Drugs for Asthma and Other Pulmonary Disorders

Demographics

• Asthma: A Chronic Pulmonary Disease
  – 24.8 Million cases in U.S. (17.7 Million (non-institutionalized) adults, 7.1 Million children).
  – 1.5 Million ER visits/yr, 1/3rd admitted to Hospital
  – 5,500 deaths/yr
  Dramatic increase in incidence since 1980’s among all ages, genders, and ethnic groups, esp. African Americans.

Common Causes

• Air Pollution
• Allergens
• Chemicals and foods
• Respiratory infections
• stress
Asthma

3 Components:

• Inflammation or swelling of the Bronchiole
• Bronchospasm &/or constriction of the bronchiole smooth muscle
• Excessive mucus secretion (histamine release due to inflammatory response)

As Evidenced By:

• intense breathlessness
• Coughing
• Gasping for air
• Nocturnal awakenings
• Exercise Intolerance
• Status asmaticus: severe prolonged form of asthma unresponsive to drug treatment which can lead to respiratory failure

Treatment Goals for Asthma

Pharmacological Management:

• Terminate Acute Bronchospasm in progress
• Decrease frequency of attacks
• Minimize severity of attacks

Katzung, B., 2007
Drugs via Inhalation

• Physiology:
  – Administration of drugs via the Respiratory System provides a direct method of delivery for inhaled medications. The large surface area of the alveoli and bronchioles and extensive pulmonary capillary bed with its rich blood supply supports a localized, rapid onset of drug action. This local response avoids a systemic reaction and therefore systemic side effects.

Case study

Tommy is a 12 y.o. 7th grade student at a local junior high school. He was diagnosed with Asthma last year. His mother, Mrs. P. has enrolled him in the Asthma Program which is administered by their school nurse Jane. Tommy uses Salmeterol (Seravent) metered dose inhaler (MDI) 2 puffs 2 X daily which he keeps at home. Nurse Jane keeps his pirbuterol (Maxair) inhaler for acute episodes of asthma while at school.

Different Asthma Drug Groups

1st Drug Group: **Bronchodilators**
Bronchodilators relax bronchial smooth muscle, thus widening the airway and making breathing easier for the client.

A) Beta-Agonists/Sympathomimetics
B) Methylxanthines
C) Anticholinergics
A) Beta 2-adrenergic Agonists

- Sympathomimetic = Bronchodilator = relaxes smooth muscles thereby dilating the airways, less cardiac side effects than Beta 1 agonists
- Drugs of Choice for Acute Bronchoconstriction (sudden and/or severe asthma attack)
- No anti-inflammatory action

Beta-adrenergic Agonists

pirbuterol (Maxair) Metered Dose Inhaler (MDI) 2 puffs QID (max. 12 puffs/day).
{Rescue Inhaler: Onset 5 min.
Shorter acting @ 2-6 hrs
}
albuterol (Proventil, Ventolin, VoSpire): 
{Metered Dose Inhaler (MDI)
2 puffs 3-4 X daily as needed
{Rescue Inhaler: Onset of action: 5-15 min.
Intermediate acting @ 8 hrs

More Beta-adrenergic Agonists:

Levalbuterol (Xopenex): MDI 2 puffs Q4-6 H,
Nebulizer 0.63mg tid-qid
Onset: 5-15 min, duration 3-6 hrs
Salmeterol (Seravent): Dry Powder Inhaler
(DPI) 2 aerosol inhalations 2 X daily or 1 inhalation of powder diskus BID. Helps prevent exercise-induced bronchospasm.
Onset of action: 10-25 min., peak 3-4 hrs.
Duration @ 12 hrs (9 hrs in adolescents).
Adverse Effects

- Common: H/A, Dizziness, tremor, nervousness, throat irritation, drug tolerance

- Serious: Tachycardia, dysrhythmias, hypokalemia, hyperglycemia

B) Methylxanthines

Chemically related to caffeine, narrow margin of drug level safety (5-20mcg/mL), many drug interactions; Available as PO/IV, no inhalation.

**Indications:** Long term/chronic use when Beta-adrenergics and Corticosteroids are no longer effective

**Theophylline** (Theo-Dur, Theobid, etc.) 5mg/kg PO loading dose, then 3mg/kg 3 to 4 X daily

Adverse Effects

Common:
- Nervousness, tremors, dizziness, H/A, anorexia, n/v

Serious:
- Tachycardia, dysrhythmias, hypotension, seizures, circulatory failure, respiratory arrest
C) Anticholinergics

• Blocks Parasympathetic Nervous System Response, results in bronchodilation similar to beta 2 agonists

  Ipratropium bromide (Atrovent, Combivent)
  MDI, 2 puffs 4 X daily (max: 12 puffs daily)

  Note: Combivent (albuterol & ipratropium) has a stronger and longer effect then either beta 2 or anticholinergic alone.

Tommy

• Occasionally, Tommy requires his Maxair inhaler when he plays hard at school, becoming SOB. Over the last 3 weeks Nurse Jane notes he has had an increasing need of the MDI. In addition, his weekly peak-flow meter evaluations have demonstrated a slow but steady reduction in lung capacity.

Tommy Cont’ed

• Upon assessment today, Jane notes that Tommy has moderately harsh inspiratory wheezing in the upper airways both anterior and posterior, with a mildly labored respiratory rate (RR) of 26 while at rest. She calls Mrs. P. with this information and recommends Tommy be seen by his Pulmonologist, Dr. A., who consequently put Tommy on a tapering dose of oral Prednisone.
Quality and Safety Education for Nurses

- QSEN Competency
- Evidence-based Practice (EBP):
  Integrate best current evidence with clinical expertise and patient/family preferences and values for delivery of optimal health care.

Nurse Jane

- Knowledge: Understands and can explain the role of evidence in determining best clinical practice.
- Skills: Bases individualized care plan on patient values, clinical expertise and evidence.
- Attitude: Value the concept of EBP as integral to determine best clinical practice and appreciates the importance of regularly reading relevant professional journals.

2nd Drug Group

Anti-Inflammatory Drugs

Inhaled and Oral Glucocorticoids

Mast Cell Stabilizers

Leukotriene Modifiers
Anti-Inflammatory Drugs

- **Glucocorticoids**: potent natural anti-inflammatory
  - Decrease activity of inflammatory response
  - Increases production of anti-inflammatory mediators = decreased edema and mucus production = lessens airway obstruction
  Also: sensitizes bronchial smooth muscle response to beta agonist & lessens sensitivity to allergens.
  Caution: avoid glucocorticoids if active infection present

Oral & Inhaled Glucocorticoids

“Prednisone Taper”

Tommy received 4 days of Prednisone, beginning with 10 mg PO BID X 1 day, 5 mg PO BID X 1 day, 5 mg PO daily X 1, and 2 mg PO daily X 1, then d/c. Following this, he began Beclomethasone MDI 1 puff BID.

Oral Glucocorticoids

**Prednisone** (prototype drug), a synthetic glucocorticoid. Few serious adverse effects when used for short term therapy. Long term treatment can result in growth retardation in children, Cushing's syndrome (adrenal gland atrophy, hyperglycemia, fat redistribution to shoulders and face, muscle weakness, thin skin, bruising, gastric ulceration, and bones that easily fracture).
Inhaled Glucocorticoids

- **Beclomethasone** (Beclovent, Vanceril, etc.)
- MDI: 1-2 inhalations 3-4 X daily (max: 20 daily)

**Adverse Effects:**
- Common: Hoarseness, dry mouth, cough, sore throat
- Serious: Oropharyngeal candidiasis, hypercorticism, hypersensitivity reactions, angioedema

Nursing Process

**Nursing Diagnosis:**
- Gas Exchange-Impaired, related to bronchial constriction
- Activity Intolerance, related to ineffective drug therapy

**Planning:**
- Exhibit adequate oxygenation as evidenced by improved lung sounds, pulmonary function values and exercise tolerance
- Reported reduction in subjective symptoms of respiratory deficiency
Nursing Process

• Implementation:
  – Monitor VSS, pulmonary function tests, clients use of inhaler and compliance.
  – Instruct client/family in: use of medications even if feeling well, report SOB/wheezing/anxiety.
  – Teach: relaxation/breath control techniques, proper technique of MDI use, rinse the mouth with water after MDI use to decrease side effects, ongoing compliance and follow up.

Nursing Process

• Implementation cont’ed:
  – Maintain clean environment, adequate nutrition & hydration
  – Provide emotional and psychological support during periods of shortness of breath (SOB)

Nursing Process

• Evaluation:
  – Tommy’s breath sounds and pulmonary function values demonstrate adequate oxygenation
  – He reports a decrease in respiratory deficiency symptoms
  – He understands that he must continue with his medications even when feeling well because they decrease inflammation and help prevent future asthma attacks
Tommy

- Tommy is tolerating his new inhaler and now is able to fully participate at play and in sports at his school. Nurse Jane reports to his Mom and the pulmonologist that peak-flow meter measurements are back to normal range and he is rarely requiring his albuterol MDI.

Neuman System Model

- Was Tommy’s Flexible Line of Defense responsive and successful in dealing with the asthma stressor or was it penetrated?
- Normal Line of Defense?
- Lines of Resistance? Degree of Reaction?

Other Types of Anti-Inflammatory Drugs: Mast Cell Stabilizers

- Inhibit Histamine release from Mast Cells
- **Cromolyn (Intal)** MDI, 1 puff 4 X daily

**Adverse Effects**

- Common: Nausea, sneezing, nasal stinging, throat irritation, unpleasant taste
- Serious: Anaphylaxis, angioedema, bronchospasm
Leukotriene Modifiers

- Reduces inflammation, edema, and eases broncho-constriction indirectly by inhibiting leukotriene synthesis by the mast, neutrophil, basophil and eosinophil cells.

1) Montelukast (Singulair):
   10 mg PO daily at HS. Approved for children as young as 6 years old.
   **Adverse Reactions**
   - Common: H/A, Nausea, Diarrhea
   - Serious: None

2) Zileuton (Zyflo): 600 mg PO 4 X daily
   **Adverse Effects**
   - Common: H/A, Nausea, Diarrhea
   - Serious: Occasional liver toxicity
     - Katzung, B.

Chronic Obstructive Pulmonary Disease

C.O.P.D.

- Asthma, Chronic Bronchitis, and Emphysema
- Cough-mucus production-impaired gas exchange
- No Cure-only symptomatic relief
- 85-95% of non-asthmatic COPD due to smoking
- A progressive disease
Goals of Treatment

• Relieve symptoms
• Avoid complications: treat infections, control cough, relieve bronchospasm
  – Treat with short & long acting bronchodilators, beta2 agonists, or glucocorticoids, mucolytics, expectorants, long term O2, antibiotics, Omega 3’s
  – Avoid drugs causing broncho-constriction or respiratory depression
  – stop smoking

References

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