Asthma Management 2 CEUs
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INTRODUCTION

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A two-hour course, covering the pathophysiology, mechanism, epidemiology, and treatment options for asthma and bronchospasm.

Objectives

By the end of this lecture, the participant should be able to...

1. Explain basic pathophysiology of asthma
2. List appropriate assessment techniques for the asthmatic patient
3. Describe the specific diagnostic guidelines for asthma
4. List effective methods of treating asthma
5. Describe the risks and benefits of the current and newer pharmacologic agents

Epidemiology

- Between 10 and 13 million, or 1 in 25 people in the United States have asthma.
- It has been well documented that morbidity and mortality from asthma has been increasing worldwide.
- It is estimated that over 5,000 people die each year from asthma.
- Prevalence of asthma is highest in African Americans and the pediatric population.

References:

1. Brown-Heitschmidt, M. G., & Cassidy, J. B. (1997). Heliox: A new treatment for life-threatening asthma. Pediatric Nursing, 23(5), 479-482.
2. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.
3. National Institute of Health. (1997). Expert panel report II: Guidelines for the diagnosis and management of asthma (NIH Publication No. 97-4051). Bethesda, MD: Author.
4. Kavuru, M. S., & Wiedemann, H. P. (1998). Diagnosis and management of asthma. Caddo, OK: Professional Communication, Inc.

Pathophysiology

- Asthma is considered to be a chronic disease characterized by varying levels of airflow obstruction.
- This obstruction is believed to be caused by inflammation and bronchial hypersensitivity.

- The airflow obstruction can be either chronic or reversible.
- Since inflammation is the major component in the pathophysiology of asthma, practitioners have changed the way they treat asthma.
- Multiple cellular mediators and inflammatory cells are involved in the changes that produce the different symptoms of asthma.
- The reaction is a cascade that involves mast cells and macrophages, which in turn release other chemical mediators.
- Histamines, prostaglandins and leukotrienes are released in the reaction.
- As a result, these changes lead to:
    - Acute and chronic bronchial obstruction.
    - Hyperresponsiveness to outside stimuli.
- The current treatment of asthma reflects a better understanding of the mechanisms of inflammation and hypersensitivity, which plays the major role in this diagnosis.

References:
1. Busse, W. W. (1998). Inflammation in asthma: The cornerstone of the disease and target of therapy. Journal of Allergy and Clinical Immunology, 102(4), 17-22.
2. Cotran, R. S., Kumar, V., Robbins, S. L., & Schoen, F. J. (1994). Robbins pathologic basis of disease (5th ed.). Philadelphia: W. B. Saunders Company.
3. Graber, M. A., Toth, P. P., & Herting, R. L., Jr. (1997). University of Iowa family practice handbook (3rd ed.). St. Louis, MO: Mosby-Yearbook, Inc.
4. National Institute of Health. (1997). Expert panel report II: Guidelines for the diagnosis and management of asthma (NIH Publication No. 97-4051). Bethesda, MD: Author.

Assessment and Diagnosis

- The assessment and diagnosis of asthma can be a difficult one.

History

- The first step is to obtain a thorough history identifying:
    - The onset of the current symptoms
    - Precipitating factors (ie. upper respiratory tract infection, allergies, exposure to irritants, drugs or foods)
    - Inquire about past treatments (ie. recent hospitalizations, prior intubations, steroid use)
    - All the historical findings are important because of the asthmatic patient's need for a rapid assessment.
- The information gained during the history can give the clinician an idea of how the patient will fare.
- For the severe asthmatic, time is a critical issue and treatment should not be delayed.

References:
1. National Institute of Health. (1997). Expert panel report II: Guidelines for the diagnosis and management of asthma (NIH Publication No. 97-4051). Bethesda, MD: Author.

Physical Exam

- The clinician should focus the physical exam on the respiratory tract, chest and skin.
- When the thorax becomes hyper expanded, the patient may be hunched forward or sitting up with the use of accessory muscles.
- Accessory muscles that are not used during normal ventilation can include the scalene, sternocleidomastoid, trapezius and pectoralis muscles.
- Breath sounds are important in the examination of the asthmatic patient, but they do not diagnose asthma.
- Patients may or may not be wheezing during an acute exacerbation of asthma.
- A patient that is having a severe attack may be so constricted that breath sounds may be minimally heard on exam.
- As the patient is being treated with appropriate medications, breath sounds may begin to be heard.
- Wheezes are usually heard during the expiratory phase, which may be prolonged.
- Wheezes heard on exam do NOT always indicate asthma, therefore the exam should continue with investigation of associated conditions such as rhinitis and sinusitis.

References:

1. National Institute of Health. (1997). Expert panel report II: Guidelines for the diagnosis and management of asthma (NIH Publication No. 97-4051). Bethesda, MD: Author.
2. Graber, M. A., Toth, P. P., & Herting, R. L., Jr. (1997). University of Iowa family practice handbook (3rd ed.). St. Louis, MO: Mosby-Yearbook, Inc.
3. Shapiro, B. A., Kacmarek, R. M., Cane, R. D., Peruzzi, W. T., & Hauptman, D. (1991). Clinical application of respiratory care (4th ed.). St. Louis, MO: Mosby-Yearbook, Inc.

Tests

- Asthma, as stated earlier, is an obstructive lung disease, but is different from those such as emphysema and chronic bronchitis.
- In the case of asthma, the diffusing capacity is normal and the obstruction may be partially to completely reversible.
- Pulmonary function tests should be done in the evaluation of asthma.
- A Forced Expiratory Volume in a second (FEV1) is the amount of air exhaled in the first second of a forced vital capacity (FVC).
- A FVC is when a patient inhales maximally and exhales all the air out of their lungs in one forceful contraction.
- A patient with obstruction will have a decrease in the FVC1 to FVC ratio.
- When testing the patient, the clinician will do pulmonary function tests both before and after bronchodilator therapy.
- On post treatment, there is usually an increase in the FEV1, which will also increase the ratio of FEV1 to FVC.
- This demonstrates some reversibility of the disease.
- There are more advanced pulmonary function tests beyond the scope of this guide.

- Chest x-rays are not routinely done unless otherwise indicated due to fever or suspect consolidation on physical exam.
- In most cases of an acute asthma attack, the chest x-ray results will minimally change your treatment approach.
- A common finding with chest x-rays would include hyperinflation with mucous plugging resulting in atelectasis.
- Other tests such as complete blood counts and arterial blood gases should be used when indicated.
- With the asthmatic patient, the arterial blood gas measurements have done little to change a clinician's treatment.
- The need for arterial blood gases with the use of pulse oximetry has diminished
- Most patients with asthma will have a typical blood gas of a pH of 7.45 with a PCO2 of 30 or less and a PaO2 of 80 to 100mmHg.
- Most asthmatic patients are able to maintain their ventilation and are not hypoxic. You may have a patient with a severe asthma exacerbation who has a normal O2 saturation! Always rely first on your clinical assessment.
- It is important to decide if additional testing will have a positive impact on the patient or cause a change in the course of therapy.

References:
1. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.

Treatment

- The treatment of asthma begins with the avoidance of possible triggers that may cause an acute episode.
- Also take into consideration that a patient may have an underlying medical condition that may exacerbate their asthma.
- It is crucial to treat all underlying causes that may be implicated.
- Treatment methods for asthma have adjusted as the focus has turned to treating inflammation.

References:
1. Graber, M. A., Toth, P. P., & Herting, R. L., Jr. (1997). University of Iowa family practice handbook (3rd ed.). St. Louis, MO: Mosby-Yearbook, Inc.

Beta Agonists

- Beta agonists such as Albuterol have been part of the mainstay of treatment over the years.
- They are ideal in treating acute bronchospasm because of their rapid onset with short half-life.
- Beta agonists can be given as a meter dose inhaler or nebulized treatment.
- The beta agonist is being more frequently used as a rescue inhaler versus maintenance medication.

- The concern of cardiac toxicity is not as likely as once thought. It was thought that the tachycardia associated with their use could be damaging to the myocardium. However, not treating asthma and its hypoxia aggressively is usually more dangerous than the mild beta agonist-induced tachycardia.
- It is still important to monitor cardiac function when administering repeated doses of a beta agonist.

References:
1. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.

Anti-inflammatory

- Anti-inflammatory medications are being used more and more in the prevention and long-term management of asthma.
- Two main classes of medication are
  - Corticosteroids
  - Mast cell stabilizers
- Glucocorticosteroids are considered to have the greatest effect of reducing inflammation.
- Steroids work on decreasing:
  - Mucous production
  - Vascular leakage
  - Reducing inflammatory cells
- When long-term steroids are used, side effects are high.
- Possible long-term effects include adrenal suppression, osteoporosis, hyperglycemia, hypertension, cataracts, impaired immune response, and weight gain.
- Fortunately, there has been an increased success with inhaled steroids, which have less side affects than the oral dose steroids.
- Some common inhaled steroids used are:
  - Beclomethasone (Vanceril, Beclovent)
  - Budesonide (Pulmicort)
  - Flunisolide (AeroBid)
  - Fluticasone (Flovent)
  - Triamcinolone acetonide (Azmacort)
- Inhaled steroids are not systemically absorbed and therefore have far fewer side effects.
- A common side effect for inhaled steroids may include oral candidiasis.
- Patients can decrease the incidence of oral candidiasis by always rinsing their mouth after administration of the medication.

References:
1. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.

Mast Cell Stabilizers

- Mast cell stabilizers are believed to work by decreasing the mediators released from the mast cells.
- The use of mast cell stabilizers has evolved in the treatment of chronic asthma with some use in allergic asthma.
- The drugs in this category works to decrease the airway's hyperreactivity.
- The two common medications in this group are:
  - Cromolyn sodium (Intal)
  - Nedocromil sodium (Tilade)
- Although structurally different, they both work at the same site to decrease inflammation.
- Possible side effects are minimal. They include bad taste, cough, and pharyngitis.
- Many feel it takes days to see a therapeutic response from mast cell stabilizers, though a role has been discovered for their use as a prophylactic treatment for allergies.
- Using mast cell stabilizers as a prophylaxis showed a therapeutic response within 5 to 10 minutes after the initial dose.
- Mast cell stabilizers are currently under prescribed.
- This is probably due to the lack of understanding of the role they play in the management of asthma.
- This is unfortunate because many people could benefit from them.

References:

1. Graber, M. A., Toth, P. P., & Herting, R. L., Jr. (1997). University of Iowa family practice handbook (3rd ed.). St. Louis, MO: Mosby-Yearbook, Inc.
2. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.

Anticholinergic Agents

- The use of anticholinergic agents such as ipratropium bromide has not been used in the long-term treatment of asthma.
- It has, however, emerged as the front-runner in the treatment of emphysema and chronic bronchitis.
- Many institutions are finding it common to mix ipratropium bromide with albuterol and give the combined medications to the patient via the nebulizer.
- It is believed that these two medications cause an increase in bronchodilation.
- At the present time, there is a meter dose inhaler on the market by the name of Combivent, which is ipratropium bromide and albuterol premixed.
- Its role is still not well understood for the use with the asthmatic patient.

References:

1. Graber, M. A., Toth, P. P., & Herting, R. L., Jr. (1997). University of Iowa family practice handbook (3rd ed.). St. Louis, MO: Mosby-Yearbook, Inc.

Theophylline

- Theophylline has decreased over the years for the treatment of asthma.
- It is considered a third line therapy, which can be a potent bronchodilator and increase respiratory muscle contractility.
- Although its use has decreased, it can still be seen in the treatment of both the adult and pediatric population.
- Theophylline needs to be closely monitored because of its narrow therapeutic range (10 to 20 ug/ml).
- There are a number of possible drug interactions that can occur; therefore, a thorough and current medical history must be taken to decrease this risk.

References:

1. Graber, M. A., Toth, P. P., & Herting, R. L., Jr. (1997). University of Iowa family practice handbook (3rd ed.). St. Louis, MO: Mosby-Yearbook, Inc.
2. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.

Leukotriene Antagonist

- A new class of drug therapy in the treatment of asthma.
- Although there are no precise guidelines in asthma management due to the lack of published material on long-term clinical efficacy, the leukotriene antagonists seem to be effective over a wide range of asthma disease severity.
- The cysteinyl leukotriene mediators are part of the inflammatory and bronchial constriction that occurs during asthma.
- With the use of the leukotriene antagonist, practitioners are able to block the cysteinyl leukotriene response; therefore, a more localized effect takes place in reducing inflammation and increasing bronchodilation versus the broad effects of glucocorticoids.
- As of now, the use of leukotriene antagonist has remained low due to limited clinical testing.

References:

1. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.

Heliox

- The idea of helium and oxygen as a gas mixture has been known for sometime.
- It has been used in the treatment of upper airway obstruction and in diagnostic studies.
- Helium decreases turbulent flow of the gas.
- Turbulent flow is related to the density of a gas.
- Helium is less dense than oxygen and nitrogen, hence giving a less turbulent flow.
- In a patient presenting with acute severe asthma with respiratory acidosis and a short duration of symptoms, heliox can rapidly improve ventilation.

- Heliox is primarily used in the emergency departments for acute asthma attacks. No other conventional treatment should be withheld while using heliox.
- Heliox will not prevent all intubations but will improve ventilation and decrease the work of breathing for the patient.

References:

1. Kass, J. E., & Castriotta, R. J. (1995). Heliox therapy in acute severe asthma. Chest, 107(3), 757-760.
2. Kudukis, T. M., Manthous, C. A., Schmidt, G. A., Hall, J. B., & Wylam, M. E. (1997). Inhaled helium-oxygen revisited: Effect of inhaled helium-oxygen during the treatment of status asthmaticus in children. Journal of Pediatrics, 130(2), 217-224.

Management

- Asthma can be divided into three categories mild, moderate, and severe.
- Each level requires a certain amount of intervention to properly control the patient's symptoms.
- In all stages, early intervention is crucial for maintaining and treating this disease.
- Although the following criteria may not be achieved in every patient, it provides reasonable goals for treatment:
    - Minimize or eliminate chronic symptoms including nocturnal symptoms
    - Reduce frequency of exacerbations, including the need for emergency department visits and hospitalizations
    - Minimize the need for acute rescue therapy such as inhaled beta2 agonist
    - Established a normal lifestyle with no limitations on activities including exercise
    - Normalize pulmonary functions
    - Minimize or eliminate adverse effects from medications
- A patient who is considered to have mild asthma can progress to severe asthma if not educated and treated properly.
- With this type of patient, the symptoms are episodic and well controlled with a Beta2 agonist meter dose inhaler as needed.
- Patients are encouraged to avoid known triggers and monitor their peak expiratory flow rates (PEFR) weekly.
- If the patient notices a decline in their PEFR, with an increase in symptoms, they should notify their health care provider.
- They can be managed by their primary care provider and should be seen in the office on an as needed basis.
- If the symptoms begin to increase, an anti-inflammatory or mast cell stabilizer agent should be added along with the beta2 agonist.
- In moderate cases of asthma, primary medication used to control symptoms should be an inhaled corticosteroid or mast cell stabilizer.
- Beta2 agonist should be used as needed.
- Other underlying contributory factors should be treated.
- Patients should closely monitor their PEFR daily and record results.
- These patients should have a pulmonologist involved in their care when needed.

- Management of these patients can be done with good communication between patient and medical staff as well as patient education.
- Those with severe asthma are in a constant state of fluctuation.
- Symptoms are not controlled and their health may deteriorate at any time.
- Pulmonologist should be the patient's primary caregiver and guide their treatment.
- Medications usually consist of beta2 agonist, inhaled corticosteroids, oral steroids and theophylline.
- Patients usually have a history of multiple hospital admissions and emergency department visits.
- Close follow up and patient education can decrease hospital visits.
- With these patients, families must be educated to understand the warning signs and risks for the patient with asthma.

References:
1. Lemanske, R. F. & Busse, W. W. (1997). Primer on allergic and immunologic disease - fourth edition. Journal of the American Medical Association, 278, 1855-1873.
2. Graber, M. A., Toth, P. P., & Herting, R. L., Jr. (1997). University of Iowa family practice handbook (3rd ed.). St. Louis, MO: Mosby-Yearbook, Inc.

The Case

- You respond to call for a 22-year-old female in respiratory distress. The dispatcher has sent both an ACLS and basic unit to the scene. On arrival you find the patient leaning forward in a chair. Her parents state she has a long history of asthma but have never seen her like this before. The patient is unable to communicate with you.

PMH
- Asthma
- Multiple pneumonias

PSH
- None

Social History
- Smokes 1 PPD

Medications
- Albuterol 2 puffs every 4 hours
- Beclovent 2 puffs QID

- Family states they noticed she began to have increasing trouble over the weekend. The mother believes that the patient's boyfriend has a new dog. Her last dose of albuterol was 2 minutes ago without any relief.

Patients Vital Signs
- Blood Pressure: 140/90
- Pulse: 140
- RR: 28-36
- SaO2: 90% on room air

- Lungs: BS diminished throughout with minimal air movement

- Just looking at the patient you can tell she is in moderate to severe distress. You apply supplemental O2 and transfer her to your stretcher. The patient is put on the monitor and the paramedic gives an albuterol treatment. You attempt to calm the patient encouraging her to take slow deep breaths.

- On re-evaluation, you notice a improvement of her breath sounds from distant to inspiratory expiratory wheezes throughout.

- In route to the hospital, the patient begins to be able to communicate with you. She states her asthma had been getting worse over the past week. She also reports that she currently has a cold with increasing postnasal congestion. The paramedic decides to repeat the breathing treatment times three and not give any SQ epi at this time.

On re-evaluation

- BP: 130/86
- HR: 120
- RR: 24-26
- Sa02: 98% on the breathing treatment
- Lungs: BS coarse wheezes through out with increased aeration

You arrive at the ER and transfer the patient to a stretcher. The ER staff commends you on a job well done.

Question Answer

Question
What are some of the possible reason for this patients worsening asthma?

Answer

1. Smoking history
2. Recent upper respiratory tract infection
3. Possible exposure to known allergen (the dog)

Question
Is the patient's respiratory status improving or worsening?

Answer
Respiratory status is improving. She is now moving air but still has a way to go!

Question
Why did the patient respond to the medication given by the paramedic?

Answer

She had only taken her MDI inhaler in the past and the penetration of the medication in person who is in respiratory distress can be limited. Also we must factor in that oxygen in considered a natural bronchodilator.

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