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Snake Bite Emergency

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Abstract

At the site of the bite, two stab wounds from the serpent's teeth, 6-8 mm apart, are usually noticed, although sometimes there may be only one wound or a scratch. Within a few minutes, and in some cases after a few hours, swelling, sharp pain, subcutaneous bleeding or even blisters filled with bloody contents occur at the site of the bite. Immediately after the bite, at the bitten also presents general symptoms: headache, dizziness, unconsciousness, nausea and vomiting, and after a while regional lymph nodes also swell. In cases of shock, which is usually the main cause of death, blood pressure drops, rapid heartbeat, the skin is sweaty, cold and pale, and respiratory failure can occur.

Keywords: Bite; Snake; Treatment

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 focusses 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.

Snake Bite

The majority of snakebites victims are men between the ages of 17–27 years [5]. Alcohol intoxication is a contributing factor in many envenomations. More than 95% of bites are on extremities (lower more than upper) and most occur between April and October, with peak months July and August. These months coincide with the times when native snakes are active. Humans are more prone to be bitten during outdoor activities, especially during these months. Twenty five percent of all pit viper bites are “dry” (i.e., do not result in envenomation). The cardinal characteristic of the rattlesnake is the tail rattle, which is formed by a group of interlocking keratin rings that vibrate against each other, producing the characteristic buzzing sound when the snake is aroused. Although rattlesnakes are generally quick to sound out a warning when threatened, it is a misconception that they always do so before striking.

Definitive diagnosis of snake-venom poisoning requires positive identification of the snake and clinical manifestations of envenomation. Patients may bring the snake into the ED, alive or dead, in parts or whole, for identification. Snake parts should never be handled directly because the bite reflex in recently killed or decapitated snakes remains intact, rendering them capable of inflicting a bite. The most common reaction to any snakebite is impending doom. Fear might cause symptoms such as nausea, vomiting, diarrhea, fainting, tachycardia orcold, clammy skin. The primary local clinical findings after most pit viper bites emerge within 30-60 minutes. Common characteristics of crotaline envenomation include the presence of one or more fang marks or puncture wounds, pain, edema, erythema, or ecchymosis of the

bite site and adjacent tissue. Localized burning pain and early progressive edema around the bite site are common. Over a period of hours to days, the patient may develop hemorrhagic or serous vesicles and bullae at the bite site that may extend proximally.

The factors that most reduce snakebite-related injuries and mortality in the United States are rapid transport, intensive care and antivenom. Once airway, breathing and circulation have been assessed and secured, a rapid, detailed history should be obtained. Key points include the time and circumstances of the bite, a general description of the snake, first-aid measures used, coexisting medical conditions, drug and food allergies, allergy to horse or sheep products, and history of snakebite and therapy. The bite should be examined for fang or tooth marks and scratches, edema, erythema and ecchymosis. All rings, watches, and constrictive clothing should be removed. Baseline circumferential measurements at several points above and below the bite should be documented, with measurements at the same sites repeated every 20-30 minutes until the swelling subsides. Laboratory studies should include a CBC with platelet count, coagulation profile (PT, aPTT, INR, fibrinogen), electrolytes, BUN, serum creatinine and urinalysis. Tests such as CK, blood typing and crossmatching, chest radiography, and electrocardiography might be indicated based on age, comorbid history and severity of the envenomation. Tetanus prophylaxis should be administered based on the patient's immunization history.

The understandable anxiety associated with snakebite regularly creates a group of signs and symptoms that can mislead both patients and their physicians [6]. These include tachycardia, palpitations, sweating, overbreathing/hyperventilation (causing acroparesthesia, tetany, lightheadedness, faintness, and syncope) and, in extreme cases, histrionic conversion disorders. These features are often misinterpreted as signs of envenomation and are described naïvely and uncritically in accounts of snakebites written by the victims themselves or by authors without medical training. Autonomic responses to even a medically insignificant bite can exacerbate some comorbidities, such as ischemic heart disease (angina) or generalized anxiety disorder (panic). Thus, attendance and review by a physician is strongly recommended in any case reportedly featuring medically significant effects. It is disconcerting that fewer than 35% of published cases (not including retrospective reviews) feature medically qualified evaluation of the victim.

Patients with wounds resulting from bites by snakes judged nonpoisonous should be treated with antitetanus prophylaxis, cleansing, a period of observation (~6 hours) in the emergency department (ED), and a wound check in 24 to 48 hours [7]. After this interval, patients without evidence of local or systemic toxicity can be discharged. Snakes do not transmit rabies.

Most continents have venomous creatures, with many millions suffering death and disability each year as a result of bites and stings [8]. It is estimated that world wide there are 2.5 million envenomings and 125 000 snakebite deaths per year. The health burden of snake bite coupled with reduced production of snake antivenom has seen the World Health Organization list snakebite as a 'neglected tropical disease'. The two main groups of venomous snakes in the world are vipers (mainly in Americas, Africa, Eurasia) and elapids (mainly southeast Asia, Australia, PNG). It is important to realize that not all people bitten by snakes are envenomed. This explains the frequent reports of homeopathic first aid methods (e.g. black stones or electric shock therapy) resulting in survival from snake bite.

If envenomed, most patients will display a mix of local tissue destruction, paralysis, bleeding disorders and paralysis. Bite sites may be obvious but not always so. First aid revolves mainly around immobilizing the bitten body part and the patient and supportive care. Definitive treatment of envenoming revolves around using antivenom, although adjunct treatments (e.g. neostigmine in management of paralysis due to cobra and death adder envenomings) have proved effective if no antivenom is available. Problems with antivenom include cost, need for refrigeration and a high rate of anaphylaxis. Snake identification can also be difficult making use of specific antivenom problematic.

First Aid

A number of first aid techniques for venomous bites or stings may be instituted by well-meaning "rescuers." [9]. Many such measures are of no value. Some may even be worse than the bite or sting itself. For most arthropod envenomations, ice application to and elevation of the affected body part are adequate first-aid therapies. It is difficult, however, to make broad recommendations for snakebites beyond getting the victim to medical care as soon as possible. Little definitive research has been done on field management approaches for snakebite. Ice should be avoided in venomous snakebite, as additional cold injury can worsen local venom-induced tissue damage. One technique demonstrated to delay absorption of a number of snake venoms is the Australian pressure immobilization technique. The victim's entire bitten extremity is wrapped firmly (at pressures similar to those used for wrapping a sprained ankle), beginning at the bite site, and the limb is then splinted. Use of this technique in situations where necrosis is unlikely to occur following the bite, as with many elapid venoms, appears prudent. Use in situations where tissue loss may be compounded by limiting venom strictly to the site, as with most viperid venoms, may be unwise unless the victim is a great distance from medical care and has suffered a lifethreatening bite. Techniques to avoid include application of electric shocks, incision and suction, use of tourniquets, and application of topical poultices, such as meat tenderizer.

Pathology

The severity of any venomous snakebite depends on the species and size of the snake, the amount and toxicity of the venom injected, the location of the bite, first aid treatment performed, the timing of definitive treatment, comorbid conditions, and the patient's unique susceptibility to the venom [10]. Snake venoms are comprised of a chemically complex mixture of proteins, many with enzymatic properties. Quantity, lethality, and composition vary with the age and species of the snake, the time of year, the geographical location, and the snake's diet. Venom proteins include transaminase, hyaluronidase, phospholipase, phosphodiesterase, and endonucleases. These proteins damage capillary endothelium, resulting in blebs, dilation of the perinuclear space, and plasma membrane destruction. Plasma and erythrocytes leak into the tissues, resulting in massive accumulation of fluid in intracellular spaces, manifested as edema and erythema or ecchymoses.

Plasma loss reduces the circulating blood volume and can lead to hypovolemic shock, hemoconcentration, and lactic acidosis. The peptides of snake venom appear to bind to multiple receptor sites in the prey. Crotalidae venom components have the most deleterious effects on the cardiovascular, hematological, respiratory, and nervous systems. Consequently, attempting to label a venom as a "neurotoxin," "cardiotoxin," "myotoxin," or "hemotoxin" is misleading.

Emergency Treatment

Emergency treatment for venomous snakebites begins with the basic principles of evaluation and support of airway, breathing, and circulation, along with close monitoring of vital signs [11]. A rapid detailed history should be obtained with circumstances of the bite, description of the snake, time elapsed since bite, first aid administered, as well as allergy history and tetanus status. If the snake is brought in (dead or alive), an assistant knowledgeable in herpetology should be tasked with identifying the species with the assistance of pictures, and contact made with the local poison control center.

Blood is drawn and sent for type and cross, baseline renal panel, hematocrit, platelets, and a DIC panel. Note that this is performed early because, by threet of our hours following a rattlesnake bite, the patient's serum may no longer becross-matchable. The blood urea nitrogen (BUN), creatinine, and creatine phosphokinase (CPKs) are sequentially evaluated because nephrotoxicity can occur, secondary to venom-induced rhabdomyolysis or following administration of horse-serum-derived antivenom. Urinalysis, electrocardiogram, and chest radiography are performed as indicated.

Next, evaluation of the extremity to scrutinize the type of bite, and monitoring for progression of swelling is important. With pit viper envenomations, local clinical findings usually emerge within 10 to 60 minutes. Commonly, erythema along with subcutaneous edema emerges around the bite site where fang marks, typically with ragged edges, can be visualized. Ecchymosis, along with serous or hemorrhagic bullae, can appear within several hours.

Responsibility of the Physicians

The aim is to provide excellence in emergency department (ED) care by cultivating the following desirable habits [12]:

- 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 [13]. 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 [14]. 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. 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

Regardless of whether it is a bite of a non-toxic or viper snake, medical attention should be requested. If it is a viper bite, the bitten should be rested strictly, the bitten part of the body should be immobilized, the wound should be covered with sterile gauze. Above the bite wound (5-10 cm), the limb should be bandaged, preferably with an elastic bandage, a grip that should prevent venous and lymphatic flow to prevent the spread of poison, but not arterial. It is not recommended to suck out poison or any other procedures such as placing ice, grass or grease, incising or burning a wound, etc. Bitten must be transported to a health care facility as soon as possible.

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