

Research Article

Asthma Emergency

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Abstract

Asthma is a chronic obstructive disease that causes breathing problems. Asthma is characterized by a variety of recurrent symptoms, reversible obstruction of the respiratory tract and bronchospasm. During seizures, there is cramping of the muscles in the lungs, the respiratory tract is narrowed and breathing is difficult. It is characterized by an inappropriately strong immune response and chronic inflammation of the tracheobronchial tree.

Keywords: Asthma; Lungs; Breathing; Pathophysiology

Introduction

An emergency is commonly defined as any condition perceived by the prudent layperson or someone on his or her behalf as requiring immediate medical or surgical evaluation and treatment [1]. On the basis of this definition, the American College of Emergency Physicians states that the practice of emergency medicine has the primary mission of evaluating, managing, and providing treatment to these patients with unexpected injury and illness.

So what does an Emergency Physician (EP) do? He or she routinely provides care and makes medical treatment decisions based on real-time evaluation of a patient's history; physical findings; and many diagnostic studies, including multiple imaging modalities, laboratory tests, and electrocardiograms. The EP needs an amalgam of skills to treat a wide variety of injuries and illnesses, ranging from the diagnosis of an upper respiratory infection or dermatologic condition to resuscitation and stabilization of the multiple trauma patients. Furthermore, these physicians must be able to practice emergency medicine on patients of all ages. It has been said that EPs are masters and mistresses of negotiation, creativity, and disposition. Clinical emergency medicine may be practiced in Emergency Departments (EDs), both rural and urban; urgent care clinics; and other settings such as at mass gathering incidents, through Emergency Medical Services (EMS), and in hazardous material and bioterrorism situations.

In healthcare delivery, we attempt to meet the health and medical needs of the community by providing a place for individuals to seek preventative medicine, care for chronic medical conditions, emergency medical treatment, and rehabilitation from injury or illness [2]. While a healthcare institution serves the community, this responsibility occurs at the level of the individual. Each individual expects a thorough assessment and treatment if needed, regardless of the needs of others. This approach is different than that practiced

by emergency managers, whose goal is to assist the largest number of people with the limited resources that are available. As such, emergency management principles are focused on the needs of the population rather than the individual. When either planning for a disaster or operating in a disaster response mode, the hospital should be prepared at some point to change its focus from the individual to the community it serves and to begin weighing the needs of any individual patient versus the most good for the most patients with scarce resources. Moving from the notion of doing the most for each individual to doing the best for the many is a critical shift in thinking for healthcare institutions considering a program of comprehensive emergency management. While the initial planning for emergencies by hospitals is focused on maintaining operations and handling the care needs of actual or potential increased numbers of patients and/or different presentations of illness or injury than is traditionally seen, there is also the need to recognize that at some point during a disaster, act of terrorism, or public health emergency there may be an imbalance of need versus available resources. At this point the approach to delivering healthcare will need to switch from a focus on the individual to a focus on the population. This paradigm shift is one of the core unique aspects of hospital emergency management that allows the hospital to prepare to maximize resources in disasters and then to know when to switch to a pure disaster mode of utilizing its limited and often scant resources to help the most people with the greatest chance of survival.

The healthcare delivery system is vast and comprised of multiple entry points at primary care providers, clinics, urgent care centers, hospitals, rehabilitation facilities, and long-term care facilities. The point of entry for many individuals into the acute healthcare system is through the Emergency Department (ED). Since the late 1970s, the Emergency Medical Services (EMS) system has allowed victims of acute illness and injury to receive initial stabilization of life-threatening medical conditions on the way to the emergency department. Among the many strengths of the ED is the ability to integrate two major components of the healthcare system: Pre-hospital and definitive care. The emergency department maintains constant communications with the EMS system and serves as the direct point of entry for pre-hospital providers into the hospital or trauma center. Emergency physicians represent a critical link in this process by anticipating the resources that ill and injured patients will need upon arrival at the ED, and initiating appropriate life-saving medical care until specialty resources become available. In this context, the healthcare system is an emergency response entity.

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Materials and Methods

Patient conditions

In most emergencies there is no time to disclose the necessary information for an informed consent [3]. Here the providers simply act according to what they think will be in the best interests of the patient. These situations frequently happen in hospital emergency rooms and when emergency medical personnel arrive on the scene of an accident or sudden illness.

The emergency exception to informed consent is often quite obvious, but this is not always so. It does not apply, for example, when personnel taking care of somebody in an emergency happen to know what the patient wants. In such a situation they would not do what they think is best for the patient but what they know the patient wants.

It is important to note that the emergency exception that allows physicians to do what they think is best for the patient without obtaining informed consent from the patient or proxy has one major restriction; namely, they cannot do what they think is best if it is otherwise than what they know the patient or proxy wants. Sometimes, for example, emergency department personnel might know from previous admissions that a particular patient from a local nursing home desires only palliative care. If that patient arrives by ambulance at the same emergency department, it is hard to see how it would be morally reasonable for physicians to take aggressive measures to keep the patient alive when, even though there is no time to obtain consent for orders not to attempt resuscitation or not to intubate, they know he or she or a proxy has decided not to have aggressive life-sustaining measures performed.

Patients accessing emergency care services can present with complaints that are extremely diverse, and the way doctors, nurses and paramedics elicit information from patients predominantly focuses on obtaining biomedical details [4]. In some cases, this approach is warranted, as the urgent need to identify signs and symptoms of life-threatening illness or injury is paramount. Yet, 90% of patients accessing emergency services are not critically ill or injured but seek help and advice. In addition to seeking advice, patients may also be anxious, frightened, intoxicated, misusing drugs or have unhealthy lifestyles. They may have psychosocial reaction to physical disease or vice versa- physical illness such as irritable bowel syndrome, asthma, tension headache can be triggered by psychosocial factors. The effects and interpretation of illness will trigger a different response to the individual depending on their view and experiences. All these factors will have different needs and concerns and it is important to elicit these concerns within a consultation. However, it has been found that nurses working in emergency care disregard the potential for anxiety and the need for support and reassurance in patients who are not severely ill or injured. In addition, where communication skills of junior doctors working in emergency departments have been researched, they are found to use approaches considered to be more physician/illness orientated than patient-centered. By way of similarities of patient presentations in the pre-hospital setting, this could equally be assumed for paramedic practice.

Discussion

Asthma

Asthma is a chronic disease characterized by increased airway responsiveness to various stimuli [5]. This causes widespread narrowing of the lower airways that reverses either spontaneously or with treatment. Although the exact pathophysiology of asthma is

complex and poorly understood, inflammation is thought to play a central role. Pathologic changes that occur in asthma include smooth muscle hypertrophy, mucosal edema, and mucous plugging. Asthma affects 4% to 5% of adults and 10% of children. Onset usually occurs in children and young adults.

Asthma is characterized by airway inflammation with an abnormal accumulation of inflammatory mediators in response to various stimuli [6]. Acutely this accumulation leads to a reversible reduction of airway diameter caused by smooth muscle contraction, vascular congestion, bronchial wall edema, and thickened secretions. Chronic asthma can lead to airway remodeling, with sub epithelial collagen deposition and increased airway resistance that manifests as a progressive decline in Forced expiratory Volume in 1 second (FEV1) measurements. Once airway remodeling has occurred, the pathologic changes may become irreversible.

Pathologic findings in patients with chronic asthma include bronchial wall thickening due to inflammation and edema, bronchial narrowing or obstruction, and the presence of mucus plugs that at times may be large and thick. This airway narrowing leads to alveolar hyperinflation and, in a subset of patients, may lead to the formation of bullae, the potential for bullae rupture, and the development of pneumothoraces.

COPD is a triad of disease entities that includes the pathophysiology of asthma as well as incorporates the irreversible changes associated with both chronic bronchitis and emphysema. Chronic Obstructive Pulmonary Disease (COPD) is a disorder characterized by abnormal tests of expiratory flow demonstrating air flow obstruction that becomes fixed and does not change markedly over a period of months. It is a multifocal pathology encompassing the triad of emphysema, chronic bronchitis, and asthma. The increasing prevalence and the large burden these disease entities impose on emergency medical care make the diagnosis and management of acute exacerbations vital to any health care provider.

Approach

The Emergency Department (ED) is a challenging environment for patients, families, and medical personnel [7]. Many challenges result from our practice's principles: available at any time for any patient with any complaint. Patients who come to the ED are not familiar with us personally, yet must feel confident about our abilities to help them during their time of greatest concern. Their needs may be as straightforward as an excuse note for work or a prescription refill in the middle of the night, or as complex as an acute illness or injury, an exacerbation of a chronic condition, or a cry for help if depressed or suicidal. Even providing reassurance about a child's fever to a concerned parent is a critical function of Emergency Physicians (EPs).

Qualities successful EPs exhibit include intelligence, sensitivity, humility, insight, proficiency making decisions with and acting on limited information, and the ability to multi-task. Being skillful negotiators, working well with individuals having different backgrounds and ethnicities, and advocating strongly for patients at all times are essential qualities. In addition to these traits, EPs must be experts in trauma and medical resuscitation of adults and children, and in sharing news with patients and family members about the outcomes of these events.

The majority of patients use the ED infrequently. Many may be experiencing this setting for the first time. Patients' lack of familiarity

with this environment, fear, stress, waiting times, painful procedures, and overall discomfort often preclude them from having a positive experience. These are only some of the issues that patients contend with in the ED.

EPs confront numerous challenges when taking care of patients presenting to the ED. Perhaps the greatest challenge is the spectrum of diseases which EPs must be able to identify. Rather than having to know only the first 15 minutes of an illness, EPs must be familiar with all stages of all illnesses, often presenting in atypical fashion. In addition, time pressures inherent to providing emergency care, the lack of existing relationships with patients, unfamiliarity with their medical history, and the inability to review patients' medical records challenge EPs daily. EPs must rapidly and simultaneously evaluate, diagnose and treat multiple patients with multiple conditions, often with limited information, without confusing subtle nuances between patients. They must be insightful, anticipatory, and prepared to act and react to prevent morbidity and, when possible, mortality. Considering worse case scenarios is fundamental to EM practice. Most importantly, EPs must be comfortable providing detailed, often devastating information in a concise yet understandable manner to patients and family members who may have different cultural backgrounds.

It is indeed a privilege to be in a position to offer care to patients during what is likely to be their time of greatest need. Approaching patients sensitively, recognizing their apprehension, pain, concerns, and perhaps shame is critical to our mission. This is true no matter how trivial a patient's problem may seem. Often, patients consult with EPs to seek approval about their desire to leave a spouse, to get an opinion regarding a physician's recommendation for surgery, or to receive confirmation that they are making the right decision about a parent, child, or loved one. Serving in this capacity, without judgment, is not only appropriate but also essential.

Etiology

Asthma is commonly classified as allergic (extrinsic) or nonallergic (intrinsic) [5]. Allergic asthma is more common and is responsible for the majority of childhood asthma and a significant portion of adult disease. These patients are sensitive to specific inhaled allergens. Patients with allergic asthma frequently have a personal and family history of allergic diseases, including allergic rhinitis and atopic dermatitis. In contrast to patients with intrinsic asthma, those with allergic asthma have increased levels of immunoglobulin E (IgE). Inhalation of an allergen induces a response in two phases.

- a) The early response usually begins within minutes of exposure and lasts up to period of several hours. Caused by mast cell degranulation. Mediator release subsequently induces bronchoconstriction and an inflammatory reaction.
- b) The late response is characterized by airway inflammation that results in further bronchoconstriction and mucous production. Symptoms may persist for days to weeks after the initial exposure.

Nonallergic asthma is associated with numerous stimuli including exercise, emotion, air pollution, cigarette smoke, medications, and occupational exposures.

Diagnosis

Asthma is a chronic disease affecting over 16 million adults and 5 million children's in the United States alone, with nearly 20% requiring hospitalization annually [8]. Worldwide estimates place

the number of asthmatics at over 300 million. Efforts to improve outpatient care for this disease have been promoted through the development of treatment guidelines, but many patients remain either undertreated or undiagnosed. Visits for asthma exacerbations comprise approximately 1.5% of US Emergency Department (ED) visits and, while standard ED asthma management is straight forward (including bronchodilators, steroids, and occasionally adjunctive treatments including magnesium), a certain percentage of refractory asthmatics will require hospitalization and monitoring. Since this decision is often the crux of the ED evaluation of a patient with asthma, a number of studies have sought to classify asthma severity and predict which patients will require hospitalization and which, if discharged, will relapse.

A definitive diagnosis is made via Pulmonary Function Tests (PFTs) that demonstrate reversible airway obstruction [5]. PFTs are not practical for use in the Emergency Department (ED) where the diagnosis is made clinically. Patients generally complain of dyspnea and cough. Severity ranges from mild to life threatening. Note that dyspnea is likely unrelated to hypoxia and may not resolve with supplemental oxygen. The cough can be either dry or productive. Patients with "cough-variant asthma" present with a nonproductive cough that tends to be nocturnal. They may not have audible wheezing. These patients have ventilatory impairments demonstrable with PFTs and usually experience relief with bronchodilator therapy.

Patients often have tachypnea and tachycardia that should improve with appropriate treatment. Pulsus paradoxus is associated with acute asthma but is not a practical aspect of the ED evaluation. Common auscultatory findings include wheezing, decreased breath sounds, and prolongation of the expiratory phase. Absence of wheezing may be indicative of severe airway obstruction. Reexamination after bronchodilator therapy in such patients is often notable for increased wheezing. AMS, increased work of breathing, hypoxia, and hypercarbia indicate ARF and mandate immediate intervention.

The Emergency Physician (EP) must always search for a cause of acute exacerbation especially in those patients with severe symptoms. Allergen exposure is the most likely but respiratory infection, PTX, and Pulmonary Embolism (PE) are important and potentially fatal problems that must be identified. The EP should remember that "all that wheezes is not asthma." Other conditions to consider include COPD (Chronic Obstructive Pulmonary Disease), congestive heart failure, allergic reaction, airway obstruction, and pulmonary embolism. A directed history and physical examination, along with proper use of diagnostic testing, will help to differentiate these entities.

Management

Asthma is a condition characterized by airway obstruction due to bronchial smooth muscle constriction and inflammation that is at least partly reversible [9]. Any asthmatic is susceptible to suffering from an exacerbation ('asthma attack'), which may be caused by allergic triggers (e.g. pollen, mould), respiratory infection, medications (e.g. NSAIDs (Non-Steroidal Anti-Inflammatory Drugs) or β -blockers) or lack of compliance with treatment.

The severity of an asthma exacerbation is based upon objective parameters and should always be evaluated in any asthmatic presenting to the ED. A moderate asthma exacerbation describes asthmatics with increased symptoms and a peak expiratory flow rate (PEFR) of >50% than their best or predicted value. Acute severe asthma describes an individual with any of the following features:

- PEFR 33% to 50% best or predicted value
- Respiratory rate \geq 25/min
- Heart rate \geq 110/min
- Inability to complete sentences in one full breath.

Arguably the most important aspect of managing acute severe asthma is monitoring response to interventions. Regular measurements of PEFR and blood gases, together with clinical assessment (symptoms, degree of wheeze, ability to complete sentences, oxygen saturations), are required to ensure that patients who are not responding adequately are identified promptly. In situations where there is a poor response to initial therapy, there is limited evidence for adjunctive therapies such as intravenous magnesium or aminophylline, and these should only be used after consulting with senior physicians.

Asthma is fundamentally an airway pathology, and therefore, evidence of any of the above (or even where an asthmatic has not responded well to initial therapy but does not yet meet criteria for life-threatening disease) should prompt early and urgent referral to Intensive Care. Assisted ventilation may be required in up to 5% of patients with severe asthma; the majority of these individuals require intubation and mechanical ventilation, although Non-Invasive Positive Pressure Ventilation (NIV) has also been shown to have some beneficial impact. Even when patients are intubated or receiving NIV, it is important to continue nebulised bronchodilators and steroids as these are the disease-modifying therapies—the purpose of mechanical ventilation is to maintain adequate oxygenation and reduce work of breathing whilst waiting for these therapies to exert their effects. Despite these efforts, the prognosis for asthmatics admitted to the Intensive Care Unit is guarded, with an in-hospital mortality of 7% in those who are mechanically ventilated. It is therefore vital that clinicians managing asthma in the ED are wary of the potential for deterioration and have no hesitation in involving senior physicians and/or the Intensive Care team if initial therapy does not appear to be effective.

Intubation of an asthmatic in the ED is a dreaded complication of this illness, as asthmatics can deteriorate rapidly on the ventilator without close monitoring and active management [10]. The goal with a ventilated asthmatic is to prevent breath-stacking or auto-PEEP (Positive End-Expiratory Pressure), and the hemodynamic instability that can result.

Before discussing the ventilator management of asthma, clinicians should note that intubation of an asthmatic should trigger even more active management with medications, rather than less. Intubated asthmatic patients should continue to receive aggressive treatment with bronchodilators, steroids, magnesium, as well as deep sedation and possibly even neuromuscular blockade in the initial hours after intubation, in an effort to relax the chest wall musculature and gain control of the situation. Please note that neuromuscular blockade only works on skeletal muscle and therefore will not bronchodilate smooth muscle in the airways. In addition, it is very critical to be aware of the patient's intravascular volume status, as the excess positive pressure can lead to hemodynamic collapse. Moreover, the excess pressure, including the auto-PEEP, can result in barotrauma, such as the development of a pneumothorax very quickly in this patient population.

Responsibility of the physicians

The aim is to provide excellence in Emergency Department (ED)

care by cultivating the following desirable habits [11]:

- Listen to the patient.
- Exclude the differential diagnoses ('rule out') and refine the possible diagnosis ('rule in') when assessing any patient, starting with potentially the most life-or limb-threatening conditions, and never trivializing.
- Seek advice and avoid getting out of depth by asking for help.
- Treat all patients with dignity and compassion.
- Make sure the patient and relatives know at all times what is happening and why, and what any apparent waits are for.
- Maintain a collective sense of teamwork, by considering all ED colleagues as equals whether medical, nursing, allied health, administrative or support services.
- Consistently make exemplary ED medical records.
- Communicate whenever possible with the General Practitioner (GP).
- Know how to break bad news with empathy.
- Adopt effective risk management techniques.

The duty of care is a physician's obligation to provide treatment according to an accepted standard of care [12]. This obligation usually exists in the context of a physician– patient relationship but can extend beyond it in some circumstances. The physician–patient relationship clearly arises when a patient requests treatment and the physician agrees to provide it. However, creation of this relationship does not necessarily require mutual assent. An unconscious patient presenting to the ED is presumed to request care and the physician assessing such a patient is bound by a duty of care. The Emergency Medical Treatment and Active Labor Act (EMTALA) requires ED physicians to assess and stabilize patients coming to the ED before transferring or discharging them. Such an assessment presumably creates the requisite physician–patient relationship.

When caring for a patient, a physician is obligated to provide treatment with the knowledge, skill, and care ordinarily used by reasonably well-qualified physicians practicing in similar circumstances. In some jurisdictions, these similar circumstances include the peculiarities of the locality in which the physician practices. This locality rule was developed to protect the rural practitioner who was sometimes deemed to have less access to the amenities of urban practices or education centers. However, the locality rule is being replaced by a national standard of care in recognition of improved information exchange, ease of transportation, and the more widespread use of sophisticated equipment and technology.

Establishing the standard of care in a given case requires the testimony of medical experts in most circumstances, unless the breach alleged is sufficiently egregious to be self-evident to the lay jury member for example, amputating the wrong limb or leaving surgical implements in the operative field. A physician specializing in a given field will be held to the standard of other specialists in the same field, rather than to the standard of non specialists.

To be eligible to receive federal funds such as Medicare and Medicaid, hospitals with an emergency department must offer emergency and stabilizing treatment services to the public without bias or discrimination [13]. The Emergency Medical Treatment

and Active Labor Act is a comprehensive federal law that obligates hospitals offering emergency services to do so without consideration of a patient's ability to pay. It's important to note that this obligation does not apply to inpatients or non-emergent conditions. The absence of bias in the delivery of care should not be misunderstood to suggest all hospitals must provide all medical services, but rather the services they choose to offer must be delivered without bias to the individual patient.

A hospital and its entire staff owe a duty of care to patients admitted for treatment [14]. Following an emergency call, the ambulance service has a duty to respond and provide care. Accident & Emergency (A&E) departments have a duty of care to treat anyone who present themselves and are liable for negligence if they send them away untreated. Hospitals without an A&E facility will display signs stating the location of the nearest A&E department. This ensures that the hospital could not be held negligent if a patient presented and required emergency treatment as the hospital or its staff had never assumed a duty of care. Once a patient is handed over, a duty of care is created between the patient and the practitioner and this cannot be terminated unless the patient no longer requires the care or the carer is replaced by another equally qualified, competent person. It is therefore extremely important that practitioners are aware of their local policies, professional standards and their scope of practice to avoid becoming liable for litigation by putting a patient at risk, delivering ineffective care or breaching their duty of care.

Conclusion

Asthma is a chronic respiratory disease characterized by hypersensitivity to various external and internal factors. External factors are most commonly associated with allergic reactions induced by allergens, and internal with inflammatory response of immune cells and the substances they excreted. The most common internal asthma triggers are viral infections, cold air, polluted air, body fatigue, acetylsalicylic acid and other nonsteroidal anti-inflammatory drugs, emotional stress, smoke cigarettes. In both cases, is coming to muscle contractions in the bronchial walls, the bronchial mucosa swelling, and increased mucus production in secretion cells of the bronchial mucosa, resulting in increased resistance to air flow through narrowed bronchi. It occurs shortness of breath, irritable cough, wheezing and chest tightness. This state is important to recognize in time and begin with treatment immediately.

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