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Case report

Lightning injury in a desert

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ABSTRACT

Thunderstorms and lightning are uncommon in the Arabian Gulf. Lightning is a giant spark of electricity in the atmosphere or between atmosphere and ground. Most frequently fatalities after the lightning injury are due to direct lightning strike and cardiorespiratory arrest. It is essential that acute care physicians as well as paramedical personnel are aware of lightning injury and its management. This is a case of a field worker who was struck by lightning while working, which led to a cardiorespiratory arrest.

A young male was brought to the emergency room with a history of having been struck by lightning while he was at work in the desert on a roadside project in a thunderstorm. The lightning injury was witnessed by his colleagues and they started immediate basic life support when they found him unconscious without a pulse. He was intubated, ventilated and started on vasopressors in the nearest primary health centre. He was then transferred to an intensive care unit. He was weaned off vasopressors and ventilation by day four and was extubated then transferred to the ward and subsequently discharged home.

Awareness of the danger posed by lightning injury is essential. Early life support is important for better outcome of lightning induced cardiorespiratory arrest.

Keywords: lightning injury, cardiorespiratory arrest basic and advanced cardiac life support

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INTRODUCTION

Lightning injuries are the third most common cause of weather-related casualties in the United States¹ but rare in the Middle East. These injuries occur as a result of direct strike, contact injury, side splash, ground current, or an upward streamer. It is commonly associated with a mild to severe burn and cardiorespiratory arrest is the frequent cause of death. Twenty per cent of lightning strike patients die at the scene.² The majority of deaths are due to cardiac arrest.³ To improve the outcome, it is essential to provide immediate basic or advanced life support to these patients at the scene. This is a case of lightning injury which resulted in cardiorespiratory arrest at the scene and immediate life support lead to a positive outcome.

CASE REPORT

A 24 year old male patient was brought to the emergency department with a history of having been struck by lightning while he was working on a road project in the desert during a thunderstorm. One of his co-workers witnessed the lightning strike and found him unconscious without any pulse or breathing. He immediately started basic life support and then transported the patient to the nearest primary health center within five minutes away. In the primary health centre, he was unconscious, hypotensive with palpable pulse. He was intubated and started on dopamine 7 mcg/kg/minute and transferred to the tertiary care hospital.

On arrival at the hospital, his heart rate (HR) was 122 beats/minute with no arrhythmia, oxygen saturation was 99 per cent on the ventilator with fraction inspired oxygen (Fio₂) of 0.4, and blood pressure was 113/56 mm Hg. He was localizing to pain with pupils equal and reacting to light. He had 25 per cent superficial to deep burns, on his shoulders, arm and upper chest. His electrocardiogram (ECG) was normal but he had a rupture of the right tympanic membrane. He was then transferred to the surgical intensive care unit (SICU).

In SICU he was connected to a ventilator, started on daily required intravenous fluid, anti-ulcer prophylaxis and flomazine ointment and given local dressing for his burn. His ECG was normal, but his cardiac biomarkers and lactate levels were elevated (Figure 1). He remained hemodynamically stable with the same dose of dopamine. On day two after a sedation vacation, he was able to obey simple commands and capable of moving all his limbs. He was weaned off dopamine by day three and weaned from the ventilator and extubated by day four. He was on tramadol and paracetamol for analgesia and a high caloric/high protein diet. He was transferred to the burns unit on day seven and discharged home on day ten. After a year, burns on his sternum were keloid and he underwent excision under anesthesia.

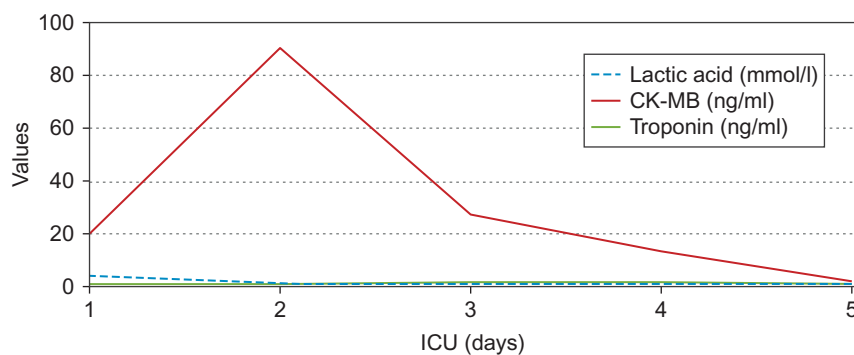


Figure 1. Cardiac biomarkers and serum lactate levels.

DISCUSSION

Thunderstorm and lightning injuries are rare events in the Arabian desert. Cardiorespiratory arrest is the immediate cause of death in lightning injury patients. Awareness of lightning injuries and the early need for basic or advanced life support will improve morbidity and mortality of these patients. There is insufficient evidence on lightning injury and cardiorespiratory arrest.

Lightning injuries as well as fatalities are reduced in United States of America (USA) but remain a public health concern in the developing countries. In USA the lightning fatalities have dropped to less than 0.3 per million population, but has remained high in Africa and South Asian countries.⁴

Commonly lightning strikes young males and they are 5.5 times more at risk of lightning injury. In the USA, two thirds of lightning victims were enjoying water related leisure activities when lightning struck whereas in Africa and South Asian countries, lightning fatalities are high among the manual agriculture field workers.⁵

Risk of lightning injury is increased when individuals are unaware that open areas are unsafe during a thunderstorm and a failure to understand that lightning poses a real danger. It is a common belief that nothing attracts lightning but isolation, height and narrowness of objects are risk factors for being struck by lightning. Two factors relevant to humans include cell phone /iPod use which puts the user at risk of lightning injury as these electronic devices distract the attention of the user during thunderstorms. Landline phone users are also at risk of lightning injury as the hard wires to these devices act as a conduit for the lightning charge to enter and exit from the structures. Manual labourers working in open fields or individuals playing golf during a thunderstorm are also at risk of lightning injury.⁶

Lightning injuries are classified into minor, moderate and severe. Loss of tympanic membrane integrity and amnesia are minor injuries. Motor weakness, seizures and coma are considered moderate injuries whereas severe lightning injuries can cause cardiorespiratory arrest and hypoxic brain injury.⁷

Lightning causes mild to moderate burns, as the contact period is brief. It can cause tympanic membrane rupture due to barotrauma. Cardiorespiratory arrest can be primary due to the lightning injury and usually these patients die. Secondary cardiorespiratory arrest, following lightning injury can also occur due to paralysis of respiratory centers in the brain, causing hypoxia and cardiac arrest. This can occur even if the heart regains spontaneous circulation but the patient remains apneic.⁸ Lightning injuries rarely can cause severe stunned myocardium.⁹

Lightning injury can be diagnosed by the history of being struck by lightning. Occasionally, there can be a triad of arboreal burns, Lichtenberg figures; and a disheveled appearance of the patient. Patients may be confused or amnesic. Severe lightning injury patients may present with cardiorespiratory arrest. All patients with a history of a lightning injury should be evaluated for tympanic membrane integrity. Ophthalmological examination should also discover visual acuity and early cataract.

Severe lightning injury patients should be evaluated for any electrolyte abnormality, complete blood count and cardiac biomarker levels. All these patients should have 12 lead ECG and continuous ECG monitoring. Radiological evaluation depends on the severity of the injuries and patient presentation. If the patient is hypotensive, presence of secondary injuries should be evaluated.

Lightning injuries should be differentiated from high voltage electrical injuries. In high voltage electrical injuries, commonly there will be entry and exit wounds, marked muscle injury, rhabdomyolysis and renal impairment or failure; there will be no tympanic membrane injury.¹⁰

In the management of lightning injuries airway control is necessary including, breathing assistance, restoration of circulation, evaluation of disabilities and calculation of burn surface area.

Cardiorespiratory resuscitation must be started as early as possible, preferably at the scene of the lightning. As the risk of secondary cardiac arrest is high, resuscitation should be continued until the airway is secured and ventilation is assisted.¹¹ Prevention is the best means of safety against lightning injuries. Optimal prevention is dictated by the proverb "when thunder roars, go indoors!"

During a thunderstorm one should move away from towers/tall buildings, avoid shelter under a tree, avoid open fields, hill or ridge tops. Additionally, one should avoid water, wet items, metal objects and if camping in an open area, set up camp in a low area or in a valley. If indoors, stay off corded phones, do not touch electric instruments, avoid plumbing, do not wash hands, take shower or wash dishes and do not lie on concrete floors or lean against concrete walls.¹ Lightning may result in permanent disabilities due to cataract, neuropathies, deafness and sympathetic instability. Reported mortality in lightning injury is 0-32 per cent.¹ Prognoses is poor if the patient has leg burns, cranial burns and or cardiopulmonary arrest.⁸

CONCLUSION

Cardiorespiratory arrest is an immediate cause of death in lightning injury patients. Lightning injuries are common in males and 25 per cent of these injuries occur while working outside during a thunderstorm. The primary risk factor for a lightning injury is being unaware of the danger of lightning injuries. Cardiorespiratory arrest in lightning injury patients could be primarily due to a massive lightning injury or secondary due to paralysis of respiratory centers. Earlier cardiopulmonary

resuscitation is the key for a better outcome. Prevention of lightning injuries can be dictated by the proverb “when thunder roars, go indoors!”.

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