Emergency doctors find new life-saving use in old machine

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Slammed in the gut by a wrecking ball, the construction worker arrived at the University of Maryland Shock Trauma Center in dire condition years ago.

Doctors removed his devastated liver but he died before being matched with a new one, frustrating staff that longed for something to temporarily maintain the organ's function, like their machines for hearts, lungs and kidneys.

Now they think they've found one in a little-used machine designed to detoxify people who overdose on acetaminophen and other medications. Doctors at Shock Trauma used it to save a teenage gunshot victim, and then a college football player and an amateur triathlete who suffered heatstrokes.

Twenty-seven patients facing death from liver failure were hooked to the machine from 2013 through 2016 and the majority lived - a tally Maryland doctors now hope spurs a new look at the old technology.

"Our goal is to continue to increase our patient population and tell people about it," said Dr. Steven I. Hanish, a liver transplant surgeon at the University of Maryland Medical Center who works closely with Shock Trauma and was the lead researcher on a paper about the cases published recently in the Annals of Surgery.

It's an off-label use of the Molecular Adsorbent Recirculating System
machine, or MARS, which has been around for decades. MARS is approved by the U.S. Food and Drug Administration only to treat poisoning cases and brain swelling from liver failure. Its manufacturer, Baxter International, says 20 hospitals use it.

Livers primarily filter blood coming from the digestive tract, metabolizing toxins such as alcohol and drugs, and creating vital proteins. People cannot live without a functioning liver.

Shock Trauma doctors wanted to try the MARS device as a temporary stand-in for badly damaged livers, giving patients a chance to begin healing or for transplants to be arranged, but first they had to find one.

After checking with Baxter, they found an area hospital that was returning a MARS machine.

"We literally got one off the back of a truck driving up I-95," said Dr. Thomas Scalea, the center's physician-in-chief.

The machine is a small device filled with albumin, a protein that binds to toxins and is normally made by the liver.

Doctors liken pumping a patient's blood through it to kidney dialysis, only MARS treatment is far more temporary. Patients using it can survive for only about three days, Hanish said.

About 20,000 people are on the national list for liver transplants, according to United Network for Organ Sharing, but most have a chronic condition like hepatitis slowly diminishing their livers.

Shock Trauma doctors envision using MARS for a smaller group of people with acute liver failure, about 1,600 new U.S. cases annually that typically result from injury.
Doug Wetzel was one of the patients Maryland doctors treated - and saved - with the machine. The executive chef at Gertrude's restaurant in Baltimore was competing in the Rock Hall International Triathlon on Maryland's Eastern Shore in 2015 when he fell off his bike, launching a chain reaction that began with compartment syndrome, or dangerously excessive pressure, in his thigh and ended with heatstroke and liver failure.

He doesn't remember the helicopter ride from University of Maryland Shore Medical Center in Chestertown to Shock Trauma or the days of extreme effort by more than 200 to save his life.

At first, doctors didn't think he'd survive the night. With the help of MARS, he survived three days, long enough to find a matching liver from a stroke victim.

"I didn't die, but I got as close as you really want to get," Wetzel said. "After I woke, I had a new liver and they had to explain what happened and how the machine helped save me."

Wetzel said it took about a year to get back to feeling normal, and he's now doing some running and biking again. He said he feels thankful to the medical staff, the donor's family and the MARS machine. He wants doctors around the country to learn about his case and consider using MARS in their own programs.

At least one other hospital uses the machine for patients with acute liver failure, even more regularly than Shock Trauma.

Dr. Rab Subramanian, a transplant hepatologist and an intensivist for Emory Healthcare in Atlanta, said his team has been using MARS about once a week for about seven or eight years and he occasionally gets calls from other doctors interested in the machine.
"Anecdotally, I think it works," he said. "But what I can't say is it definitely works because I don't have a control group."

That means a randomized study, where patients with similar injuries are randomly hooked to MARS or not hooked to the machine and the outcomes compared.

Shock Trauma did the opposite of such a study, treating a variety of patients - anybody doctors thought it might help - with MARS.

Dr. Deborah Stein, chief of trauma and director of Neurotrauma Critical Care at Shock Trauma, chooses the MARS patients and said the goal was saving lives and not conducting a proper medical trial. She acknowledged the data collected does not pass scientific muster.

"We'll do anything to save a life," said Stein, who co-authored the journal paper with other transplant and trauma doctors, who also have positions in Maryland's School of Medicine. She said she will continue to refine who could benefit from MARS and who wouldn't, such as those with multiple organ failure.

Stein said past studies of using MARS for liver dialysis may have not shown an increase in survival because patients were very sick and required many treatments, including others for liver failure. Trauma medicine also has improved over time.

The Maryland doctors said designing a study now would be challenging. Acute liver failure remains relatively rare and a study would take years and many centers to enroll enough people. Further, Hanish said organs aren't always available for transplant, and he wouldn't be willing to withhold MARS from a patient who would certainly die without it.

Even comparing lab tests of liver function might not be instructive
because Shock Trauma patients' numbers haven't always reflected the overall patient improvement the doctors' observed, Hanish said.

Still, Emory's Subramanian said he would participate in a carefully constructed study. So would Dr. Andrew Cameron, surgical director of liver transplantation for Johns Hopkins Medicine.

Cameron said trauma and transplant doctors really want liver dialysis technology, and the strong reputations of Shock Trauma and the surgical journal have helped gain attention and propel optimism about MARS.

But he said most doctors likely wouldn't use a technology that didn't show significant value in past studies. Even in patients likely to die, Cameron said, doctors could cause harm, though Shock Trauma doctors dismissed that notion.

It's also adding costs and the machines are rare, Cameron said.

"I applaud their aggressiveness in trying to help sick people," he said. "But unfortunately it leaves us not much closer to understanding if the machine made a difference over everything else they do at Shock Trauma, where patients get the best available standard of care."

There is little quibble from Scalea about the need for evidence. He hopes a trial can be designed. In the meantime Maryland doctors will continue to track patients and report their findings.

"Will we keep using it?" he said. "Hell yes."

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