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CASE REPORT

A Lightning Multiple Casualty Incident in Sequoia and Kings Canyon National Parks

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Multiple casualty incidents (MCIs) are uncommon in remote wilderness settings. This is a case report of a lightning strike on a Boy Scout troop hiking through Sequoia and Kings Canyon National Parks (SEKI), in which the lightning storm hindered rescue efforts. The purpose of this study was to review the response to a lightning-caused MCI in a wilderness setting, address lightning injury as it relates to field management, and discuss evacuation options in inclement weather incidents occurring in remote locations. An analysis of SEKI search and rescue data and a review of current literature were performed. A lightning strike at 10,600 feet elevation in the Sierra Nevada Mountains affected a party of 5 adults and 7 Boy Scouts (age range 12 to 17 years old). Resources mobilized for the rescue included 5 helicopters, 2 ambulances, 2 hospitals, and 15 field and 14 logistical support personnel. The incident was managed from strike to scene clearance in 4 hours and 20 minutes. There were 2 fatalities, 1 on scene and 1 in the hospital. Storm conditions complicated on-scene communication and evacuation efforts. Exposure to ongoing lightning and a remote wilderness location affected both victims and rescuers in a lightning MCI. Helicopters, the main vehicles of wilderness rescue in SEKI, can be limited by weather, daylight, and terrain. Redundancies in communication systems are vital for episodes of radio failure. Reverse triage should be implemented in lightning injury MCIs. Education of both wilderness travelers and rescuers regarding these issues should be pursued.

Key words: lightning, multicasualty incident, helicopter EMS transport, wilderness rescue, parkmedic, National Park Service

Introduction

Recreation in our national parks is an increasingly popular way for people to spend their free time and experience the natural beauty of our nation.[1] In the heart of California, Sequoia and Kings Canyon National Parks and Inyo National Forest are home to the tallest peak in the 48 contiguous United States, Mount Whitney, at 14,505 feet (4421 m) above sea level. The peak season for a summit attempt is during the months of June through October, when hikers aim to avoid winter conditions requiring the use of ice axes and crampons. Summer thunderstorms are common during these peak months of recreation, leading to an increased risk for lightning injury. Despite a downward trend over the last 50 years, lightning injuries have remained the second most common cause of storm-related death in the United States (behind flash floods).[2,3] Lightning morbidity and mortality in the United States affects nearly 400 persons annually, with approximately 40 deaths per year.[3]

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For those wishing to summit Mount Whitney, a lottery system for permits is in place to grant access to all routes. The most direct route to the summit is a 10.7 mile one-way hike from Whitney Portal, on the eastern side of the Sierra Nevada. Western access, which is often less crowded, is via the High Sierra Trailhead leaving from Giant Forest in Sequoia National Park (Figure 1). Western access takes a minimum of 10 days (round trip) to complete, comprising 70 miles from trailhead to summit one way.

We present a case of an MCI due to lightning striking a Boy Scout troop in Sequoia National Park, approximately 50 miles from the trailhead at Giant Forest to the west and more than 20 miles from Whitney Portal to the east.

This case was challenging for the prehospital providers, balancing personal safety in hazardous weather conditions against their duty to deliver rapid life-saving patient care. The objectives of this report are to review

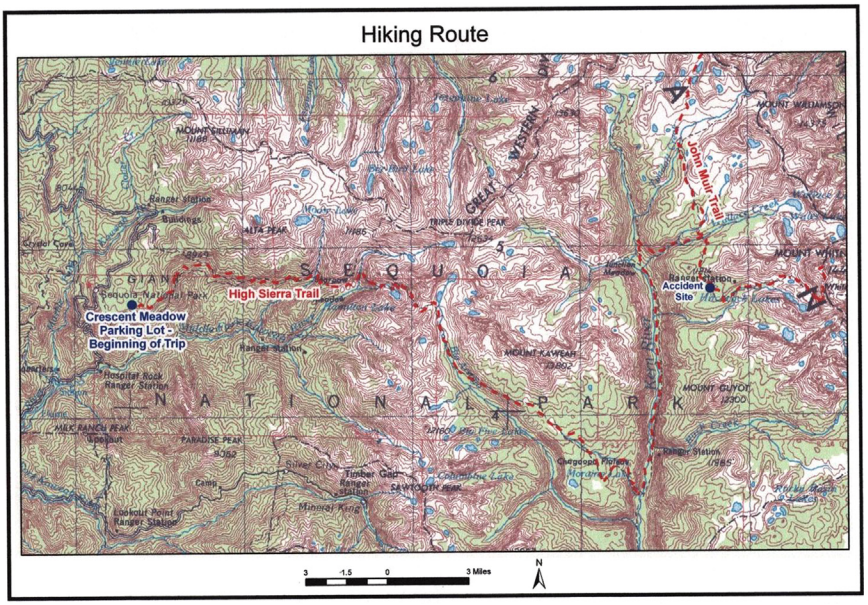

Figure 1. Hiking route.

the response to a lightning-caused MCI in a wilderness setting, address field management of lightning injury, and discuss evacuation from remote locations in inclement weather.

Methods

The University of California San Francisco, Fresno (UCSF Fresno), Department of Emergency Medicine provides medical oversight for SEKI through the Parkmedic/Emergency Medical Services (EMS) program. The Parkmedic/EMS program, in operation since 1982, has provided prehospital training and protocols, and has played a lead role in the development of a unique hybrid parkmedic scope of practice utilized by EMS providers operating in our national parks. Although training is similar to that for emergency medical technician–intermediate, certified park rangers have an expanded pharmacological and procedural scope of practice allowing establishment of a definitive airway, administration of 25 to 30 different medications, and protocol-based decision-making in cases of radio failure.

A Freedom of Information Act release was obtained from the National Park Service (NPS) in 2010 to present this case to a medical audience. The details of the prehospital care were ascertained from the documentation provided, as well as firsthand accounts from the field providers involved. In addition, 3 of the authors (S.S., D.C., G.S.) were emergency physicians on duty, at the receiving facility for critical victims at the time of the incident, and have personal recollections of the event.

CASE PRESENTATION

A party of 5 adult chaperones and 7 teenage Boy Scouts were on a backpacking trip to the summit of Mount Whitney in late July 2005. In the 24 hours immediately preceding the lightning strike, they encountered deteriorating weather conditions with the accumulation of storm clouds and frequent bouts of rain. At 53 miles into their trip, and a full day's hike from the nearest road access on the eastern side of the Sierra Nevada mountain range (Whitney Portal), the group stopped at an anticipated camping site in Sandy Meadow at approximately 1300 hours. Sandy Meadow is at 10,600 feet (3231 m) above sea level and is seen from the air as a kidney bean–shaped green clearing cradled by pines and a granite backdrop that includes the Whitney zone (Figure 2). At approximately 1430 to 1500 hours, the troop noticed an incoming storm and hastily broke into groups and erected tarpaulin (tarp) 1, tarp 2, and a tube tent at the edge of the meadow. The actual field drawing from the rescue shows the arrangement of these shelters and their occupants in relation to one another (Figure 3). Tarp 1 was strung between 2 mature foxtail pines, guyed out with parachute chord, and covered 4 chaperones and 2 scouts. Tarp 2, which covered 2 scouts, was 50 feet uphill of tarp 1 and was supported on stacked logs in a V-shape formation previously constructed by other campers. Fifty feet further uphill was a tube tent with a father and son. One scout was standing outside at the time of the incident. At 1610 hours, lightning struck one of the trees supporting tarp 1 and injured multiple victims (Table 1).