Resuscitation and survival rates from out-of-hospital cardiac arrest nearly double (w/ Video)

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Virginia Commonwealth University Medical Center and the Richmond Ambulance Authority have improved resuscitation and survival rates dramatically for cardiac arrest patients by training and equipping paramedics to begin lowering a patient's body temperature in the field during resuscitation and following up at the hospital with a host of high-tech strategies to improve the odds of survival.

The VCU and RAA initiative, known as the Advanced Resuscitation Cooling Therapeutics and Intensive Care Center, or ARCTIC, is the most comprehensive program of its kind in the United States, and its strategy resulted in an almost two-fold improvement in the return of spontaneous circulation, from 25 percent in 2001 using conventional treatments to 46 percent in 2008. In turn, the survival rate to hospital discharge improved from 9.7 percent in 2003 to 17.9 percent at the end of 2008. The national average is less than 7 percent.

ARCTIC has two goals: to restart the heart as quickly as possible following onset of cardiac arrest, and to protect the brain by starting cooling as early as possible and bringing resuscitated patients to a single specialized post-resuscitation facility. Between 2001 and 2008, the team evaluated 1,598 cases of adult, out-of-hospital cardiac arrest events in Richmond, Va., and concluded that a building block strategy comprised of a unique combination of mechanical chest compressions, airway management, drugs that restart the heart, and cold saline given during

resuscitation prior to the return of spontaneous circulation, sequentially improved patient outcomes.

"What we now know is that we have to protect the brain and vital organs during resuscitation and after the heart is restarted and this has led to a totally new strategy for how we treat cardiac arrest patients," said Joseph P. Ornato, M.D., chair in the Department of Emergency Medicine at the VCU School of Medicine and operational medical director of the Richmond Ambulance Authority.

"Richmond Ambulance Authority paramedics are the first in the country to initiate the cooling process during resuscitation. RAA's treatment strategy includes using a combination of drugs given early to support circulation and restart the heart, and performing high quality CPR using a mechanical device - available in all RAA ambulances - that squeezes the chest to achieve better blood pressure and oxygen delivery than that achieved with just standard CPR," he said.

"The Richmond Ambulance - VCU Medical Center partnership is so successful because it provides a continuum of care for the cardiac arrest patient from the time the 911 call is received until the patient walks out of the hospital. We are constantly sharing and assessing detailed data to improve the clinical and operational process, and the dramatic increase in our survival rate reflects this," said Chip Decker, chief executive officer of the Richmond Ambulance Authority.

Decker continued, "The EMS system in the city of Richmond is a team approach between the Richmond Ambulance Authority and Richmond Fire Department, with Fire as first responder, and it works extremely well. Our rapid response times, combined with leading-edge clinical protocols like the cooling process implemented under Dr. Ornato's guidance, have enabled us to deliver a more viable patient to VCU."

VCU Medical Center is continuously staffed with a team of specially trained physicians and nurses experienced in post-resuscitation care who continue the rapid cooling process by placing a high-tech plastic coil into a large vein soon after arrival at the emergency department. Patients are treated by specially trained coronary care unit nurses and physicians who administer complex "goal-directed" treatment protocols and maintain the patient's body temperature at 93° F for at least 24 hours, following which the patient is gradually rewarmed in a computer-controlled sequence.

In previous work, researchers have found that patients who undergo controlled hypothermia using simple techniques such as cooling blankets and ice packs, have a better chance of brain recovery and survival following cardiac arrest than those whose body temperature is not lowered. However, such techniques are crude and often result in large temperature swings. The catheter technique used at VCU allows precise control of the cooling and rewarming process in an attempt to minimize brain injury following the cardiac arrest. The comprehensive ARCTIC approach is showing greater benefit than that which was seen using just conventional resuscitation and simple cooling techniques alone.

"One of the novel things about VCU's ARCTIC program is that we have been able to seamlessly incorporate the care of the cardiac arrest patient from the time they arrest in their home to the time they return home with good neurologic survival," said Mary Ann Peberdy, M.D., Professor of Medicine and Emergency Medicine in the Division of Cardiology at the VCU School of Medicine.

"We have been able to develop a partnership with our EMS system as well as our referring hospitals and initiate therapies that are unparalleled in the country. The care that this multidisciplinary team provides gives patients better outcomes than we have seen with traditional cooling alone," she said.

The team presented their findings on Nov. 14 and 15 during the Resuscitation Science Symposium at the American Heart Association Meeting in Orlando, Fla.

In a second study of 181 consecutive, out-of-hospital cardiac arrest patients who were successfully resuscitated in the field and brought to VCU from various EMS agencies or other hospitals throughout Central Virginia between 2001 and 2009, the study showed survival to hospital discharge was 19% in 2001-3 when standard post-resuscitation care was provided. It increased to 38% in 2004-7 when simple cooling techniques were added, but further improved to 49% in 2008-9 using the full ARCTIC strategy.

Additionally, patients whose cardiac arrest was caused by the abnormal rhythm, ventricular fibrillation (VF), now have a 72% chance of surviving to hospital discharge if treated in the ARCTIC program. The aggressive ARCTIC treatment also improved the neurological outcomes for VF patients over simple cooling alone.

Additional Background

Cardiac arrest is a condition in which the heart suddenly stops beating, most commonly due to a rhythm disturbance known as ventricular fibrillation (VF). Within 10-20 seconds, the brain and other vital organs are deprived of oxygen, and the victim collapses to the ground unconscious and pulseless. Delivering an electrical shock to the heart promptly with a defibrillator can often start it beating again, but a defibrillator is not often available immediately. Cardiopulmonary resuscitation (CPR) can provide life sustaining blood flow and oxygen delivery to vital organs until trained rescuers can arrive and administer standard resuscitation techniques such as defibrillation, drug therapy, and other treatments. Unfortunately, survival from out-of-hospital cardiac arrest averages only 6-7%, claiming the lives of approximately

350,000 Americans each year using standard techniques. In many communities, paramedics can initially resuscitate cardiac arrest victims, but the majority will never regain consciousness and die due to brain injury.

It has long been thought that the brain can only survive without blood and oxygen for 4-6 minutes before irreversible damage occurs. That is now known to be incorrect. Brain cells begin to show signs of abnormal function soon after they are deprived of oxygen, but recent studies show that permanent damage begins after the heart restarts and oxygen returns to the brain. The cells try to consume the oxygen, but their injured machinery converts the oxygen into poisonous chemicals called "free radicals" which kill the cells. Cooling the brain as quickly as possible, ideally before the heart even restarts, slows its metabolism so it can't generate a large quantity of "free radicals". Maintaining precise temperature control for 24 hours and rewarming gradually using the catheter device is designed to prevent large swings in the body temperature which can result in a surge of metabolism and "free radical" production.

Source: Virginia Commonwealth University (news : web)