Did near-infrared spectroscopy leave us in the dark?

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In this issue of the *Journal*, Stowell and colleagues¹ compare the results of tissue oxygenation measurements in cardiac surgical patients after transfusion of packed red blood cells (PRBCs) with shorter or longer storage duration. The study attempted to fill in two knowledge gaps. (1) Does it matter whether older or newer units of PRBCs are being transfused? (2) Ultimately, do we help or harm our patients by transfusing?

A large body of recent literature demonstrates that despite a logical assumption that fresh PRBCs are better; the clinical outcomes are surprisingly similar between those who received old or new PRBCs.² To find a physiologic explanation for these results, Stowell and colleagues¹ evaluated tissue oxygenation by near-infrared spectroscopy of the thenar eminence and sublingual microcirculation. Both minimally invasive methods are relatively easy, and in addition some of the coauthors of the article have used an identical protocol on healthy volunteers in the recent past.³ As we learn from the article, transfusion of either fresh or old PRBCs did not change the tissue oxygenation much, and thus the transfusion in general might have been pointless.

But can one be sure that not too many assumptions have been made before drawing these conclusions?

The first assumption is that somatic near-infrared spectroscopy provides an adequate surrogate for the tissue perfusion on the basis of which one could accurately judge red blood cells' oxygen delivery and capacity to remove carbon dioxide.⁴ Perhaps, but would the changes persist hours after the transfusion, when the measurements were actually performed? The lack of cardiac output data, mixed venous saturation values, and lactate levels before and after measurements also makes the interpretation of the results difficult. In addition, the study group was small.

The second assumption is that because the tissue oxygenation did not change, transfusion may have been futile. There was no group in the study randomly allocated to receive no transfusion, however, so no conclusion can be made as to whether the transfusion was useful.

One more assumption is that older and newer PRBCs are significantly different. Some experts argue that erythrocyte

deterioration unfortunately occurs within just a few hours after cooling to 4°C. It is to be hoped that the application of the new “-omic” technologies might provide some insight into what happens with intracellular metabolites and membranes of red cells after cooling. Cryopreservation might be a better way to protect erythrocytes function in the future.⁵

Unfortunately, because of the current lack of clinically applicable technology, we are forced to acquire the knowledge from surrogate measurements. For both medieval doctors who believed in therapeutic bleeding and 20th century doctors who believed in transfusions, the knowledge was largely based on assumptions, and the truth remained in the dark.

Stowell and colleagues' point, however, is well taken; there are no axioms in medicine, and widely accepted dogmas can and should be questioned. Taking it “with a grain of salt,” we now know that according to near-infrared spectroscopy, tissue oxygenation did not change after transfusion of either older or fresher units of PRBCs. In that case, should we transfuse at all? More research is clearly needed in the near future.

References

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Central Message

Somatic near-infrared spectroscopy showed no significant difference in tissue oxygenation after transfusion of older or newer packed red blood cells; however, many confounders could influence results.

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