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EM CASE OF THE WEEK

BROWARD HEALTH MEDICAL CENTER DEPARTMENT OF EMERGENCY MEDICINE

Florida is the lightning capital of the country and has the highest number of lightning injuries. Most deaths from lightning occur in the first hour so timely care can mean the difference between life and death. This month we review the typical manifestations of lightning injury and how to manage them

EM CASE OF THE WEEK

EM Case of the Month is a monthly "pop quiz" for ED staff. The goal is to educate all ED personnel by sharing common pearls and pitfalls involving the care of ED patients. We intend on providing better patient care through better education for our nurses and staff.

Lightning Injuries

Three 30 year old men are playing golf when an afternoon thunderstorm takes them by surprise. Lightning strikes the ground between them and the men are thrown several yards. Two off-duty paramedics who happen to be nearby run over to find the men lying on the ground with their clothes in tatters and a fernlike red pattern on their skin. Man A is unconscious with a weak pulse, chest rise, severe burns, and blood coming from his ear canals. Man B has no severe burns but is already dead, with no breathing and no pulse. Man C is minimally conscious, confused, and can't move his legs. Which man should the paramedics help first?

A. Man A

B. Man B

C. Man C

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Lichtenburg figures are red, branching patterns of burst capillaries on the surface of the skin. They are not true burns.

Take Home Points

- Lightning can carry 2 billion volts and reach 90,000 degrees F
- Patients who appear "dead" with cardiac and/or respiratory failure can be readily resuscitated and should receive care first
- Lightning can cause superficial red patterns on the skin, deep burns, arrhythmias, respiratory failure, brain injury, paralysis, and blast trauma

Lightning

The correct answer is B. Unlike in cases of cardiac arrest caused by mechanical trauma, patients who appear to be dead after being struck by lightning should be treated first. A high percentage of these patients can be revived with an automated defibrillator and/or CPR. Though their myocardium and respiratory centers were stunned by the electricity, they do not necessarily have severe burns or deep tissue injury. Prolonged CPR alone is also sometimes successful.

Florida may be known for sunshine but we also experience more lightning here than any other state and, along with Texas, have the greatest number of lightning-related fatalities in the country. While the average number of lightning injuries per year is only in the hundreds, about a third of them will be fatal and two thirds of survivors have permanent disability. Most deaths occur within the first hour after the lightning strike from fatal cardiac arrhythmias or respiratory arrest, both of which are preventable with BLS or ACLS practices. By knowing what to look for and responding quickly after a lightning strike, anyone could easily save a life with minimal training. On the following page we will review the pathophysiology and common sequelae associated with lightning strikes.

Types of Lightning Strikes

Lightning bolts have millions or even billions of volts and can be 90,000 degrees F. Lightning can strike a person in several different ways and can even hit multiple people at once:

Direct strike- Lightning hits a person

Contact strike- Lightning hits an object a person is holding

Side flash- Lightning hits an object and then jumps to a nearby person

Ground current- Lightning strikes the ground near a person and then travels up their legs. The foot closer to the strike has a higher voltage potential than the far leg, so the electricity will tend to go up one leg and back down the other, causing isolated injury to the lower half of the body.

Pathophysiology

Lightning can travel over the surface of the skin in a phenomenon called flashover but can also travel deeper into the body through major organs causing severe burns. Flashover is the reason why victims with wet skin often have no serious injuries. The extreme heat of a lightning bolt, although very brief, can cause rapid expansion of the air that can lead to barotrauma and blunt force injury.

Effect on the Body

Cardiac: Asystole and arrhythmias, decreased contractility, coronary artery spasm. Hypertension and tachycardia that spontaneously remit. ECG will show ST elevation and QT prolongation.
Neurologic: Depressed consciousness, lower extremity weakness, mechanical brain injury from concussive force or fall, heat-induced coagulation of cerebral cortex. Stunning of respiratory centers in medulla causing respiratory arrest. Autonomic dysfunction (dilated pupils/anisocoria not related to brain injury). Confusion, amnesia, and paralysis usually resolve in 24 hours.
Ocular: Bilateral formation of cataracts weeks to years later. Hyphema, retinal detachment, and abrasions can also occur.
Auditory: Rupture of tympanic membranes
MSK: Rhabdomyolysis (although less common than with household electrical injury), tetany-induced shoulder dislocation and spinal fractures. Immobilize C-spine and image entire vertebral column.
Skin: Lichtenburg figures are red, branching patterns of burst capillaries on the surface of the skin and not true burns. Flash burns similar to arc welding injury manifest as erythema and may involve cornea. Metal touching the skin may produce contact burn. Linear burns in areas of skin folds due to flash-boiled moisture. Contact wounds such as those seen in household electrical injury are not commonly seen.

Sources:
Tintinalli's Emergency Medicine, 7e
"Environmental and weapon-related electrical injuries." Uptodate.com. Updated May 20 2014.

ABOUT THE AUTHOR:
This month's case was written by Steve McCauley. Steve is a 4th year medical student from FIU HWCOM. He did his emergency medicine rotation at BHMC in August 2015. Steve plans on pursuing a career in Emergency Medicine after graduation.