

New container seeks better transport of blood



Lt. Col. Frank Rentas of the Department of Blood Research at the Walter Reed Army Institute of Research preconditions the Golden Hour blood container that lets Special Forces medics carry blood far forward in battle.

WRAIR photo

by Karen Fleming-Michael
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A staple in television medical dramas is the emergency room doctor rushing alongside a wounded patient's gurney, ordering units of blood -- stat. But when the patient is a Special Operator who's far away from doctors and medical supplies, getting blood, let alone getting it stat, hasn't been an option until now.

The new Golden Hour blood container created by a contractor in Minnesota brought to fruition the vision of a three-person staff at the Blood Research Department at Walter Reed Army Institute of Research.

"Things converged about a year ago when the military was in Afghanistan, said Col. Tom Reid, chief of the Department of Blood Research at WRAIR." A number of surgeons who were there came back [in April 2002] and said they were concerned about getting blood far forward ... [because there are] small groups going out [and face] delayed evacuation time."

In fact, Reid said, during Operation Anaconda, an Air Force Special Operations medic who packed units of blood saved the life of a badly wounded ranger in Afghanistan.

"We bleed out the oxygen-carrying capability on to the ground and at some point you get sick enough that you need to replace that," said Col. John Holcomb, a trauma surgeon and the Army surgeon general's trauma consultant.

During the April discussions, the recurring question the surgeons asked was "Do we actually need blood far forward and, if so, what are we doing about it now? Reid said.

The idea wasn't new. Medics have taken blood forward in battle since World War I, according to Brig. Gen. Douglas Kendrick's 1964 volume titled "The Blood Program in World War II." Though carrying blood far forward in the field is not doctrine, "obviously medics and soldiers in the field do what they have to do. If they think they need to get blood forward, they will get it forward," said Dr. Victor Macdonald of WRAIR.

Transporting blood, which is regulated by the Food and Drug Administration, is no simple task.

"You can't just throw it in your ruck [like you can with IV solutions]," said Holcomb, who also is the commander of the U.S. Army Institute of Surgical Research in San Antonio.

In the past, medics put units of red blood cells in coolers filled with wet ice to keep blood at its optimal temperature of between 1 and 10 degrees Celsius. "When your [outside] temperature is 110 [degrees Fahrenheit] or is cold, the units of red blood cells won't stay at the right temperature for very long," Macdonald said.

When blood isn't kept at the right temperature, the cell membranes break down in a process called hemolytic. "At some point, you start causing significant harm to the patient, like kidney failure and death," if you give bad blood to patients, Holcomb said.

After creating five or six prototypes, the Minnesota company arrived at the Golden Hour container. Its name is based on the tenet that beating the effects of shock within the first hour of injury -- by giving a blood transfusion, for instance -- is vital to trauma patients' survival.

The container, a nearly 10-inch square box that needs no power source to maintain its internal temperature, uses a combination of the vacuum-insulated panels and an internal container that has a liquid phase-change material, like the reusable freezer packs people toss in coolers.

"The black, internal portion of the container is put in a refrigerator or freezer for at least two hours, then is put back in the container along with the units of red blood cells. The lid is put on, and that's it," Reid said. The container can hold four units of red blood cells and weighs 10 pounds when it's full.

"The point of the box is for the medic to have blood with him, ready to use when he needs it," Reid said.

How long the blood stays useable in the container depends on the outside temperature, said Lt. Col. Frank Rentas, assistant chief of blood research at WRAIR. According to tests run in the Blood Research Department, when the outside temperature is -9 degrees Fahrenheit (below freezing), the red blood cells stay good for more than 97 hours; at 105 degrees Fahrenheit, they're good for more than 78 hours; and at room temperature, they can last 121 hours.

"The beauty of this is that the box isn't just good for red cells but for anything that needs to be transported forward like biologicals, vaccines, reagents," Rentas said.

The WRAIR team is already looking at a second-generation box that can constantly monitor the internal temperature of the box. Right now, the advice the researchers have given the Special Forces customers who purchased 20 boxes, is to use temperature-sensitive stickers that indicate when blood's gone below or above the recommended temperature.

"That's actually what most people use right now when they ship red blood cells from one location to another," Rentas said. "It's not the ideal solution because they're not 100 percent sensitive, but it's better than not having anything at all in there."

Would having blood far forward made a difference to Holcomb when he was operating on rangers injured during the 1993 Battle of Mogadishu in Somalia? "Possibly," he said. "There were guys who were exsanguinating [bleeding profusely] that, if they had blood going in, would [have lived]."

The solution to red cell replacement on the battlefield, Reid said, may be a hemoglobin-based oxygen carrier. Also called HBOC, the solution could do the red blood cells' oxygen-carrying job and be thrown in a medic's rucksack. The product is currently working its way through the FDA approval process. This approach, combined with new homeostatic dressings aimed at stopping bleeding, may significantly decrease mortality on the battlefield, Holcomb said.

