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Review Article

Endodontic Considerations in Pulmonary Disorder Patients

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Abstract: Oral health is mirror of general health. Oral healthcare professionals must be able to identify patients with systemic diseases, compromising conditions, and disabilities that have an impact on, and can be impacted by, oral and maxillofacial health care. The ability to properly practice dentistry within the context of the larger health care system is often a challenge for the dental practitioner but need not be so. Inappropriate identification of a patient with a compromising systemic condition through improper history taking and interpretation, can create ineffective, or even detrimental, oral health care.

Keywords: Oral health, Inappropriate identification, disabilities, Endodontic.

INTRODUCTION

The respiratory system is basically responsible for O_2 and CO_2 exchange between the blood and the external environment. This gas exchange takes place passively across partial pressure gradients within the terminal respiratory units (alveolar spaces). Flowchart-1 schematically represents the structural and functional components of the respiratory system. Maintenance of the mentioned partial pressure gradients is essential for ensuring adequate pulmonary gas exchange [1]. Chronic obstructive pulmonary disease (COPD) is an irreversible and slowly progressing disorder characterized by a limitation of airway flow (in some cases partially reversible), resulting from an abnormal pulmonary inflammatory reaction to harmful gases or particles – particularly tobacco smoke. Examples of COPD are chronic bronchitis and lung emphysema. Asthma in turn is a pulmonary disorder characterized by reversible stenosis or stricture of the peripheral bronchi, and is most often seen in children [2].

The Endodontist must know how to deal with an asthma attack, and must know the drugs which are to be avoided in such patients. Patients with an established diagnosis of tuberculosis (TB) can also be seen in the dental clinic, and the Endodontist in any case must be familiarized with the main signs and symptoms of the disease: productive and persistent cough, blood in sputum, nocturnal perspiration, weight loss, fever or anorexia, or a combination of these manifestations.

On the other hand, endodontist often work with small objects or elements, and when the patient is placed in the supine or semi-raised position, such objects might be swallowed or aspirated into the oropharynx. Prevention is clearly the best approach in such cases, though adequate and rapid intervention in the event of accidental aspiration is essential for ensuring patient safety.

DESCRIPTION OF DISEASE/CONDITION

Asthma

Asthma is a respiratory disease characterized by reversible, diffuse stenosis or stricture of the peripheral bronchi, increased responsiveness or sensitivity to different stimuli, and frequently also signs or laboratory test evidence of an allergic alteration. Asthma is a common condition, typically affecting children and with a prevalence of 5-6% [2].

Asthma is a heterogeneous disease with different underlying disease processes that are grouped into asthma phenotypes. Exposure to a trigger produces release of histamine and cytokines that result in bronchospasm, hypersecretion of mucus, and diminished ciliary motion.

Two Major Asthma Phenotypes Are:

Extrinsic (or allergic) asthma

- Accounts for over 50% of asthma (>90% in children)
- Triggered by activation of mast cells and histamine degranulation following exposure to allergens such as dust, pet dander, mold, and pollen.

Intrinsic (or nonallergic/idiopathic) asthma

- Tends to occur after the age of 30
- Common triggers include respiratory irritants (e.g., tobacco smoke and air pollution), respiratory infections, exercise, cold air, anxiety and stress, and gastroesophageal reflux disease.

Other phenotypes include late-onset asthma, asthma with fixed airflow limitation and asthma with obesity. A subtype of intrinsic asthma is induced by aspirin and other nonsteroidal anti-inflammatory drug (NSAID) medications. This is not an allergic reaction but appears to be the result of these medications' effect on cyclo-oxygenase. About 10% of asthma sufferers will have both extrinsic and intrinsic triggers. Symptoms are frequently worse at night or in the early morning.

Chronic Obstructive Pulmonarydisease

COPD is a term used to describe preventable respiratory disorders that involve airway obstruction that is not fully reversible. Examples of COPD are chronic bronchitis, peripheral airway disease (bronchiolitis), and emphysema [3]. These often present with overlapping symptoms, the most characteristic being cough and sputum production that may precede the development of chronic and progressive dyspnea.

COPD is a progressive disease associated with an abnormal inflammatory response to noxious agents, such as tobacco smoke or occupational/ environmental pollution. Chronic inflammation causes narrowing of the small airways that decreases airway flow and destroys lung parenchyma and alveolar walls.

Worldwide, the most significant cause of COPD is cigarette smoking:

- Approximately 20% of current smokers and 14% of former smokers have some degree of clinically significant COPD [6].
- The degree of severity of COPD increases as the number of cigarettes smoked per day and the duration of smoking increases.
- Smoking cessation, even when significant airflow limitation is present, can lead to improvement in lung function and can slow or halt disease progression.

Bacterial colonization may play a significant role in airway inflammation and the pathogenesis and progression of COPD. Respiratory tract infections have been associated with acute exacerbations of this condition.

Bronchitis

Airflow obstruction is the result of chronic inflammation of the bronchioles. The lungs become poorly ventilated, leading to hypoxemia, cyanosis, CO2 retention, and polycythemia.

Emphysema

Airflow obstruction that hinders expiration develops when there is an irreversible enlargement of the bronchioles and the alveoli.

Tuberculosis

Tuberculosis (TB) is one of the main causes of death throughout the world. Approximately one-third of the world population is infected with Mycobacterium tuberculosis [4, 5].

Tuberculosis can affect any body organ, though the lungs are the most common location. At first exposure to the bacterium (primary infection with the Koch bacillus), the latter induces a characteristic granulomatous reaction (tuberculous follicle or granuloma).

The lungs are the most common site of TB infection. Once an airborne droplet containing T *bacillus* is inhaled, it travels through the lungsto the terminal bronchi and alveoli.

In hosts with healthy immune systems, the majority of the bacilli are destroyed. The ones not immediately destroyed can enter the bloodstream and spread throughout the body, infecting other sites, orremain in the alveolus. Within 2–6 weeks, the bacilli are engulfed by macrophages that form a barrier shell, called a granuloma, that keeps the bacilli contained and prevents systemic dissemination, resulting in latent TB infection (LTBI).

Asymptomatic LTBI occurs in 90% of those infected with the bacilli, with only a 10% lifetime chance of progressing to TB disease. Patients with LTBI are not infectious and cannot spread organisms to others. Progression from LTBI to TB disease occurs when the immune system cannot prevent the TB bacilli from multiplying. Coinfection with HIV is the strongest risk factor for progressing to active TB disease, and TB is one of the leading causes of death among people infected with HIV worldwide [7].

Obstructive sleep apnea syndrome (osas)

Obstructive sleep apnea1 syndrome (OSAS) is characterized by partial or complete upper airway obstruction during sleep, causing apnea and hypopnea, coupled with daytime symptoms, most often excessive sleepiness.

- Apnea is the cessation of airflow at the nose or the mouth for at least 10s.
- Hypopnea is a 30–50% reduction in airflow for at least 10s and oxygen desaturation of at least 2–4%.
- The apnea–hypopnea index (AHI) is the number of apneas and hypopneas per hour of sleep.
- In obstructive sleep apnea/hypopnea syndrome:
  - Mild cases have an AHI of 5–14;
  - Moderate cases have an AHI of 15–30;
  - Severe cases have an AHI >30.

Patients with moderate to severe OSA have significantly increased mortality. Even mild-to-moderate OSA (AHI 5–15/h) increases the risk for hypertension, stroke, myocardial infarction, and injury due to motor vehicle accidents. OSA is caused by a narrowed upper airway and increased collapse of the muscles and soft tissues. As the muscles and tongue relax during sleep, they can partially occlude the opening to the airway and cause increased resistance to airflow.

Risk factors include obesity, smoking and alcohol use, having hypertension, or any anatomical deviation that narrows the dimensions of the upper airway, including deviated nasal septum and enlarged turbinates, elongated soft palate and uvula, retrognathic mandible, enlarged tongue, and redundant parapharyngeal folds.

Lung Cancer

Lung cancer forms in tissues of the lungs, usually in the cells lining air passages. The two main types are small-cell lung cancer and non-small-cell lung cancer.

Most lung cancers fall into three pathological types: squamous cell carcinoma, adenocarcinoma, and small-cell (oat-cell) carcinoma.

DENTAL MANAGEMENT

Evaluation

Patients presenting with cough, shortness of breath, wheezing, and using supplemental oxygen by nasal cannula with a mobile oxygen tank should raise suspicion of pulmonary disease. For the patient carrying a diagnosis of a specific pulmonary condition, the boxed Key Questions given in table 1,2,3 will assist the dentist in medical assessment and risk management related to dental care.

Dental Treatment Modifications

Asthma

Elective care should only be performed on asymptomatic or well-controlled patients. The presence of asthmatic symptoms, such as wheezing or coughing, warrants reappointment. It is important to educate asthmatic patients about dental disease and increased caries risk. Controversy exists over the relationship between asthma and increased caries risk, but no strong evidence suggests a causal link [8, 9].

- Only treat when patient is asymptomatic

- Determine triggers and/or precipitating events
- Assess level of control, frequency of attacks, medications used
- Have patient take all medications as scheduled before appointment
- Have patient bring rescue bronchodilator (e.g., albuterol) metered dose inhaler to each appointment
- Stress reduction protocol
- Consider use of nitrous oxide–oxygen analgesia
- Use rubber dam to decrease exposure to aerosols if tolerated

Recognize signs of acute attack and be prepared to treat
Management of asthma attack shown in Table-4.

Chronic Obstructive Pulmonarydisease

- Patients presenting with dyspnea at rest, cyanotic changes, or the presence of an acute respiratory infection are not good candidates for elective dental care and should be rescheduled.
- Patients who are stable and have adequate breathing can be treated with care taken not to further compromise the airway.
- Specifically, it is advisable to treat the patient in the vertical position. The way in which rubber dams are used should also be modified in some cases, since the patients may complain that they produce a suffocating sensation
- Hypnotics, narcotics, antihistamines and anticholinergic agents are to be avoided.
- Ambulatory general anesthesia is totally contraindicated.

Lung Cancer

- During chemotherapy: Dental treatment should only be done after consultation with the patient's oncologist to coordinate treatments with the patient's optimal hematological status.
- Frequent recalls to help maintain a clean oral cavity and reinforce patient education can be useful in preventing or minimizing oral complications.

Tuberculosis

- Always consult and confirm with the patient's physcians. The type of drug therapy recommended for your patient and the status of the disease.
- Evaluate the liver function tests (LFTs), serum creatinine, complete blood count (CBC) with platelets, and WBC differential before initiating dental treatment.
- Avoid all drugs metabolized by the liver to minimize hepatotoxicity.
- Use no more than 2 carpules of local anesthetics.
- Avoid aspirin, NSAIDS, extra-strength acetaminophen (Tylenol), meperidine (Demerol), and propoxyphene (Darvon).
- Avoid macrolides, ampicillin, tetracycline HCL, and metronidazole. Use penicillins, cephalosporins, and clindamycin when needed.
- *Mycobacterium aviumintracellulare* (MAI) and/or *Mycobacterium kansassi* (MK) occurs only in the HIV patient due to a dramatic reduction in immunity. The T4 cell count is usually <200 cells/mm3 when MK occurs.

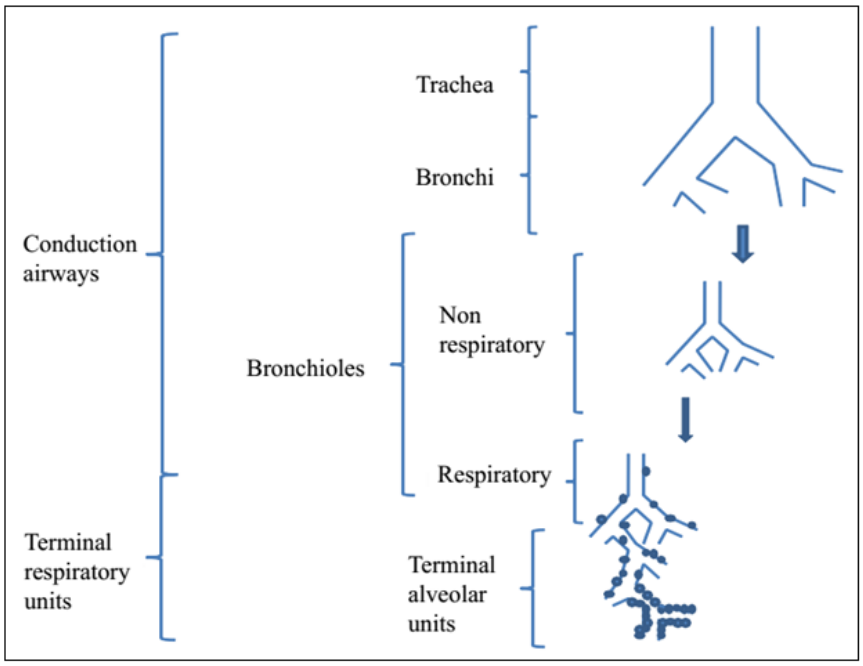
Foreign Body Aspiration

Many dental materials and elements are of small size, and when exposed to saliva it may be difficult to manipulate them correctly. When the patient is placed in the supine or semi-raised position, such objects might be swallowed or aspirated into the oropharynx. Depending on the size, shape and flexibility of the object, swallowing may pose only minimum risk or potentially can prove fatal. Prevention is clearly the best approach in such cases, though adequate and rapid intervention in the event of accidental aspiration is essential for ensuring patient safety.

When a foreign body is aspirated into the oropharynx, the patient should sit up and be instructed to cough forcefully. The immediate priority is to ensure that the airways remain free. If breathing is affected, clearly recognizable symptoms quickly develop, such as asphyxia, inspiratory stridor and the need to breathe with accessory muscle support. If vigorous coughing is not effective, the Heimlich maneuver should be used: with the patient in the standing position, we grasp him or her from behind with both arms.

If this maneuver likewise proves ineffective, the patient must be moved to the nearest emergency medical center as quickly as possible. While waiting for patient transfer, the dental professional should apply vital support measures, including airway permeation by means of a cricothyroidotomy, where necessary.

If the airway is not affected, the swallowed object should be recovered to thus calm the patient. If retrieval of the object is not possible, the situation should be explained to the patient, and due chest and abdominal X-rays and clinical evaluation in the hospital will help identify the location of the object [11]. In brief Approach to foreign body aspiration is shown is Table-5.



Flowchart-1: The structural and functional components of the respiratory system

Table-1: Key questions to ask the patient with asthma

Key questions to ask the patient with TB
❖ Is it pulmonary TB or does it involve other areas of your body?
❖ Is your TB active? Have you had recent night sweats, frequent cough, fever, fatigue, weight loss, chest pain, cough that produces blood in the sputum or mucopurulent sputum
❖ When was your TB diagnosed? When did you start TB treatment?
❖ What types of anti-TB medications are you taking?

Table-2: Key questions to ask the patient with TB

Key questions to ask the patient with COPD
❖ Do you have emphysema or bronchitis?
❖ Exposure to risk factors:
• Do you smoke
• If yes, how many cigarettes/how much tobacco per day
• Would you like to quit smoking?
❖ Disease progression and complications:
• How much can you do before you get short of breath?
• Have you had to reduce your activities because of your breathing or any other symptom?
• Has your breathlessness or any of your symptoms worsened, improved, or stayed the same since your last medical visit?
• Have you experienced any new symptoms since your last medical visit?
• Has your sleep been disrupted by breathlessness or other chest symptoms?
❖ Monitor pharmacotherapy and other medical treatment:
• What are the names, doses, and schedule of medicines that you take?
• Has your treatment been effective in controlling your symptoms?
• Has your treatment caused you any problems?
• Do you require supplemental oxygen?
❖ Monitor exacerbation history:
• What causes your symptoms to get worse?
• Have you ever experienced difficulty breathing during dental treatment?

Table-3

Approach to foreign body aspiration
1. Raise the patient and instruct him or her to cough forcefully.
2. If breathing is affected (asphyxia, inspiratory stridor and the need to breathe with accessory muscle support) and vigorous coughing proves ineffective, perform the Heimlich maneuver.
3. If this likewise proves ineffective, notify the emergency medical service immediately. While waiting for patient transfer, apply vital support measures, including airway permeation by means of a cricothyroidotomy, where necessary.
4. If the airway is not affected, the swallowed object should be recovered to calm the patient.

Table-4: Management of asthma attacks

Key questions to ask the patient with asthma
❖ What type of asthma do you have (e.g., allergic, infectious, stress induced, drug induced, exercise induced)?
❖ If drug induced, which drugs have been triggers for you? Aspirin, NSAIDs, food preservatives?
❖ How severe is your asthma? How often do you have asthma attacks? What do you do to resolve the attacks?
❖ What treatment are you receiving? Do you use a systemic or inhaled steroid?
❖ Do you have your bronchodilator with you? You should bring it to each appointment.
❖ Has this ever been insufficient to stop an attack so that you needed an epinephrine injection?

Table-5: Approach to foreign body aspiration

Management of asthma attacks
1) Suspend the dental procedure and raise the patient to a comfortable position.
2) Establish and keep the airways free, and administer an inhalatory β2 agonist.
3) Administer oxygen with a mask. If no improvement is observed or the symptoms worsen, administer subcutaneous epinephrine (1:1000 in solution, 0.01 mg/kg body weight, with a maximum dose of 0.3 mg).
4) Maintain adequate oxygen levels until the patient breathes regularly and/or medical help arrives [10].

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