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# ORAL MANIFESTATION OF PULMONARY DISEASE IN PAEDIATRIC POPULATION - NARRATIVE REVIEW

Dentistry

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## ABSTRACT

Children with pulmonary disease are mostly affected with oral health. The various oral health problems, which are caused in these children are due to the respiratory disease by itself or due to the side effects of medication they are taking for the disease such as inhalation therapy with bronchodilators and inhaled corticosteroids in asthmatic patients, systemic antibiotics and pancreatic enzyme replacement therapy in cystic fibrosis patients and also due to nutritional habits. In order to prevent, early diagnosis and effective treatment strategies are necessary in these children to reduce the oral disease and it also improves the patient's quality of life.

## KEYWORDS

### Introduction

Respiratory diseases account for about 25% of all pediatric consultations, and 10% of these are for asthma. The other main pediatric respiratory diseases, in terms of incidence, are bronchiolitis, acute bronchitis and respiratory infections.[1] It is known that asthma is a risk factor for dental caries in children. In addition cystic fibrosis related diabetes is more common with high incidence of tooth discolouration, low incidence of dental caries, high incidence of mouth breathing and open bite malocclusion associated with chronic nasal and sinus obstruction.[2] This review focuses on oral manifestation of the pulmonary disease in children.

### Asthma

Asthma is a chronic inflammatory disease, characterised by episodes of cough, wheezing, chest tightness and difficult breathing. Its prevalence in childhood is increasing worldwide, causing hospital admissions, school and work absenteeism, decreased quality of life and even asthma-related death. Latest Global initiative for asthma (GINA) estimated that the number of people with asthma in the world may be as high as 334 million. Although prevalence of asthma varies widely between the countries, it is estimated that about 14% of the world's children were likely to have had asthmatic symptoms.[3] Asthma affects approximately 10% of children and the prevalence is rising, possibly due to the rise in allergens in the environment that leads to increased airway responsiveness in atopic children. Asthma is by far, the commonest of all chronic diseases of childhood. Asthma may have its onset at any age. As many as 10%–15% of boys and 7%–10% of girls may have asthma at some time during childhood. About 80%–90% have their first symptom before 4–5 years of age and 30% of them are symptomatic by 1 year of age.[4]

### Oral manifestation:

Oral diseases in Asthma patients are associated with frequent use of inhaled bronchodilators or chronic use of inhaled corticosteroids. Excessive or prolonged use of either nebuliser or β2 agonists can lead to a reduced salivary flow which is essential for oral health. Alteration of protective role of saliva leads to increased number of cariogenic microorganism.[5] A dry powder inhaler (DPI) is a device that delivers asthma medication in size of respirable particle (from 1-5µm in diameter) in mixture with excipients which carries the active drug. Most commonly used carrier is carbohydrate - lactose monohydrate. During inhalation from DPI, drug particles separate from the carrier and carried into small airways in the lungs. Larger, lactose particles, are deposited on the oropharyngeal mucosa which can contribute to elevated caries risk.[6]

The asthmatics children are in a higher risk to develop dental erosions. This is due to negative influence of frequent consumption of acidic soft drinks, acidity of some nebulised solutions (pH<5.5), and possible presence of gastroesophageal reflux disease, which show the erosive effect. Chronic therapy with inhaled corticosteroids, oral dryness due to mouth breathing, and pro inflammatory cytokine release in persistent asthma have been related to greater incidence of gingivitis in asthmatic patients. [8] Children with allergic asthma phenotype frequently have associated allergic rhinitis, manifested with various degree of nasal obstruction. Partial nasal obstruction and reduced nasal clearance may cause pronounced mouth breathing with reduced salivary flow. This leads to subsequent bigger accumulation of dental plaque.The raised prevalence of dental calculus in asthmatic children which can be contributed to the increased concentrations of salivary calcium and phosphate ions.[10] Overall the asthmatic children have increased incidence of caries, gingivitis, candidiasis, tooth erosion, changes in the salivary flow and composition.

### Cystic fibrosis

Cystic fibrosis (CF) is a genetic disorder caused by mutations in the CFTR gene. The lung is one of the most affected organs. Mucus accumulation, inflammation, and infection are already evident early during development. Abnormal host-environmental interactions in the cystic fibrosis (CF) lung lead to progressive airway destruction, bronchiectasis, and premature death. The hallmark features of Cystic fibrosis lung disease include abnormal mucus, inflammation, and infection Cystic fibrosis lungs are histologically normal at birth, but lung disease begins early in life with bronchiectatic airways detectable by 1 year in some children with Cystic fibrosis.[10] Therapy consists of high-calorie diet, pancreatic enzyme replacement therapy (PERT), fat soluble vitamins supplementation and medications that lead to increased mucus clearance (bronchodilators, mucolytics). In addition, patients are treated with inhaled and systemic antibiotic therapy in order to control chronic bacterial colonisation in lower airways or treat exacerbation of suppurative lung disease.[12]

### Oral manifestation:

Numerous studies showed that children with Cystic fibrosis have significantly lower incidence of caries and better gingival health when compared to healthy peers. It has also been shown that the incidence of dental caries in the primary dentition was lower in children with Cystic fibrosis in comparison with children with other chronic respiratory diseases.[13,14] Increased salivary pH and higher concentration of calcium in saliva may result in increased calculus formation. The prevalence of dental calculus formation was not found to be significantly different between children with Cystic fibrosis and other chronic respiratory diseases.[14] Enamel defects on permanent teeth were more prevalent in Cystic fibrosis children than in healthy controls. High prevalence of tetracycline discolouration associated with frequent use of these drugs in the past.[15]

**Tuberculosis**

Tuberculosis in children most commonly results from exposure to a household contact with active TB, and represents ongoing transmission of Mycobacterium Tuberculosis in the present with disseminated disease and have an increased risk of community.Infants and young children have an increased risk of infection following exposure and progress more readily from infection to active TB disease. Even low bacillary load can cause severe and acute illness, be it respiratory or disseminated, even in children younger than two years of age.[16] Once infected with M. tuberculosis, young children (aged <5 years) are at greater risk than adults of progressing to disease, including its most severe forms. This depends on the child's susceptibility, which is highest during the first years of life, probably from immunological immaturity. Without Bacille Calmette-Guerin (BCG) vaccination, approximately 30% of infected infants (<1 year old) will progress to intrathoracic TB, and 10–20% will develop disseminated disease. In children aged 1–2 years, the risk of progressing to intrathoracic TB is 10–20 and 2–5% for disseminated disease. These risks decline slowly until around 10 years of age when adult-type disease starts to emerge. Thus, early diagnosis is important, especially in infants and young children who are at greatest risk of rapid disease development and clinicians should consider the full clinical spectrum of intrathoracic syndromes.[17]

**Oral manifestation:**

Oral TB lesions may be either primary or secondary in occurrence. Primary lesions are uncommon, seen in younger patients, and present as single painless ulcer with regional lymph node enlargement. Primary oral TB can be present as painless ulcers of long duration with enlargement of the regional lymph nodes. Oral TB may occur at any location on the oral mucosa, but the tongue is most commonly affected. Other sites include the palate, lips, buccal mucosa, gingiva, palatine tonsil, and floor of the mouth. Salivary glands, tonsils, and uvula are also frequently involved. The oral lesions may be present in a variety of forms, such as ulcers, nodules, tuberculomas, and periapical granulomas. Primary gingival involvement is more common in children and adolescents than adults .It usually presents as a single painless indolent ulcer, which progressively extends from the gingival margin to the depths of the adjacent vestibule and is often associated with enlarged cervical lymph nodes. They may be single or multiple, painful or painless and usually appear as irregular, well-circumscribed ulcers with surrounding erythema without induration. Satellite lesions are commonly found.[18]

**Pneumonia**

Pneumonia is one of the most common reasons for hospitalisation among children. It is caused by bacteria, viruses, and simultaneous infection with both types of pathogens. For bacteria, culture-based methods remain the most common method for identifying pneumonia pathogens. Childhood pneumonia can also lead to significant morbidity and chronic disease. Early life pneumonia can impair long-term lung health by decreasing lung function. Severe or recurrent pneumonia can have a worse effect on lung function, increasing evidence suggests that chronic obstructive pulmonary disease might be related to early childhood pneumonia. S. pneumoniae and H. influenzae type B as the most important bacterial causes of pneumonia, with Staphylococcus aureus and Klebsiella pneumoniae associated with some severe cases. Respiratory syncytial virus was the leading viral cause, identified in 15–40% of pneumonia cases, followed by influenza A and B, parainfluenza, human metapneumovirus and adenovirus.[19,20]

**Clinical features:**

Cough or difficulty breathing
– Fever often high (> 39 °C), but the child may present with low-grade fever or may have no fever (often a sign of serious illness)
– A child has tachypnoea (increased respiratory rate) if:

RR ≥ 60 breaths/minute in children under 1 months
RR ≥ 50 breaths/minute in children from 1 to 11 months
RR ≥ 40 breaths/minute in children from 12 months to 5 years

– On pulmonary auscultation: dullness with diminished vesicular breath sounds, crepitations and sometimes bronchial breathing or normal pulmonary auscultation.

– Signs of serious illness (severe pneumonia):
Chest in-drawing: the inferior thoracic wall depresses on inspiration as the superior abdomen expands Cyanosis (lips, oral mucosa, fingernails) or SpO2 < 90%

Refusal to drink or feed
Aspiration pneumonia:

The oral cavities of patients who contract aspiration pneumonia have characteristic mucous membranes, soft tissue, teeth and oral function. The key points to observe to prevent aspiration pneumonia or improve the prognosis are

- Residue in oral mucous epithelium and oral dryness
- Morphological damage to oral hard tissue - Food residue tends to adhere to the residual root of the decayed teeth, creating bacterial plaque, and forming bacterial flora.
- Impaired oral function

Aspiration pneumatic can be be broadly divided into 2 groups: one caused by micro-aspiration (the aspiration of microorganisms into the trachea) and macro-aspiration (the aspiration of food). Micro-aspiration can be prevented by cleaning of the oral cavity. Macro-aspiration can be addressed by improving eating and swallowing functions. [21]

**Bronchopulmonary dysplasia**

Bronchopulmonary dysplasia is characterized by alveolar simplification, arrest in lung growth, impaired vascular development, and abnormal pulmonary function. It occurs in preterm infants receiving mechanical ventilation and supplemental oxygen and ultimately leads to long-term lung disease. Bronchopulmonary dysplasia remains firmly associated with repeated hospitalisations, neurodevelopment impairment, and significant long-term pulmonary morbidities. Infants with BPD exhibit abnormal pulmonary function and airway hyper-responsiveness and, in some cases, emphysematous changes that persist into adulthood. Notably, pulmonary hypertension often complicates moderate to severe BPD and is associated with increased mortality.Collectively, BPD is no longer considered a disease restrained to the neonatal period, but a condition with lifelong consequences.[23]

**Oral manifestation:**

The development of palate in preterm infants was affected by intubation, feeding type, diet, nasogastric feeding tube, tube characteristics, head structure and birth weight in premature and low birth weight babies. Long-term oral intubation is known to produce asymmetries with changes in the palate structures Potential consequences of oral intubation can be caused by lack of oxygen, by the laryngoscope blade or by the tube itself.Enamel hypoplasia in 18 – 70% of preterm neonates severe disruption of the developing enamel organ and deviation of the crown/root angulation , dilaceration of primary teeth, retarded eruption of primary teeth impaired amelogenesis, effects on the position of the central incisors.[24]

**Obstructive sleep apnea**

Children with obstructive sleep apnea will experience partial or complete obstruction of the upper airway during sleep, with resultant oxygen desaturation and hypercapnia, leading to increased respiratory effort.[26] Obstructive sleep apnea in the pediatric population is defined as either frank obstruction or evidence of hypopnea or obstructive hypoventilation on a sleep study, occurring in the context of a history of snoring, laboured breathing during sleep, daytime sleepiness, or learning and behavioural issues.[25]

**Oral manifestation**

Dental caries, dental erosions and periodontal diseases are seen due to xerostomy in children with OSA. Periodontal diseases are seen more commonly in patients with OSA due to nasopharyngeal obstruction due to adenoid and tonsillar hypertrophy. Periodontal disease are the result of snoring and mouth breathing in children with neuromuscular insufficiency without adenotonsillar hypertrophy. Bacteria that can be isolated from dental plaque such as pseudomonas aeruginosa, staphylococcus aureus have been reported to have a high risk of pneumonia in patients hospitalised in the intensive care unit of the hospital, and periodontitis has been reported to trigger lung infection. The other clinical features and symptoms include Bruxism, clenching causes regressive alteration in the teeth, mobility of the anterior teeth due trauma from occlusion, tongue crenellations – caused when the patient's tongue is forwardly placed in mandibular anterior teeth

regularly to open oral airway, due to the tongue position anterior open bite occurs, development of pro facial pain, reduced jaw height and erythema in larynx and pharynx caused due to snoring and mouth breathing.[27]

## Conclusion

Regular oral examination of the children with respiratory disease is important for early diagnosis of the disease and for maintaining oral health in these patients. Dentist must be able to recognise the oral manifestation in these children. Early diagnosis and effective treatment planning will improve the quality of life.

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