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## Red blood cell sedimentation of Apheresis Granulocytes

Michelle A. Lodermeier, Karen M. Byrne, and Willy A. Flegel 

Sedimentation of Apheresis Granulocyte components removes red blood cells. It is used to increase the blood donor pool when blood group-compatible donors cannot be recruited for a patient because of a major ABO incompatibility or incompatible red blood cell antibodies in the recipient. Because granulocytes have little ABO and few other red blood cell antigens on their membrane, such incompatibility lies mostly with the contaminating red blood cells. Video Clip S1 shows the process of red blood cell sedimentation of an Apheresis Granulocyte component. This video was filmed with a single smart phone attached to a commercial tripod and was edited on a tablet computer with free software by an amateur videographer without prior video experience.

### TRANSFUSION CLIP DESCRIPTION

The component in this video was collected by apheresis (Cobe Spectra; Terumo BCT) as an unlicensed product in accordance with US Food and Drug Administration guidelines. The recruited donor had normal screening assay results within 30 days of the donation. Dexamethasone and granulocyte-colony-stimulating factor (Filgrastim; Amgen) were

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From the Department of Transfusion Medicine, National Institutes of Health Clinical Center, National Institutes of Health, Bethesda, Maryland.

*Address reprint requests to:* Willy A. Flegel, MD, NIH Clinical Center, Department of Transfusion Medicine, Building 10, Room 1C733c (MSC-1184), 10 Center Drive, Bethesda, MD 20892-1184; e-mail: [waf@nih.gov](mailto:waf@nih.gov).

This work was supported by the Intramural Research Program (project ID Z99 CL999999) of the National Institutes of Health Clinical Center.

The opinions expressed in this review are those of the authors and do not necessarily represent the views or policies of the National Institutes of Health, the Department of Health and Human Services, or the US Federal Government.

Received for publication April 20, 2017; revision received June 5, 2017; and accepted June 5, 2017.

doi:10.1111/trf.14251

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TRANSFUSION 2017;57;2551–2552

administered to the donor 12 hours before collection. This helped to increase the harvest yield to  $3.67 \times 10^{10}$  granulocytes, thus exceeding the AABB standard requirement of  $1.0 \times 10^{10}$  granulocytes.<sup>1</sup>

After collection of the component, ABO/Rh typing and an isohemagglutinin titer were tested on the donor sample, and the manufacturing process was initiated. In our case, the donor and recipient presented as an ABO major mismatch, requiring red blood cell sedimentation. In the video, the process of red blood cell sedimentation is performed at room temperature with the use of a plasma extractor (Fenwal).<sup>2</sup> Hydroxyethyl starch (Hespan, 6% solution; B. Braun Medical), which was added during collection to aid granulocyte recovery, also facilitated sedimentation.<sup>2,3</sup> The time-lapse video allows us to watch the slow process of red blood cells settling at the bottom of the collection bag. Sedimentation time is unique for each component, because it is dictated by the donor's baseline red blood cell sedimentation rate.<sup>4</sup> Although this typically occurs between 2 and 3 hours and has been documented to take up to 7 hours, the entire process cannot surpass the expiration of the unit at 24 hours from the end of collection.<sup>2</sup> While a large majority of red blood cells are removed by sedimentation, the process cannot reduce the red blood cells to less than 2 mL, thus still requiring a crossmatch per AABB standards.<sup>1,2</sup> Optimal sedimentation achieves a balance between minimizing the red blood cell contamination and maximizing the recovery of granulocytes, while not exhausting the short lifespan of the granulocytes during the process.

The efficacy of transfusion with granulocytes<sup>5</sup> and the safety of hydroxyethyl starch<sup>6</sup> have been studied and reviewed. The Apheresis Granulocyte component in the video was transfused to a 28-year-old man undergoing haploidentical hematopoietic progenitor cell transplantation with coinciding, persistent abdominal abscesses caused by *Candida albicans*, *Candida glabrata*, and vancomycin-resistant *Enterococcus faecium*. He received six granulocyte transfusions over 2 weeks until hematopoietic progenitor cell engraftment occurred and the white blood cell concentration recovered (an audio transcript for the Video Clip S1 is provided in Appendix S1, which is available as supporting information in the online version of this article).

#### ACKNOWLEDGMENTS


This study was performed as part of the NIH Clinical Center, Specialist in Blood Bank Technology Program (<http://clinicalcenter.nih.gov/dtm/research/sbb.html>). We thank Elizabeth J. Furlong for her editorial comments and the Transfusion Services Laboratory staff at the NIH for their support. KMB and WAF conceived the project. MAL recorded and edited the video and photos and wrote associated text. All authors reviewed and edited the manuscript.

#### CONFLICT OF INTEREST

The authors had no conflicts of interest.

#### REFERENCES

1. Levitt J, editor. Standards for blood banks and transfusion services. 29th ed. Bethesda (MD): AABB; 2014.
2. Bryant BJ, Yau YY, Byrne PJ, Stroncek DF, Leitman SE. Gravity sedimentation of granulocytapheresis concentrates with hydroxyethyl starch efficiently removes red blood cells and retains neutrophils. *Transfusion* 2010;50:1203-9.
3. Lee JH, Leitman SE, Klein HG. A controlled comparison of the efficacy of hetastarch and pentastarch in granulocyte collections by centrifugal leukapheresis. *Blood* 1995;86:4662-6.

4. Lee JH, Klein HG. The effect of donor red cell sedimentation rate on efficiency of granulocyte collection by centrifugal leukapheresis. *Transfusion* 1995;35:384-8.
5. Price TH, Boeckh M, Harrison RW, et al. Efficacy of transfusion with granulocytes from G-CSF/dexamethasone-treated donors in neutropenic patients with infection. *Blood* 2015; 126:2153-61.
6. Hartog CS, Natanson C, Sun J, Klein HG, Reinhart K. Concerns over use of hydroxyethyl starch solutions [serial online]. *BMJ* 2014;349:g5981. 

#### SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's website.

**Video Clip S1.** Red blood cell sedimentation in an Apheresis Granulocyte component.

**Appendix S1.** Audio transcript.

#### WEB RESOURCE

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