

# Lightning Injury



## OVERVIEW

There are an estimated 25 million lightning flashes in the United States each year. During the past 30 years, lightning has killed an average of 66 people per year. Lightning kills more people per year than tornadoes. Yet because lightning usually claims only one or two victims at a time, and does not cause mass destruction of property, it is underrated as a risk. While documented lightning injuries in the United States, average about 300 per year, undocumented injuries are likely much higher.



20 Million Volts of electricity

## Facts about Lightning

- ◆ Lightning strikes with a force of about 20 million volts
- ◆ The mortality rate of a direct strike is about 30%
- ◆ Lightning tends to produce mainly nervous system injury
- ◆ Permanent sequelae, mainly neurological are present in 60% of direct strikes
- ◆ Loss of consciousness is common in all forms of lightning injury
- ◆ The type of injury predicts the prognosis and treatment
- ◆ Lightning is a direct current as opposed to the alternating current of most electricity
- ◆ The person struck is not "charged" with electricity
- ◆ Lightning contact is much shorter than a typical high-tension electrical contact therefore burns to the skin and muscle are rare
- ◆ Initial injuries are primarily the result of a "blast" effect, due an immense local explosion that occurs
- ◆ Cardiac arrest at scene is the most common cause of death
- ◆ The skin can be involved in a process called "ferning" where the skin has the appearance of the imprint of a small fern leaf after 'flash over' lightning strikes

## How does Lightning Produce Injury?

There are a number of ways a lightning strike can produce injury as will be described below. The mechanism of injury is very important to ascertain if the injuries sustained will be related to this factor.

**Direct strike**

**Flash over**

**Flash discharge**

**Ground current**

**Shock wave**

### Types of Lightning Injury

#### **DIRECT STRIKE**

- ◆ The person hit is the major grounding site
- ◆ Head entry is the most common site
- ◆ A small burn on the scalp may be present
- ◆ Person usually is unconscious
- ◆ CPR is commonly needed
- ◆ Mortality is high



Immense force of lightning strike



Direct strike causes neurological damage

#### **Flash Over**

- ◆ The lightning current travels along the outside the conductor, namely the victim
- ◆ The clothes are destroyed but the person struck is usually not injured, superficial "ferning" of the skin (no damage) may be present



Current Goes Around the Body

### Flash Discharge

- ◆ The most common form of lightning
- ◆ The lightning is deviated from another object to the victim
- ◆ Injury can be severe but less than a strike

### Ground Currents

- ◆ The initial strike is the ground
- ◆ The current then travels to the grounded person
- ◆ Injury is less severe and usually not fatal

### Shock Wave

- ◆ The lightning strike can produce a massive concussive force
- ◆ Patient can be thrown
- ◆ Tissue trauma, from the transmitted energy, is common



Although the telephone system may be grounded, lightning is too fast and strong for typical grounding systems to be effective and reaches the person before the circuit breaker or other protection can be effective.

### Lightning Injuries: Initial Findings

- ◆ Unconscious state
- ◆ Respiratory arrest from temporary chest wall paralysis
- ◆ Cardiac dysfunction; asystole, arrhythmias
- ◆ Death toll is 10% from cardiac arrest
- ◆ Seizure, intense headache
- ◆ Tinnitus (ringing in ears/ ruptures)
- ◆ Musculoskeletal pain from spasm
- ◆ Fractures, Dislocations from any traumatic injury from may be present
- ◆ Blunt Traumatic Injuries from the concussion force

### Prevention for Injury

#### WATCH FOR DEVELOPING THUNDERSTORMS:

- ◆ Thunderstorms are most likely to develop on spring or summer days but can occur year round
- ◆ As the sun heats the air, pockets of warmer air start to rise and cumulus clouds form
- ◆ Continued heating can cause these clouds to grow vertically into towering cumulus clouds, often the first sign of a developing thunderstorm.

## Initial Management

Resuscitate the patient as indicated base on clinical status (including advanced cardiac life support [ACLS]). Immobilize if transporting staff suspect fractures of the history indicates possible fracture.



Remember that the victim struck does not carry an electrical charge. If their heart has stopped, CPR needs to be performed immediately. Also, take a look at the victim, other injuries require urgent care.

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## Outdoor Activities

### Minimize the Risk of Being Struck:

- ◆ Most lightning deaths and injuries occur in the summer
- ◆ Where organized outdoor sports activities take place
- ◆ Coaches, camp counselors and other adults must stop activities at the first roar of thunder
- ◆ Everyone must get into a large building, shelter, or safe space

Leaders of outdoors events should have a written plan that all staff are aware of and enforce

## Indoor Activities

### THINGS TO AVOID:

- ◆ If inside building, stay off corded phones, computers and other electrical equipment that put you in direct contact with electricity of plumbing
- ◆ Buy ground fault protectors for key equipment



Risks of indoor activity with potential lightning strike