California Wildland Fire Coordinating Group

Pre- Season Safety Alert

SUBJECT: Exertional Heat Injury

AREA of CONCERN:

1. Physical training
2. Fire Operations
3. Field/project work

DISTRIBUTION: All Firefighters

DISCUSSION: The leading cause of firefighter deaths is "stress/overexertion". This category of fatalities includes heart attacks, cerebrovascular accidents and exertional heat stroke (USFA 2011). Exertional heat stroke (EHS) is a very different type of heat stroke compared with the traditional teaching and understanding of heat stroke. Rhabdomyolysis (rhabdo) is an exertional injury associated with EHS caused by the break down of muscle cells. Rhabdo is gaining attention in the fire service because prompt recognition and treatment are important to prevent muscle and kidney damage. With some exceptions, exertional heat injury should be considered a preventable disease.

Exertional Rhabdomyolysis (Rhabdo) – is a medical condition, thought to be due to prolonged or unaccustomed physical exertion, resulting in muscle tissue breakdown and necrosis. If not recognized and treated early, it can cause permanent muscle damage, renal failure, and may be fatal. This exertional injury can occur in well-conditioned athletes doing their usual workouts. DO NOT ignore the symptoms.

What are Exertional Heat Injury Facts?

- EHS is the rapid development of hyperthermia associated with altered mental status. Any change in mental functioning (confusion, slurring speech, stumbling, poor decision making, dizziness, head ache, looking out of it) must be considerd EHS.
- EHS can happen at any time and very importantly, in the absences of high environmental temperatures.
- Minor signs of extertional heat illness can rapidly progress (less than 30 minutes) to EHS.
- Passive cooling alone DOES NOT work; active cooling is necessary to decrease core body temperature that is produced with heavy exertion.
- One episode of untreated exertional heat injury can weaken you, making you at risk to others during firefighting operations.
- Lack of proper nutrition can contribute to dehydration and rhabdo.
- Rhado can cause permanent disability and end your career; it can also kill you.
- Unfit, overweight firefighters have an increased risk of myocardial infarction and sudden cardiac death.
- You can be a young, fit, well-hydrated firefighter and still die from EHS.

MITIGATION:

What are the active cooling treatment strategies?

For Exertional Heat Stroke, Heat Syncope and Heat Exhaustion:

- Remove all PPEs and immerse both hands and arms in ice cold water (this is the quickest way to lower core body temperature (consider using your ice chests as a practical option).
- Ice cold towels placed around the neck and over the head. It is a good idea to stock towels on the rigs.
- Drink ice cold electrolyte beverages.
- Excessive body temperature destroys brain tissue. Treatment must be rapid and immediate:
  - Remove all PPEs and quickly cool the body (this is a top priority for a heat stroking firefighter).
    - Options for cooling include: Layering the body with ice cold towels and rotating the towels as needed; pouring cold water over the body and fanning to move cool air across the skin, apply ice cold packs to the body (back of neck, groin, and armpits).

What are the strategies that strengthen a fatigued firefighter and mitigate heat injury?

Know Your Risk Factors:

- Drinking or taking: high sugar content beverages, energy drinks, excessive caffeine intake, some weight loss products, creatine, ephedrine, alcohol, amphetamines, cocaine, and/or ecstasy.
- History of a previous heat injury.
- Motivation to push oneself past the point of exhaustion (warrior mentality).
- Reluctance to report issues or illness.
- Recently or currently taking decongestants, antihistamines, cholesterol lowering drugs (statins), diuretics, beta blockers, certain antibiotics (check with your personal physician).
- Having a recent respiratory or gastrointestinal virus.
- Having a recent medical procedure associated with dehydration or electrolyte disturbances.
- Lower level of fitness and/or higher percentage of body fat.
- Inadequate heat acclimatization.
- Skin conditions (sunburn, skin rash, etc.).
- Dehydration and/or inadequate nutrition.

Pre-hydration:

- Dehydration before the event weakens you and sets you up for heat injury.
- Pre-hydrate daily by drinking at minimum 6-8 eight-ounce glasses of water in addition to liquids consumed during meals (8 eight-ounce glasses = 2 quarts). This should include off-duty days. The body can't be dehydrated for four days and then regain cell and tissue hydration status within the first day of returning to work. You can drink lots of fluids, but it still takes time for the water to distribute to all the compartments of the body and provide the best benefit.
- Drink throughout the day, not at one time.
- Know your own sweat rate!
  - Weigh yourself both before and after a challenging workout.
    (2 lbs. of weight loss = approximately 1 liter of fluid loss)

Hydration

- Firefighters engaged in arduous tasks can lose as much as 1-2 liters of fluid per hour.
- Replace sweat loss during an event by drinking, at a minimum, 1 liter of fluid for every 1 hour of exertion. (4 eight-ounce water bottles = approximately 1 liter).
- A general rule after one hour of work is adding in sports drinks (Gatorade) to replace carbohydrates, sodium and electrolytes. (1 twelve-ounce can of Gatorade followed by 3 eight-ounce water bottles equals approximately 1 liter).
- Never mix bottled Gatorade with water; it upsets the formula that is designed for easy digestion.
- Carry powdered Gatorade to add to water if bottled Gatorade may not be available.
- **"Energy" drinks such as Monster, Redbull or Rockstar can cause tachycardia and dehydration. They contribute to heat injuries and should not be consumed at fire incidents or in the emergency response environment.**
- Urine should be clear or very minimally yellow. Darker urine is the body's way of telling you it needs more fluids.

Heat Acclimatization

- Heat acclimatization improves your tolerance to exertional heat loads.
- Start a heat fitness program that includes *gradual* daily workouts in the heat.
- Full acclimation takes approximately two weeks and must be practiced daily.

Nutrition

- **Fire season is not the time to diet.** Low Carb/high protein diets increase your risk of a heat injury.
- Graze throughout the day on healthy snacks, in addition to the standard three meals a day.
- Stock on-the-go carbohydrate supplements for quick fuel replacement.
- Caloric intake must be commensurate to what you expend during physical exertion. If not, you are at a greater risk for dehydration, heat injury and exertional rhabdo. The body needs calories to off-load heat by sweating. Calorie intake must be done with water intake to get the most out of your body's ability to lose heat. If possible, frequent, small feedings are best, but often difficult to do while working.

Crew Monitoring

- **Use the "buddy system".**
- Watch for stumbles, confusion, and fatigue.
  - If symptoms are noticed, have the person count backward from 10 to ascertain cognitive level. If heat injury is suspected, immediately start active cooling. Do not leave affected personnel alone. **Start EMS protocols**.

Please review additional references from the NWCG Risk Management Committee web site located at: *http://www.nwcg.gov/branches/pre/rmc/index.htm*

Exertional Injury Signs/Symptoms and Treatments

Exertional Injury	Signs/Symptoms	Treatments
Heat Cramps	Painful spasms of skeletal muscles; can appear rapidly, without warning; may occur in any muscle group, especially arms, legs, abdomen.	Remove PPEs and lie down in cool, shaded area; hydration with electrolyte beverages; stretching and massaging affected muscles; Basic Life Support medical evaluation.
Heat Syncope	Light-headed, dizziness and/or fainting.	Remove PPEs and lie down in cool, shaded area; initiate immediately active cooling and hydration with electrolyte beverages; Advanced Life Support (ALS) medical evaluation at minimum.
Exertional Heat Exhaustion	Headache, weakness, dizziness, chills, nausea, vomiting, diarrhea, visual disturbances; irritability, low blood pressure, elevated pulse, hyperventilating, decreased muscle coordination (stumbling, staggering); inability to continue exercise.	Remove PPEs and lie down in cool shaded area; initiate immediately active cooling and hydration with electrolyte beverages; ALS medical evaluation at minimum with possible transport.
Exertional Heat Stroke (EHS)	Hot, diaphoretic (sweating can be very profuse), pale or flushed skin, signs with central nervous system (CNS) dysfunction during an exertional event. CNS dysfunction signs can include: confusion, visual disturbances; slurred speech, stumbling, altered level of consciousness; unresponsiveness.	Immediate PPE removal and aggressive active cooling (total body immersion in ice water bath is the standard); rapid ALS treatment/ transport with active cooling continued, IV normal saline and all other interventions conducted en route to the most accessible receiving facility. NOTE: The progression from minor/mild heat injury to EHS can be very fast. When in doubt, cool aggressively, initiate the transport process.
Exertional Rhabdomyolysis	Muscle pain out of proportion to exercise performed; tea colored urine; muscle swelling (compartment syndrome)	May not be evident initially. Seek immediate medical attention to have the appropriate tests performed (serum creatine phosphokinase: CPK or CK) to look for proteins in the blood.

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