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Asthma Emergency in Children

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Abstract

Symptoms or signs that may indicate that a child has asthma are onset of dry cough with a feeling of shortness of breath, sometimes with audible phenomena such as wheezing or whistling. Symptoms occur especially at night and early in the morning in response to a variety of specific and non-specific stimulus factors from which we can isolate inhalation and nutritional allergens, viral infections, physical activity, tobacco smoke, air pollution and weather conditions.

Keywords: Asthma; Child; Physician; Symptoms

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 patient. 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: prehospital and definitive care. The emergency department maintains constant communications with the EMS system and serves as the direct point of entry for prehospital 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.

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-centred. By way of similarities of patient presentations in the pre-hospital setting, this could equally be assumed for paramedic practice.

Asthma in children

Asthma is an intermittent, reversible obstructive airway disease [5]. The major mechanisms thought to contribute to the pathophysiology of asthma are increased airway responsiveness, inflammation, mucus production, and submucosal edema. Airway responsiveness is defined as the ease with which airways narrow in response to various nonallergic stimuli. These stimuli include inhaled pharmacologic agents, such as histamine and methacholine, and physical stimuli, such as exercise. The critical role of airway inflammation in both the development of obstruction and the degree of hyperresponsiveness has only recently been appreciated. Increased mucus production and submucosal edema add to the obstruction that occurs secondary to bronchospasm and inflammation.

There are several differences in the anatomy and physiology of a child compared to those of an adult that make children more prone to obstruction and more vulnerable to respiratory failure. The peripheral airways are smaller and thus offer greater resistance to airflow. Infants do not possess the collateral channels for ventilation that are present in older children and adults. In infancy, the diaphragm is the primary muscle of respiration. Any degree of abdominal distension will provide significant interference to diaphragmatic function and lead to secondary ventilatory insufficiency. The infantile diaphragm possesses muscle fibers that are more prone to fatigue. The chest wall of the pediatric patient is more compliant, preventing adequate stabilization during periods of increased respiratory distress.

Warning signs of a severe asthma flare vary for individual children [6]. Flares occur when a trigger increases inflammation in the airways of the lung. Research suggests that common colds and flu viruses trigger the great majority of severe flares, although conditions in the environment (such as smoke and allergens) can also be important triggers. Airway inflammation leads to increased mucus production and contraction of the muscles in the airway wall

(bronchospasm). When the airways in the lung narrow, more work is needed to push out waste gases, such as carbon dioxide. The body's normal response to this airway obstruction is to increase its effort to breathe by using muscles between the ribs and in the neck, which may become more noticeable than usual.

The chest and belly may move in opposite directions like a seesaw as muscles below the diaphragm help to move air up and out of the lungs. A child may stop doing other activities and sit up straight to focus on breathing. His rate of breathing will increase. He may become short of breath and able to speak only a few words at a time.

Symptoms

Asthma affects the airways and is characterized by the triad of bronchial hyper-responsiveness, inflammation, and airflow obstruction (National Heart, Lung, and Blood Institute - NHLBI) [7]. In response to an allergen or trigger, the smooth airway muscles constrict causing airway narrowing and subsequent airflow limitation. In persistent asthma, inflammation is prominent, leading to overproduction of mucus and airway edema, which further limits airflow. Airflow limitation manifests in variable and recurring symptoms including cough, wheeze, chest tightness, and shortness of breath. Asthma symptoms are chronic and the underlying inflammation and predisposition to allergic responses are present even when symptoms are not.

The course of asthma varies among individuals. Some young children wheeze only after they have had a viral illness (i.e., viral-induced asthma). For children whose symptoms are not viral-induced, triggers can include exercise, pollutants (e.g., cleaning chemicals), secondhand smoke exposure, and weather changes. Stress is an important consideration for youth with asthma given the impact of stress on the body's immune response resulting in increased risk for asthma exacerbation following exposure to triggers. Among children whose asthma is not viral-induced, asthma is classified into non-atopic (non-allergic) and atopic (allergic) asthma. The mechanism of non-atopic asthma is less well understood than that of atopic asthma. Children with atopic asthma develop symptoms primarily in response to allergens. These children have positive skin prick tests, show elevated immunoglobulin E or antibodies in response to allergens, and often have other types of allergies. Children with atopic asthma frequently have a positive family history of asthma, other allergies, and more persistent asthma symptoms, and symptoms are typically triggered by exposure to allergens.

While a large number of infants with wheeze do not go on to develop asthma, the one consistent factor predicting ongoing disease is the presence of atopy [8]. Non-atopic wheezers have a disease of very different pathogenesis and long-term implication and often remit in early childhood. Thus, a focus on the factors that influence the development of atopy will in turn indicate which factors are important in the genesis of the airway inflammation component of asthma. However, while asthma is strongly associated with atopy, it cannot be explained by this alone. Indeed, the population-attributable risk of asthma from atopy is less than 50%. Other etiological factors are as, if not more, important to the development of asthma. Therefore it is essential to consider factors predisposing not only to the development of atopy but also to the

increased risk of developing asthma. The additional component of asthma is abnormal lung function and/or BHR (bronchial hyperresponsiveness) which in turn probably reflects alterations in the structure of the airway. While these occur independently of atopy, they commonly co-exist with atopy, particularly in persistent and severe disease.

Even though almost 80% of asthmatics start having symptoms during the first 5 years of their life, asthma diagnosis in infants and preschool-aged (preschoolers) children is more challenging than in older children and adults [9]. Recurrent wheezing is frequently reported in preschoolers and is often associated with upper respiratory tract infections (URTI), which in this age group occurs approximately six to eight times per year; however, for many of these children wheezing does not recur later in life. An additional challenge in this age group is that clinicians and practitioners often rely on parentally reported wheezing, which may be unreliable. Furthermore, other conditions give rise to snoring, upper airway secretions, rattling sounds reflective of airway secretions or noisy breathing, all of which could be misinterpreted as a wheeze, and conventional pulmonary function testing is unavailable in most medical centres for children under the age of 5 years. Preschoolers are often diagnosed with asthma when a cough with wheezing or dyspnoea, which fluctuates over time, is reported in combination with the findings from a physical exam, family history and the presence of other clinical atopic diseases, such as eczema or allergic rhinitis; response to treatment (either bronchodilator or continuously administered anti-inflammatory therapy) is also taken into account.

Imaging

Chest radiography and chest CT are the mainstays of clinical imaging in pediatric asthma, but their role is primarily limited to the detection of alternative diagnoses or complications of asthma [10]. The role of CT in asthma research may expand as improved methods for extracting information from CT scans are developed, and this may, in turn, lead to the expansion of the clinical utility of CT. Both chest radiography and chest CT provide information about lung structure, and typically lung function is inferred indirectly from secondary signs such as air trapping. Two new imaging modalities for the lung, ^{13}N PET scanning and hyperpolarized gas MRI, show promise for non-invasively providing functional information about the lung including regional ventilation and ventilation-perfusion ratio. This information may be useful in research to elucidate the underlying pathophysiology of asthma and to understand the response to treatment.

Prevention

Asthma is a chronic respiratory disease characterized by hypersensitivity to various external and internal factors [11]. 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, it 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.

Primary prevention (preventing high-risk infants becoming sensitized) and secondary prevention (preventing sensitized children developing asthma) are not considered to be of prime priority in developing countries [12]. This owes to physicians' lack of basic awareness and knowledge (rather than parents' awareness) about allergy prevention possibilities and strategies (food elimination, environmental control of house dust mites and cockroaches, etc.). In addition, there is a lack of basic epidemiological data regarding risk factors for asthma in children, a lack of well-laid-out preventive strategies, and a relative lack of reliable products for environmental control. In spite of limited resources for allergy prevention, certain actions could be implemented. Examples of these actions are identification of high-risk infants (e.g. those born to atopic parents), curbing exposure to parental cigarette smoking, research into methods for manipulating indoor environments, amelioration of outdoor pollution, improvement of nutrition, and control of childhood viral respiratory infections.

Responsibility of the Physicians

The aim is to provide excellence in emergency department (ED) care by cultivating the following desirable habits [13]:

- 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 [14]. 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 nonspecialists.

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. 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.

Discussion

A hospital and its entire staff owe a duty of care to patients admitted for treatment. 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

The diagnosis of asthma is primarily based on symptoms and clinical examination, which are often sufficient for clinical diagnosis, and laboratory and pulmonary function tests are used to confirm the diagnosis or to determine the degree of the disease. There is no single diagnostic test for the diagnosis of asthma, so the condition is often difficult to diagnose, especially in young children. Specifically, pulmonary function cannot be measured in this age group, and the disease often manifests only as recurrent episodes of coughing and /or wheezing, which may resemble the symptoms of some other diseases. As asthma often occurs before the age of five and may start before the age of three, early diagnosis, follow-up and effective treatment are also essential in these patients.

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