Discovery opens new options for improving transfusions

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Donated red blood cells lose a key feature that diminishes their lifesaving power the longer they have been stored, according to researchers at Duke University Medical Center.

The finding, published Friday in the journal Critical Care Medicine, details how banked blood undergoes a change during storage that decreases its ability to transport oxygen.

Slowing that process could offer a way to boost the longevity and vitality of stored blood - more than 14 million units of which are used each year in the United States to treat cancer, acute heart syndromes, trauma and other critical illnesses.

"Studies have indicated that older red blood cells appear to be inferior for some patients," said Timothy J. McMahon, M.D., PhD, associate professor of medicine at Duke and senior author of the study.

"With the supply and demand balance for red blood cells very, very tight, it's important to find ways to optimize the benefit of transfusions and extend the shelf life of stored blood," McMahon said.

Doctors have long noted complications among some critically ill patients who have undergone transfusions for anemia, and researchers have been working to ease these problems by identifying and correcting the shortcomings of stored blood.

One finding reported previously by Duke scientists focused on nitric oxide, a chemical that helps keep blood vessels open. Banked blood quickly begins losing nitric oxide, making it difficult for it to speed through the body and deliver oxygen.

The current Duke team's finding offers an additional insight. Stored red blood cells also lose the ability to release a key molecule called adenosine-5'-triphosphate (ATP), which works as a sort of anti-adhesive.

As their ability to release ATP diminishes the longer they're stored, red blood cells develop a sticky quality. When transfused, these older cells tend to adhere to the blood vessels in the lungs instead of transporting their oxygen payload throughout the body.

When that happens, patients may be at risk for heart attacks, respiratory failure and other complications that have been associated with transfusions.

"We show that the export of ATP is important to prevent red blood cells from sticking to the inner lining of blood vessel walls," McMahon said. "Whereas previous reports had shown increasing adhesion as a function of storage time, there were very few studies on the mechanism of that adhesion."

McMahon said the researchers are now exploring whether they can ease the problem, perhaps by fortifying stored red blood cells with additional ATP or with an agent that stimulates ATP release.

Provided by Duke University Medical Center