Initiation of Pre-hospital Hypothermia

My name is Cody Sprayberry. I'm currently a Sumner County EMS EMT-IV in Paramedic School at Volunteer State Community College. I hypothesize that pre-hospital cooling via invasive methods such as cooling via rapid infusion of ice cold normal saline or lactated ringers is appropriate and needed in the pre-hospital setting to improve the odds of a good neurological outcome in post cardiac arrest situation as per current AHA ACLS guidelines. The question remains that, with all that is going on during and after CPR is this something we should be worrying about after a ROSC or should this be a hospital only treatment? Is it even beneficial when a hospital would begin cooling the patient soon after their arrival to the hospital? Based on my research outcome regarding these questions few factors pop up; the first thing is the average cost of the devices that would keep these fluids cold enough to meet the recommendation of a four degrees Celsius isotonic solution of some kind such as the above mentioned Normal Saline 0.9% and Lactated Ringers.The second thing is to observe that, whether this pre-hospital cooling brings any favorable outcomes in real life patients. The final thing I would concentrate on is the average transportation time for EMS. Transportation time, I believe would play a major role in determining whether certain EMS systems need to purchase the cooling equipment or not; because should the transportation time can be kept low, there is no requirement for costly cooling equipment. The ACLS guideline recommends a bolus of 4 degree Celsius isotonic solution and administration of a sedative to maintain sedation. The administration of paralytics is a must as this would stop the patient from shivering. Otherwise, this would hinder the attempt of cooling and make the process longer to reach the target temperature.

However, the first major concern is the cost of these specialized devices. Upon researching different sites and investigating for the one that we would use here at Sumner EMS it is found that, these are over two thousand dollars each. Now that doesn't sound like a lot of money considering the number of ambulances a particular service has, it would become obvious that the turn over period for this amount would be very small. If there is a medium sized county service of say sixteen ALS units then this would require thirty two thousand dollars to facilitate all the ALS units. Quite a bit of money considering the fact that all the other required expenditures that these companies have to purchase each year. However these are specialized pieces of equipment that were previously thought required actually aren't. According to a study done by the Journal of pre-hospital Emergency Medicine in 2009, it was proven that ice cold fluids can be maintained at 4 degrees Celsius simply by using Ice coolers that can be found at a normal barbeque. The investment in price would drop from a thousand dollars a unit to about 30 dollars for a cooler, ice packs, and of course some normal saline or lactated ringers which would already be readily available on the truck. It was however noted that it would take extra work on the crews part because this method while effective only for about 24 hours when under ambient temperatures at about 75 degrees Fahrenheit. However in significantly hotter environments the fluid will have to be changed out more than once per shift as it was on average effective for about 10 hours. This is good news as also stated in the journal is that a major road block to the widespread implication of this protocol is the apparent cost of buying the specialized equipment made apparent by this quote "suffoletto et al. reported from a 2007 survey that only 6.2 % of EMS physicians were affiliated with EMS agencies implementing pre-hospital hypothermia therapy, reflecting low pre-hospital involvement in induced hypothermia. The same survey found that 60.0% of EMS physicians view thelack of refrigeration equipment as a barrier to beginning a cooling protocol." (The Journal of Pre-hospital Emergency Medicine, 2009). So without the need for the specialized equipment albeit it makes thing much more full proof in a situation in which time is of the essence. This study proves the fluids needed for the induced hypothermia protocol can be stored in an inexpensive store bought ice coolers. Therefore, ruling out cost as a reason as to why the induced hypothermia protocol would not be used in the pre-hospital system. That being said it the whole cheap induced hypothermia equipment places sole responsibility on the employees of the service to keep the things stocked and maintained or they will be useless.

The second major topic I address is the difference between cooling the patient in the field and beginning cooling upon arrival at the hospital and to see if there is a noticeable difference. First off the protocol states that patients should be cooled to around 34 degrees for 12 to 24 hours. According to a study in published in JEMS talks about a random control trial that took place over a 2 year period. In the study Therapeutic Hypothermia for Out-of-Hospital Cardiac Arrest Patients Produces Promising Results (JEMS, 2010) the study was stopped because it was not yielding any real difference between the two. The study went on to state that Out of paramedic-cooled patients, 47.5% had a favorable outcome compared with the 52.6% of hospital-cooled patients who had favorable outcomes (JEMS, 2010). A study

published on the TCTMD site stated that the actual temperature difference between ems started cooling was about 1.20 Celsius however this only decreased the time to reach the goal temperature by about one hour in comparison with the control group. (tctmd, 2013). The chart of the studies values stated pts that survived to hospital discharge (from a Ventriculfar fibrillation arrest) was 62.7 percent as opposed to the 64.3 percent that had no pre-hospital cooling while only 57.5 percent of the 62.7 percent had a full recovery or just a mild impairment and 61.9 percent of the 64.3 percent who received no cooling had the same outcome. Not only did it seem that patients in this particular received cooling had a worse outcome as far as only cooling goes but they have a higher incidence of re-arrest in EMS care and had increased pulmonary edema. The doctor in charge of the study had this to say about the results "Although cold normal saline reduced core temperature by hospital arrival, pre-hospital cooling does not add benefit to hospital-initiated cooling," Dr. Kim said (TCMD, 2013). It went onto reevaluate the patients at the one hundred and eighty day mark and saw a fifty percent mortality rate with the cooled patients and a forty eight percent mortality with non-cooled however it was noted that the cooled patients had a higher percentage of serious adverse effects at ninety-three percent while the hospital cooled had ninety percent. As far as the numbers go, it would appear that pre-hospital cooling is not necessary and can be detrimental to the patients. Secondarily, the study reported on by TCTMD.com made report of the chances of a non v fib ROSC however the data between the cooled and the non-cooled was of very little difference and of extremely low survival rates of around 20 percent.

The third and final thing I threw out there is the consideration of transport times as it relates to this subject greatly. While in none of my researches did I find anything on the average times I feel like throwing national average times out as food for thought as it makes a difference. Clearly, the difference in an urban emergency service transport times are going to differ greatly from somewhere in a very rural environment. All of these studies (that give their location) take place in urban environments therefore by that model one can extrapolate a shortened scene to closest hospital time. According to pubmed.gov the national average time for transport times to the hospital from the urban, suburban, and rural areas transporting times were 10.77, 10.86, and 17.28 minutes showing a decent difference in in the rural area transport times. It is stated by a paramedic reviewing the study JEMS that was conducted in Melbourne Australia was that, "Comparing EMS in the U.S. to EMS in Australia isn't fair; we operate two completely different systems—not to mention the Melbourne system is a major urban/suburban one, which isn't very applicable to rural EMS" (JEMS, 2010)

In conclusion, I believe my hypothesis renders the question, is pre-hospital induced hypothermia necessary? While it was made clear that it is possible to purchase "cheap" equipment for chilling the fluids, it is worthy to note that, this method would remain cheap and would work well as long as the crews are sincere to keep the ice pack rotated out. It is my opinion that pre-hospital induced hypothermia is not a necessary thing as proven by the above paragraphs. While I am not arguing it as a good treatment with obvious beneficial outcomes to the patient I am saying that it should be more of a once you arrive at the hospital treatment where everything is a more controlled environment. I base this mostly on the studies provided in JEMS 2010 and TCTMD 2013 that state not only is not shown to be any more effective than hospital initiated cooling but it caused a higher rate of re-arrest and more instances of pulmonary edema . That being said I do believe more research needs to be done into this subject as it pertains to rural EMS. I believe it is in the rural setting is where patients will see the most benefit from the use of the pre-hospital induced hypothermia protocol.

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