Whole Blood: More than the Sum of the Parts

To the Editor:
Dr. Weiskopf’s editorial, “Reconstructing Deconstructed Blood for Trauma,”1 should prompt serious examination of conventional blood banking practices, not just as they pertain to trauma, but also to other areas of patient care that involve significant blood component transfusion. He mentions two small trials in adult cardiac surgery that have had less-than-convincing results,2,3 but he omitted one landmark study in pediatric cardiac surgery. Manno et al. at the Children’s Hospital of Philadelphia, Pennsylvania, compared use of whole blood and “reconstituted” blood (packed erythrocytes, fresh frozen plasma, and platelets) in children undergoing cardiac surgery with cardiopulmonary bypass. 4 This study showed that in the highest risk group, children less than 2 yr of age having high complexity surgery, postoperative blood loss in the group receiving reconstituted blood was around twice that of the whole blood group. Very fresh whole blood did not have a significant advantage over whole blood stored for 24–48 h. In addition, they showed that the platelets in reconstituted blood had significantly more abnormal aggregation in response to adenosine diphosphate, epinephrine, and collagen, suggesting that preservation of platelet function may be one reason for the superiority of whole blood in treating the postcardiopulmonary bypass coagulopathy. Lavee et al. showed a similar effect of whole blood on preservation of platelet function by showing that platelet aggregation as assessed by electron microscopy after cardiopulmonary bypass in adult patients was restored by 1 unit of whole blood to a level equivalent to 8–10 platelet units.5 It is not only patients (of trauma and otherwise) who would benefit from more widespread use of whole blood in terms of clinical outcome and limitation of their exposure to donors. Somewhat counterintuitively, use of whole blood may also help eke out a dwindling blood supply by being substantially more efficient than components, particularly platelets, which may have lost much of their efficacy in the process of being separated and stored apart. It will require effort by clinicians to convince the blood bank community that the whole is more than the sum of the parts.

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References
2. Triulzi DJ, Gilmor GD, Ness PM, Baumgartner WA, Schulteis...
Whole blood has potential indications other than that of trauma, although current studies and greatest interest are focused on trauma. The U.S. military continues to use whole blood for some combat injuries, but the road to the return for its use in civilian practice will require a concerted effort by interested clinicians, such as Drs. Pitkin and Rice.

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References


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In Reply:

I thank Drs. Pitkin and Rice for their interest in my editorial, “Reconstructing Deconstructed Blood for Trauma,” and the issue of the utility of whole blood. Although my editorial focused on trauma, I agree with Drs. Pitkin and Rice that the potential for the appropriate utilization of whole blood applies to other clinical circumstances of substantial blood volume replacement, as well.

When citing the limited supportive clinical trial literature, I was careful to indicate that those studies addressed adults. I did not cite the study performed in pediatric cardiac surgery patients because it was not fully blinded and only partially randomized, thus making interpretation of the results quite problematic. In addition, the analysis in that publication of a subpopulation (whose removal from the overall analysis reduced the results to statistical nonsignificance in the remaining population: those younger than 2 yr with surgery of lesser difficulty, and all those studied who were older than 2 yr) appears to have been post hoc, thus providing an interesting hypothesis, but not proof.

As I wrote, determination of platelet efficacy is not straightforward and requires careful analysis of source, and storage conditions (time, temperature, and medium), as well as the timing and method of assessment. Platelet quantity and quality are critical components of coagulation, making transfusion of viable, functional platelets an important consideration for the use of whole blood.

The author has a relationship with or consults for the following companies and organizations that have an interest in erythrocytes, plasma, or whole blood transfusion: US Food and Drug Administration (Rockville, Maryland), US National Heart, Lung, and Blood Institute/National Institutes of Health (Bethesda, Maryland), US Department of Defense (Washington, D.C.), Cardian BCT (Lakewood, Colorado), CSL Behring (King of Prussia, Pennsylvania), Integricon (Research Triangle, North Carolina), OPK Biotech (Cambridge, Massachusetts), and Sangart Inc. (San Diego, California). The author was project/corporate vice president and executive scientific advisor at Novo Nordisk A/S ( Bagsvaerd, Denmark) 2005–2007.

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