

Aspiration-Related Pulmonary Syndromes

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Aspiration of foreign matter into the airways and lungs can cause a wide spectrum of pulmonary disorders with various presentations. The type of syndrome resulting from aspiration depends on the quantity and nature of the aspirated material, the chronicity, and the host responses. Aspiration is most likely to occur in subjects with a decreased level of consciousness, compromised airway defense mechanisms, dysphagia, gastroesophageal reflux, and recurrent vomiting. These aspiration-related syndromes can be categorized into airway disorders, including vocal cord dysfunction, large airway obstruction with a foreign body, bronchiectasis, bronchoconstriction, and diffuse aspiration bronchiolitis, or parenchymal disorders, including aspiration pneumonitis, aspiration pneumonia, and exogenous lipoid pneumonia. In idiopathic pulmonary fibrosis, aspiration has been implicated in disease progression and acute exacerbation. Aspiration may increase the risk of bronchiolitis obliterans syndrome in patients who have undergone a lung transplant. Accumulating evidence suggests that a causative role for aspiration is often unsuspected in patients presenting with aspiration-related pulmonary diseases; thus, many cases go undiagnosed. Herein, we discuss the broadening spectrum of these pulmonary syndromes with a focus on presenting features and diagnostic aspects.

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ABBREVIATIONS: BOS = bronchiolitis obliterans syndrome; GER = gastroesophageal reflux; GERD = gastroesophageal reflux disease; HRCT = high-resolution CT; IPF = idiopathic pulmonary fibrosis

Aspiration is defined as the entrance of foreign matter into the airways and lungs.^{1,2} It is a common event and can occur in healthy individuals. For example, radiotracer studies have shown that nearly one-half of healthy subjects experience aspiration of pharyngeal secretions during sleep.^{3,4} Although aspiration generally triggers coughing, it can be silent, causing difficulties in recognizing aspiration as the cause of undiagnosed respiratory diseases.⁵⁻¹⁰ For example, aspiration was suspected clinically in only 9% of 59 patients in whom aspiration was confirmed on lung biopsy.¹¹

Aspiration syndromes, such as airway obstruction from an inhaled foreign body, aspiration pneumonitis, and aspiration pneumonia, are well recognized.^{1,12,13} Aspiration pneumonitis is defined as acute lung injury occurring after inhalation of a large volume of acidic gastric contents. Aspiration pneumonia refers to an infectious process secondary to aspiration of colonized oropharyngeal secretions. In recent years, however, it has become apparent that the spectrum of aspiration-related pulmonary syndromes is broader and more varied in clinical and radiologic presentation than

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previously thought. Herein, we provide an overview of these aspiration-related pulmonary disorders, focusing particularly on those entities not widely appreciated and on recent advances in our understanding of aspiration-related pulmonary syndromes, which can be broadly grouped into those predominantly affecting the airways or the lung parenchyma (Table 1).

Epidemiology

Aspiration-related pulmonary syndromes are encountered in subjects of any age, from infancy to the aged. However, specific pulmonary syndromes are more likely to be encountered in certain age groups or in clinical contexts in which there are risk factors for aspiration. For example, foreign body aspiration is encountered most commonly in young children and the elderly, particularly those with impaired mental status or swallowing mechanism.^{14,15} Aspiration pneumonitis typically occurs in the setting of depressed consciousness from general anesthesia or drug overdose, thus predisposing to regurgitation and inhalation of a large volume of gastric contents. Aspiration pneumonia is a relatively common form of pneumonia in the elderly with chronic medical disorders and in those residing in nursing homes.⁹

Risk Factors for Aspiration

Major risk factors for aspiration include depressed consciousness, compromised airway defenses, dysphagia, gastroesophageal reflux disease (GERD), and recurrent vomiting (Table 2).^{13,16} States of depressed consciousness include general anesthesia, alcohol intoxication, and drug overdose. Under these conditions, swallowing mechanisms and airway defenses are impaired. Airway defenses are also impaired in subjects with vocal cord immobility, oropharyngeal deformities

TABLE 1] Aspiration-Related Pulmonary Syndromes

Syndrome
Airway
Vocal cord dysfunction
Foreign body aspiration (mechanical obstruction)
Bronchiectasis
Bronchoconstriction (eg, exacerbation of asthma)
Diffuse aspiration bronchiolitis
Bronchiolitis obliterans syndrome
Parenchyma
Aspiration pneumonitis
Aspiration pneumonia
Exogenous lipoid pneumonia
Interstitial lung disease

TABLE 2] Risk Factors for Aspiration-Related Pulmonary Syndrome

Risk Factor
Depressed consciousness (eg, sedation, anesthesia, alcohol intoxication, drug overdose)
Compromised airway defenses (eg, vocal cord paralysis, endotracheal intubation)
Dysphagia
Neurologic disorders (eg, stroke, multiple sclerosis, Parkinson's disease, dementia)
Altered upper aerodigestive tract (eg, cancer, prior surgery, radiation therapy)
Esophageal diseases (eg, cancer, prior surgery, motility disorders, tracheoesophageal fistula)
Gastroesophageal reflux disease
Recurrent vomiting

caused by surgery or radiation therapy, or endotracheal intubation.

Dysphagia can be caused by neurologic disorders, such as stroke; neuromuscular disorders, especially those with bulbar involvement; or upper aerodigestive alterations related to prior surgery or radiation therapy.^{16,17} Aspiration complicates many genetic or metabolic disorders associated with significant neurologic compromise and dysphagia, particularly in children (eg, familial dysautonomia [Riley-Day syndrome]).

GERD is a common disorder in the Western world, with symptoms experienced by 10% to 20% of the adult population at least once a week, and it can underlie occult aspiration.¹⁸ Esophagogastric sphincter dysfunction, motility disorders involving the esophagus or stomach, postsurgical anatomic alterations, and obesity (increased gastric pressure) augment the likelihood of gastroesophageal reflux.¹⁹ If typical symptoms of GERD are absent, or symptoms do not respond to empirical medical therapy, diagnostic testing for GERD, such as ambulatory esophageal pH testing or upper GI endoscopy, may be needed.

Pathophysiology

When aspiration occurs in healthy subjects, the amount of aspirated material is usually minimal and cleared without clinical sequelae. When aspiration results in adverse clinical consequences, the character of the evolving illness is determined by the nature and volume of the aspirated material, the chronicity, and the host responses.

In patients with GERD, laryngeal injury with mucosal damage results from direct exposure to refluxed gastroduodenal contents that include acid, pepsin, and bile

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