

## Transcript for Module 3: Basic: Burn Treatment and Stabilization

The third module, we'll talk a little bit about the treatment and stabilization of burns. The objectives here are to describe the basics of initial burn assessment and management and discuss the follow-up care and transfer criteria, and then also to go over some of the special situations pertaining to burn patients and their mechanisms.

The initial care is one of which where we focus on stopping the burn process and then moving onto the American Trauma Consortium on the A, B's, and C's. And then of course, follow-up by the DNE. But most notably, I always think of these patients as trauma patients first, so first assess their airway.

Look into the breathing, see how their circulation is doing. Look for other associated disabilities and exposures, and then begin your fluid resuscitation protocol. When talking about airway and breathing in burn patients and the indications for intubation, we always assess the patient as a whole. There are a number of these listed criteria that in and them themselves are not going to be indications for intubation. However, when you start to put them together and then the patient as a whole, that's when we start to talking about indication for intubation. So, if you see a patient that just has some singed nasal hairs and no other signs of an inhalation injury or a compromised airway, that in itself is not an indication to place a breathing tube. However, if you have voice changes, stridor, you may be associated with a very large burn or if they're having difficulty swallowing or signs of obstruction, these are all things that you should look at and put together and then protect the patient's airway.

Moving forward onto circulation, the first thing you want to do is assess for pulses and extremities and the patient's hemodynamic stability. If there's active hemorrhage, control with direct pressure and if this fails, you possibly will need a tourniquet or a surgical control. The burn will remain stable throughout the hemorrhage stabilization, it's not something that needs to be managed immediately. Once you have the patient stabilized from a hemorrhage control, move forward to beginning your Crystalloid (LR) and blood products as needed to treat hypotension, in addition to the burn fluid resuscitation. Remember, purely burned patients, we don't bolus their fluid resuscitation. However, if they are hypotensive or their blood pressure is low, then I think it is important to treat that first.

We'll talk a little bit about the first thing you do when you see a burn, sometimes when you -- when they come in, there's a -- the smell of burning flesh can be overwhelming and if it's not something that you're accustomed to, it can make you stray from your normal algorithms, but what you need to do is come back to the basics and once you've treated the ABCs and looked at all of the other things and you're onto your secondary survey, you want to cool the burn.

Typically in America, the American Burn Association has stemmed away from putting cold compresses or cold, wet dressings onto patients as they quickly become hypothermic, but if they're continuing to be burned or continuing to have things such as chemicals, you do want to

remove those and reverse those processes. Again, our skin is responsible for our thermal regulation and once that is injured or damaged, patients become hypothermic relatively quickly, and that's why we recommend, especially for transfer, placing the patients in dry dressings.

When we've identified and cared for the patients and we've stabilized them and we've begun their fluid resuscitation and feel that we've identified any other traumatic injuries that could harm or hurt them, we like to talk about their follow-up care and/or transfer criteria. The referral criteria for a burn center is laid out pretty nicely by the American Burn Association, and it's available on their website.

Typically, any burn greater than 10% total body surface area, burns that involve the hands, face, feet, genitalia, or burns that what we -- what are considered at that time to be third-degree, those patients should be referred.

Electrical injuries including lightning strikes, chemical burns, patients that have an inhalation injury with or without cutaneous burns, or patients with extensive pre-existing conditions should also be transferred to a burn center. Again, a lot of times these patients are associated with other trauma and caring for both the burn and the trauma can be situations that overwhelm our facilities, and these patients should also be transferred, followed up with patients -- pediatric patients as well as patients with special social or emotional rehab needs.

When getting a patient ready for transfer, the thing I want to make sure that people do is to secure all the lines and tubes, cover the wounds with dry, sterile dressings, don't delay transfers for imaging and labs. Get them and then make sure that they get sent along.

Always update a tetanus, start IV fluids if you can at the Parkland Formula. However, if -- we'll go over some criteria for basic resuscitation. If one is not sure of the burn size and the patient's weight, then just use -- utilizing a quick and dirty method of approximately 500cc's per kilogram, or excuse me, 500cc's to begin the resuscitation while we're working on transfer. Determine whether the patient needs to be transferred via air or ground, and whether or not the burn center is able to accept them directly. The Parkland Formula was written about and described by a Charlie Baxter in Parkland, Texas, back in the 60s. He wrote about that patients treated with approximately 4cc's per kilogram, per percent total of body surface area were more likely to survive in the first 48 hours of their injury than patients treated with normal trauma resuscitation. Initially, this was discovered in dog models and then subsequently extrapolated into humans. But basically, the equation calls for the total volume of fluids to be given over the first 24 hours with the first half being infused within the eight hours, and the second half being given over the subsequent 16 hours. There's an example on the slides for you to look at. The thing to remember, also, is that this is a starting point. If the patients require more or less of fluids based on their urinary output, then we should titrate our fluids to the appropriate volume.

When estimating percent total body surface area, a quick and dirty way, especially when utilizing looking at children is to think of the size of their palm and to consider that palm being approximately -- the palm of the patient to be approximately 1% of the total body surface area

of that patient. Remember, your palm on a ten-month old baby would be far more than 1%. So remember, it's the palm or surface of the patient.

The rule of nines is a quick and dirty way that deviates from the Lund & Browder Method, but is very accurate when done correctly. The one caveat to it is to remember that when we -- in our very young children, the head is larger compared to the rest of the body than that of adults, allowing for a larger designation of total body surface area when their head and face are burned. But essentially, what it spells out is that 9% of total body surface area for each arm, 18% total body surface area for the chest and back, and in an adult, it's 18% for each leg, and then the head is 9% in adults and 18% in a child, as depicted by the picture.

The guidelines for safe transport is, again, keep the patient warm and dry. No wet dressings. Secure an airway if necessary and evaluate. Initiate your fluid resuscitation. Place a foley catheter so we can monitor accurate urinary outputs in our ongoing resuscitation protocol. Update their tetanus, continue pain and sedation medications as this is a very painful process for patients to go through. And remember, no Bolus therapy unless the patient is hypotensive with associated trauma. Transport issues, this is basically a laundry list of local regional areas that -- with their associated dispatch phone numbers, and what can be used to help transfer patients. Criteria for observation and outpatient care, essentially if a small -- if the total body surface area is less than 10%, first and second-degree burns can be monitored. Burns that are non-circumferential and patients that have need for IV hydration and intractable pain.

To prep a patient for outpatient clinic or to be followed either after being admitted or being discharged from the emergency department, make sure that they have the ability to receive the appropriate topical ointments such as Bacitracin or Neosporin or triple antibiotic ointment. Silvadene will, at times, is very good for full thickness burns, however in partial thickness burns it can alter the appearance of the wound for follow-up, and have the ability to build up what we would consider is called a pseudo eschar. You want to make sure that the patient's, again, tetanus has been updated, that they be given the appropriate medications to control their pains as an outpatient, and make sure they have access to the appropriate supplies and dressings. Again, here's a list and some pictorials of some of the dressings that we use.

One of the last points of discussion is -- in this module, is to discuss special situations pertaining to mechanisms. Special circumstance surrounding burns are that of electrical injuries, inhalation injuries, and chemical burns.

Electrical injuries are largely considered and inside-out injury, meaning muscle and internal compartments are damaged rather than from an outside-in, meaning that a lot of times that they develop what we call compartment syndromes of their extremities from the fascial exposure and the muscle injury as opposed to the eschar that develops from our normal thermal injuries. We want to monitor their CK levels for rhabdomyolysis and treat them with an increased amount of IV fluids, and plus or minus alkalinization of their urine to protect their renal distal tubules. We always monitor our cardiac patients -- or excuse me, our electrical injury patients on a cardiac monitor, as well as obtaining the appropriate EKGs as well as cardiac enzyme levels such as your troponins. We consider electrical injuries significant when they are in contact with greater than 1,000 volts. The discussion of what injures patients versus amps versus volts is one surrounding the conversation, however although voltage being

something is not a measure of what actually injures our patients, it is something that people and providers are more accustomed to discussing. So, when we see patients that are in contact with greater than 1,000 volts, that's when we sort of activate our electrical injury protocol.

Inhalation injury or smoke inhalation is basically when people breathe in the combustible particles from a fire. When we see somebody with an inhalation injury, not to mention just the physiological process of moving air being compromised, we also worry about poisonous gases, most notably carbon monoxide. Carbon monoxide is 200 times more of -- has a greater than a 200 times affinity than hemo -- than oxygen for our hemoglobin, which essentially starves out our red blood cells from carrying oxygen and essentially is suffocating us from within. One of the pitfalls of this is that when people have a carbon monoxide injury -- or excuse me, exposure, they can actually have normal or closely normal appearing SpO<sub>2</sub>s. The half-life of carbon monoxide at room air is approximately 250 minutes. If patients intubated on 100% FiO<sub>2</sub>, it's roughly an hour. At hyperbaric oxygen, it moves down to approximately 20 minutes. The symptoms -- the signs and symptoms associated with carbon monoxide poisoning, basically if it's under 10% is none. Patients really are asymptomatic at this point, where with symptoms such as headache, vasodilation, pulsating temples, things of that nature, nausea and vomiting, moving as our percentage increases into 10, 20, 30, and 40%. When we get above 50 to 60% of hemoglobin saturation of carbon monoxide, that's when we start to see loss of consciousness, inability to breathe, and cardiopulmonary collapse and I think people can even die at that level.

Another gas that people can breathe in that's commonly encountered when they have a smoke inhalation injury is cyanide poisoning. Cyanide is commonly produced by synthetic compounds that are burning, such as carpets, vinyls, other household goods. Cyanide has a tendency to unravel our mitochondrial energy synthesis process and block cellular respiration and synergy with carbon oxide. It's effects begin within seconds after inhaling, and it's basically diagnosed in the setting of an inhalation injury with persistent lactic acidosis that's refractive to resuscitation. I always consider this when you have a closed smoke -- closed space smoke exposure, and consider the treatment or the need to treat cyanide toxicity when you see persistent elevated levels of lactic acid. The treatment for this, the old Cyanide kit is not used very often anymore. There's a new Cyanokit basically made up of hydroxocobalamin, it's a Vitamin B-12 precursor. It's given in five milligram doses, and it may be repeated more than once. It's side effects really are that of flushing and hypertension, and it can interfere with some of our normal lab values. Of note also, the Cyanokit turns a lot of our normal body excretions such as urine, sweat, and tears into a dark beet-like color purple. This fades over subsequent days. Again, coming back to our fundamentals of burn care. "Trauma always trumps burn," and the meaning behind that is that the burn is something that will be stabilized over the process of 12 to 24 hours, where there are traumatic injuries that can take people's lives in the first minutes to hours, so we should make sure that when we're caring for burns that we don't get distracted by these injuries, and focus on our normal, natural trauma algorithms.

Chemical burns, another specialty area of burn care is basically made up of an exposure to a chemical of either an alkaline or an acid. Alkaline burns are typically a lot deeper and end up being a lot more traumatic to the patient than the acid burns. There are a couple of acids out there that will require special consideration, most notably that of hydrofluoric acid is that it's antidote is that of a calcium infusion or topical calcium application. The main thing when treating patients with hydrofluoric acid injuries or exposures is to recognize it, 'cause often

times, patients don't even know that they've been in contact with this. When you're treating a chemical injury, you want to make sure that you protect yourself. Wear the appropriate equipment, as you can become a victim yourself. You want to brush off any dry chemicals, remove clothing, and then irrigate the wounds or the affected extremities or areas for up to 60 minutes, at times checking with a pH stick to see if you've neutralized or returned to a normal pH range.