PHYSIO CONTROL

# LUCAS™ CHEST COMPRESSION SYSTEM

CASE STUDY

## Cypress Creek Emergency Medical Services and a Case for the LUCAS Chest Compression System

### Situation

Nearly 300,000 people die in the United States every year from sudden cardiac arrest (SCA).[1] Although outcomes vary considerably by city and region, national SCA survival rates average about 5 percent.[1]

Dr. Levon Vartanian, Medical Director

Recognizing this as a problem within their community, Cypress Creek Emergency Medical Services (CCEMS) began an intensified campaign in 2004 to increase SCA survival rates in their region. This campaign was spearheaded by their medical director, Dr. Levon Vartanian, and his clinical staff, and was inspired by attending a conference that provided the latest information about resuscitation science, emergency medical care, and the 2005 AHA Guidelines that would be released later that year.

In reality, even when defibrillation is readily available and excellent patient care is provided, administering consistent, quality chest compressions is often difficult.

Why is this? Emergency medical services (EMS) personnel are well trained in CPR and continuously refresh and refine their skills in order to provide the best quality of care for their patients. However, several studies show it is difficult to assure proper depth and rate are achieved as recommended by the American Heart Association and the European Resuscitation Council.[2] Factors, such as rescuer fatigue[3] and the challenge of orchestrating complex therapies with limited resources, can also have the potential to impact the quality of care provided.

### Solution

Sudden cardiac arrest is a complex condition that requires a multifaceted approach. A combination of many therapies, implemented in a coordinated way, offers the best results. The LUCAS Chest Compression System is an integral component of the CCEMS treatment strategy for treating cardiac arrest.

LUCAS is designed to provide mechanical external chest compressions and is easy to carry and simple to apply in prehospital and hospital settings. It gives rescuers, including emergency medical technicians (EMTs), paramedics, doctors and nurses, the ability to administer consistent and effective chest compressions. It frees up care providers' hands for assessing the patient and providing other treatments. It also enables care providers to wear seatbelts during transport, while the resuscitation continues.

### Scene

CCEMS serves residents of northern Harris County, an unincorporated area of northwest Houston. According to Bradley J. England, executive director, recent years have been full of "growth, ...medical advancements and agency expansion. Staff and volunteers have a vision as a result of the five-year plan courageously created by the CCEMS Board of Directors. That vision will guide us to continue our tradition of outstanding pre-hospital emergency care." The area is described by personnel as a "suburban sprawl," and the service provides care to nearly 500,000 residents in a 250 square mile area.

CCEMS started as a volunteer organization over 34 years ago, with no city government to support it. Later it began to ask each household served by the water district to contribute $1–$3 each, based on assessed value, and raised $1.2 to $1.3 million to support services provided. As time went on, CCEMS wanted to provide additional emergency and preventive services to the burgeoning population. At that time it began to seek reimbursement from insurance and patients. As the service grew, it also continued to receive private donations from the many citizens who had prospered from the oil business. In 2005, CCEMS became an official Texas Emergency Services District, and began to receive financial support through taxes.

**"…We heard about it [LUCAS] at conferences and were impressed. It improves the way you provide compressions.... Our ROSC rates are about 50 percent…to hospital. I'm optimistic about what the future holds with LUCAS and ResQPOD."**
**Dr. Levon Vartanian, Medical Director**

The new space for Cypress Creek EMS features a conference facility that offers more space and flexibility for educational programs

Early in 2009, CCEMS moved into a new six-acre complex, which includes administrative offices, a new education facility, a state-of-the art communications center, and an EMS station. Having a centralized location for these departments will enable the service to function even more efficiently and effectively.

Cypress Creek EMS serves its community with 125 paid employees, 125 volunteers and 20 ambulances. Ten run 24/7, with four peak hour units, and five are held in reserve in case maintenance or repair issues arise. One of the ambulances serves as a tactical unit that supports local, state and government agencies. CCEMS is fortunate to have five local hospitals and a world renowned medical center within close proximity. In addition, there are eight area fire departments that are staffed by volunteers who are all very well equipped and well trained. Each of these departments has an automated external defibrillator (AED). The fire crews are often the first to arrive at the scene of a cardiac arrest and can provide CPR and defibrillation until EMS arrives. In addition, about 20 law enforcement officers are AED equipped. In this regard, CCEMS has established an amazing public access defibrillation (PAD) program for area citizens.

When asked about the innovative culture at CCEMS, everyone is ready to credit others. Field personnel cite their aggressive medical director (a former paramedic), the medical director credits the executive director (also a former paramedic), the executive director credits the forward-thinking board of directors and the progressive medical director, and supervisors credit the committed and motivated field team. Clearly, there is a team culture at CCEMS.

## Science

CCEMS personnel are pleased with the trends they are seeing in response to their aggressive approach to cardiac arrest treatment. Dr. Levon Vartanian, medical director, said, "Our ROSC rate was 10-14 percent. The addition of the ResQPOD® [an impedance threshold device that promotes better circulation] improved our outcomes but we wanted to do even better. AHA was focusing on CPR perfusion. Provider CPR wasn't efficient enough, and was fatiguing, and there were too many hands-off intervals. We heard about it [LUCAS] at conferences and were impressed. It improves the way you provide compressions….Our ROSC (return of spontaneous circulation) rates are about 50 percent…to hospital. I'm optimistic about what the future holds with LUCAS and ResQPOD."

Kevin Traynor, a clinical supervisor who oversees staff training and new technology acquisition, said, "LUCAS provides consistent, quality compressions. It does not tire." He believes the LUCAS Chest Compression System has improved patient outcomes. "From August 2007 to September 2008, with 122 uses, we had an 11 percent increase in ROSC. Although results are not yet statistically significant, we are seeing a nice upward trend. We need more cases for evaluation."

He added, "We have learned there is no 'single therapy' or 'magic pill' that will increase survival rates. It is really the ability to focus on the basics, and provide quality post resuscitative care, in addition to implementing new innovations like the LUCAS Chest Compression System."

Nick Robbins, a clinical manager who oversees training, education, protocols, accreditation and teaching of paramedics, said his favorite thing about LUCAS is "The success we get from it, the way it's designed, the way it works, the physiology it creates…."

Nick Robbins,
Clinical Manager

CCEMS personnel report that LUCAS is easy to train personnel on and easy to deploy in the field. "It can take anywhere from 15 to 60 seconds to apply, depending on the number of people there to help and the size of the patient," said Justin Clifford, a field supervisor. CCEMS personnel are instructed to attempt to apply the device even if it seems the patient may be too large, as they have found that it often will fit, when estimating would indicate otherwise.

Justin Clifford,
Field Supervisor

Before LUCAS, fire department personnel provided compressions, lining up personnel and switching out every two minutes to help ensure quality compressions. Initially, firefighters were concerned that LUCAS would replace them. This has not been the case, as they are now assigned to other aspects of the resuscitation effort.

"LUCAS is one of the best members of your crew," Clifford said. "It doesn't get tired, it doesn't get distracted, and it provides the best chest compressions I've ever seen."

**"LUCAS is one of the best members of your crew. It doesn't get tired, it doesn't get distracted, and it provides the best chest compressions I've ever seen."**
**Justin Clifford, Field Supervisor**

Additionally, CCEMS is using hypothermia treatment (infusing cold saline intravenously) for patients after ROSC has been obtained. The body is cooled to 32 to 34 degrees Celsius (approximately 90 to 93 degrees F) in order to help preserve neurological function. "We are one of the first services in Texas to use hypothermia," said Dr. Vartanian. "Hypothermia closes the resuscitation and allows them [patients] to neurologically heal on their own." In addition to hypothermia, CCEMS is also activating the cath lab from the field when indicated for some patients experiencing a myocardial infarction, which can often be the primary cause of cardiac arrest.

## Challenges

Implementation of a new device can often be challenging. One of the early concerns was how CCEMS would be able to fill the compressed air bottles that are needed to power LUCAS. Since they are a third service EMS agency and not fire based they did not have the bottles readily available.

CCEMS worked with a local representative of a self contained breathing apparatus (SCBA) manufacturer to secure loaner bottles. CCEMS was then able to work with their fire departments to use their cascade systems to fill the bottles. CCEMS supervisors were trained by fire department personnel on how to fill them. This solution has worked well for them.

## Cypress Creek EMS at a Glance

| | |
|---|---|
| Population served | Nearly 500,000 |
| Area served | 250 sq. mi. |
| Total call volume for 2008 | 45,470 |
| Total EMS Calls for 2008 | 27,540 |
| Total CA | 174 |
| ROSC for 2008 | ~50% |
| Total STEMI 2008 | 51 patients |
| D2B | 51 minutes |
| E2B | 87 minutes |

## Scenarios

Those who respond to emergency calls live with vivid memories. They remember the people who needed care, the family and friends, the job on-scene, and ultimately the outcome. These are not always easy memories to live with, but responders do what is necessary to assist their fellow citizens in need.

Kevin Traynor,
Clinical Supervisor

Traynor remembers a cardiac arrest case where LUCAS was used on a woman in her 60s who ultimately survived. "We were able to obtain ROSC and rapidly perform a 12-lead EKG, with the LUCAS device still in place. The EKG confirmed that she had experienced an MI, which caused her to collapse. We alerted the cardiac catheterization lab while still in the field and she was later released from the hospital without any neurologic deficits."

Clifford recalls a scene where the patient had a pulse oximetry reading of 95 percent while being resuscitated with LUCAS and had not yet been intubated. He also reports when LUCAS is deployed on a patient, blood pressures in the range he believes support brain function can be achieved.

Traynor remembers another case when a 60-year-old male collapsed in cardiac arrest while at home. The patient's wife witnessed the event, called 9-1-1, and was prompted by dispatchers to perform CPR. Fire department personnel arrived on-scene first with an AED, and within minutes of EMS arriving, the LUCAS device and ResQPOD were being utilized. The goal of CCEMS is to have the ResQPOD in place for the first ventilation and LUCAS applied as soon as it arrives with the supervisor. During this case, advanced life support medications were given through an interosseous infusion system. The patient was defibrillated a total of five times with ROSC occurring within 12 minutes of EMS arrival. A 12-lead EKG was performed post arrest and a left bundle branch block was identified, which does not meet the criteria for alerting the cath lab. The patient was intubated, but

**[My favorite thing about LUCAS?] "The success we get from it, the way it's designed, the way it works, the physiology it creates…."**
**Nick Robbins, Clinical Manager**

**"We have learned there is no 'single therapy' or 'magic pill' that will increase survival rates. It is really the ability to focus on the basics, and provide quality post resuscitative care, in addition to implementing new innovations like the LUCAS Chest Compression System."**
**Kevin Traynor, Clinical Supervisor**

shortly afterwards began having purposeful movement and spontaneous respirations while on-scene. The patient was sedated to help maintain airway control and, after a nine day stay in the hospital, was released neurologically intact with a Modified Rankin Score of one (some symptoms without significant disability).

## Summary

EMS today faces many challenges due to funding issues and unemployment, with people losing their health insurance. There are also legal issues to manage and contingency planning for the region's tropical storms. Yet forward-thinking leadership and motivated CCEMS personnel will do anything it takes to improve survival rates of people who experience cardiac arrest – including early defibrillation and expert CPR with the assistance of an external chest compression device such as LUCAS.

As usual, Cypress Creek EMS is looking to the future and partnering with its local hospitals to improve EMS services for the community. "We are working as one to accomplish a goal," Traynor said.

CCEMS personnel attend major EMS conferences across the country, constantly looking to improve patient care by implementing state-of-the-art science and technology into their system. The service is currently working to improve hypothermia care by collaborating with area hospitals, and defining centers with excellent post resuscitation care as designated resuscitation centers. Treatment protocols are revised every two years to keep up with the changes in healthcare, with SCA and STEMI care remaining a priority.

Moving into the future, Cypress Creek EMS is definitely an organization to keep your eye on as a leader in the newest EMS trends and practices.


**REFERENCES**

1. American Heart Association website, June, 2009.
2. Wik L, et al. Quality of cardiopulmonary resuscitation during out-of-hospital cardiac arrest. *JAMA* 2005 Jan 19; 293 (3): 299-304.
3. Ochoa, FJ, Ramalle, et al. The effect of rescuer fatigue on the quality of chest compressions. *Resuscitation* 2005; 37 (3): (1998) 149-152.



**For further information please contact your local Physio-Control representative or visit www.physio-control.com**

HEADQUARTERS / MANUFACTURING
**Physio-Control, Inc.**
11811 Willows Road NE
Redmond, WA 98052 USA
Tel 425 867 4000
Toll Free 800 442 1142