

New approach to cardiac arrest buys survival for California man

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Credit: Unsplash/CC0 Public Domain

Sterling Sinema is alive today because of quick actions taken by his wife and a diverse group of medical personnel—and a pioneering program to get rapid aid to victims of cardiac arrest.

Headed for urgent care in Escondido, Calif., to manage a severe bout of heartburn, Sinema suddenly collapsed sitting in the passenger seat of his

wife Renee's vehicle.

"She's told me I started decompensating or convulsing, whatever it's called," Sinema said. "I went into cardiac arrest, and she turned the car around."

On the way out of town they had passed Ramona's Fire Station 80 and noticed that the full complement of firefighters and paramedics happened to be on hand. Getting back to that spot, with its ambulance and trained paramedics, was suddenly the only priority.

"She turns the car around and flies back to Station 80; I mean, running red lights, she'll say she was Mario Kart Princess Peach Derby," Sinema said, a look of pride in his eyes. "She pulls in, yells at the paramedics, blares the horn, jumps out, comes around to undo my seatbelt, checks for a pulse, nothing."

Paramedics loaded him on a gurney and headed toward the nearest hospital, Palomar Medical Center Poway. But Palomar's Dr. Christian McClung, overseeing ambulance transport by radio that morning and reviewing the details of this patient's case, called and made a counterintuitive demand.

"I told them not to go to Poway but to take him to Sharp Memorial in San Diego," McClung said. "We could see that he met the criteria for ECMO, and that could save him if they hurried."

And that's what ended up happening. Grumbling a bit about the idea of driving a patient without a pulse farther away, the crew nonetheless made the trip, and Sinema, 45, a husband, father and chief petty officer in the U.S. Navy, made it through.

He is one of a handful of patients that has made a spectacular recovery

under the region's ECPR Pilot Program, a joint effort of several local hospitals and the emergency medical services community to put qualifying cardiac arrest patients on extracorporeal membrane oxygenation therapy as quickly as possible.

When speed is everything

Timely use of ECMO has shown a miraculous ability to save the lives of some who suffer sudden cardiac arrest, a condition where loss of pulse kills roughly nine out of every 10 patients, according to the American Heart Association.

The therapy involves inserting thick tubes called cannulas into a patient's main vein and artery, diverting blood flow into a machine equipped with a pump that keeps blood flowing and a special membrane that can strip away carbon dioxide and infuse oxygen.

Quick treatment of cardiac arrest is the latest use of ECMO technology, but it is far from the first. Similar to the heart-lung machines that have been used in [heart bypass surgery](#) for decades, ECMO was used during the COVID-19 pandemic to buy time for patients' damaged lungs to recover. It is also commonly used in heart and lung transplantation.

It is a bridge therapy, keeping patients' internal organs supplied with freshly oxygenated blood while the root cause of their illness is diagnosed and addressed.

In Sinema's case, the problem turned out to be a blocked left anterior artery. This vessel supplies the front left side of the heart muscle with the blood it needs to keep pumping properly.

Dr. Saul Levine, a key player in the county's ECMO pilot project, happened to be on duty when Sinema came in that Sunday morning, Oct.

1, 2023. Inserting the cannulas and getting him quickly "on circuit," he said, bought time to do medical imaging, spot the blockage and insert a stent to restore blood flow to the heart muscle.

"We put Sterling on ECMO and, 24 hours later, he's cracking jokes and high-fiving people," Levine said.

San Diego hospitals in pilot

Today three San Diego County hospitals are part of the ECPR pilot project. In addition to Sharp Memorial, Scripps Memorial Hospital La Jolla and Sharp Grossmont Hospital in La Mesa have signed on. UC San Diego Health confirmed this past week that it has also applied to join the effort.

In its first year of operation, the program has handled fewer than 100 cardiac arrests. The precise number has not yet been released as the program is still processing data collected since July 1, 2023.

Given that the county averages about 3,000 cardiac arrests per year, it's clear that the pilot program is very specific in which patients qualify.

Patients must be aged 18 to 70 and have a "shockable" heart rhythm—one that could be reset using an automatic defibrillation machine. And their cardiac arrest must have been witnessed with bystander CPR provided in less than five minutes.

Further, two defibrillation attempts must have failed, and responding paramedics must have a mechanical chest compression machine available to keep blood flowing during transport to the hospital. And a receiving hospital must not be more than 45 minutes away.

These criteria are designed to select only those patients who research

shows stand the best chance of benefiting from ECMO treatment after sudden cardiac arrest.

Dr. Demetri Yannopoulos, a University of Minnesota interventional cardiologist who helps lead a team that has extensively researched the use of ECMO in treating sudden cardiac arrest, notes that the shorter the amount of time between such an incident and the initiation of therapy has the biggest impact on saving lives.

"If you're placed on ECMO after receiving continuous CPR for 30 minutes, it's a 60% to 80% survival rate," Yannopoulos said. "From 30 minutes to 45 minutes, it's a 50% survival rate, and from 45 minutes to 60 minutes, it's 25%."

An agonizing hour

Sinema was on the long end of that scale.

Doctors said he spent seven minutes at the fire station, 44 minutes on the road to Sharp Memorial, and it took 13 minutes for the hospital's emergency team to insert cannulas so that the ECMO pump could restore oxygenated blood flow.

Learning more about the program has made it clear to Sinema just what a close call his survival was.

"Everything had to line up perfectly," he said.

His travails did not stop when he came off the ECMO pump after five days.

When the heart problems were sorted and it was time to finally escape the intensive care unit, Sinema could not move his legs. An MRI found

that, during treatment, his spinal cord suffered significant injury.

Doctors said he likely would not walk again, but a transfer to the world-renowned spinal cord physical therapy program at the VA San Diego helped Sinema gradually regain his ability to stand and then walk with the help of a cane.

Nearly one year later, a wheelchair is still necessary for trips to places like SeaWorld where significant walking is required. But Sinema's mind, except for those few hours around the cardiac arrest, is sharp.

His muscles atrophied, and the incident has cost him his career. He will retire from the Navy soon despite a previous lifestyle that included 10-mile runs on the beach.

Sinema said his Christian faith reminds him that he has been blessed.

"I'm grateful to be alive," he said. "I'm grateful that my spinal cord injury isn't complete.

"Yes, there is a question mark there in how much more I'll be able to recover, but I can feel my toes."

Shaving minutes

Today, emergency medicine at every level is looking for ways to shave as many minutes from the cardiac arrest response time for those who qualify for ECMO.

That is the goal of San Diego County's current pilot project. Studying efforts in Minnesota to train paramedics to recognize cases of cardiac arrest that could benefit from the therapy, the San Diego County Emergency Medical Services Office is committed to modifying its

standard way of handling cardiac arrest cases outside hospitals.

Cardiac arrest occurs when the heart suddenly stops pumping blood. Arrest, often caused by electrical short circuits called arrhythmias in the heart muscle, is usually fatal, though automatic defibrillators can shock the cardiac muscle back into the right rhythm, allowing a patient who has fallen down to rise again.

Standard paramedic procedure has been to deliver shocks and, if they are unsuccessful, to administer medications, insert a breathing tube and discuss the situation with the nearest "base station" hospital to get advice on further life-saving steps.

However, for those patients with the particular presentation that doctor McClung spotted on Oct. 1, the new practice is to cut out everything after the shocks.

This approach, notes Dr. Kristi Koenig, medical director of county emergency medical services, is a massive departure from what has been the standard of care for a long time. That is because, until recently, there has not been much extra that a hospital can do for a cardiac arrest patient that can't be performed by paramedics in the field working under the guidance of base station doctors and nurses.

"Now, with ECMO ... suddenly, for a select group of patients with what we call refractory shockable rhythms, we do have something available in the hospitals that we don't have available in the field," Koenig said. "We have to do a complete mind shift in terms of getting it on the radar of the paramedics to identify these patients and get going, get going right away, to a hospital that's capable of rapidly putting them on ECMO."

Putting qualified patients on ECMO has been going on in San Diego for a long time. It's getting the first responders involved that's new.

Local pioneers

As near as anyone can tell, Dr. Zack Shinar, chair of emergency medicine at Sharp Memorial, was the first in the region, and probably first in the nation, to put a cardiac arrest emergency patient on ECMO back in 2010. After that first patient survived with his faculties intact, connections were gradually made with other local health systems, especially the emergency doctors over at Scripps La Jolla.

Shinar has found himself traveling in the United States and internationally, even starting his own podcast, to share ECMO experiences with colleagues.

That first patient, he said, has challenged his assumptions about how long the human body can go without a heartbeat and still recover with cognition intact.

"The previous paradigm was that the brain survives about five minutes without chest compressions and about 15 minutes with chest compressions," Shinar said. "The understanding was, if you're doing any more than that for a cardiac arrest patient, you're just wasting your time.

"Well, that's just flat-out not true, and it's something we've learned in the last 15 years. The brain can survive a lot longer if we can get blood perfusion back to a meaningful standpoint, and that's what ECMO does."

Dr. Shawn Evans, an [emergency medicine](#) specialist at Scripps La Jolla, has been collaborating with his Sharp colleagues on ECPR using ECMO for years. He said the immediate goal is to bring the amount of time spent on scene down from a previous average of 25 minutes to a much, much lower number when a patient qualifies for the ECMO program.

"We've got to get to five minutes, and we have to make this a public

health priority," Evans said. "Unlike 20 years ago, we now have the ability to take over for the heart and lungs at that critical time when the heart and lungs are performing at their worst.

"We have an opportunity to get people back to their families and back to the community and to the lives that they once enjoyed."

San Diego twist

San Diego's twist is to use emergency doctors to insert the cannulas to start ECMO rather than waiting for cardiac surgeons or other specialists.

This, Shinar, Evans, Levine and Koenig said, is thought to be the first ECPR program in the nation to cross-train emergency personnel to act quickly, rather than waiting for cardiac or other surgical specialists.

"One of the huge advantages we have over almost every other place is that, as soon as the patient hits the ER, they get cannulated," Shinar said. "We don't have to wait for a cardiothoracic surgeon to drive in from home.

"When you know that time is everything, this model really might be the model of the future that the whole world takes. We don't know that for sure, but that's what we're trying to prove with San Diego's pilot program."

Yannopoulos, the University of Minnesota interventional cardiologist who has been a key leader in ECMO cardiac arrest efforts for years, said the program continues to use specialists such as interventional cardiologists, to place the cannulas quickly. He said he tried to train emergency specialists to do the work in ERs but was unsuccessful.

"I have challenged a little bit the concept that you can teach every

emergency doctor to do it with the current structure of the machine and the tubes and the wires to be done in a timely fashion without a major number of complications," Yannopoulos said. "That said, I would be very happy if I would be proven wrong."

Shinar pushed back, noting that doctors working in ERs understand how to work in difficult situations where precision is required.

"There are no doctors more experienced at placing central catheters in patients during chest compressions than emergency physicians," Shinar said.

The University of Minnesota has made its own significant inroads by putting those cardiac specialists into a special mobile ECMO truck, a \$1.8 million investment that is on call round-the-clock, rendezvousing with transporting ambulances at agreed-upon locations midway between [cardiac arrest](#) locations and destination hospitals and significantly reducing travel times.

The French have taken things further still, with photos popping up on the Internet of medical teams putting patients on the heart pump in a diverse range of public locations from train stations to the Louvre.

As equipment and practice evolve, Yannopoulos said, there are many reasons to think that the ultimate location will be at the scene of cardiac arrests rather than in hospitals.

"Eventually, I think we will see highly trained teams in hospitals and EMS-based teams when the location is further away, that will travel to the patient," Yannopoulos said.

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