



A lightning strike victim

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Direct lightning strikes are associated with high mortality but patients who survive the initial lightning strike, as in the discussed case of a young man who had a side splash lightning strike, usually have no major problems. Survivors do, however, need to be followed up to detect any delayed complications.

Electrical injuries may be divided into the three broad subgroups of lightning injuries, high-voltage (more than 1000 V) electrical injuries and low-voltage (below 1000 V) electrical injuries, with differences in the assessment and management of patients in each group.¹ One example of the different management is that in patients in whom the electrical current provokes a cardiac arrest, cardiopulmonary resuscitation (CPR) is important in those struck by lightning whereas early defibrillation is important in those injured by generated electricity. This is because the cardiac arrest is more likely to be asystole from a lightning strike and ventricular fibrillation (VF) from a household AC current. It is safe to perform CPR on victims of lightning strikes as they are not 'charged'.

This article focuses on lightning injuries and discusses the case of a young man who is struck by lightning but does not sustain immediate severe injuries.

Case scenario

As a GP working in your own practice and the emergency department of the local hospital it is always interesting when patients present with injuries resulting from storms and environmental emergencies.

The weather forecast was for heavy rain with possible flash flooding. At 3 p.m., the emergency department was informed via the 'Bat phone', the direct line from the ambulance service, that a young man who had been struck by lightning was being rushed in. His vital observations at that time were:

- heart rate, 50 beats per minute, sinus rhythm
- blood pressure, 140/60 mmHg
- Glasgow Coma Scale score, 15 (i.e. fully awake)
- blood glucose level, 5.4 mmol/L
- oxygen saturation, 97% on room air.

Medicine Today 2015; 16(6): 50-52

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1. INJURIES ASSOCIATED WITH LIGHTNING STRIKE¹

Skin

- Burns – feathering or flowers (transient, not burns but electron showers)
- Superficial (often in patterns of sweat lines, or wet exploded clothing)
- Deep entry and exit wounds; imprints of metal buttons, belt clips, ignited clothing

Ear

- Tympanic membrane rupture, barotrauma

Eye

- Onset of cataracts, eye trauma and disruption of anatomy

Heart

- Asystole, ventricular fibrillation, arrhythmias, infarct (rare), transient hypotension or hypotension

Limbs

- Trauma
- Keraunoparalysis – a temporary neurovascular dysfunction in most serious strikes, usually resolves in hours but permanent sequelae possible

Central nervous system

- Seizures, mental state similar to that after electroconvulsive therapy
- Amnesia (very common), psychological sequelae

Trauma

- Blunt injuries and fractures from being thrown by the shockwave

Although the presentation did not fit the criteria for a major trauma, hospital protocol required that a resuscitation team be assembled because of the potentially critical injuries to several systems that may occur in patients who have been struck by lightning.

On arrival at the hospital, the patient looked relatively well, as do most patients who survive a lightning strike. The history was that he had been outside in

TABLE. TYPES OF LIGHTNING STRIKE¹

Lightning strike type	Mechanism	Comments
Direct strike	Current passes through person, or Current passes over person (flashover), often via wet clothes, which may explode or burn	Associated with high mortality Most often occurs in people out in the open
Side splash	Lightning strikes an object directly but the current flow seeks the path of least resistance and jumps from its original pathway onto the person (the person becomes part of the main conductor) Can sometimes 'splash' indoors from metal objects such as plumbing and telephones	Most common cause of lightning injury Splashes can travel from person to person if close enough
Direct contact	Person in physical contact with the main conductor (e.g. taking shelter next to metal)	Associated with high mortality, especially if current traverses the heart
Stride potential	Current from a lightning strike travels along the ground near a person who has his/her legs separated, and takes the path of least resistance up a leg, across the body and down the other leg (rather than along the ground)	Associated with significant mortality

the storm, barefoot, sweeping with a wooden broom to unblock a drain. His family saw a flash of bright white light and 'felt the lightning.' The patient had appeared stunned for a short period of time, and then had walked into the house but was not himself, complaining of stiffness in his jaw and altered sensation in his hands and fingers bilaterally. A short time later he became agitated, shouting and screaming. He was amnesic to events.

Physical examination, especially looking for signs of trauma, entry or exit burn wounds, visual acuity and barotrauma to ears, was unremarkable (Box 1). The diagnosis of a lightning side splash was made (Table). ECG and urine and blood test results were normal.

As with any electrical injury, any current that could traverse the heart (e.g. arm to arm) is of concern. The patient was observed for six hours and fully recovered. He and his family were

advised of possible complications and follow-up requirements to ensure no long-term sequelae, including psychological stress, and he was discharged.

Types of injuries from lightning strike

Lightning injuries involve many body systems and vary widely in severity as they result from the electrical current through or over the body, the associated heat, trauma due to being thrown by the blast or from falls or violent muscle contractions, and anoxia (post-arrest).¹

Generally, patients who survive the initial lightning strike will have no major problems, although they need to be followed up appropriately to detect delayed complications to the eyes, ears, heart and nervous system and also post-traumatic stress. Patients with mild or moderate injuries due to lightning may experience musculoskeletal discomfort and subjective sensations of

2. ELECTRICAL STORM SAFETY¹

Avoid exposure to lightning

- Stay indoors (the safest place), or shelter in a car with the windows up and avoiding touching metal parts. If lightning strikes the car, the metal body will conduct the charge down to the ground; contrary to popular belief, the rubber of the wheels offers no protection
- Avoid contact with any metal, indoors or outdoors, including golf clubs, umbrellas, tent poles, gates, roofs and hair clips
- Avoid open spaces such as fields, golf courses (most now have electrical storm warnings systems) and sporting fields – 28% of deaths and 29% of injuries due to lightning occur in open locations³
- Avoid standing under the tallest object in the area, or the only object, such as a tree or a pole (18% of deaths and 13% of injuries), i.e. do not be in or near the potential line of current from the top of a tall object to the ground³
- Avoid boating, fishing and other water activities (13% of deaths and 6% of injuries)³
- Avoid sheltering near tractors, heavy road equipment and telephone booths

If caught outdoors during an electrical storm

- If time between lightning flashes and thunderclap is less than 30 seconds, shelter immediately until the storm pauses and the duration is more than 30 seconds
- Avoid being in a group – spread out from each other so that, if necessary, help can be called for and CPR performed
- Keep low – curl up on the ground, preferably in a ditch, away from tall objects. Do not stand with feet apart
- Remove hair clips and avoid touching any metal
- Although a person who has been struck by lightning may appear dead (dilated pupils), immediate life support and manoeuvres are often effective (this is the opposite of the standard multiple casualty approach)

paraesthesias, irritability and other nonspecific neurological sequelae, depending on the location and intensity of the strike.² In those with severe lightning injury and especially those in whom CPR was required, permanent neurological deficit and hypoxic injury are common.²

Electrical storm safety

The vast majority of injuries due to lightning occur outdoors, mainly in people participating in outdoor recreation activities such as golfing and hiking. A few people, however, are injured indoors every year from contact injuries with plumbing or landline telephone-mediated strikes.² Most fatalities occur in the summer storm season, and about 30% of victims who are struck die and up to 75% can have serious complications.¹

Educating people about safety during electrical storms is therefore important, as discussed in Box 2.¹

Conclusion

Lightning injuries involve many body systems and vary widely in severity. Patients who survive the initial lightning strike, as in the discussed case of a young man who had a side splash lightning strike, usually have no major problems, although they need to be followed up appropriately to detect delayed complications. Direct strikes most often occur to people in open spaces, and are associated with high mortality. As people who have cardiac arrest provoked by a lightning strike have a better chance of survival than people who have an arrest from other causes, including household electricity, CPR should be performed

SUMMARY POINTS

- Lightning injury is different from high voltage electrical injury
- It is safe to perform CPR on victims of lightning strikes – they are not 'charged'
- Injury from the electrical and blast mechanism of lightning strikes should be excluded
- Delayed sequelae such as post-traumatic stress disorder and ophthalmological complications necessitate appropriate follow up

immediately in people who have been struck by lightning.

With storms apparently becoming more frequent and unexpected, the public need to know how to stay safe during electrical storms, especially those participating in outdoor recreational activities. Lightning does strike twice in the same spot, and we need to take care. **MT**

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Further reading

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COMPETING INTERESTS: None.