AirWaves

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One Cool Flight *Therapeutic Hypothermia Protects Brain Function in Post Cardiac Arrest*

58-year-old George Clark was relaxing at home on December 22, when he suddenly broke out in a sweat and felt nauseated. It was noon, but George followed his instincts and went back to bed, feeling worse by the minute. Soon he felt too ill to get out of bed and used his cell phone to call 911. "All I remember is getting in the ambulance and next thing… I'm here at Bronson," he said.

A number of events occurred before George arrived at Bronson Methodist Hospital. When the ambulance arrived at Sturgis Emergency Department, George's heart rate was in rapid ventricular tachycardia, making his blood pressure unstable. Despite the administration of an Amiodarone drip and cardioversion following ACLS (Advanced Cardiac Life Support) guidelines, he experienced a PEA (pulseless electrical activity) cardiac arrest. For 20 minutes the staff of Sturgis ER performed CPR stopping occasionally when pulses would return only to lose pulses again. Dr. Christopher Fish intubated George's airway and requested West Michigan Air Care be called.

Jennifer Zeigler, RN, Dr. Gabriel Pedraza and Gerald Stubbs, RN from Bronson MICU provided critical care for Mr. Clark which included the use of equipment to cool his body and blood in order to protect his brain function.

Cold Therapy

Upon arrival the air crew, flown by pilot Brian Vanderberg, arrived to find George securely intubated and with recovering vital signs. Flight nurse Darby Brauning performed bedside preparations to transfer the patient while flight nurse and Director of Clinical Operations, Jan Eichel, assessed George, received full report and then called the receiving physician. She briefed Dr. Pedraza at Bronson's Medical Intensive Care Unit (MICU) on the patient's condition and advised him that "induced hypothermia" would be implemented according to West Michigan Air Care protocol to preserve George's brain function. (See next article: The Cold Facts of Induced Hypothermia.)

Cold saline replaced George's IV fluids and ice packs were strategically applied to bring down his core temperature. Sedation was given and George was carefully monitored to assure he did not begin shivering, which has been shown to rapidly reverse the therapeutic cooling process.

After the 16-minute flight to Kalamazoo, George was whisked to Bronson's MICU and a cooling blanket device called the Arctic Sun was used to keep his temperature within a constant mild hypothermic range. George's tenuous status eventually improved and therapeutic hypothermia was discontinued. He remained in a critical care bed until December 28th when he was transferred to the cardiology floor, his neurological status intact. At this time, George's cardiology team determined he would need a pacemaker to prevent future adverse cardiac events. George came through this procedure without complication and continued to get stronger until the day he was finally discharged.

Patient Transport at the Highest Level

Initiating "cold therapy" to preserve brain function in post-cardiac arrest patients is one of many critical care interventions West Michigan Air Care provides based on well supported, evidence-based research. Air Care personnel use intensively reviewed protocols as they coordinate patient care with sending and receiving physicians. Other advanced skills provided by Air Care's flight team include RSI (Rapid Sequence Intubation), minor surgical procedures such as chest tube insertion, monitoring of invasive lines, and therapeutic titration of medications. By delivering the highest level of critical care transport in southwest Michigan, Air Care creates a seamless bridge of critical care until the patient arrives at their destination. Bronson Methodist Hospital and Borgess Medical Center endow Air Care with this exceptional level of care to safely and quickly transport sick and injured patients to Kalamazoo from the surrounding region. For patients like George, the difference Air Care provides is best measured in his quality of life today.

Susan Yuska, R.N. and E'Coe Hill, R.N., B.S.N. provided care for Mr. Clark along with Dr. Christopher Fish (not pictured) – Sturgis Hospital

One Cool Outcome

George is an ideal example of the positive effects of induced hypothermia on neurological function at discharge. Among his other plans for the future, George intends to spend more time with family, take a trip "south" with his girlfriend, and play more baseball, football and horseshoes. George said the care he received at Bronson Hospital was exceptional, and though he can't recall his time at Sturgis ER or his flight with Air Care he wishes he could track down everyone who helped him that day. "I'd like to shake their hand and say 'Thanks, I really appreciate it.' They did a tremendous job."

By Dawn Johnston, RN, NREMT-P, CFRN
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West Michigan Air Care

The Cold Facts of Induced Hypothermia

Over the past several years Induced Hypothermia (IH) has appeared in the literature for a multitude of patient treatments ranging from spinal cord injury to post-cardiac arrest. In one recent study published by Tilney et al. (2009) in The Air Medical Journal, *56% of post- cardiac arrest patients treated with IH had complete neurological recovery.* This is one of many studies that show tremendous improvements in patient outcomes when IH is utilized. As a leader in critical care transport for southwest Michigan, West Michigan Air Care has been quick to adopt and implement this research. Just over a year ago Air Care became the second air medical transport program in the United States to incorporate an IH protocol for use in post-cardiac arrest patients. In this article we will examine what IH is, what methods of IH are considered best practice, and what patient populations should be included or excluded. We will also discuss what equipment, medications, protocols and procedures need to be in place to successfully navigate patient changes.

Best Practices for IH

IH is the purposeful placement of a patient with near normal temperature (37°C) into a hypothermic state of 32 - 35°C. Induction of hypothermia must occur within 30-60 minutes of circulation return to provide the greatest benefit to patient outcomes. A review of the recent literature showed that chilled saline and ice packs are the preferred method for patients in regional hospitals requiring transport.

Simple cooling methods that utilize only patient exposure and augmentation of conduction and evaporation have proven to be unreliable in reaching and maintaining an appropriate temperature. This was demonstrated by Fukodome et al. (2009) in a recently published article in Critical Care Medicine comparing spontaneous versus induced hypothermia.

Another method utilizing cooling blankets and wraps was shown to better control the amount of conduction/convection cooling that occurs. However, using this cooling blanket method, Clifton et al., (2001) found that it took 8.4 hours (+/- 3 hours) to reach 33°C. Patient outcomes were worse for these patients with increased end-organ damage and mortality compared to patients treated with normothermia. One sub-group of patients in this study did show improved outcomes compared to the normothermic group. These patients arrived in the treating facility already in a hypothermic state and were induced further, then maintained at an induced level. These results emphasize the need for IH to be implemented early.

Clifton et al. (2009) recently published preliminary results of a new IH study including the results of a device that has gel adhesive pads which better control cooling conduction and facilitate a target core temperature of 33°C in 4.4 (+/- 1.4)hours.

A similar reduction in temperature can be obtained using chilled IV fluids and icepacks. Ing-Marie Larson et al. (2010) published a very recent article in Circulation that evaluated the use of 4°C cold saline and ice packs to the groin, axillae and neck regions to induce hypothermia. Surprisingly these patients reached optimum temperature of 32 - 34°C in 3.6 (+/- 2.95) hours, which is close to the temperatures and times noted prior by Clifton et al. The advantages of chilled IV fluids and ice packs are cost, portability and technical ease for both smaller hospitals and transport agencies. This is the primary reason that West Michigan Air Care utilizes this method to initiate Induced Hypothermia on some post cardiac arrest patients.

Inclusion Criteria

Time is obviously an important factor in inducing hypothermia, so a rapid assessment of which patients should and should not have therapy needs to be easy to identify. Inclusion criteria for IH include:

- Glascow Coma Score (GCS) < 8 after ROSC
- Intubation and Mechanical Ventilation in place
- Systolic blood pressure > 90 mmHg (even if fluids/vasopressors required)

The GCS is important because patients that show significant improvements in the GCS already demonstrate that the amount of initial neuronal damage that occurred during the cardiac arrest is minimal. Induction of hypothermia in these patients would expose them to an unnecessary therapy. Conversely, implementing IH in patients with a GCS < 8 helps limit the damage that continues to occur post-resuscitation. Patients with a reduced GCS require protection of the airway as well as control of ventilation due to the known changes that will occur at the cellular level when induction and maintenance of hypothermia occur. Lastly, since maintaining cerebral perfusion pressure is directly related to maintaining mean arterial pressure, vasoactive medications and fluids may be required to maintain an adequate blood pressure.

Exclusion Criteria

Exclusion criteria for patients in whom induction of hypothermia may worsen outcomes include:

- Patients showing neurological recovery
- Significant cardiac arrhythmias
- Severe sepsis
- Inability to maintain and adequate blood pressure (despite therapy)
- Known pre-existing coagulopathy
- Recent major surgery
- Current pregnancy
- Multi-system trauma
- Already hypothermic patients (< 32°C)

Although many of these patients may benefit from induced hypothermia, the risk-benefit analysis must be considered. For example, IH has been shown to decrease platelet aggregation, so a patient with a pre-existing coagulopathy may have a worse outcome related to this pathology despite the other benefits of IH.

Who Should Initiate IH?

The prelude to this question is "Which hospitals and transport agencies can allocate the time and resources to become proficient in this treatment modality?"

The first issue to address is initial and continuing education. Clearly, all personnel involved in implementing IH should have a thorough understanding this therapy. Consequently, education should focus on not only the initial induction but also in airway and ventilatory management, hemodynamic management, and appropriate sedation,

analgesia and neuromuscular blockade, if applicable. This level of education normally is found in clinicians that regularly practice in the critical care environment and are comfortable with making independent decisions on how to proceed with care.

Adequate resources to manage such a patient include ventilator therapy capable of managing different patient populations, (i.e. normal, restrictive lung pathologies, ALI/ARDS). The patient may also require IV pumps to precisely control vasoactive and sedation/analgesia medications. Clinicians should also have the availability of appropriate pharmacotherapy since patient needs may change significantly and abruptly. Other needed resources include chilled IV fluids and appropriate monitoring equipment such as pulse oximetry, EtCO2, and hemodynamic monitoring if required. Lastly, there must be an established protocol that helps direct the clinician caring for the patient.

Failure to put in place appropriate protocols in ICU patients is frequently cited in the literature as a reason behind treatment failures for a number of complex patient pathologies. An example of a well-developed protocol that has improved outcomes for patients is The Sepsis Campaign that has shown significant decreases in mortality when followed. Evolution of the protocol is needed as published research shows benefits or complications with any step in the protocol. This helps to limit the number of patients exposed to treatments that are no longer advised.

Providing Best Practices at the Highest Transport Level

As the leader of critical care transport in SW Michigan, West Michigan Air Care is proud to provide IH to patients who may benefit from it. The Air Care staff is involved in continuing critical care education that enables implementation of these and other interventions to improve patient outcomes. As the first transport provider in Michigan who regularly provides IH to post cardiac arrest patients, Air Care has the optimal transport platform that allows inclusion of patients for this treatment in a large geographic area. For example, Air Care can respond to a smaller community like Clare, Michigan in an estimated time of 41 minutes after lift-off and initiate therapy immediately upon arrival. A similar distance traveled by ground would take roughly2.5 hours before the critical care transport team could arrive.

Air Care would like to thank the numerous medical and nursing staff from Bronson Methodist Hospital, Borgess Medical Center and Life Flight of Maine who assisted with the development of this treatment for post cardiac arrest patients. Questions or comments are always welcome. In addition, references for this or any of the protocols and procedures utilized by Air Care medical crews are available to practicing clinicians upon request. Contact information can be located on the web at www.aircare.org.

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Safety Corner

By Shawn Maxwell, Safety Manager, Pilot
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Winter Safety at Hospital Helipads

The challenging season of winter brings many potential hazards to the world of Helicopter Emergency Medical Service (HEMS). Of particular interest is the Hospital Landing Zone (LZ) or Heliport/Helistop/Helipad. Help us keep everyone safe by following these important winter tips.

Snow

Snow blown by helicopter rotor wash can cause an unsafe condition known as "white out". Removing snow from the helipad/LZ in a timely manner can avoid this. Helicopter travel times are often short. The helipad should be clear of snow and ice when Air Care is activated. Keeping the helipad clear of snow as soon as it accumulates is the best practice. This will ensure the aircraft will not have to delay for snow removal.

The aircraft requires enough space to clear the front tip of the rotor to the tip of the tail. For this reason, avoiding "snow stacking" within the landing zone is essential. A general rule is to clear an area of 100' x 100'. Lastly, remember to clear a path from the LZ to your facility for patient cart transport.

Ice

Ice is a danger to patients and personnel on the helipad, but so are de-icing products. Clear helipads of ice as soon as possible, then assure removal of solid de-ice products before aircraft arrival. De-ice salt can become hazardous as the "rotor wash" of the helicopter turns the pellets into flying objects. Also, too much salt can be difficult to walk on or push the patient cart over.

Cold temperatures and wind chill

The cold winter temperatures and wind chills are hazardous to personnel securing the helipad. The addition of winds created by the "rotor wash" can be quite high, in the range of 40-50 mph. The facility should insure their helipad personnel are dressed properly with hands and face covered. A distance of 100' from the edge of the landing area is a good rule.

Thanks to all of our helipad facilities and landing zone coordinators for helping us maintain a high level of safety. Send related comments/questions to sdmaxwell@aircare.org.

Spring Landing Zone Classes *Prepare Now for Summer Scenes*

West Michigan Air Care provides free Landing Zone classes to requesting agencies within our service area. These classes are particularly encouraged for fire departments that have not had a class recently, or have a number of new members. To request a class, go to www.aircare.org and click on "event request." We will take your information and call back to arrange a time and place.

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