

Pretreating red blood cells with nitric oxide may reduce side effect linked to transfusions

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A new treatment may diminish a dangerous side effect associated with transfusions of red blood cells (RBCs) known as pulmonary hypertension, an elevated blood pressure in the lungs and heart that can lead to heart failure, suggests a new study published in the November issue of *Anesthesiology*, the peer-reviewed medical journal of the American Society of Anesthesiologists (ASA). The treatment involves exposing RBCs that have been collected, processed and stored for transfusion to the gas, nitric oxide.

"Blood transfusions are one of the top five medical procedures performed by physicians worldwide," said Warren M. Zapol, M.D., study lead author and director of the Anesthesia Center for Critical Care Research at Massachusetts General Hospital in Boston. "Transfusions can be a life-saving therapy to replace blood cells or blood products lost as a result of severe bleeding after trauma, accident or surgery. Most blood transfusions are not 'whole blood' transfusions, but rather transfusions of certain blood products, with [red blood cells](#) being the most common."

Because supplies of freshly stored RBCs are limited, the U.S. Food and Drug Administration allows transfusion of human RBCs that have been stored for up to 42 days. However, recent studies suggest that transfusion of RBCs that have been stored for more than 30 days may lead to [pulmonary hypertension](#) and reduced survival of transfused RBCs, which can cause the body's cells to not get enough oxygen. Each year, approximately 326,000 patients in the United States receive one or more RBC units that have been stored for more than 30 days.

In the study, RBCs taken from lambs were stored for 40 days and then exposed to [nitric oxide](#) - a type of gas often given to treat term infants with

pulmonary hypertension. One set of lambs received the treated RBCs through transfusion, while another set received stored RBCs not exposed to nitric oxide.

Researchers found transfusing RBCs that had not been pretreated with nitric oxide nearly doubled the constriction of blood vessels in the lungs, compared to RBCs pretreated with the gas. From this, the authors concluded that pretreating stored RBCs with nitric oxide reduces the risk of pulmonary hypertension.

In addition, treatment with nitric oxide increased the survival of stored RBCs after transfusion. When the 40-day-old pretreated RBCs were transfused into lambs, 87 percent of the cells remained in circulation after one hour, compared with 75 percent of non-treated RBCs. After 24 hours, 78 percent of red cells treated with nitric oxide remained in circulation, compared with 73 percent of RBCs not treated with nitric oxide.

"Extended storage of RBCs makes them rigid and decreases their ability to change shape, which is necessary as they travel through small blood vessels," said Dr. Zapol. "We found that pretreatment with nitric oxide actually rejuvenates RBCs, making them more flexible so they can more easily travel through [blood vessels](#). This can further reduce the risk of pulmonary hypertension."

Further studies with transfused human-stored RBCs are required to confirm the beneficial effects of nitric oxide exposure, the researchers wrote.

Provided by American Society of Anesthesiologists

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