An Alternative Method for Treating Exertional Heat Stroke: Tarp Assisted Cooling

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Adams WM. An Alternative Method for Treating Exertional Heat Stroke: Tarp Assisted Cooling. *Athletic Training and Sports Health Care.* 2019;11(3):101-102.

Made available courtesy of SLACK: https://doi.org/10.3928/19425864-20190422-01

Abstract:

Exertional heat stroke, defined as a body temperature greater than 40°C to 40.5°C (104°F to 105°F) with associated central nervous system (CNS) dysfunction, is a medical emergency, and can lead to long-term complications or death without prompt recognition and proper care. Evidence shows that reducing body temperature below the critical threshold for cell damage (40.83°C) within 30 minutes of collapse ensures 100% survival without long-term sequelae.[1–4] Evidence-based best practices clearly dictate that prompt assessment of body temperature using rectal thermometry and immediate, "cool first, transport second," whole body cooling with cold water immersion is the standard of care for exertional heat stroke.[5–7] However, what are clinicians to do if the gold-standard method of treatment, cold water immersion, is not feasible at the location where an exertional heat stroke occurs? The aim of this commentary is to provide clinicians with an alternative option for the treatment of exertional heat stroke in the event of cold water immersion not being available or feasible at a location where exertional heat stroke occurs.

Keywords: exertional heat stroke | hyperthermia | sports medicine

Article:

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Evidence-based best practices clearly dictate that prompt assessment of body temperature using rectal thermometry and immediate, "cool first, transport second," whole body cooling with cold water immersion is the standard of care for exertional heat stroke.[5–7] However, what are clinicians to do if the gold-standard method of treatment, cold water immersion, is not feasible at the location where an exertional heat stroke occurs? The aim of this commentary is to provide clinicians with an alternative option for the treatment of exertional heat stroke in the event of cold water immersion not being available or feasible at a location where exertional heat stroke occurs.

Although this commentary provides an alternative option for the treatment of exertional heat stroke, there is no dispute that rectal temperature is the only accurate and reliable means of assessing body temperature in exercising individuals suspected to have exertional heat stroke, and it is essential in guiding the clinical decision for treatment.[5–9] Using cold water immersion as the gold standard method of exertional heat stroke treatment is grounded by water's greater capacity for heat transfer than that of air.[4] Furthermore, scientific literature supports that an ideal cooling modality to treat exertional heat stroke should have a cooling rate of at least 0.15°C/min to minimize the time above critical threshold temperature.[2,5,10]

Although most organized athletics events should have the capability of implementing cold water immersion in the event of exertional heat stroke, this may not be feasible in settings such as remote military operations, wilderness/remote athletics events, or various labor situations (eg, construction or wilderness fire-fighting). Recent evidence[11,12] has investigated the efficacy of modified/alternative methods of whole body cooling by using a tarp-assisted cooling method with reported cooling rates of 0.15°C to 0.17°C/min. The practical application of this cooling method would result in cooling a patient with exertional heat stroke from 42.22°C to 38.89°C in roughly 19.5 to 22.2 minutes, which is well within the 30-minute time frame to optimize patient outcomes.

Table 1. Step-by-Step Procedures for Successfully Implementing TAC for EHS Treatment

Step	**Instructions**
1	When EHS is suspected (ie, athlete exhibits CNS dysfunction and/or collapses during exercise), a rectal temperature must be obtained by the responding medical provider to rule in the condition.
2	With a confirmed diagnosis of EHS, the athlete should be placed in a supine position in the center of the tarp that is spread out on the ground. If the tarp is rectangular in shape, the athlete should be placed parallel with the longest edge of the tarp to ensure that body surface area is maximized for cooling. Note: If possible, the tarp should be placed in the shade to remove the athlete from direct exposure to the radiative load of the sun.
3	The clinician(s), one being at the athlete's head and the others assisting being equally spread out along the athlete's body, will hold up the sides of the tarp to create an enclosed space around the athlete with the athlete in a semi-recumbent position to keep his or her head out of the water.
4	Once positioned, another individual is charged with filling the enclosed space with ice and water. The volume depends on the athlete being treated, but a volume of 110 to 151 L has been shown to be effective and maximize body cooling. Individuals holding the tarp must ensure that the ice water remains contained within the tarp to prevent loss of ice water for cooling. Note: The amount of ice water that can be used during TAC may vary depending on the size of the athlete being cooled and the size of the tarp. Treatment goals are to maximize the body surface area that is being cooled.
5	Individuals holding the sides of the tarp are able to circulate the ice water by oscillating the tarp to maximize convective heat losses.
6	On completion of cooling (ie, rectal temperature reaches 38.89°C), the tarp can be drained of water and the athlete prepared for transport to the nearest hospital by EMS for follow-up care.

TAC = tarp-assisted cooling; EHS = exertional heat stroke; CNS = central nervous system; EMS = emergency medical services

Implementation of the tarp-assisted cooling method is cost-effective and can be done seamlessly with as many as 3 to 6 individuals actively involved with cooling the patient. When purchasing the tarp (or other water impermeable sheet), the clinician must ensure that the tarp is large enough to allow a large patient (ie, football line-man) to lie supine within the confines of the tarp; dimensions of 2.43 × 3.04 to 3.65 × 4.87 m is generally sufficient to accommodate most patients. In addition, the clinician must be conscious of the amount of ice water to use during treatment, the goal of the former being submersing as much of the body's surface area as possible to maximize the convective cooling properties of water. Table 1 outlines a series of steps that can assist clinicians in cooling a patient with exertional heat stroke via the tarp-assisted cooling method.

On-site, aggressive whole body cooling is a vital component to exertional heat stroke care and survival and, although cold water immersion is the gold standard for exertional heat stroke treatment, clinicians should be cognizant that the tarp-assisted cooling method is an ideal alternative to treat exertional heat stroke.

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