It Is All One Airway
Or How Allergic Rhinitis and Its
Management can Affect Asthmatic Patients

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May 9, 2018

Introduction
• Allergic Rhinitis
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• Testing for Allergies
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• Differential for Allergic Rhinitis
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Allergic Rhinitis (AR)
• Rhinitis is a symptomatic inflammatory disorder of the nose
• Defined as being characterized by 1 or more nasal symptoms:
  – congestion
  – rhinorrhea (anterior, posterior)
  – sneezing
  – itching

Allergic Rhinitis
• Allergic rhinitis affects between 10-30% of all adults and as many as 40% of children
• Rhinitis is a significant cause of widespread morbidity, medical treatment costs, reduced work productivity and lost school days
• Sometimes mistaken as a trivial disease
• Rhinitis can have a significant affect on QOL and can be associated with conditions such as fatigue, headache, cognitive impairment, and sleep disturbance in addition to sinusitis and asthma flares
Rhinitis

- Many different causes such as allergic, nonallergic, infectious, hormonal, drug induced, and occupational
- Additional causes are from disease such as sarcoidosis and necrotizing antineutrophil cytoplasmic antibody positive (ANCA+) Wegener's granulomatosis
- Rhinitis is usually associated with inflammation, but some forms of rhinitis such as vasomotor rhinitis or atrophic rhinitis are not predominantly inflammatory

Allergic Rhinitis

- Risk factors for allergic rhinitis include:
  - Family history of atopy
  - Serum IgE > 100 IU/mL before age 6
  - Higher socioeconomic class
  - Presence of positive allergy skin prick testing

Allergic Rhinitis

- Pathophysiology of allergic rhinitis results from a complex allergen-driven mucosal inflammation caused by interplay between resident and infiltrating inflammatory cells and a number of vasoactive and pro inflammatory mediators, including cytokines
- Sensory nerve activation, plasma leakage and congestion of venous sinusoids also contribute
- Allergic rhinitis may be characterized by early-phase and late-phase responses
- Each type is characterized by sneezing, congestion, and rhinorrhea, but congestion predominates in the late phase

AR and its relationship to Asthma

- Patients with allergic rhinitis are at increased risk for the development of asthma
- Upper and lower airways are closely related with respect to rhinitis and asthma
- There is also evidence of inflammatory interaction between the upper and lower airways
AR and Asthma

- Patients with allergic rhinitis without asthma, especially those sensitized to dust mites, often have nonspecific bronchial hyper-responsiveness (BHR).
- Many patients with seasonal allergic rhinitis experience a seasonal increase in bronchial hyper-responsiveness (BHR).
- Nasal allergen provocation has been shown to result in temporary increases in bronchial hyper-responsiveness (BHR).
- Subsegmental bronchial allergen challenge in patients with allergic rhinitis has been shown to result in both bronchial and nasal inflammatory responses.

AR and Asthma

- There is clinical evidence that treatment of rhinitis can improve the status of coexisting asthma.
- Treatment with intranasal corticosteroids has been shown to prevent the seasonal increase in BHR experienced by patients with allergic rhinitis, to reduce existing BHR, to improve pulmonary functional tests, to diminish asthma symptoms, and to reduce exhaled nitric oxide and hydrogen peroxide.
- Treatment of allergic rhinitis with intranasal corticosteroids and certain second-generation antihistamines may improve asthma control when both diseases coexist.

AR and Asthma

- Given the convincing relationship between allergic rhinitis and asthma and the beneficial effects of treating rhinitis in patients with asthma, it is imperative that practitioners treating patients with asthma also consider identification and aggressive treatment of coexisting rhinitis.
- Allergen specific subcutaneous immunotherapy (allergy shots) has been associated with a reduction in nonspecific bronchial hyper-responsiveness (BHR) in patients with perennial allergic rhinitis.
- Several controlled studies have also reported a reduction in the incidence of asthma in pediatric patients with allergic rhinitis treated with subcutaneous immunotherapy - this effect appears to be sustained at least 2 years after discontinuing immunotherapy.
- Likewise, sublingual immunotherapy for allergic rhinitis (most not FDA approved yet), may reduce the development of asthma in children.

Anatomy of Upper Airway

- Nasal cavity is lined with pseudostratified columnar epithelium except for nasal vestibule lined with stratified squamous epithelium.
- Inferior, middle, and superior turbinates are located laterally in each nasal cavity.
- Turbinates regulate temperature and filter and humidify inspired air.
- Nasal mucosa is extremely vascular and changes in blood flow can lead to obstruction.
Anatomy of Upper Airway

- Nasal mucosal vasculature is affected by the autonomic nervous system
- Sympathetic stimulation leads to vasoconstriction and consequent decrease in nasal cavity resistance
- Parasympathetic stimulation has the opposite effect
  - promotes nasal gland secretion
  - increases nasal cavity resistance

PATHOPHYSIOLOGY

- Allergic rhinitis is an IgE mediated reaction to the protein or glycoprotein component of inhaled aeroallergens
- Includes pollens, molds, animal danders, dust mites, cockroaches

PATHOPHYSIOLOGY

- On inhalation, the allergen deposits in the nasal mucus
- After deposition, antigen-presenting cells in the nasal epithelial mucosa phagocytose and process the allergen
- Subsequently, allergen is presented to CD4+ T cells in local lymph nodes
- Allergen-stimulated T cells proliferate in a TH2 pathway and release cytokines including IL-3, IL-4, IL-5 and IL-13

PATHOPHYSIOLOGY

- These cytokines lead to local and systemic production of IgE antibodies by plasma cells
- These antibodies bind to mast cells and basophils
- This process is referred to sensitization
PATHOPHYSIOLOGY

- On re-exposure, the allergen is recognized by IgE antibodies, which are bound to mast cells and basophils
- The recognition and subsequent binding leads to degranulation of mast cells and basophils that release preformed mediators including histamine and enzymes such as tryptase and chymase

PATHOPHYSIOLOGY

- Also, rapid de novo synthesis of other mediators such as cysteinyl leukotrienes and prostaglandins
- These mediators lead to vasodilation of arteriolar venous anastomosis, plasma leakage from blood vessels, increased secretion of mucous, and stimulation of afferent nerves with consequent occlusion of the nasal passages
- Histamine produces pruritus, rhinorrhea and sneezing
- Leukotrienes and prostaglandins are associated with nasal congestion

PATHOPHYSIOLOGY

- This comprises the early or immediate-phase response
- Cytokines released during the immediate phase response mediate a cascade of events over the next 4-8 hours, referred to as late-phase response
- Clinical symptoms of early and late phase are similar, but nasal predominates during the last phase

PATHOPHYSIOLOGY

- Mediators released at the post capillary endothelial cells, during the early phase response, promote the expression of adhesion molecules that assist in migration of eosinophils, neutrophils, and basophils and, eventually, macrophage and CD4+ TH2 cells into the superficial lamina propria of the nasal cavity
- These cells become activated and produce more mediators that are similar to those involved in the early response phase except for mast cell-derived typtase, chymase and PGD2
PATHOPHYSIOLOGY

- On repeat exposure to an allergen, the nasal mucosa becomes more sensitive and there is a progressive decrease in the amount of allergen required to elicit symptoms, known as priming.
- Priming may lead to increased sensitivity of the nasal mucosa to non-allergenic triggers such as cigarette smoke and strong odors.

Diagnosis of Allergic Rhinitis

Testing for Allergy

- Skin prick testing is the gold standard for aeroallergens.
- Tests for immediate (IgE) mediated allergy to standard inhalants (plus others).

Common Allergens That Trigger Asthma

- Cockroach
- Dust mites
- Molds
- Cats/dogs +/- other animals/birds
- Trees
- Grasses
- Weeds
Differential of Allergic Rhinitis

- Occurrence of ocular symptoms - itching, redness, and tearing make allergy a more likely cause of rhinitis
- Vasomotor rhinitis or non-allergic rhinitis primarily manifests as nasal congestion and rhinorrhea and less commonly as nasal itching and sneezing
- Symptoms occur in response to nonallergic triggers such as changes in temperature or relative humidity, strong odors, cigarette smoke, and alcohol ingestion

Differential of Allergic Rhinitis

- Hormonal changes such as in puberty, pregnancy and with thyroid disorders can mimic allergic rhinitis
- Pregnancy related rhinitis typically starts in 2nd trimester and is relieved by 2 wks after delivery, congestion predominates
- Rhinitis medicamentosa can occur with intranasal adrenergic decongestant sprays if used for > 4-7 days

Differential of Allergic Rhinitis

- Oral hypertensive agents such as angiotensin-converting enzyme inhibitors and beta-blockers may cause nasal symptoms
- Nonsteroidal anti-inflammatory drugs such as aspirin and ibuprofen also cause rhinitis in same individuals
- Repeat use of cocaine or amphetamines can lead to rebound nasal congestion
- Ingestion of ethanol in alcoholic beverages causes vasodilation of nasal blood vessels resulting in nasal congestion

Differential of Allergic Rhinitis

- Gustatory rhinitis is characterized by rhinorrhea and is associated with ingestion of hot or spicy food
- Atrophic rhinitis is characterized by atrophy of the nasal mucosa, nasal dryness, and foul-smelling nasal crusts after associated with a constant sense of malodor
- Can be primary because of infection or secondarily associated with nasal surgery, irradiation or trauma
- Acute viral upper respiratory tract infections typically manifest with nasal symptoms, although nasal pruritus is typically absent and constitutional symptoms are often present
**Treatment of Allergy**

- Treatment of allergic rhinitis may improve asthma control in patients with coexisting allergic rhinitis and asthma.
- Management of allergic rhinitis combines allergen avoidance measures with pharmacotherapy, allergen-specific immunotherapy and education.

**Treatment of Allergy**

- Pharmacotherapy includes nasal corticosteroids, nasal antihistamines, and/or oral antihistamines.
- Leukotriene receptor antagonist.
- Allergy immunotherapy.

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**Summary**

- Identification and treatment for allergic rhinitis can have a significant role in the treatment and management of asthma.
- Clinical evidence that treatment of rhinitis can improve the status of coexisting asthma.
- Treatment with intranasal corticosteroids has been shown to prevent the seasonal increase in BHR experienced by patients with allergic rhinitis, to reduce existing BHR, to improve pulmonary functional tests, to diminish asthma symptoms, and to reduce exhaled nitric oxide and hydrogen peroxide.
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**References**

Questions?