

Aggressive EMS Treatment for the Fire Victim

By: Stephen Wilcox

“Does our EMS treatment match the level of our department’s aggressive search culture?” This was a question that I found myself asking many years ago as a single-role paramedic in a department that is known for its strategic aggressive search culture. At the time I had been in EMS for over ten years and honestly had never really thought about what “Aggressive EMS Treatment for the Fire Victim” even looked like. First thing that probably comes to mind for most EMS clinician’s and firefighter’s when thinking about “aggressive” EMS treatment for a fire victim would probably be RSI which is definitely a small part of it, but really there’s a lot more to it.

Preparation Is Key

Before even getting to the actual medical treatment, we must make sure that we are well prepared for these patients. That means we must be completing continuing education that includes treatment for smoke inhalation (IE carbon monoxide and cyanide poisoning), treatment for thermal burns, frequently practicing our intubation techniques on high fidelity airway manikins, alternative airways (needle and surgical cric), live first five-minute drills with victims, and firefighter CPR. We must have high quality/realistic training in all categories above in order to be able to perform our best when needed. The old saying “How you practice is how you play” could not be truer when it comes to training for fire victims. If you haven’t at least pulled out your equipment and practiced a cricothyrotomy in the last year, odds are it’s probably not going to go so well on your patient that has severe burns to their airway, and it’s swollen to the point that an ETT isn’t going to pass. The fact is we always revert back to our training, so if you are not training regularly on these things then this has to become the first priority.

Another part of being prepared is knowing your role as EMS on the fire ground and being dang good at it. Every department and system may look slightly different, but if you are sitting in the cab of an ambulance a block away or standing near command with no equipment then you aren’t going to be prepared and ready to go to work when firefighters remove a victim or when a mayday is called. EMS’s priority on any fire scene should be victims/patients. Whether the fire department runs its own EMS, or a private EMS provider runs the EMS for that fire district this transition should be practiced during fire training. EMS should set up just like they would on a live fire and work with fire personnel on the transition, from removal to EMS treatment and transport. If your department is not doing this, you are failing the victims.

EMS Standby on the Fire Ground

EMS standby on the fire ground may look a little different from one department to the next, but the priorities should be relatively the same. Arriving EMS units should find the best place to park their apparatus without obstructing the fire department's access while making sure they have a way out if needed. EMS should then be taking the stretcher and the gear that is necessary to the side of the structure near command/operations. I say "necessary" because it may be different from one scene to the next. We used to take our stretcher, two bags, backboard, Lucas, and cardiac monitor to every structure fire. We realized the more equipment we take the more equipment we must get back to the ambulance while trying to treat our patient. Now we only take the stretcher, backboard, Lucas, and monitor with us. The only time we take bags with us is if we are a great distance from the medic, but 99% of the time that is not the case. Once at the command post, EMS should check in with command to make sure they do not already have any patients. If no immediate patients are found then EMS should monitor the radio channel in case a victim is located, or a MAYDAY is called. Of course, there are other tasks that are secondary to patient care on the fire ground which would be rehab, SCBA bottle exchange, and keeping an eye on firefighters that are rotated through rehab.

While running rehab one of the most important things EMS personnel can do is monitor the radio. Listening for "victim victim victim" or "Mayday Mayday Mayday" and the radio traffic to follow is pertinent. If able to hear where the firefighters will be removing the victim to or where the downed firefighter is then preparing to meet them at that location to take over patient care is ideal. Whether it is a civilian or a downed firefighter having your equipment deployed where they are removed, or as close as possible allows for quicker treatment. The primary goal once the victim is removed should be to determine whether they are in cardiac arrest and then providing the immediate care that is needed and getting them moved from the warm zone to the back of the ambulance for further care and treatment.

Fire Victim's Injuries and Medical Complaints

Fire victims can have anything from minor injuries/medical complaints to severe injuries/medical complaints. Minor injuries/medical complaints include small burns, mild smoke inhalation, or even injuries sustained from trying to escape. Severe injuries/medical complaints include large burns, severe smoke inhalation, cyanide/carbon monoxide poisoning, airway burns, and cardiac arrest. Many people assume that most fire victims die from burns, but this is not true at all. The number one killer of structure fires is not burns; it is smoke inhalation. This is often referred to as "The Toxic Twins" which is cyanide and carbon monoxide poisoning. This leads to cardiac arrest/death much faster than thermal

burns. Fires are down, but victim deaths have increased over the last fifty years. This was noted in the NFPA Reporter's Guide:

“According to NFPA's latest reports, home fires and home fire deaths declined by about 50% since 1980. However, the 7.8 deaths per 1,000 reported home fires reflects a 10% increase over the 7.1 rate in 1980. In other words, while the number of U.S. home fires and home fire deaths has significantly declined over the past few decades, the death rate per 1,000 reported fires is actually a little higher. These numbers show that while we've made strong progress in preventing fires, mitigating their effects when they do happen remains a challenge.”

The main reasons deaths have increased are due to the lightweight construction and the significant amount of synthetic materials that are in our households now. The lightweight construction causes a shorter amount of time for victims to get out of the structure and the synthetic materials burning creates a toxic environment that overcomes victims quickly causing them to go unconscious and into cardiac arrest quicker. This is where aggressive search cultures and tactics pay off by removing victims quickly. Even further, this is where the transition between victim removal and EMS treatment must be seamless. EMS personnel must be ready to receive the victim and begin treatment immediately.

Treatment Considerations

Just like with any other patient, treatment of a fire victim should start with the primary assessment. Use the ABCDEF (Airway, breathing, circulation, disability, exposure, and flight/transport) mnemonic to help simplify the approach. If the patient is conscious and ambulatory then getting them out of the warm zone to the ambulance as quickly as possible is ideal to get a good assessment of their mental status, airway, and injuries. Minor injuries and medical complaints can usually be treated with basic care IE wound bandaging, oxygen administration, and supportive care. Patients who suffer from more severe/larger burns should be assessed using the same mnemonic and treatment should begin as soon as possible. If the patient is found to have burns to the face and neck then the patient's airway should be evaluated for inhalation injuries. The decision to intubate the patient early should be based on multiple clinical findings such as second/third degree burns to the face and neck, soot and edema in the oropharynx, respiratory distress, stridor, altered mental status, and circumferential burns to the thoracic area causing shallow ineffective ventilation. Airway assessment and management is extremely important in these patients since edema of the oropharynx can become severe enough that endotracheal intubation is not possible nor is supraglottic airway placement. If intubation is elected then placing a 7.5 mm or bigger endotracheal tube is ideal to allow the burn center physicians to complete a bronchoscopy without having to exchange the tube.

However, just because a patient has smoke inhalation or soot in their airway does not mean they should be intubated. Knowing when not to intubate a patient is just as important as knowing when intubation is necessary.

Patients that have partial thickness burns less than 10% TBSA can be treated with sterile water dressings to stop the burning process, pain medication as needed, and transported to a local hospital for further evaluation and treatment. Patients that have partial thickness greater than 10% TBSA, full thickness burns, or any deep partial or full thickness burns to their hands, face, feet, genitalia, and joints should be transported to a burn center for further evaluation and treatment. Treatment for these patients should include keeping the patient warm, pain management, dry sterile dressings, and administering warm lactated ringers. In the past we have used the Parkland burn formula which was cumbersome to say the least and was hardly ever done correctly in the prehospital field. ABLS is now suggesting that prehospital providers administer lactated ringers to patients who have burns greater than 20% TBSA at ml/hr rates to administer a steady continuous amount versus large boluses of fluid that is usually incorrect. Patients 5 years old and younger should receive 125 ml/hr (20 gtt/min), Patients 6-12 years old should receive 250 ml/hr (40 gtt/min), and patients 13 years and older should receive 500 ml/hr (80 gtt/min). Once at the burn center they will calculate what they call an “adjusted fluid rate” and titrate to urine output and physiological response.

92% of all burn patients are alert and oriented to their normal mental status, so fire victims that are not alert and oriented to their normal mental status should raise a red flag. Obtaining a blood glucose level to rule out a diabetic emergency is appropriate, but suspicion should be leaning towards carbon monoxide and cyanide poisoning (The Toxic Twins) if the patient had been in a smoke-filled structure or enclosed “container”. 50-80% of fire associated fatalities are due to smoke inhalation injuries, so these patients should be managed aggressively to reverse the toxins actively killing the patient. If available place an SPCO monitor on the patient to obtain the patient’s carbon monoxide level. If the patient’s SPCO is greater than 10% you have now confirmed the patient does indeed have carbon monoxide poisoning. If a SPCO is not available and the patient has headache, fatigue, N/V, dizziness, or AMS then assume the patient has carbon monoxide poisoning and begin treatment. To begin reversing the carbon monoxide poisoning the patient should be administered 100% FIO₂. Depending on the patient’s needs this can be done by NRB, CPAP, or endotracheal intubation. If the patient has an altered mental status, seizures, coma, or is in or pending cardiac arrest you should also assume the patient has cyanide poisoning and administration of a Cyanokit should be priority. Cyanokit is a cyanide antidote also called hydroxocobalamin which works by binding to cyanide ions removing them from the hemoglobin molecule very quickly. Cyanide ions and hydroxocobalamin form cyanocobalamin which is then excreted in the urine producing a wine-colored urine.

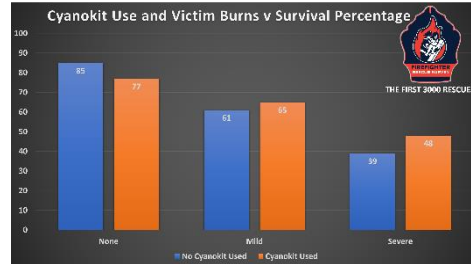
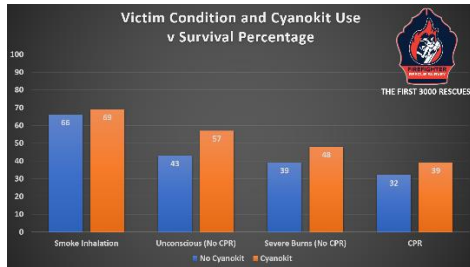
The Cyanokit comes packaged in a glass vial that has 5g of Hydroxocobalamin. For administration to an adult patient, the vial is mixed with 200 ml of normal saline, slowly reconstituted over one minute, and then administered over 15 minutes using a vented ten drop set. Administration to a pediatric patient is slightly different due to the dose being 70 mg/kg up to 5g. To do this correctly the vial is still mixed with 200 ml of normal saline, slowly reconstituted over one minute, the excess amount of the medication is then wasted, and then the volume to be administered is given over 15 minutes. To simplify the pediatric dosing BTG pharmaceutical has the following chart to help determine the correct dose and volume to be administered.

CYANOKIT® Dosing & Administration Chart with Broslow®-Luten Zones⁴ (5 to 36 kg)

Patient Weight (kg)	CYANOKIT® Dose (mg)	Volume to Waste (mL)	Volume to be Administered (mL)
5	350	186	14
6	420	183	17
7	490	180	20
8	560	178	22
9	630	175	25
10	700	172	28
11	770	169	31
12	840	166	34
13	910	164	36
14	980	161	39
15	1050	158	42
16	1120	155	45
17	1190	152	48
18	1260	150	50
19	1330	147	53
20	1400	144	56
21	1470	141	59
22	1540	138	62
23	1610	136	64
24	1680	133	67
25	1750	130	70
26	1820	127	73
27	1890	124	76
28	1960	122	78
29	2030	119	81
30	2100	116	84
31	2170	113	87
32	2240	110	90
33	2310	108	92
34	2380	105	95
35	2450	102	98
36	2520	99	101
END OF BROSLow®-LUTEN ZONES			

Administration of the Cyanokit can be administered via IV or IO but must be administered in its own dedicated line. Keep in mind that if administering via IO it is in a glass vial, so humoral head IO would be ideal to allow adequate flow of the medication. If distal femur or tibia is the only site available then administration via a syringe push is going to be the only way to administer the medication. The main thing is that the medication gets administered if cyanide poisoning is suspected!

Unfortunately, Cyanokits are expensive, and a lot of departments/agencies shy away from purchasing them due to the high cost and low usage. Evidence is also hard to prove due to diagnostic testing taking over 24 hrs to have results. This is why the Cyanokit is administered solely based on symptoms, because if the hospital waited on the diagnostic result to treat, the patient would have already died. However, Fire Rescue Survey has been gathering some great data on patient outcomes with the administration of the Cyanokit. Below are two bar graphs that show the Cyanokit to truly improving the outcomes of fire victims.



The Answer

So, to answer the question that I asked three years ago, “Does our EMS treatment match the level of our department’s aggressive search culture?”. The answer was no at that time. We were doing everything discussed above except carrying and administering the Cyanokit. Once I recognized this I compiled all the research I could find and forwarded it to our admin. I explained to our Chief that even though our firefighters were making aggressive searches on structure fires, without this medication we might as well leave the victim that is in cardiac arrest in the yard because without a cyanide antidote there was a great chance the outcome would not change. Thankfully we have a chief and administration that listens when we bring forward research and data. The Cyanokits were ordered and placed in service the following week. When we promise victims that we will come for them it means more than just removing them from the fire, it means we will do all the things above to make sure they have the best chance of survival.

Stephen Wilcox has worked in the EMS field for over 15 years, working in rural and suburban departments. Stephen holds a Bachelor of Science in Emergency Health Sciences and has presented at many different conferences over the last three years. Stephen is currently a paramedic for The Colony (TX) Fire Department, a flight medic for CareFlite (TX), and the Division Chief of EMS for the Whitesboro (TX) Fire Department.

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