A Comparison of Cooling Times with and without Football Equipment Following Exercise Induced Hyperthermia

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Context: Exertional heat stroke (EHS) is one of the three leading causes of sudden death in sport however it is 100% survivable when proper recognition and management protocols are implemented. When managing EHS, core body temperature ($T_{\text{core}}$) should be lowered to less than 39°F within 30 minutes of collapse and cold water immersion (CWI) is the most effective way to accomplish this. Current protocols recommend removal of all equipment and clothing prior to immersion to enhance cooling. This can be a tedious process and could possibly affect patient morbidity and mortality by causing a delay in cooling. However, comparisons in total cooling time with and without equipment removal have not been assessed. Objective: To compare time to immersion and overall cooling times with and without football equipment removal following exercise induced hyperthermia. Design: A randomized and counterbalanced cross over design. Setting: Research laboratory. Participants: Six healthy collegiate football athletes (age=21.2 ±0.75 y, height=187.5 ±7.08 cm, mass=106.4 ±21.5 kg) without a history of diagnosed EHS or any contraindication to CWI participated. Interventions: Each participant reported to the laboratory on two occasions separated by seven days. On each occasion they performed a bout of exercise on a stationary cycle in a climate controlled chamber maintained at 35°C while wearing a typical football uniform with full equipment until they achieved a $T_{\text{core}}$ of 39.5°C. Once the target temperature was achieved, the participants were fully immersed in water maintained at 10°C either with or without the clothing and equipment removed by a clinician until a $T_{\text{core}}$ of 38.4°C was achieved. The helmet was removed in both conditions to allow for immediate airway access. When the participants returned for the second session, identical procedures were followed using the remaining condition. Main Outcome Measures: $T_{\text{core}}$ was assessed using a rectal thermometer (DataTherm® II Continuous Temperature Monitor) and was used to determine baseline temperature, achievement of target temperatures and to determine cooling rates. The time from exercise target temperature (diagnosis) to immersion, from immersion to cooling target temperature and total times were used to compare cooling times and rates between the two conditions. Results: A significant difference ($t_5=16.32, p=.001$) in the time it took to immerse the subjects in the cold tub was observed as it took longer to immerse the subjects during the equipment removal condition (170.87 ±13.93 s) than during the non-removal condition (63.02 ±18.84 s). However, no differences were noted when comparing the cooling time ($t_5=.840, p=.439$), overall treatment time ($t_5=.516, p=.628$) and the cooling rate ($t_5=1.41, p=.217$). Conclusions: The results do not suggest the need to change current protocols. However, if there is difficulty in equipment removal, CWI should not be delayed and the patient should be immersed with the equipment on. Word Count: 449.