

Revitalizing the nearly-dead



By *Keith Lurie, M.D., professor of emergency medicine and internal medicine, University of Minnesota*

Every day, nearly 2,000 people in the United States die from sudden cardiac arrest, about half outside the hospital. Many of these deaths occur in individuals who are otherwise healthy, but who have severe, undetected coronary artery disease. Contrary to popular belief, many of these deaths occur in the prime of life. Despite cardiopulmonary resuscitation (CPR), nationally fewer than 5 percent of patients survive an out-of-hospital cardiac arrest. While in Minnesota our results are slightly better—about 10 percent survive—clearly, this is a medical epidemic.

Adding two devices to CPR

Standard manual CPR provides only 10 to 20 percent of the normal blood flow to the heart and about 20 percent of normal blood flow to the brain. Inspired by a family who, 20 years ago, used a common household plunger to resuscitate a patient, investigators at University of Minnesota focused efforts

on improving efficacy of CPR. Active compression-decompression, or ACD CPR, improves efficacy using a suction cup device. The device actively lifts the chest after each compression, drawing more air and some blood into the lungs. However, even with this new approach, most patients in cardiac arrest still die.

While the ACD device by itself creates a vacuum within the thorax with each chest wall decompression, much of the potential hemodynamic benefit is lost by the influx of inspiratory gases. In 1995, investigators at the university studying the mechanism of blood flow during CPR developed an inspiratory impedance threshold valve or ITD. This small (35 mL) disposable plastic valve attaches to the endotracheal tube or facemask to transiently block the influx of air during the chest wall recoil phase of CPR. It thereby augments the amplitude and duration of the negative intrathoracic pressure. Such pressure creates a larger vacuum within the thorax, forcing more venous blood back into the heart with each compression-decompression cycle.

Since 1995, multiple animal and clinical studies in Europe have demonstrated that the combination of ACD CPR and an ITD improves coronary perfusion pressures, resulting in a nearly 4-fold increase in blood flow to the heart and brain compared with standard CPR alone.

Study may lead to FDA approval

Since the Food and Drug Administration has not yet

approved the ACD CPR in the United States, researchers at the University of Minnesota have focused on the benefits of the ITD with standard manual CPR. A study conducted by the Milwaukee, Wisc., emergency medical services system showed that use of the ITD during standard CPR more than doubled blood pressures and short-term survival rates in cardiac arrest patients presenting with pulseless electrical activity. As a result, the American Heart Association its 2005 CPR guidelines highly recommends the ITD for patients in cardiac arrest. In 2006, Twin cities hospitals, including some Fairview hospitals, began using it to treat patients.

Based on the success of the combination of ACD CPR and

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Take Heart America is a pilot program developed in part by University of Minnesota physicians, in collaboration with community leaders. Launched at four U.S. sites, including St. Cloud and Anoka, the program brings together a variety of approaches shown to help increase survival. Techniques range from training people in CPR and automatic defibrillator use to working with doctors, paramedics and hospital personnel on advanced resuscitation techniques and post-resuscitation care. The program includes deployment of the ITD.

Physicians anticipate that this combined treatment approach will result in more than doubling survival rates following sudden cardiac arrest. Learn more at takeheartamerica.org.



The inspiratory impedance threshold valve or ITD is a small (35 mL) disposable plastic valve that attaches to the endotracheal tube or facemask.

Discharge form is crucial for seamless care



Physicians, nurses and social workers all need to contribute to the Interagency Transfer Form, required by nursing facilities which belong to the Fairview Transitional Care Network.

Complete information on a patient's condition is vital for seamless care when that patient leaves the hospital for a rehabilitative environment, such as those in the Fairview Transitional Care Network (TCN). To support patient transfer from the hospital team to the transitional care network team, Fairview staff uses a community-

developed Interagency Transfer Form (also called the discharge form or IATF).

"When this information is not complete, provider teams are hampered in their ability to safely assume care of these complex patients," says **Ken Kephart, M.D.**, medical director, Fairview Geriatric Services.

In addition to the discharge

form, receiving care teams also need:

- a diagnosis for each medication, required by all nursing homes on admission,
- a 10-digit pager number of the transferring physician, to answer any immediate questions
- a completed discharge summary available at the time of transfer, or a note indicating who will dictate the summary and when, and
- orders that are appropriate to provide at the transitional care level.

Transitional care teams require that the transfer form and supporting materials be faxed to the TCN facility at least one hour before transfer, to allow for clarification of questions or concerns. Similarly, staff must not discharge the patient from the hospital until the

receiving facility calls during the one-hour review time. If the receiving facility does not call with questions within that hour, hospital staff may assume the transitional facility is ready for transfer.

The Transitional Care Network consists of a number of metro area nursing facilities' transitional care units, staffed by Fairview physician and geriatric nurse practitioner teams. (View the list on the Fairview intranet: From the homepage, use the dropdown menu under Physician Resources and select Nursing Home/TCU Network. Call 612-672-6805 for a password.) Each Fairview metro-area hospital has its own discharge process, with physicians, nurses and social workers all responsible for input. The unit social worker usually reviews the form. *For more information, contact **Sherrill Zebr**, TCU network manager, 651-488-8242, szehr1@fairview.org.*

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the ITD in Europe, a large National Institutes of Health-funded multi-center trial is underway in six U.S. cities, including Minneapolis and St. Paul. Locally, investigators from University of Minnesota and Hennepin County Medical Center are conducting the study. The study will evaluate the difference between using an ITD with ACD CPR, and using an ITD with conventional CPR, on neurological recovery and survival to discharge of patients following an out-of-hospital cardiac arrest. The study will

be completed in the spring of 2008, and investigators anticipate that if results are positive, the FDA will approve the ACD CPR device.

Treatment after successful resuscitation

Despite the increased cardiopulmonary circulation achieved with ACD and ITD CPR, most cardiac arrest patients still die before hospital discharge. Clinicians need additional measures to help preserve brain and cardiac function in the post-resuscitation phase. Recent studies suggest that adding

hypothermia and other metabolic hibernation strategies help preserve vital organ function after resuscitation. Treatment teams are using better circulation during CPR and better care after resuscitation at large hospitals across Minnesota. Along with more rapid and aggressive techniques to open clogged arteries in patients after resuscitation and implantation of defibrillations thereafter, these measures offer tremendous help. Still, more research is needed to increase long-term survival rates.

For more information about research, contact Fairview Research Administration, 612-672-7647, or visit fairview.org/research.

Keith Lurie, M.D., is professor of emergency medicine and internal medicine at University of Minnesota, and faculty at Minnesota Medical Research Foundation. He also is co-inventor of the impedance threshold valve and the active compression-decompression CPR device. He founded Advanced Circulatory Systems Inc., of Eden Prairie to develop the ITD device described in this article. References available on request. Contact Lurie at 952-947-9590.