavernous sinus thrombosis, meningitis, osteomyelitis of the frontal bone with subperiosteal abscess (Pott's puffy tumor), epidural abscess, subdural abscess, brain abscess(6).

- **Diagnosis:** The diagnosis of uncomplicated acute bacterial rhinovirus infection in children is typically made on clinical grounds. Imaging studies are typically conducted in children with suspected orbital and intracranial complications of acute bacterial rhinovirus infection. In cases where children present with potential orbital or intracranial complications of acute bacterial rhinovirus, we utilise contrast-enhanced CT imaging of the orbits, sinuses, and brain(7).

- **Treatment:** The recommended course of antibiotic treatment is 14 to 21 days, or seven additional days following the resolution of symptoms. The most appropriate antibiotics for selection are amoxicillin, amoxicillin in combination with clavulanate, macrolide, and second-generation cephalosporin (7).

### **Acute Pharyngitis**

The condition is most prevalent in individuals between the ages of four and seven years. The condition is typically attributed to a viral etiology. Bacteria are

only responsible for 15% of cases. Additionally, a mycoplasma infection may be a contributing factor (8).

**- Clinical findings:**

\* **Viral pharyngitis:** The patient presented with a fever, malaise, loss of appetite, a moderate sore throat, conjunctivitis, rhinitis, a cough, and a runny nose. An exudate may be observed in the tonsils and soft palate. There is a notable enlargement of the cervical lymph nodes. The aforementioned symptoms persist for approximately five days.

\* **Streptococcal pharyngitis:** It is common between 2-15 years of age. Headache, abdominal pain, vomiting, high fever, sore throat and swelling, enlargement and reddening of the tonsils, anterior cervical lymphadenopathy, redness of the tonsils and palate, petechiae, purulent discharge, crypts appear. Under 2 years of age, it is characterised by postnasal discharge and variable fever(8).

- **Diagnosis:** A rapid diagnosis may be achieved through the utilisation of a throat culture and the subsequent detection of streptococcal antigen in a throat swab.

**- Complications**

\***Suppurative:** Acute otitis media, retropharyngeal or peritonsillar abscess, sinusitis, rarely meningitis.

\***Non-suppurative:** Acute rheumatic fever, acute glomerulonephritis.

- **Treatment:** The following antibiotics are employed: penicillin, amoxicillin, cephalosporin and macrolide. Dexamethasone has been demonstrated to alleviate sore throat during the initial three-day period.

**Croup-Acute Laryngitis**

It is an acute infectious condition that presents with a barking cough, occasionally accompanied by hoarseness, inspiratory stridor and respiratory distress. The condition affects the larynx, trachea and bronchi. The primary symptoms are contingent upon the extent of involvement of the larynx(9).

- **Etiology:** Parainfluenza (in  $\frac{3}{4}$  of cases), adenovirus, RSV, influenza, *H.influenzae* type b (viral agents are most common between 3 months-5 years of age, *H.influenzae* between 3-7 years of age)(10).

**- Clinical findings:**

The patient presents with a mild cough and intermittent respiratory stridor. It is possible to observe the participation of the nasal wings in respiration, as well as supra-sub-intercostal retractions. The patient may experience increased respiratory distress when lying flat, accompanied by a sensation of air hunger.

**Acute Epiglottitis**

The condition manifests between the ages of two and seven years, with the majority of cases occurring between the ages of three and five years. It is a severe and potentially fatal infection. The infection may present with symptoms such as fever, sore throat, dyspnoea and rapidly developing airway obstruction. The child

attempts to obtain air by extending the neck to its maximum extent. The nasal wings are involved in respiration, and inspiratory retractions are observed. On direct examination, the epiglottis is observed to be red and swollen. It is recommended that a blood gas analysis be conducted. Visualisation of the aforementioned structures can be achieved through the use of lateral neck radiography. Intubation may be indicated. The patient should be admitted to the hospital and monitored for a minimum of two to three days. The treatment regimen includes parenteral antibiotics. Ceftriaxone and ampicillin-clavulanate may be selected as a treatment option(11).

### **Acute Laryngotracheobronchitis**

The condition is most prevalent among children between the ages of three and six. The aetiological agent is typically a virus. The presence of a high fever, accompanied by a reduction in respiratory sounds, as well as the audible manifestation of rales and ronchi, may be observed. Additionally, rhinitis and conjunctivitis may be present. The severity of the symptoms tends to increase at night<sup>(12)</sup>.

### **Bacterial Tracheitis**

It may be a bacterial complication of a viral infection. The most common agents are *Staphylococcus aureus*, parainfluenza type 1, *Moraxella catarrhalis* and *H. influenzae*. The patient may present with a fever and cough. Intubation may result in the necessity for tracheostomy. Antibiotic and supportive treatments are administered(13).

### **Acute Bronchitis**

This phenomenon typically manifests subsequent to a viral infection of the upper respiratory tract. In the vast majority of cases, the trachea is also affected. The most frequently identified agents are *Streptococcus pneumoniae* and *Haemophilus influenzae*(14).

- **Clinical findings:** The condition typically manifests three to four days following the onset of rhinitis, presenting with a dry cough, burning sensation in the chest, and chest pain. Subsequently, the cough transitions into a productive cough producing sputum. The cough with phlegm persists for a period of 5-10 days. The patient's breathing sounds become coarse, and the presence of rales and ronchi is audible.

- **Treatment:** The patient is treated with antibiotics and supportive measures. The use of expectorants or antihistamines is not recommended. The use of anti-tussive syrups provides temporary relief from symptoms, but this can increase the likelihood of subsequent suppuration(14).

### **Acute Bronchiolitis**

It is a chronic inflammatory condition affecting the small airways, occurring in the first two years of life. The condition is most prevalent at approximately six months of age. The condition is most prevalent during the winter and early spring months. RSV is the causative agent in over 50% of cases. Additionally, other viruses, such as parainfluenza 3 and adenovirus, may also be responsible for the condition(15).

- **Clinical findings:** The patient presents with a fever, paroxysmal cough and wheezing. The illness begins as a mild upper respiratory tract infection and reaches a temperature of 39°C within a few days. Dyspnoea and restlessness are also present. The severity of the symptoms is contingent upon the degree of bronchiolar obstruction, which is determined by the presence of oedema and mucus accumulation. Hypoxaemia develops as a consequence of decreased ventilation. Nutrition is compromised. In infants, tachypnoea may be observed, with a respiratory rate reaching 60–80 per minute. The presence of air hunger, cyanosis, and withdrawal reflexes due to respiratory distress, as well as palpable liver and spleen due to the pushing of the lungs with excessive ventilation, can be observed. The expiration phase is prolonged. The presence of thin rales can be discerned through auditory examination(15).

- **Radiological appearance:** A complete or localised increase in lung aeration. Atelectasis may result from the absorption of air that has become trapped in the alveoli. The anteroposterior diameter of the chest is increased in the lateral radiograph. The presence of consolidation areas is evident.

- **Treatment:** The initial 48 to 72 hours represent a critical period. Recovery is achieved within a few days. Prolonged apnoea seizures may result in death. It is recommended that infants experiencing respiratory distress be admitted to the hospital for further observation and treatment. It is of the utmost importance to provide supportive treatment. The application of cold steam has been demonstrated to be beneficial in such cases. In cases where parenteral hydration is required, it should be provided. Bronchodilator drugs may be administered via the respiratory tract. The efficacy of corticosteroids in this context is a matter of contention. There is a paucity of consensus in the literature regarding the efficacy of this approach, with studies yielding disparate results. In specific instances, such as those involving premature birth and congenital heart disease, antiviral medications, including ribavirin, may also be employed(15).

### **Pneumonia**

The most prevalent form of community-acquired pneumonia in paediatric patients is bronchopneumonia. The most frequently identified agent is pneumococci, representing over 90% of cases. Additionally, group A beta haemolytic streptococci may be observed. The condition may manifest unilaterally or bilaterally, affecting a portion or the entirety of the lung. In most cases, the causative agent gains access to the body through the respiratory tract. The presence of underlying predisposing factors serves to facilitate the development of pneumonia. Such predisposing factors may include underlying diseases such as asthma or cystic fibrosis, anatomical defects such as tracheoesophageal fistula, gastroesophageal reflux, neurological or mental disorders that facilitate aspiration, immune system deficiencies, and haemoglobinopathies(16).

- **Clinical findings:** The presenting symptoms in children include a high fever, cough and chest pain, which can be adequately expressed verbally. Respiratory soun-

ds may be diminished in the affected lung field or may manifest as coarse, medium rales. The most common type of rale is crepitant, and rhonchi may also be heard. It is possible that breathing sounds may be exaggerated on the opposite side of the affected area, leading to a misdiagnosis of the pathology in that area. The cough, which is initially dry, becomes productive in accordance with the progression of pneumonia. Meningism may be observed in cases of infection affecting the right upper lobe. Abdominal distension may result from the ingestion of air. The severity of the disease is accompanied by the presence of cyanosis, air hunger, fever reaching up to 41°C, restlessness and dyspnoea(17).

- **Laboratory findings:** The leucocyte count is within the range of 15,000 to 40,000. A leucocyte count below 5,000/mL in the presence of pneumonia is indicative of a poor prognosis. Hypoxaemia may also be present. The causative agent can be isolated from a nasopharyngeal swab. Additionally, the causative agent is sought to be isolated from potential sources, including sputum obtained through deep cough, tracheal aspiration, and blood and pleural fluid. Additionally, bacteraemia is present in 30% of patients. An indirect test may be conducted using a latex agglutination test on either blood or pleural fluid. Radiological consolidation and pleural reaction may be observed.

- **Treatment:** The antibiotics that may be prescribed include penicillin, amoxicillin with clavulanic acid, ampicillin with sulbactam, cephalosporin, macrolides and vancomycin. There are notable differences in the presentation of pneumonia according to the causative agent. The aforementioned categories may be analysed as follows:

\***Staphylococcal pneumonia:** The causative agent is *Staphylococcus aureus*. A history of a staphylococcal skin lesion may be present. It results in a severe and rapidly progressive form of pneumonia. It is most commonly observed in infants. In 30% of cases, the patient is under three months of age, while in 70% of cases, the patient is under one year of age. It frequently manifests subsequent to an upper respiratory tract infection. The clinical course is typically unilateral or more dominant on one side. This may result in the development of haemorrhagic necrosis or cavitation within the lung. A fibrinopurulent exudate is typically observed on the pleural surface. The presence of multiple abscesses may be observed. A pyopneumothorax may be observed in instances of subpleural abscess rupture(18).

- **Clinical findings:** The patient may present with a high fever, cough, respiratory distress, vomiting, anorexia and abdominal distension. The most salient feature is its markedly rapid progression. The presence of respiratory sounds may vary according to the specific pathological condition. Radiological examination may reveal involvement of the entire lobe, as well as a patchy appearance, abscesses, and findings indicative of pyopneumothorax.

- **Treatment:** The antibiotics methicillin, ceftriaxone, first-generation cephalosporins and vancomycin are employed in the treatment of infection. The recommended course of treatment is 3-4 weeks. Mortality rates remain as high as 30%.

**\*Klebsiella pneumonia:** It is typically observed in children with compromised immune systems. In children with cystic fibrosis, the most common bacterial infections are those caused by *Staphylococcus aureus* in the early stages and *Klebsiella pneumoniae* in the late stages. In its fulminant form, the infection causes the formation of pulmonary abscesses and the development of cavitation. Bacteremia, empyema, and residual parenchymal damage may also occur. A combination of a third-generation cephalosporin and an aminoglycoside is employed in the treatment regimen. The mortality rate is 50%.

Additionally, *Pseudomonas pneumonia* has been observed in late-stage cystic fibrosis and premature infants.

### **Tuberculosis**

It remains one of the most prevalent infections globally. In adults, the infection is transmitted directly or via droplets. Furthermore, adolescents or older children with adult-type tuberculosis may also serve as a source of transmission. Infection in children that does not result in the formation of a cavity is not considered to be contagious. In humans, the causative agents of tuberculosis are the species *Mycobacterium tuberculosis*, *Mycobacterium bovis*, and *Mycobacterium africanum*. The interval between initial infection and the onset of clinical disease may vary considerably, with disseminated and miliary tuberculosis taking up to 26 months to manifest and lymph node and endobronchial tuberculosis occurring within a shorter timeframe of 3–9 months. Tuberculosis of the bone and joints may manifest years after initial infection, while tuberculosis of the kidneys may take decades to appear. In children, tuberculosis is predominantly pulmonary, with 85% of cases affecting the lungs, and 15% occurring in other organs(19).

Pulmonary reactivation of tuberculosis occurs when partially encapsulated endogenous bacilli are revitalised up to one year after the primary infection. This form of tuberculosis is uncommon in children and more prevalent in adolescents and young adults. It is most commonly observed as infiltration or cavitation in the right apex, where oxygen is dense and blood flow is high.

- **Clinical findings:** The most common presentation of paediatric tuberculosis is a constellation of non-specific symptoms. The disease causes a mild fever, a mild cough, malaise, and a flu-like picture. Such symptoms may dissipate within a period of approximately one week.

- **Diagnosis:** The most definitive diagnosis is that which results from the isolation of the causative agent. In order to obtain culture material, sputum samples are taken from older children who are able to cough, while gastric juice is collected from infants who are fasting by means of a gastric lavage performed in the morning, before peristalsis begins. Nevertheless, even under optimal conditions, the growth rate in gastric fluid obtained over three consecutive days is below 50%(20).

**- Treatment:**

For cases of pulmonary and/or hilar lymphatic tuberculosis, a six-month course of treatment comprising isoniazid and rifampicin, with pyrazinamide administered for the initial two months, is recommended. The same treatment may be administered on a daily basis for the initial two-week period, followed by a regimen of two days per week, with meticulous observation. In the case of bone, joint, miliary and meningitis tuberculosis, a course of treatment lasting between nine and twelve months is typically prescribed. In cases of central nervous system tuberculosis and bone and joint tuberculosis, the use of a ventriculoperitoneal shunt and surgical debridement, respectively, may be considered(19).

**- Treatment of latent Tuberculosis:**

Isoniazid is administered on a daily basis for a period of six months in children who have tested positive for purified-protein derivative (PPD), in the absence of any clinical or radiological indications. In the event of difficulty in adhering to the recommended daily regimen, isoniazid can be administered on two days per week under close observation. In children under the age of six, contact with an adult patient with tuberculosis or infants born to a mother with tuberculosis requires the administration of isoniazid treatment, even in the absence of a positive PPD result. It is possible that these children have been infected with mycobacteria but have not yet developed late-type susceptibility. In children who have been in contact with an adult case and who have been diagnosed with PPD-negative, the PPD test is repeated at three-month intervals. In the event of a negative result on the second test, the isoniazid treatment is discontinued. In the event that the second test result is 5 mm or above, a tuberculosis infection is confirmed and full treatment is initiated. Children with HIV infection or other immunosuppression are treated for a period of 12 months(19).

**- BCG vaccine:**

The efficacy of the BCG vaccine in protecting adults and children is approximately 50%. The most beneficial aspect of the BCG vaccine is its capacity to safeguard against lethal forms of tuberculosis in infants and young children. The efficacy of the BCG vaccine is 50% to 80% in the prevention of tuberculosis meningitis or miliary tuberculosis(21).

**- Perinatal Tuberculosis:**

In the event of a suspected case of tuberculosis in the mother at the time of birth, the infant is separated from the mother until a chest X-ray has been performed. In the event that the mother's chest film is found to be abnormal, the infant is maintained in a separate environment until such time as the mother has been diagnosed definitively by all available methods. Congenital tuberculosis may present with symptoms from the time of birth. The condition typically manifests during the second or third week of life. The symptoms and findings are non-specific. In

congenital tuberculosis, there is usually a miliary appearance on chest radiography. Hilar and mediastinal lymphadenopathy and lung infiltration may be present. In 30-50% of cases, diffuse lymphadenopathy and meningitis are also present. Although isoniazid is not teratogenic, treatment of asymptomatic pregnant women is postponed until after delivery(22).

### **B- Wheezy Infant**

The most prevalent causes of wheezing in infants are viral infections and asthma. Twenty percent of infants experience at least one episode of wheezing by the age of one year, 33 percent by the age of three years, and 50 percent by the age of six years.

Infants are classified into three groups based on the type of wheezing observed.

- Temporary
- Permanent (starts before the age of 3, does not recover)
- Late onset (starts between 3-6 years)

#### **- Risk factors:**

The two most significant independent risk factors for the onset of persistent wheeze are a family history of atopy and a history of lower respiratory tract infections.

An atopic constitution affects the response of the lower respiratory tract to viral infections, which in turn affect the development of allergic disease. There is a direct interaction between allergens and viral infections. The most significant viral respiratory infection in infants during the first three years of life is (RSV) infection. Such exposure increases the likelihood of allergic sensitisation in the future(23).

#### **- Clinical findings:**

The clinic is entirely attributable to respiratory distress. The presence of wheeze in a single lung indicates the presence of a foreign body, whereas bilateral wheeze suggests a more general condition. An event in the upper or lower respiratory tract, such as croup, tracheomalacia or bronchomalacia, may present with congestion, stridor and wheeze in the upper respiratory tract. Additionally, interstitial events, such as infection, bronchopulmonary dysplasia, or pulmonary oedema resulting from heart failure, can also manifest as various wheezing and rales.

#### **- Laboratory findings:**

Chest X-rays are not typically indicated in most children presenting with a single episode of wheezing, except in instances where they may support positive additional findings or serve to alleviate parental concern. In cases of recurrent wheezing episodes or suspicion of a congenital anomaly, an anteroposterior and lateral chest X-ray should be performed in order to demonstrate the anomaly and/or excessive ventilation. In the event of suspicion of a structural abnormality, further investigations may be necessary, including computed tomography, magnetic

resonance imaging, or direct laryngobronchoscopy. In the event of an atopic family history and/or the presence of physical examination findings, it may be appropriate to conduct additional allergic investigations, such as skin testing or RAST testing. An infantile pulmonary function test may be employed to detect a reduction in pulmonary function.

**- Treatment:**

The treatment plan is developed based on the underlying cause. In the case of viral infections, such as those caused by RSV or parainfluenza, the administration of supplemental oxygen and bronchodilators may be considered as a means of preventing hypoxia. Systemic corticosteroid therapy is not indicated in the treatment of acute viral bronchitis. The evidence regarding the use of inhaled corticosteroids is inconclusive and the practice is controversial.

**- Prognosis:**

The majority of infants (approximately 60%) who experience early-onset wheeze will make a full recovery. A small proportion of infants (14-15%) constitute a risk group for the development of persistent asthma. In accordance with the asthma predictive index (API) established by the Tucson Children's Respiratory Study, there are certain indicators that may predispose infants to the development of persistent asthma. These are classified as positive API markers. The presence of one major or two minor criteria indicates a markedly elevated risk of asthma. Subsequent studies have led to modifications being made to this index. In practical terms, the original API index is more commonly employed(24).

## **Asthma**

Asthma is a chronic inflammatory disease that is characterised by episodes of airway obstruction. The development of asthma in children is influenced by a combination of genetic predisposition and environmental factors. It is estimated that over 80% of cases of asthma manifest before the age of six(25).

**-Risk factors for persistent asthma in children:** Parental asthma, atopic dermatitis, allergic rhinitis, food allergy, inhalant allergen sensitisation, urban living, pneumonia, bronchiolitis severe enough to require hospitalisation, wheezing without a cold, male sex, low birth weight, exposure to cigarette smoke.

**- Pathogenesis:** The respiratory tract exhibits a number of pathological changes, including epithelial damage, subepithelial collagen deposition, basement membrane thickening, and hypertrophy of mucus glands and smooth muscle.

**- Clinical findings:** The presence of a dry cough, expiratory wheezing and respiratory distress has been observed. These symptoms can be elicited by physical stimuli, including exposure to cold and dry air, cigarette smoke, and exercise. The severity of the symptoms is more pronounced during the nocturnal period. In rare instances, the condition may progress to hypoxic seizure, respiratory failure, and death. During an asthma attack, prolonged breathing and expiratory wheezing can be heard with the unaided ear or by auscultation. Additionally, coarse rales and

crepitant rales may be audible due to the presence of excessive mucus and inflammatory exudate. In some cases, areas of the lungs may be obstructed, preventing respiration and resulting in the absence of audible respiratory sounds. In a severe attack, a condition known as a “silent chest” may occur, whereby respiratory sounds are undetectable in all lung fields(26).

**-Environmental risk factors:**

A number of common factors in our environment play an important role in the onset and severity of asthma in genetically predisposed individuals(27-28).

- These include airborne allergens such as house dust, pollen, moulds, recurrent lung infections, occupational stimuli, cigarette smoke, medication, indoor/outdoor air pollution and diet.
- Asthma is common in occupations such as farming and agricultural work, painting (including spray painting), cleaning and plastics production. Occupational asthma develops months or years after the onset of exposure. The risk of occurrence is especially higher in allergic individuals and smokers.
- Children of mothers who smoked during pregnancy are 4 times more likely to develop wheezing in the first year of life.
- It is known that lung function of children growing up in areas with air pollution decreases. However, there is no conclusive evidence that air pollution directly increases the development of asthma in children and adults.
- The link between nutrition and asthma, especially breast milk, has been extensively researched. It has been shown that children who receive breast milk have less wheezing than children who receive cow’s milk and soya protein.

**- Differential diagnosis:**

- Upper respiratory tract

Allergic rhinitis, sinusitis, adenoidal or tonsillar hypertrophy, nasal foreign body.

- Middle respiratory tract

Laryngotracheobronchomalacia, laryngotracheobronchitis, laryngeal band, cyst or stenosis, vocal cord dysfunction, vocal cord paralysis, tracheoesophageal fistula, vascular ring, tumour and similar masses compressing the airway from the outside, foreign body aspiration, toxic inhalation, cigarette smoke exposure cough.

**Lower respiratory tract**

Bronchopulmonary dysplasia or chronic lung diseases of preterm infants, bronchiolitis, gastroesophageal reflux, bronchiectasis, chronic aspiration, primary ciliary dyskinesia, bronchiolitis obliterans, interstitial lung diseases, hypersensitivity pneumonitis, pulmonary eosinophilia, Churg-Strauss vasculitis, pulmonary haemorrhage, tuberculosis, pneumonia, pulmonary oedema due to heart failure, use of beta adrenergic agonists or ACE inhibitors causing chronic cough(29).

**- Laboratory tests:**

- Pulmonary function test
- Radiological evaluations
- Allergy tests (such as prick, specific IgE measurement)

**-Treatment goals of paediatric asthma:**

- Maintaining normal activity.
- Ensuring school and nursery attendance.
- Ensuring participation in sports, physical exercise and other activities.
- Achieving regular sleep.
- Prevent chronic asthma symptoms.
- Prevent asthma attacks.
- To ensure normal respiratory function.
- To minimise side effects with the drugs used in treatment(30).

**Approaches that contribute to the treatment of asthma:** The regulation of environmental conditions and the treatment of concomitant conditions, such as sinusitis and gastroesophageal reflux, are also important aspects of this process.

**Asthma management in children:** The primary objectives of asthma management are to achieve optimal control of asthma symptoms, minimise the risk of asthma exacerbations, and preserve lung function while reducing the adverse effects of medication. It is anticipated that an individual with well-controlled asthma should be able to engage in typical daily activities, including sleep, work, education, leisure, and exercise, without restriction due to respiratory issues. The four fundamental elements of asthma management are patient education, minimising exposure to asthma triggers, monitoring for alterations in symptoms or lung function, and pharmacotherapy(28).

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