Selected Abstracts from the Wilderness Medical Society's 2014 Summer Scientific Meeting

The Impact of Freeze-Thaw Cycles on Epinephrine Polar Predators

Introduction.—Epinephrine is the first-line medical treatment for anaphylaxis, a life-threatening allergic syndrome that may be triggered by an insect sting, substances, medications, and certain foods. Administering epinephrine can rapidly reverse bronchospasm and other life-threatening changes from anaphylaxis. Backcountry recreationalists and guides carry epinephrine in the form of an autoinjector. Epinephrine may be exposed to cold temperatures during these expeditions. No studies have examined the stability of epinephrine after being exposed to freezing temperatures.

Objectives.—The purpose of this study was to determine whether freeze-thaw cycles alter the concentration of epinephrine and to compare these results with standards of therapeutic activity. The United States Pharmacopeia (USP) designates an epinephrine solution must contain between 90% and 115% of the labeled epinephrine amount to meet USP standards.

Methods.—Epinephrine from 6 autoinjectors (Epi-Pen, Mylan Specialty, Basking Ridge, NJ) was extracted and divided into experimental and control samples. The experimental samples underwent 7 12-hour freeze cycles at an average temperature of -25.4°C followed by 7 12-hour thaw cycles at an average temperature 22.7°C . The control samples remained at an average temperature of 23.1°C for the duration of the study. Immediately after the seventh thaw cycle, epinephrine concentrations were measured using a high-performance liquid chromatography assay with mass spectrometry detection.

Results.—The mean concentration of the freeze-thaw samples increased compared to the control samples: 1.07 mg/mL (SD 8.78, 95% CI: 1.04–1.11) vs 0.96 mg/mL (SD 6.8, 95% CI: 0.94–0.99), respectively ($P < .01$).

Conclusions.—Epinephrine concentrations remain within the therapeutically active range (90% to 115%) after repetitive freeze-thaw cycles. This knowledge benefits those who must emergently administer epinephrine after the medication has accidentally frozen and then thawed.

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Introduction.—Human presence in the polar regions of Antarctica and the Arctic continues to increase. These areas have 3 known potential human predators: polar bears (*Ursus maritimus*), killer whales (*Orcinus orca*), and leopard seals (*Hydrurga leptonyx*).

Objective.—The purpose of this study is to examine the existing evidence of documented attacks on humans by potential polar predators. These data are then utilized in an attempt to assess the level of risk to people living in or traveling to these areas.

Methods.—This is a retrospective case series providing a descriptive review of the medical and nonmedical literature of any documented human attacks by polar bears, killer whales, or leopard seals. This study was not limited by any specified period.

Results.—Reports of 11 fatalities and more than 100 serious attacks on humans by polar bears were found documented. Wild killer whales have been linked to 1 direct human attack, which was not in a polar region, 5 additional cases of perceived potential human attacks, and no documented human fatalities. Although there are many accounts of leopard seals attacking inflatable boats, only 3 direct human attacks, resulting in 1 fatality, have been documented.

Conclusions.—Human attacks, and even more so fatalities, by potential polar predators are exceedingly rare in comparison with number of interactions. Polar bears pose the highest risk to humans for injury or death. Although there have always been relatively limited interactions and avoidance behaviors have been practiced, this review takes into consideration the ever-increasing number of polar predator and human encounters. As with all wildlife, a healthy respect should be held for the animals themselves, and their potential for human harm should be appreciated.

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Healthcare Utilization Following Acute and Over-use Injuries Among Outdoor Rock Climbers

Introduction.—An estimated 4.6 million Americans participated in rock climbing in 2013. Although injuries are common among rock climbers, the conditions for which they seek medical attention are largely unknown.

Objective.—The aim of this study is to determine whether there is a difference in the cause—acute or overuse—and severity of injuries evaluated by a physician compared with injuries that are not. We also intend to describe the prevalence, type, and anatomical location of injuries sustained by rock climbers.

Methods.—A retrospective, cross-sectional, anonymous survey was distributed at popular outdoor climbing locations in North America. Descriptive statistics and χ^2 tests were used to describe the study sample and identify factors associated with medical treatment.

Results.—Of 192 people, 70.8% reported at least 1 injury in the previous 2 years. Injuries from acute events (69.8%) were more common than those from overuse (35.3%). Strenuous moves caused most acute injuries (69.5%), followed by falls (27.4%). The most commonly injured body part was the finger (38.2%), followed by the shoulder (15.4%). A physician evaluated 41.9% of all injuries. Although the injuries evaluated by a physician were more severe ($P < .0001$), there was no significant difference in the cause of the injury, either acute or overuse.

Conclusions.—The findings suggest injury severity, rather than cause, appears to be the main determinant in the decision to seek professional care. Although acute trauma is the more common cause of injuries, a large proportion of all climbing-related injuries are associated with overuse. As overuse and chronic injuries are often overlooked in the literature, our findings that many overuse injuries are serious enough to require medical attention suggest a need for further inquiry into the risk factors and behaviors associated with these injuries.

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Irukandji-Like Syndrome in the Caribbean Sea, Puerto Rico: Case Report

Objective.—Irukandji syndrome has been described as a painful envenoming event caused by different species of jellyfish, mainly in the Cubozoa class. This hypercatecholaminergic condition, with recorded fatalities and severe systemic symptoms, has been described mostly on Australian seas. To our knowledge, Irukandji syndrome has not been reported in Puerto Rico or the Caribbean Sea. Our report describes 2 cases of marine envenomation causing this syndrome in Puerto Rican divers. The aim of this case report is to raise awareness of this syndrome in the Caribbean area, thus preventing misdiagnosis, underreporting, and improper treatment strategies.

Case report.—A 40-year-old man was diving east of Puerto Rico island. After the ascend, he was struck by a box-shaped jellyfish, clear to light blue in color, with long tentacles. The diver then had lower limb weakness, severe back pain, fast heart rate, palpitations, agitation, memory impairment, disorientation, nausea, shortness of breath, diaphoresis, involuntary

tremors, and an intense feeling of doom. Hyperbaric treatment was given but was unsuccessful. The Poison Control Center of Puerto Rico made the diagnosis of Irukandji-like syndrome.

Conclusion.—The Irukandji syndrome can be a life-threatening condition if it is treated incorrectly or is misdiagnosed, as could happen if it occurs outside the usual areas. In the Caribbean area, we should be more aware of this syndrome and include it in the differential diagnosis when a patient comes to us with hypercholinergic symptomatology.

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Utilization of Wrist Protection by Snowboarders

Introduction.—Snowboarding injuries account for nearly 70,000 emergency department visits annually. Wrist injuries are the most common injury sustained while snowboarding, representing 20% to 40% of all injuries. Despite a growing body of evidence demonstrating that wearing wrist protection can reduce this risk by as much as half, the use of protective equipment remains low.

Objective.—The purpose of this study is to determine the utilization of wrist protection by snowboarders and to examine underlying attitudes toward use of protective gear.

Methods.—This is a cross-sectional study of data collected from anonymous, voluntary responses to questionnaires distributed to snowboarders visiting 1 of 3 designated study sites on the East Coast during the 2013–2014 winter season. Snowboarders under the age of 13 years were excluded from the study.

Results.—Of 245 snowboarders approached, 230 (93.8%) agreed to participate. Participants ranged in age from 13 to 58 years, with a median age of 22 years; 77.2% of respondents were male and 22.8% were female. Snowboarding experience was self-selected as novice (7.9%), beginner (25.8%), intermediate (31.9%), or expert (34.5%). Overall, 74.1% of participants reported never wearing wrist protection, and only 9.8% indicated that they always wear wrist protection. The top 2 reasons selected for not using wrist protection were, “I don’t see the need” (48.1%) and “I didn’t know wrist protectors were available for snowboarding” (37.3%). Of note, 54.2% of respondents stated that they would wear wrist protectors if available. Sex (27.55% male vs 70.37% female, $P < .0002$) and helmet use (30.30% helmeted vs 13.56% unhelmeted, $P < .01$) were found to be significant predictors of willingness to use wrist protectors if available.

Conclusions.—Although wearing wrist protectors has the potential to reduce risk and severity of wrist injury while snowboarding, utilization rates remain low. This study has identified some prevailing attitudes in this population that can be used as targets of behavior change.

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