

Asthma

General:

Chronic inflammatory disorder of the airways involving various cells (especially mast cells, eosinophils, and T lymphocytes), marked by recurrent episodes of wheezing, chest tightness, breathlessness, and cough, occurring particularly at night or in the early morning. Associated with an increase in airway responsiveness to a variety of stimuli, leading to airflow limitation, which may revert spontaneously or with treatment.

Epidemiology:

In 2009, prevalence in the US was 8.2% of the population (24.6 million people); higher among females (9.3 vs 7.0%), children, persons of non-Hispanic black and Puerto Rican race (Black 11.1%, Puerto Rican 16.6 %; lowest in Asians, 5.3% and Mexicans 4.9%), family income below poverty level and those residing in the NE and Midwest regions.

Risk Factors:

- A genetic predisposition has been recognized, though atopy (predisposition to excessive IgE reaction (i.e. hyperallergic) is strongest identifiable predisposing factor.
- Episode triggers include: airway inflammation and exposure to inhaled allergens (cockroaches, cats, seasonal pollens, house dust mites).
- Nonspecific triggers include: exercise, URIs, rhinitis/sinusitis, GERD, weather changes, and stress. Selected individuals react to aspirin and NSAIDS.
- Exposure to environmental tobacco smoke is a common trigger.

Symptoms:

- Intermittent or chronic symptoms of airway obstruction- breathlessness, cough, wheezing, chest tightness.
- Signs/symptoms vary widely in terms of intensity and frequency.
- Symptoms often worse at night.

Diagnosis:

- Peak flow testing: evaluates PEF (peak expiratory flow); need to establish baseline then zone scheme (red <50%, yellow 50-80%, green >80% of predicted). PEF <200 mL/min = severe airflow obstruction.
- Spirometry: evaluates FEV1 and FVC; degree of airway obstruction defined by % of FEV1, as follows:
 - >80%: Borderline
 - 60-80%: Mild
 - 40-60%: Moderate
 - <40%: Severe
 - An increase in FEV1 \geq 12% (or increase in FVC \geq 15%) after bronchodilator therapy suggests reversible airway obstruction/asthma
- Metacholine challenge: administration of bronchoconstrictor to monitor degree of airway narrowing. High negative predictive value for ruling out asthma. Indicated when spirometry is nondiagnostic, in establishing a diagnosis of occupational asthma, and possibly as part of chronic asthma management to monitor airway hyperresponsiveness.

Classifying severity:

Mild Intermittent: Sxs \leq twice/week; normal PEF between exacerbations; nocturnal sxs \leq twice/month; FEV1 or PEF $>80\%$; 0-1 exacerbations/year requiring systemic glucocorticoids

Mild Persistent: Sxs $>$ twice/week, $<$ once/day; nocturnal sxs $>$ twice/month; FEV1 or PEF $>80\%$; ≥ 2 exacerbations/year requiring systemic glucocorticoids

Moderate persistent: Daily Sxs; daily use of rescue inhaler; nocturnal Sxs $>$ twice/week; FEV1 or PEF $>60\%$, but $<80\%$; ≥ 2 exacerbations/year requiring systemic glucocorticoids

Severe persistent: continual sxs; limited physical activity; frequent exacerbations; frequent nocturnal sxs; FEV1 or PEF $\leq 60\%$; ≥ 2 exacerbations/year requiring systemic glucocorticoids

Treatment:

- Identification and avoidance of asthma triggers

- Chronic Pharmacologic Treatment:

- *Mild Intermittent*: Inhaled short-acting beta₂-agonist (SABA), e.g. Albuterol (ProAir, Ventolin, Proventil) and levalbuterol (Xopenex); Mast cell-stabilizing agents may be considered prior to exercise, e.g., cromolyn (Intal).

- *Mild Persistent*: Daily long term controller- **low dose inhaled corticosteroid (ICS)**, e.g. budesonide (Pulmicort) 200-600 mcg daily, beclomethasone (Qvar) 80-240 mcg daily, Fluticasone (Flovent) 88-264mcg/day, ciclesonide (Alvesco) 80-320mcg daily, flunisolide (AeroBid) 320mcg daily. **SABA** as needed for symptomatic management.

Consider leukotriene modifiers (montelukast/Singulair, zafirlukast/Accolate), mast cell-stabilizing agents, or theophylline if incomplete response to ICS. **No role for monotherapy with long-acting beta agonists (LABAs)** and combination with ICS not currently recommended for mild persistent asthma.

- *Moderate Persistent*: Daily long term controller- Addition of **LABA to low-dose ICS** (shown to be more effective in most patients than higher doses of ICSs), e.g. fluticasone/almeterol (Advair), budesonide/fomoterol (Symbicort), mometasone/fomoterol (Dulera). **Medium to High-dose ICS**, same medications as above usually at double or higher the dose.

- Severe: Daily long term controller- **High dose ICS + LABA**. **Oral glucocorticoids**, should be added for a brief course for patients with frequent daytime or nocturnal sxs, recent deterioration, or FEV1 $<60\%$ or patients with baseline stable airflow obstruction that does not reverse with inhaled bronchodilator. Also may consider addition of a third controller agent such as theophylline (although data lacking regarding efficacy when added to ICS and LABA) or antileukotriene agents, such as montelukast or zafirlukast, or 5-lipoxygenase inhibitor zileuton.

Management of Acute Exacerbations:

- **Clinical danger signs:** accessory muscle use for respiration, difficulty speaking, inability to lie supine, agitation, severe sx's that fail to improve with initial ED treatment; cyanosis, altered mental status and inability to maintain respiratory effort portend imminent respiratory arrest.
- Inhaled beta agonist: albuterol nebulizer treatment, 2.5mg q20min for three doses or 10-15 mg continuous nebs over one hour.
- Oxygen to maintain SaO₂ ≥92%
- Ipratropium bromide (atrovent) 500mcg nebulizer q20 min for three doses
- Corticosteroids: methylprednisolone 60-125mg IV or prednisone 40-60mg po
- Magnesium sulfate 2gIV over 20 min for severe exacerbations

May consider:

- Terbutaline SC if unresponsive to above therapies
- OR
- Epinephrine SC
 - Helium and oxygen (Heliox), may improve ventilation and decrease work of breathing with acute severe outflow obstruction; controversial treatment
 - Intubation and mechanical ventilation if respiratory failure seems imminent; goal for high inspiratory flow rates, low tidal volumes and low respiratory rates.

Prognosis:

- Patient education leads to decreased hospitalizations, improved daily functioning, and increased patient satisfaction linked to: understanding of and adherence to medication, knowledge of treatment plan for deteriorating condition or emergency situation, active comanagement and use of written action plan.
- Overall good prognosis when the above are achieved. However, the death rate from asthma is increasing worldwide, especially in urban minorities.

References:

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Backer, EL. Asthma Chapter In: Taylor's Manual of Family Medicine. 3rd Edition. 2008. Lippincott Williams and Wilkins. Philadelphia.

Up to Date Chapters on: "Treatment of moderate persistent asthma in adolescents and adults" "Treatment of severe asthma in adolescents and adults", "Treatment of acute exacerbations of asthma in adults".
www.uptodate.com. Accessed April 12, 2012.