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Recognizing and treating heat-related illnesses: Techniques and approaches for emergency medical services and pharmacists

Abdulkarim Hamed Alsulami
KSA, National Guard Health Affairs

Ibrahim Ahmad Dagha
KSA, National Guard Health Affairs

Saif Helal Almutairi
KSA, National Guard Health Affairs

Abdulrahman Abdullah Nazal Alanzi
KSA, National Guard Health Affairs

Najlaa Saeed Alghamdi
KSA, National Guard Health Affairs

Bandar Mansour Alanzi
KSA, National Guard Health Affairs

Abdulrahman Ramadhan Alenezi
KSA, National Guard Health Affairs

Fares Saqir Aldhafeeri
KSA, National Guard Health Affairs

Sanad Samah Alharbi
KSA, National Guard Health Affairs

Bader Naif Alotaibi
KSA, National Guard Health Affairs

Meshal Falah Alenezi
KSA, National Guard Health Affairs

Corresponding email: *akk29337@gmail.com*
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Mohammed Rashed Aldhahri
KSA, National Guard Health Affairs

Ahmed Saer Alshmari
KSA, National Guard Health Affairs

Mohammed Ayyat Alanazi
KSA, National Guard Health Affairs

Muath Saad Alsultan
KSA, National Guard Health Affairs

***Abstract*---Background:** The increasing frequency of endurance sports events and the associated risk of heat-related illnesses underscore the importance of effective recognition and treatment techniques for emergency medical services (EMS). High-profile incidents involving heat stress, such as those observed in Olympic and Ironman competitions, highlight the need for comprehensive strategies to manage exertional heat illnesses. **Aim:** This article aims to review current techniques and approaches for recognizing and treating heat-related illnesses via pharmacists, focusing on the implications for EMS during endurance sports events. **Methods:** A review of historical and recent cases of heat-related illnesses in endurance sports was conducted. This includes analyzing the physiological mechanisms of heat stress, examining the pathophysiology of heat-related injuries, and evaluating current medical guidelines and intervention strategies. Data were gathered from sports medicine literature, international sporting regulations, and recent research studies. **Results:** The review reveals that effective management of heat-related illnesses requires early recognition of symptoms, understanding the pathophysiology of heat stress, and implementing preventive measures. Key interventions include monitoring environmental conditions using wet globe bulb temperature (WGBT) indices, enforcing temperature limits in event planning, and improving athlete acclimatization and hydration strategies. The effectiveness of these measures varies depending on individual athlete responses and environmental conditions. **Conclusion:** Heat-related illnesses pose a significant risk in endurance sports, but with proactive measures, such as implementing temperature regulations and enhancing athlete preparedness, the incidence and severity of these conditions can be reduced. EMS personnel must be well-trained in recognizing and treating heat stress to ensure timely and effective intervention.

***Keywords*---**Heat-related illnesses, endurance sports, exertional heat stress, emergency medical services, temperature regulation, athlete safety.

Introduction

Historical records vividly recount the inaugural women's Olympic marathon held in Los Angeles in 1984, an event distinguished by the triumph of the local favorite, Joan Benoit. Yet, for many, the lasting image of that sweltering July day is Swiss runner Gabriela Andersen-Schiess, struggling to complete the final 400-meter stretch of the Los Angeles Coliseum [1]. Exhibiting symptoms of hyperthermia, dehydration, and hemiparesis, Andersen-Schiess's severe distress elicited a mixture of revulsion and sympathy from the helpless spectators. In the oppressive heat of the Coliseum, this disoriented athlete crossed the finish line, collapsing into the care of waiting medical personnel, a moment that remains vividly imprinted in the minds of both viewers and onlookers. Fast forward 13 years to the 1997 World Ironman Championships, where the relentless Hawaiian heat took its toll on triathletes Sian Welch and Wendy Ingraham. Once more, television audiences witnessed an extraordinary conclusion as the two heat-exhausted athletes, unable to stay upright, were reduced to an infantile crawl across the finish line, only to be swiftly attended to by concerned medical staff [2]. Similarly, at the 2016 International Triathlon final in Cozumel, Mexico, another striking incident occurred when Olympian Jonny Brownlee, with the World title and finish line in sight, succumbed to collapse. Exhibiting severe neurological impairment and presumed hyperthermia, along with depletion of energy and electrolytes, Brownlee was carried across the finish line by his sibling and fellow competitor, Alistair, who was also the reigning Olympic champion [2]. Although Brownlee's recovery was straightforward, he was evidently affected by the prolonged physical strain and environmental stressors.

These examples illustrate the phenomenon of exercise-associated collapse, with each case highlighting the severe potential outcomes linked to high ambient temperatures and evident neurological impairment. It is imperative for those responsible for on-site medical care at endurance events to remain vigilant regarding the risks of exertional heat stress and its impact on thermoregulatory functions. Furthermore, while these high-profile elite events represent only a small fraction of exertional collapse cases, numerous unpublicized, mass participation events involving amateur athletes—often referred to as "weekend warriors"—also contribute to this issue. Collectively, these cases emphasize the significant morbidity associated with contemporary endurance sports, underscoring the urgent need to address heat-related illnesses effectively.

Exertional Heat Stress:

Over the last thirty years, there has been a surge in interest in endurance sports, leading to the development of improved coaching techniques and a concurrent scientific focus on the strains associated with extended physical effort [3,4,5,6,7,8,9]. However, the cases previously mentioned raise the important issue of heat damage prevention—a strategy that seems to go against the widely accepted default position of active resuscitation. The timing, length, and energy demands of modern endurance events mean that heat-related injuries and the ensuing substantial health consequences will always be a big worry. Triathlons and other multi-sport competitions are typically held in the spring and summer, last longer than an hour, and involve both land- and water-based sports. When the body's natural ability to dissipate heat is surpassed by the combined effects of environmental stressors and energy production, they inevitably provide a challenge to the control of body temperature. With the help of major research investments, a number of international sporting federations, including triathlon (ITU), swimming (FINA), volleyball (FIVB), and athletics (IAAF), have improved our understanding of the pathophysiology of exertional heat sickness [10,11,12]. As a result, a large body of research on athletes' thermal regulation has been produced, which has improved our understanding of the condition's genesis and systemic effects [6,7,8, 13,14,15,16]. Thanks to this research, sports doctors are getting more skilled at seeing the warning signs of approaching heat disease, coaches are putting systems in place to help athletes cope with the effects of heat stress, and event planners are looking to science and clinical expertise for guidance when organizing important races. FINA has implemented evidence based on studies to set temperature limitations for the 10 km marathon swim, which has gained popularity since being added to the Olympic schedule in Beijing 2008. The ITU and FINA have also adopted water temperature limits that have an impact on wetsuit wear during triathlon competition [10, 11]. Temperature limitations on land-based endurance events have been implemented by the ITU and the IAAF. These limitations are controlled via wet globe bulb temperature (WGBT) monitoring. To identify safe circumstances for extended activity, the WGBT gadget detects the following variables: sun radiation, wind, relative humidity, and ambient temperature [12]. Recent studies on the center court temperatures at World Tour and World Beach Volleyball Championships (2009–2011), where WGBT recordings were compared to cases of medical forfeiture by athletes, have had an impact on the FIVB medical regulations. Subsequent guidelines for minimizing heat stress damage in the professional beach volleyball world have been informed by these data [14]. In an effort to reduce the risk of heat-related injuries, WGBT indices are being incorporated to the Games training and competition schedule. There has also been a call by the American College of Sports Medicine (ACSM) for the Games Organizing Committee to limit competition times to early morning or evening in an attempt to avoid the impact of sun radiation on possibly affected outdoor events [17-18]. While proactivity by responsible regulating organizations is acknowledged, the literature and public media stories would suggest that certain experienced, well-trained endurance athletes nonetheless remain susceptible to severe heat-related damage.

Research has demonstrated that not every athlete with a rectal temperature of 40 °C would progress to catastrophic end-stage exertional heat stroke with multi-organ failure for a variety of reasons, including individual variability, acclimatization, training, and nutrition [3, 6,7,8,9]. There have been reports of athletes—such as marathon runners, soccer players, open water swimmers, and American football players—with persistent rectal temperatures above the 40 °C threshold without any negative medical effects [7]. In the same spirit, it's critical to understand how the ideas of heat, tiredness, and dehydration interact. The duration to complete fatigue is also demonstrated to decrease with rising ambient temperatures above 20 °C [6, 7, 16], despite the physiological reaction to tiredness being well-founded and defined as the incapacity to sustain physical effort.

Regulation of body temperature in human:

The ability of the body to maintain a core temperature of 37 °C within a very small range (33.2–38.2 °C) is known as thermal regulation. It is a basic homeostatic process that has been recognized by observational studies and is dependent on a number of physiological parameters [4, 5, 7]. In the context of endurance sports, normal core body temperature rises quickly in response to thermal challenge. This is the result of both recognized environmental factors and the energy produced by prolonged physical exercise. These variables—which include the surrounding temperature, humidity, and sun radiation—remain outside the athlete's control and fall within the purview of the event planners. The medical advisory committees of the ITU, FINA, FIVB, and IAAF have acknowledged these outside influences, as previously mentioned [10, 11, 14]. Their concern for maintaining athletes' safety is ingrained in the regulations and guidelines unique to each sport. Furthermore, the International Olympic Committee has released a policy statement in which it acknowledges that the modern top athlete faces challenges in a range of sporting disciplines due to several environmental factors, including temperature [15].

Mammals have an inbuilt tendency toward homeostasis, and there are four established mechanisms via which body heat is transferred. These are accomplished by the main processes of radiation, evaporation, convection, and conduction. All of them play a crucial role in maintaining homeostasis and controlling core body temperature; variations larger than a few degrees can be quite problematic for thermoregulation [19]. The temperature difference between the skin's surface and the surrounding air is reflected in heat loss mechanisms that are initiated in the anterior hypothalamus. Active sympathetic cutaneous vasodilation, which raises skin blood flow in response to elevated body temperature, triggers sweating by activating eccrine glands. When skin temperature rises above ambient temperature, heat loss happens by radiation and conduction. However, the body absorbs more heat when the outside temperature rises above the skin's temperature, which is then released by sweat evaporation. As a result, engaging in physical activity in high temperatures requires sufficient evaporation; if this is hindered, the ensuing rise in body temperature could result in serious heat injury [6, 7, 9]. An athlete who drinks enough water will be able to produce enough perspiration. Furthermore, it is evident that the athlete has control over how much fluid they consume, which is further supported by the presence of enough food and drink stations throughout each course. For those in charge of choosing the race venues and scheduling them according to the seasons, ambient conditions like temperature and relative humidity continue to be problematic. As previously mentioned, any obstruction to evaporation—the main method of heat dissipation—will raise the body's internal temperature when the ambient temperature is higher than that of the skin. Sweat evaporation is hindered by prolonged physical exertion in high humidity, which is a process necessary to maintain thermal neutrality [3, 6, 19].

In conclusion, body heat produced by exercise is normally rapidly released by the adaptive "cooling" mechanisms of radiation and convective loss through the skin, sweat evaporation, and minute amounts of evaporation through respiratory loss. These defenses lessen the risk of exertional heat injuries, the most dangerous of which is heat stroke, which is typically linked to a body core temperature of more than 40 °C. There is a recognized "spectrum" of exertional heat injuries documented in the sports medicine literature, particularly in events of high intensity or prolonged duration, despite disagreements amongst authority about terminology [20]. Physicians concur that, if left undiagnosed and untreated, heat disease can manifest quite innocently as cramps, syncope, heat rash, oedema, and heat exhaustion before progressing to heat stroke or exhaustion, which is the most severe and potentially fatal end of this continuum [6, 8, 9, 14, 15, 16].

Pathophysiology and Related Factors of Heat Injury:

We now know that heat damage, along with its severe clinical consequences, first appeared in the general population during periods of abnormally high air temperatures. Exposure to extreme temperatures or extended, intense exercise might potentially result in heat stroke, which can have potentially fatal implications. A commonly acknowledged description encompasses a body temperature core exceeding 40 °C, lack of perspiration, and concomitant symptoms of central nervous system dysfunction [21]. Confusion, disorientation, ataxia, delirium, convulsions, or coma are a few examples of these symptoms. From a pathophysiological standpoint, it is also widely accepted that persistent heat stroke is fundamentally a type of hyperthermia that develops into multi-organ failure due to an inflammatory reaction within the system. Non-exertional heat stroke cases that involve people with pre-existing conditions such as heart disease, diabetes, obesity, aging, and renal impairment require immediate medical attention and have been linked to high rates of morbidity and mortality in data from North America and Europe [22, 23]. Nonetheless, the modern knowledge of exertional heat stress in sport has been shaped by the extension of the pathophysiology of non-exertional heat stroke, with prolonged, intense physical activity being the clear additional stressor to thermoregulation [21].

As we've already covered, a range of heat-related injuries are widely acknowledged. An athlete may exhibit symptoms of poor adaptation to the worsening effects of rising body temperature at different locations along this continuum. The adapted athlete will only suffer from "normal" energy depletion and eventual weariness in situations when the homeostatic system of thermoregulation is not significantly challenged [6]. This could or could not lead to what is known as exertional collapse, which is a generally benign disease that improves with cautious treatment. As a main mechanism of dissipating heat, sweating is triggered by sustained increases in body temperature, which in turn induce cutaneous vasodilatation and redirect blood from core viscera to the skin. Major organs are put under stress by this blood shunt from the central circulation to the periphery, which also causes a relative decrease in intravascular volume that may result in hypotension and the "heat syncope" phenomena. In the meantime, sweating-related losses worsen dehydration and salt depletion, which are associated with heat exhaustion and typically thought to be a factor in heat-related muscular cramping. If the challenge to core body temperature is allowed to continue unchecked, any additional loss of salt and water further hampers normal thermoregulatory processes and, when combined with the reduction in visceral perfusion, may precipitate cellular damage and ultimately organ failure [7, 17, 19, 21].

Pathogenesis of Heat Injury:

Exertional heat stroke (EHS) is caused by a complicated series of events that start at the cellular level. Heat-stressed cells experience damage to their membranes, disruptions to their energy systems, and changes in the permeability of their membranes. These alterations cause intracellular endotoxins to seep into the bloodstream, which in turn causes the multi-organ damage and failure syndrome that has been extensively studied [24, 25]. Interleukins (IL)-1 and (IL-6) from skeletal muscle are described as well as endotoxin leakage through the intestinal mucosa, which results in a process known as the "systemic inflammatory response syndrome." These proteins enter the bloodstream and trigger the generation of leukocytes, which damages vascular endothelium and increases the likelihood of microthrombotic events [25]. Heat inhibits platelet production, increases fibrin formation, and eventually causes a diffuse coagulopathy that shows up as disseminated intravascular coagulation (DIC). The leakage of intestinal gram-negative bacterial pieces into the systemic circulation, which is the cause of the alarming result of endotoxic shock, further exacerbates damage to the gut cell membrane. For any susceptible athlete, these effects are amplified in the context of dehydration and have severe clinical ramifications [26,27,28].

Apart from these consequences, it is also commonly known that temperatures higher than 40 °C pose a significant threat to the structural integrity of skeletal muscle [29]. Diffuse muscle fiber loss is the outcome of cellular structural alterations brought on by prolonged heat stress. Rhabdomyolysis is a clinical disease brought on by this pathophysiological process [28, 29]. Damaged cells release muscle enzymes, especially creatine kinase (CK), into the bloodstream. A measurement of CK levels greater than a thousand times normal is considered a reliable indicator of rhabdomyolysis. Another result of muscle damage is free myoglobin fragments, which cause dark-stained urine, which is the characteristic discoloration of frank myoglobinuria. Exercise-induced rhabdomyolysis might progress to cause serious renal damage by obstructing and poisoning the tubules. Hyperkalemia is caused by intracellular potassium, which is also discharged into the bloodstream from injured cells. This condition is known to precede lethal cardiac arrhythmia [28]. All of these potentially fatal outcomes highlight how dangerous it is to engage in prolonged physical activity while it's hot outside [30].

Heat Stress- Disorders and Symptoms:

Any scenario involving prolonged, vigorous physical exertion carries a recognized risk of heat sickness, especially in hot, humid weather. Athletes who suffer from exhaustion heat illness during intense or prolonged exertion may decide to retire from the competition or pass out while or shortly after it is over. Exercise-induced muscle cramps, heat exhaustion, and exertional heatstroke are among the disorders that can occur in athletes, despite the fact that there is recognition of a broad range in individual responses to heat stress [6]. Athletes are especially susceptible to the negative effects of heat stress, including dehydration, poor acclimatization, usage of certain drugs, and recent illness. A recognized continuum of condition encompasses a constellation of signs and symptoms linked to exertional heat sickness. Rapid cooling and early detection can lower the morbidity and death linked to these clinical difficulties, which are frequently subtle and simple to overlook. As a result, race officials, coaches, and medical staff need to keep a close eye on athletes who are considered to be at risk. Muscle cramps from exercise and heat exhaustion are usually caused by weariness, dehydration, and/or electrolyte loss rather than extreme hyperthermia. But where central mechanisms of heat regulation fail and typical heat dissipation processes fail, unidentified athletes may succumb to catastrophic results. A quick rundown of typical exertional heat injuries is provided below.

1. Severe heat cramps: The phrase "heat cramps" refers to excruciating, involuntary spasms of muscle spam brought on by prolonged exercise in hot weather. The same ailment for which Exercise-Associated Muscle Cramps (EAMC) has been named has also attracted a sizable amount of research interest. This type of cramping that affects athletes usually affects the calves, however it can also affect the arms and abdomen. Two potential aetiologies for EAMC are under scientific discussion. The first suggests that heat cramps are caused by prolonged sweating and the resulting loss of electrolytes, especially sodium. The other theory is that heat cramps are caused by "altered neuromuscular control." The latter would be favored in the current discourse as the most plausible pathophysiological mechanism [31]. During the foot plant and "toe-off" phases of running, combined eccentric-concentric, repetitive muscle contraction across a brief range of motion would suggest a predisposition for common gastrocnemii (calf muscles) cramping. Similarly, cramping in these areas can also be explained by maintaining an extended erect running position that engages static contraction of the anterior abdominal wall, with rigid, adducted arms and flexed elbows. Another theory is that hyper-excitable axon terminals spontaneously discharge, causing muscular fasciculation, which can further worsen into incapacitating cramps [32]. Despite the well-informed discussion regarding the pathophysiological cause of heat cramps, it is still generally acknowledged that the best ways to treat them are to rest, stretch passively, and replace lost sodium with oral fluids. It is still a good idea for all endurance competitors to stay hydrated during the event. For all athletes, but especially for those who perspire a lot when competing in hot weather, dehydration poses a problem. Even if we ignore the electrolytes lost through perspiration, an athlete who has lost too much fluid will not be able to start sweating and will not be able to activate a vital thermoregulatory system. Heat cramps are on the milder end of the heat injury range, but if left untreated, they could be a sign of more serious heat-related injuries linked to prolonged physical exertion.

2. Exhaustion from heat: High humidity and heat exhaustion from extended physical exertion in hot weather often coexist. As with all forms of heat injury, athletes experiencing full-blown heat exhaustion always have distressed looks, although the signs and symptoms vary from mild to moderate to severe. Severe heat cramps accompanied by tachycardia and copious perspiration may be the first indications of approaching heat exhaustion [3]. An unnamed athlete may develop confusion and disorientation, which would be an early warning sign of potentially dangerous effects on the central nervous system from an elevated body temperature. Unusual behaviors, increasing disorientation, an unsteady walk, and an improper reaction to commands could also be mild indicators of increasing heat stress that affects the brain [6]. Dizziness, nausea, and fatigue are common symptoms of heat exhaustion, along with indicators like minor fever increase and vomiting. Athletes may have previously reported experiencing muscle cramps; upon examination, they exhibit chilly, clammy skin, a fast, thready pulse, heavy perspiration, and disorientation. Race organizers should keep a tight eye on these athletes because there is frequently a sense of exhaustion and approaching collapse. If ignored and untreated, the increase in body temperature has the potential to totally overpower thermoregulatory systems and lead to serious heat stroke. Nevertheless, if heat exhaustion is caught early enough, it usually goes away with treatment for the symptoms and oral hydration [3, 6, 8, 11].

3. Heatstroke caused by exertion: As previously mentioned, there is a recognized spectrum of heat-related injuries where heat exhaustion and heat stroke can occur. However, heat stroke is invariably associated with a core body temperature greater than 40 °C. The most severe type of heat damage is called exertional heat stroke (EHS), which is characterized by prolonged, high body heat that causes a systemic inflammatory response and a state of central nervous system dysfunction [21, 33]. An athlete experiencing exertional hyperthermia can collapse due to a series of problems affecting the neurological, cardiovascular, hematological, and renal systems. This injury can be fatal and progresses from nonspecific symptoms like headache, nausea, and general malaise to severe systemic sequelae such rhabdomyolysis, hepatic failure, absence of sweating (anhidrosis), and disseminated intravascular coagulation. Arrhythmia and a potentially deadly consequence are often linked to the developing neurological indications of disorientation, delirium, and coma [3, 6, 8]. Prompt detection, quick escape from the situation, shelter from the weather, vigorous whole-body cooling, and enough fluid and electrolyte replacement are all necessary for the efficient treatment of heat stroke [6, 7].

Susceptibility of Heat Stress:

A substantial amount of knowledge gleaned from related clinical data and military records has shaped our understanding of EHI and individual susceptibility. These reports support the pathophysiological basis for heat damage and are rich in clinical presentation details. Extrinsic and intrinsic factors can both influence an individual's sensitivity to heat injury. Environmental elements including humidity, temperature, and sun radiation are included in the former [34, 35, 36, 37]. This also applies to the water's temperature in multisport competitions. As previously mentioned, international federations and race organizers are in charge of these elements and choose the locations and seasonal dates of important events [32, 38]. It is also acknowledged, though, that individual athletes getting ready for endurance competitions should be clearly well-trained, acclimated to working out in the heat, well-hydrated, free of any recent systemic illnesses, and not using any drugs that could make them more susceptible to heat stress. Certain drugs, such as stimulants, antihistamines, anticholinergics, and phenothiazines, can increase the risk of heat stroke. Sunscreen application and appropriate clothing selection (color and texture) are two more intrinsic elements that are still the athlete's responsibility. In order to reduce the risk of exertional heat stress, it is crucial that coaches and athletes get knowledge in the areas of hydration, acclimatization, and immunity to concurrent illnesses. Race officials are the ones who are most likely to recognize heat illness and its crippling effects.

It is their duty to notify the required medical support. This recognizes that pre-race preparations should involve having enough medical personnel on hand as well as tents, awnings, or other appropriate shelters for injured athletes.

Management and Treatment via Pharmacists and EMS:

Heat stroke is a severe form of heat-related illness characterized by an elevated core body temperature, usually above 40°C (104°F), and central nervous system dysfunction. It represents a medical emergency that requires prompt and effective intervention to prevent serious complications or death. The management and treatment of heat stroke in the emergency department (ED) involve a multi-faceted approach focusing on rapid cooling, supportive care, and addressing any complications.

1. **Initial Assessment:**
   - **History and Physical Examination:** Obtain a detailed history including the duration of exposure to high temperatures, physical activity, and symptoms onset. Perform a physical examination to assess vital signs, neurological status, and signs of organ dysfunction.
   - **Immediate Monitoring:** Measure core body temperature using a rectal thermometer, as it provides the most accurate reading. Monitor heart rate, blood pressure, respiratory rate, and oxygen saturation.
2. **Rapid Cooling:**
   - **External Cooling Methods:** Initiate cooling measures immediately. Methods include:
     - **Ice Packs:** Apply ice packs to the axillae, groin, and neck areas to maximize cooling.
     - **Cool Water Immersion:** If possible, immerse the patient in cool (not cold) water, which is one of the most effective cooling methods.
     - **Evaporative Cooling:** Use fans and misting with cool water to enhance evaporative cooling if immersion is not feasible.
   - **Monitor Effectiveness:** Continuously monitor core body temperature and adjust cooling methods as necessary. The goal is to lower the temperature to below 39°C (102.2°F) within the first 30 minutes.
3. **Supportive Care:**
   - **Hydration:** Administer intravenous fluids to address dehydration and restore electrolyte balance. Start with isotonic fluids such as normal saline. Consider using fluids with electrolytes if there is significant electrolyte imbalance.
   - **Oxygen Therapy:** Provide supplemental oxygen if the patient shows signs of respiratory distress or hypoxemia.
   - **Medication:** Administer antipyretics if needed to manage fever. Avoid using antipyretics as a primary cooling strategy, as they are not effective in the immediate reduction of core body temperature.
4. **Addressing Complications:**
   - **Neurological Monitoring:** Monitor and manage neurological symptoms such as confusion, seizures, or coma. Administer benzodiazepines or antiepileptics if seizures occur.

- **Organ Function:** Assess for signs of multi-organ dysfunction. Perform laboratory tests to monitor liver function, renal function, and electrolyte levels. Manage any identified organ dysfunction accordingly.
- **Rhabdomyolysis:** Check for elevated creatine kinase levels and myoglobinuria. Initiate aggressive fluid resuscitation to prevent acute kidney injury.

5. Transfer and Follow-Up:

- **Intensive Care Unit (ICU):** Consider transferring the patient to an ICU for ongoing monitoring if severe complications are present or if the patient requires advanced supportive care.
- **Discharge Planning:** Once stabilized, provide education on heat stroke prevention, hydration strategies, and signs of heat-related illness. Schedule follow-up appointments to monitor recovery and address any ongoing issues.

Conclusion

Heat-related illnesses represent a significant challenge in the realm of endurance sports, characterized by a range of conditions from heat exhaustion to life-threatening heat stroke. The reviewed cases highlight the severe outcomes that can arise from inadequate management of heat stress, emphasizing the critical role of emergency medical services (EMS) in mitigating these risks. The physiological response to heat stress involves complex interactions between environmental factors and the body's thermoregulatory mechanisms. Key to preventing heat-related injuries is understanding how these mechanisms, including sweating and vasodilation, can be overwhelmed by extreme temperatures and prolonged exertion. Effective prevention and treatment strategies are crucial for maintaining athlete safety during high-temperature events. Recent advancements have led to better preventive measures, such as the use of wet globe bulb temperature (WGBT) indices to monitor environmental conditions and inform race planning. These measures have been incorporated into guidelines by major sporting organizations, including the ITU, FINA, and IAAF. Despite these efforts, individual variability and unforeseen environmental factors continue to pose risks. EMS must be equipped with the knowledge and tools to identify early signs of heat-related illnesses and to apply appropriate treatments swiftly. Training for EMS personnel should emphasize the recognition of heat stress symptoms, the importance of rapid cooling techniques, and the management of complications such as dehydration and electrolyte imbalances. Ultimately, while substantial progress has been made in understanding and managing heat-related illnesses, ongoing research and vigilance are necessary. Ensuring that preventive strategies are rigorously applied and that EMS teams are prepared for prompt intervention will help reduce the incidence and severity of heat-related injuries in endurance sports. The combined efforts of event planners, sports scientists, and medical personnel are essential to safeguarding athletes' health and performance in challenging environmental conditions.

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والتعامل الصيدلي التعرف على وعلاج الأمراض المرتبطة بالحرارة: تقنيات وأساليب لخدمات الطوارئ الطبية

الملخص:

الخلفية :تزداد تكرار أحداث الرياضات التحميلة والمخاطر المرتبطة بالأمراض المرتبطة بالحرارة، مما يبرز أهمية تقنيات الاعتراف الفعالة والعلاج لخدمات الطوارئ الطبية .(EMS) الحوادث البارزة التي تتعلق بالإجهاد الحراري، مثل تلك التي لوحظت في المنافسات الأولمبية وأريون مان، تسلط الضوء على الحاجة إلى استراتيجيات شاملة لإدارة الأمراض الناتجة عن الجهد الحراري.

الهدف :يهدف هذا المقال إلى مراجعة التقنيات والأساليب الحالية للتعرف على الأمراض المرتبطة بالحرارة وعلاجها، مع التركيز على تداعياتها على خدمات الصيدلة والعلاج وخدمات الطوارئ الطبية أثناء أحداث الرياضات التحميلة.

الطرق :تم إجراء مراجعة للحالات التاريخية والحديثة للأمراض المرتبطة بالحرارة في الرياضات التحملية. يشمل ذلك تحليل الآليات الفسيولوجية للإجهاد الحراري، وفحص علم الأمراض للأضرار المرتبطة بالحرارة، وتقييم الإرشادات الطبية الحالية واستراتيجيات التدخل. تم جمع البيانات من أدبيات الطب الرياضي، واللوائح الرياضية الدولية، والدراسات البحثية الحديثة.

النتائج :تكشف المراجعة أن إدارة الأمراض المرتبطة بالحرارة بشكل فعال تتطلب الاعتراف المبكر بالأعراض، وفهم علم الأمراض للإجهاد الحراري، وتنفيذ تدابير وقائية. تشمل التدخلات الرئيسية مراقبة الظروف البيئية باستخدام مؤشرات درجة الحرارة في الكرة الرطبة(WGBT) ، وفرض حدود درجة الحرارة في تخطيط الأحداث، وتحسين استراتيجيات تأقلم الرياضيين وترطيبهم. تختلف فعالية هذه التدابير بناءً على استجابة الرياضي الفردية والظروف البيئية.

الاستنتاج :تشكل الأمراض المرتبطة بالحرارة خطرًا كبيرًا في الرياضات التحملية، ولكن من خلال اتخاذ تدابير استباقية، مثل تنفيذ تنظيمات درجة الحرارة وتعزيز استعداد الرياضيين، يمكن تقليل حدوث وشدة هذه الحالات. يجب أن يكون موظفو خدمات الطوارئ الطبية مدربين جيدًا على التعرف على الإجهاد الحراري وعلاجه لضمان التدخل في الوقت المناسب وفعاليته.

الكلمات المفتاحية :الأمراض المرتبطة بالحرارة، الرياضات التحملية، الإجهاد الحراري الناتج عن الجهد، خدمات الطوارئ الطبية، تنظيم درجة الحرارة، سلامة الرياضيين.