

RHABDOMYOLYSIS IN STRUCTURAL FIRE FIGHTERS: A PATIENT POPULATION AT RISK



Structural fire response and training involves exposure to heat and prolonged, intense exertion. These factors increase the risk for rhabdomyolysis. Healthcare providers can prevent debilitating consequences. Be alert to fire fighters reporting signs and symptoms of rhabdomyolysis. Have a low threshold to check serial serum creatine phosphokinase (CK) in structural fire fighters.

Elements of fire response and training associated with an increased risk for rhabdomyolysis are:

- + Carrying heavy loads such as turnout gear and air packs weighing up to 60 pounds, fire fighting tools weighing up to 80 pounds and incapacitated building occupants
- + High levels of exertion, such as victim rescue, climbing ladders and stairs with heavy gear, etc.
- + Prolonged exertion during overhaul (i.e. opening walls to check for smoldering embers, etc.)
- + Rigorous training and physical fitness tests
- + Exposure to heat from the fire, the environment, and physical effort

Death and permanent disability of fire fighters have been associated with heat stress and rhabdomyolysis in fire fighters [NIOSH 2009, 2012, 2014]. NIOSH investigators documented hyperthermia and rhabdomyolysis among structural fire fighters during cadet training which included a live fire exercise. One cadet had a peak core body temperature of 107.2°F; another was hospitalized for rhabdomyolysis [NIOSH 2015].



Photo by Hillsboro Fire Department

Fire fighter Trainee Suffers Fatal Exertional Heat Stroke During Physical Fitness Training—Texas

A case report of a NIOSH fire fighter fatality investigation highlighting the close relationship between fire fighting, heat and rhabdo

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The initial diagnoses were hyperthermia, severe dehydration, and heatstroke, with heatstroke complications including:

- + Rhabdomyolysis
- + Acute renal failure due to rhabdomyolysis
- + Disseminated intravascular coagulation



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Rhabdomyolysis may be misdiagnosed as heat stress or dehydration as the presenting signs and symptoms can be similar [NWCG 2011]. Rhabdomyolysis can have debilitating or deadly consequences if not quickly diagnosed and treatment started.

Tips for Identifying Rhabdomyolysis and Possible Complications

Suspect rhabdomyolysis in structural fire fighters with heat-related illnesses and dehydration, muscle pain, or exercise intolerance. Consider doing the following:

- + Ask about date of last fire response, training exercise, and last physical exertion. Fire fighters may not become symptomatic or seek care until several days after a fire response, job-required physical fitness tests, or recreational exercise.
- + Check *serial* CK levels. This will let you know whether levels are rising or falling. Fire fighters with rising CK levels should be monitored for complications of rhabdomyolysis (arrhythmia, seizure, acute renal failure, compartment syndrome, etc.) and fluid treatment started. A single, CK level may be misleading.
- + Do not rule out rhabdomyolysis solely on urine tests that check for myoglobin indirectly (urine dipstick positive for blood and a urinalysis with no red blood cells). Myoglobin is quickly cleared from the body so it may not be detected in the urine at the time of presentation while CK elevations in the blood may persist for days. Additionally, up to 81% of rhabdomyolysis patients may not exhibit myoglobinuria at all.



Fire fighter having blood drawn.

- + Check compartment pressures when severe muscle pain is localized to a specific compartment, diabetic neuropathy may make physical exam of that compartment unreliable, etc. Documentation of elevated compartment pressures may help facilitate rapid fasciotomy for compartment syndrome. Delayed diagnosis and treatment of compartment syndrome can result in permanent disability.

Bottom Line

Help keep fire fighters safe. Have a high suspicion for rhabdomyolysis. For information on other heat-related disorders, see <http://www.cdc.gov/niosh/topics/heatstress/>.



Right leg after fasciotomy for compartment syndrome. Note residual swelling in right leg, ankle, and foot.

References

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Additional Resources

- NIOSH [2016]. NIOSH criteria for a recommended standard; occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106.

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