

New technology preserves organs during transplant process

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Livers and other organs begin lacking oxygen the moment they are removed from the donor and may have damaged tissue by the time a transplant occurs.

For the past 40 years, donor organs have been kept in "cold static preservation" - at less-than-ideal temperatures and levels of oxygenation - while being transported and prepared for transplantation.

But now Paulo Fontes and his colleagues at the University of Pittsburgh School of Medicine, UPMC and the McGowan Institute for Regenerative Medicine have developed machine-perfusion [technology](#) that preserves [donor livers](#) by pumping them with a form of cold artificial blood known as a "cell-free oxygen-carrier solution."

The process is designed to keep donor organs oxygenated throughout the entire organ-preservation process before transplantation. If successful in human clinical trials, the technology could preserve more donor livers, reduce mortality among those on the waiting list and provide them with better post-transplant outcomes.

Based on success with pigs, Dr. Fontes and team are submitting final documentation for U.S. Food and Drug Administration approval to conduct a human clinical trial, possibly in coming months, to compare the new vs. old methods of organ preservation.

And if successful there, the perfusion-machine technology and solution

would hold grand potential.

Already, the research team is developing perfusion machines for all major donor organs, including kidneys, pancreases and composite tissues consisting of skin, bones, blood vessels, nerves and tendons, with a longer-term vision of creating "an organ ICU." Using the preservation method throughout the process, donor organs would be transported to an intensive care unit to undergo full recovery of function, before being transplanted or even sent off to transplant centers nationwide.

"We are working with the group from the Netherlands on devices for each organ, based on the right physiology, pressure and blood vessels," said Dr. Fontes, a UPMC transplant surgeon and deputy director of the McGowan Institute. "The concept is not only preservation but the promotion of resuscitation and reanimation to make organs that currently are being discarded as potentially usable for transplantation."

The Pitt-based study, published online Wednesday in the *American Journal of Transplantation*, explains how the team adapted the Organ Assist device, originally developed by the Dutch group, for combined use with the oxygenation solution developed by the Pitt team. That solution contains a hemoglobin-like oxygen carrier, biochemicals, nutrients, glucose and buffers to control pH levels to prevent acid damage to organ tissue.

A constant supply of oxygen, with other biological factors, work to restore the donor liver to full function prior to surgery, with healthier organs generally resulting in better post-operative outcomes.

In the study, six pigs received livers preserved with the new method for nine hours before surgery. All six survived and were walking within hours after the operation. But only two of the six pigs that received livers preserved by the cold-static method survived their transplants. The study

found that the enhanced oxygenation process at about 70 degrees Fahrenheit triggered regenerative and cell-protective responses, which led to better organ function after the transplant.

The technology especially could be important in preserving "donation after cardiac death," with up to 50 percent now being discarded.

The percentage of organs recovered from DCD donors has increased significantly over the last decade, Dr. Fontes said, mostly involving the patients who had decreased levels of oxygenation to their tissues for an extended period of time.

"If you don't correct that, you extend the damage and can't use the organs, and might turn them into unsuitable organs to be safely used for transplantation," he said. "That is why we were so keen to develop an effective (out-of-body) oxygenating system for [organ preservation](#)."

Cristiano Quintini, a liver transplant surgeon involved in the Ex-Vivo Organ Perfusion Program at the Cleveland Clinic, said there's been a huge movement in the last three or four years with livers and the past five years with hearts and lungs "to find ways to better preserve these organs." About 10 projects are well under way to develop perfusion technology to preserve donor organs, with growing success, he said.

"This is one more study confirming that cold static preservation is bad and machine perfusion actually is better," said Dr. Quintini, who was not involved in the study.

"With this technology, we have the opportunity we haven't had in 40 years of potentially eliminating mortality on the waiting list, with huge potential for ordinary organ repair and assessing organs for transplantation," he said. "I think this is an excellent study. The transplant community needs to transfer lab studies into clinical trials.

This (type of) technology will revolutionize how we do transplant surgeries, for sure."

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