Research: A search for safer red blood cells bags for pediatric recipients


From bottles to plastic

Over 50 years ago, plastic replaced glass as the container of choice for collection and storage of blood and blood products. This greatly improved the safety of blood for transfusion by reducing the risk of contamination and containers breaking.

Polyvinylchloride, better known as PVC, is the most popular plastic for blood bags because it is durable, strong and can resist temperature changes. However, PVC is inflexible and brittle. To make flexible bags suitable for blood storage, PVC must be combined with a chemical called a “plasticizer”, which softens the plastic.

The most widely used plasticizer in blood bags is called DEHP that is also found in toys, medical tubing, water bottles, rainwear and many other goods. Despite its extensive use, there are concerns about its toxicity. There is no clear evidence that DEHP has harmful effects in humans following transfusion, but animal studies have shown that it may affect the development of the reproductive system, particularly in males.

To explore alternative plasticizers, our researchers compared the quality of red blood cells stored in bags specifically designed for pediatric patients plasticized either with DEHP or two known less toxic plasticizers called DINCH and BTHC.

The study found that:
Metabolism of the red blood cells WAS affected by the bag they were stored in.

Metabolism was best maintained in DINCH bags, and worst in BTHC bags.

Red blood cells in BTHC bags had more signs of damage.

Arrangement of phospholipids, an important structural part of red blood cell membranes, was not different among the bags.

Red blood cell membranes were less damaged and better preserved in DEHP and DINCH bags than in BTHC bags.

Overall, red blood cells in DEHP and DINCH bags showed good quality, while red blood cells in BTHC bags stored poorly.

"It was surprising to us, how big of an impact the plasticizer choice can have on red blood cell quality," said Dr. Serrano, a research associate in Dr. Dana Devine's lab at the Centre for Blood Research at UBC. "The study shows that good alternatives to DEHP do exist."

Of the alternative plasticizers proposed so far for use in blood bags, DINCH has the lowest toxicity levels, making it an attractive option. These studies show that DINCH bags are effective at maintaining red blood cell quality during storage.

While more research is needed — for example, to understand how the plasticizers affect red blood cells stored in different storage solutions — these results support a potentially promising future for DEHP-free blood storage.

Read more about how our research teams at our Centre for Innovation labs measured quality of red blood cells. Get the full story on RED, our research, education and discovery blog.

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