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Exertional Heat Stroke (EHS): Emergency Medical Treatment Goals

Narrator:
Welcome to REACHMD. This special edition of *The Pulse of Emergency Medicine* is sponsored by Eagle Pharmaceuticals. The following activity is intended for physicians. Here's your host, Dr. Shira Johnson.

Dr. Johnson:
Exertional heatstroke, or EHS, is a sudden and unpredictable condition. Delayed treatment for heatstroke can result in brain damage, organ failure, or even death. On this program, we'll focus on EHS in the emergency medical setting, the top priorities for initiating treatment, and the best-available therapeutic options. This is ReachMD and I'm Dr. Shira Johnson. Joining me is Dr. Bill Hampton, Clinical Assistant Professor of Emergency Medicine and Osteopathic Manipulative Medicine for the Chicago College of Osteopathic Medicine at Midwestern University. Dr. Hampton practices at Holy Family Memorial Hospital in Manitowoc, Wisconsin. Dr. Hampton, welcome to the program.

Dr. Hampton:
Thank you very much. It's my pleasure to be here.

Dr. Johnson:
So, to start, because not all of our listeners are in emergency medicine, help us understand how patients with exertional heatstroke present in the emergency department setting.

Dr. Hampton:
Usually, this is a circumstance where the history explains the illness. It's often someone exercising under hot conditions, or, in my hometown, a lot of times it's been laborers working at a foundry or another hot environment that will come in, obviously, very warm to the touch, appear to be overheated, and then, also, with profound altered mental status.

Dr. Johnson:
So, is it easily recognized on presentation, or can this condition be mistaken for other entities in a rapid-response setting?

Dr. Hampton:
I'd like to say that it's easily recognized, but that's unfortunately not true. There are a number of things that can cause altered mental status, and even under circumstances such as exercise or other exertional activity, there could be something else that's going on. They could simply be ill from some other cause. There may have been an injury that went unrecognized, because no one was around them at the time; electrolyte problems such as hyponatremia, maybe they had a seizure but, for the most part, it's a pretty clear-cut story of someone was exerting themselves under hot conditions and they became altered and they came to other's people attention, and they're brought to us.

Dr. Johnson:
Could you comment on the mortality and morbidity from heatstroke?

Dr. Hampton:
Right. And it's going to be patient-dependent. It's going to be circumstance-dependent. Untreated, unrecognized, delayed care, absolutely they are going to have long-term morbidity if they, in fact, survive. In terms of overall mortality, I don't know that we have great numbers or reliable numbers, because a lot of times this simply goes unrecognized. ICD-10, ICD-10, despite it's, I don't know how many codes there are, how many tens of thousands, exertional heatstroke is not even one of the codes. So, it's a difficult thing to study,

to monitor, because it's all case reports. It's all episodic. It's all these little things that happen all over the place, and there's not a single registry that's keeping track of all of these people and all of these patients.

Dr. Johnson:
So, what are the stages, or types of heatstroke? How does it progress?

Dr. Hampton:
When we look at heat illness, in general, there are really two things we need to talk about. One is simply heat exhaustion and that's, "I got too hot, and I became ill." I collapsed, or I started feeling dizzy, or just unwell, and then heatstroke. And really, the defining character between the two is altered mental status. And admittedly, that is an emergency department term. So, we take altered mental status to mean either a change in the patient's level of consciousness, or some alteration in the way that they process information; the way they speak, or talk, or other things that you'd use to evaluate them from a neurologic standpoint.

Dr. Johnson:
Now, given the heavy toll of heatstroke on multiple organ systems, once they are in a controlled environment, like our ERs, how do you monitor organ normalization and recovery, and neurological recovery during treatment?

Dr. Hampton:
Right. So, it's important to recognize just how devastating heat can be to the body. Pretty much every organ system is affected. You'll see an increased heart rate, but overall decreased cardiac output. The heart is compromised when it's trying to work at markedly elevated temperatures. You'll see liver failure. You'll see renal failure. You'll even see coagulopathies; blood that just will not clot. Pulmonary edema can be a sign. And then, obviously, neurologic injury is what we fear the most and that's really where the morbidity of heatstroke comes in. I can save a heart. I can put somebody on dialysis for their kidneys, and the liver, as long as you take away the original insult, generally is a pretty resilient organ and will recover. But the brain, unfortunately, what we're left with a lot of time is someone who is never quite the same person as they were before the heat injury, before the heatstroke.

Dr. Johnson:
So, when you look at treatment goals for exertional heatstroke, and you're thinking about getting the temperature down rapidly, is there a golden window for initiating that treatment, and are we achieving it for these patients when you consider transport times and workups?

Dr. Hampton:
Right. And this is key. The golden window, unfortunately, is very short for true exertional heatstroke. The window, at this point in time, as best evidence as we can determine, is about 30 minutes. And that is getting the core temperature down rapidly in 30 minutes, which is very difficult to do. And so, you add in just a few minutes of the patient not being recognized that they're having heatstroke. You add in just a few minutes of EMS arrival; they're very fast, but it takes time to get there, and then their assessment on scene. And, unfortunately, we're falling outside of that window, I would say, on a fairly consistent basis. The only people that truly do a great job of it, because, well, they're aware of it, and they have protocols in place, is the military. They're watching for it. They have treatment things at the ready and they're able to respond almost instantaneously, but in the civilian world it's a little different. We are consistently… treatment gets delayed and therapy gets delayed, simply because of all the factors that go into taking care of these folks.

Dr. Johnson:
So, let's go back to your facility. When a patient comes in with suspected or recognized heatstroke, be it more than heat exhaustion, what's your ER approach? What does your protocol call for when the patient first comes in?

Dr. Hampton:
We're going to follow, of course, because it's emergency medicine, we're going to follow ABCs. So, if they're so altered that we need to take their airway and intubate them, we will. If we need to support their breathing, if we need to support their circulation, they will. Once those things are taken care of, every effort then becomes at cooling the patient. And heat loss happens through four things: radiation, conduction, convection, and evaporation. And so, we try to maximize all four of those things. We support radiation, or giving off of heat, or radiating heat, if you will, by cutting their clothes off; getting them as undressed as we can. Conduction, we're using ice packs in the groin, in the axillae, right next to those big arteries where all the blood flow's going through to cool that blood. Convection and evaporation we use in conjunction with one another. We use little water bottles to spray the patient down and then we ask housekeeping to bring down their big floor fans, setting those up, and then blowing air across the patient. Now, this is not the best cooling method, but in my emergency department, unfortunately, this is the best that I can do to cool the patient.

Dr. Johnson:
I think everybody listening to this show realizes in different facilities you have different limitations, and all of us have to do what's quickest and best for our patients in the facility that we're in.

Dr. Hampton:
Absolutely. The best cooling method is ice water immersion. And, unfortunately, the two things that I need in order to do that successfully, one is a very large bathtub, if you will, and tremendous amounts of ice water. Well, I can get the ice, but I don't have a bathtub at the ready, and of course, the other problem is, is how do you actually care for this critically ill patient when they're partially submerged in ice water? It's a real challenge. This is why the military is so successful, and this is why sporting events have recognized this. When you are in the field, they will set up, for instance, our local marathon, we will have set up an ice water bath ready to go. So, if we have somebody collapse for our marathon, we transport them immediately to the cooling tent, immerse them in ice water, and we get great cooling rates and we've had really tremendous success with this. Similar to the military, under hot conditions, they have that at the ready. If a military recruit would collapse, they immediately are immersing them in ice water and they're getting tremendous cooling rates, and they're not seeing the morbidity and the mortality that we will in other settings where you don't have that immediate cooling method.

Dr. Johnson:
So, now let's talk about a little bit about the external cooling methods. Based on physiology, isn't the evaporative proving that it still will work, it just takes more time?

Dr. Hampton:
Right. It will. Evaporative cooling absolutely will work, particularly when you add with it the high flow of fans to improve the rate of evaporation, and using a tepid water, not cold but certainly not warm. Again, if that's all you have, clearly, you need to do something for the patient in front of you, and if that's the best care that you can give, then that's what we're going to use. Ideally you have EMS that recognizes the patient's overheated and hopefully it happens under circumstances where they are able to intervene on the site, in the field, with immersive ice water cooling.

Dr. Johnson:
Can you comment on what maybe EMS in the field is doing, you mentioned the military, but even in other cities in the civilian community? Are they trying any alternate ways of bringing the temperature down cooler, especially when there's delayed time to getting them to an emergency department?

Dr. Hampton:
Right. So, one of the newer things that EMS has come up with, and I love my EMS guys and ladies, they're just, they're fantastic, and they're so, "How can we do this smarter, how can we do this better with limited resources?" One of the things that you may have seen is this: It's called the "taco" technique. And so, envision if you will, taking a tarp, because most of the EMS folks have some sort of tarp that they use for transport, putting it underneath the patient, and then scooping up the sides, like a soft taco, so the patient is then held within the tarp and then they're pouring ice water into the tarp, creating like an instant bathtub on site. Cooling the patient on site, monitoring that rectal temp, getting the temperature down, and then transporting to us. So, they're giving what is currently the definitive therapy, on site, treating them effectively, and then bringing to us. And it's just, it's fantastic, so simple and just so clever.

Dr. Johnson:
That is fantastic. It's very basic and it's using equipment that they have, and as you said, you may be preventing some of the neurological effects of heatstroke, because you're instituting therapy early in the field, which is really what EMS is all about. Any additional thoughts on treatment of heatstroke that you'd like to impart to us and to our listening audiences?

Dr. Hampton:
I would. We've gotten very, very good in medicine about keeping people alive. And that is, I think of this as, that's really 20th century medicine. We've learned how to keep people alive, how to prolong life. And as we move now, 21st century, I think our focus has changed. What can we do to preserve neurologic function? That's really the state-of-the-art of medicine. So, when it comes to exertional heatstroke, yes, certainly, we can cool a body, but if we can't protect and save the brain, then what are we doing? We're not really practicing to the fullest capabilities that we have. Remember, the brain uses between 20 to 25% of your oxygen. So, it's an organ that takes a tremendous amount of resources, and as you increase body temperature, the brain demands more and more resources. And eventually, we get to this tipping point where the body simply cannot support what the brain needs, and that is where we start to see exertional heatstroke. And that has to be our goal here in the 21st century. It's not enough to save the body anymore, if the person is left permanently disabled or debilitated; we must also save the brain.

Dr. Johnson:
Thank you, thank you very much, Dr. Hampton. I would like to thank you today for joining us to discuss: The Goals of Treatment for Exertional Heatstroke. It's been an absolute pleasure having you on the program and I hope you enjoyed being with us and ReachMD

as well.

Dr. Hampton:
Dr. Johnson, this has been wonderful. I appreciate the invitation, and thank you so much for the time and the ability to talk to your audience about this. Thank you.

Narrator:

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