Platelet dysfunction in postpartum hemorrhage and transfusion approaches assessed in a microfluidic platform

Emily P. Mihalko, PhD, Riya Sharma, Morgan Mollen, Hyagriv N. Simhan, MD MS,
Susan M. Shea, PhD, Matthew D. Neal, MD FACS, Grace Lim, MD MSc MBA

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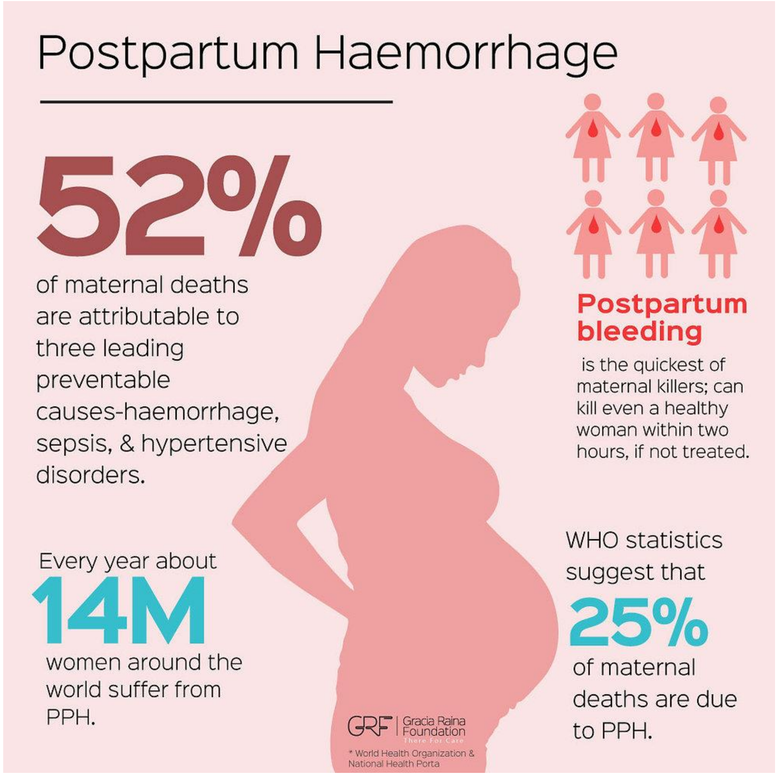
Background & Hypothesis

- Postpartum hemorrhage (PPH) affects **14 million women** annually and accounts for **27.1%** of maternal deaths
- Non-targeted, non-specific, and largely unoptimized therapies
- Acute obstetric coagulopathy can exacerbate bleeding and is associated with high rates of maternal morbidity and fetal death
- Primary hemostatic mechanisms have not been characterized
- Antifibrinolytics less effective in anemic states highlights the limitation of fibrin-centric models and underscores the importance of platelet-dependent mechanisms

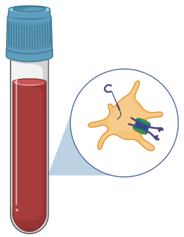


We hypothesize that platelet dysfunction may exacerbate PPH and contribute to the failure of current treatment strategies to effectively control bleeding.

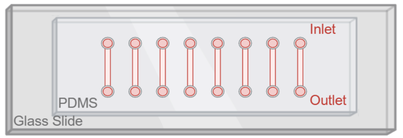
[1] Say et al., *Lancet Global Health*, 2014.
[2] Chiara M Corbetta-Rastelli et al., *Obstet Gynecol*, 2023.
[3] de Lloyd et al., *J Thromb Haemost.*, 2023.
[4] Collins et al., *Blood Adv*, 2025.

Methods

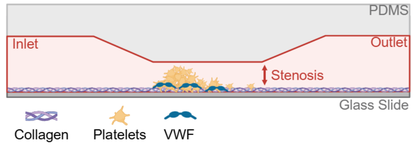
- PPH patient citrated whole blood sample capture prior to hemostatic resuscitation
  - Blood loss >1000mL or blood loss accompanied by hemodynamic instability
- Microfluidic assay for physiologic high shear platelet function testing
- Anemia model and hemostatic resuscitation simulation in microfluidic device



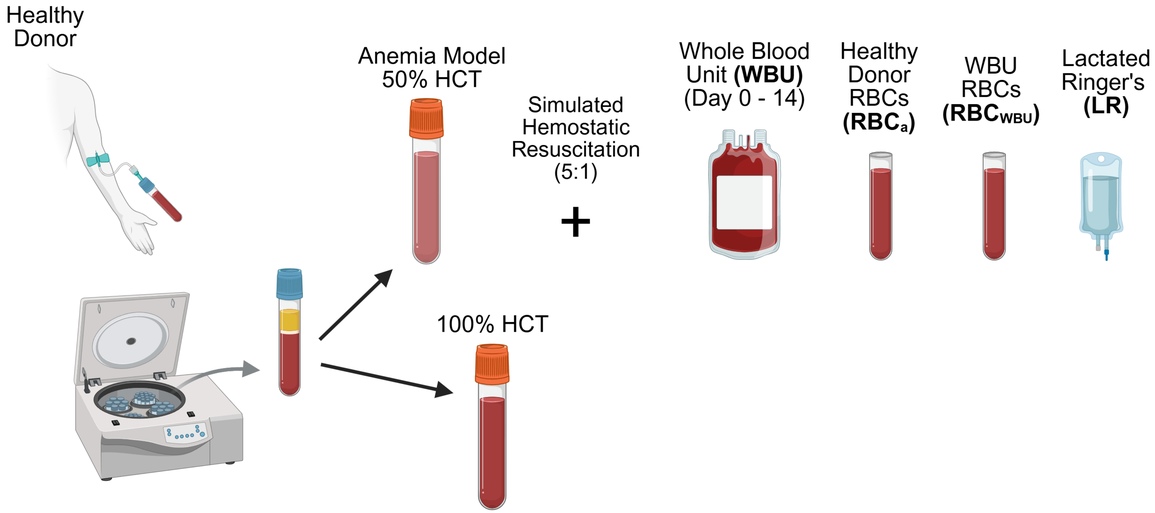
Top View of Microfluidic Device



Side View of Microfluidic Channel

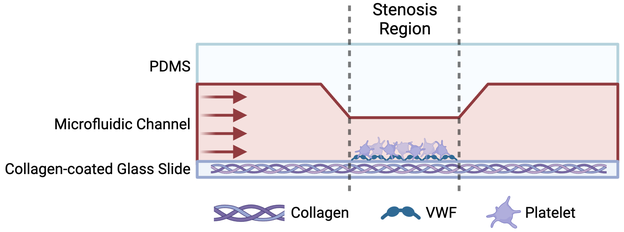


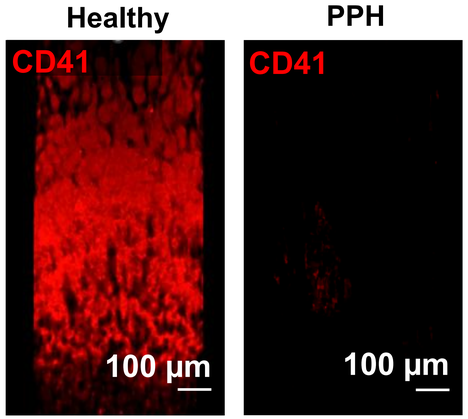
- High shear microfluidics
  - Platelet function and kinetics via real-time imaging

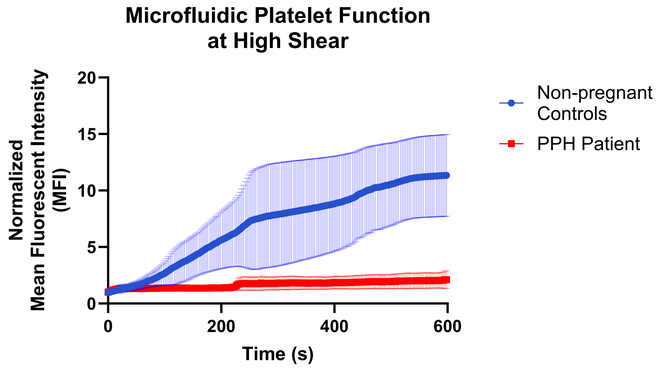


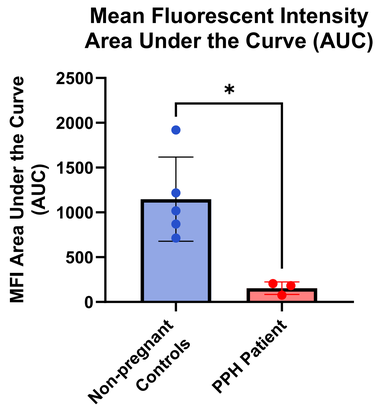
Results

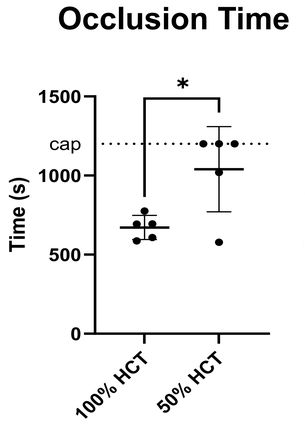
	100% HCT	50% HCT
Hemoglobin (g/dL)	11.3 ± 0.7	5.9 ± 1.2
Platelet Count (x10^3 cells/μL)	209 ± 33	180 ± 34
TEG 6s CK-R (min)	7.6 ± 1.9	8.7 ± 2.2
TEG 6s CK-K (min)	1.6 ± 0.4	1.2 ± 0.1
TEG 6s CK-Angle (degrees)	69.6 ± 4.6	73.9 ± 0.8
TEG 6s CK-MA (mm)	59.5 ± 3.2	64.3 ± 1.9

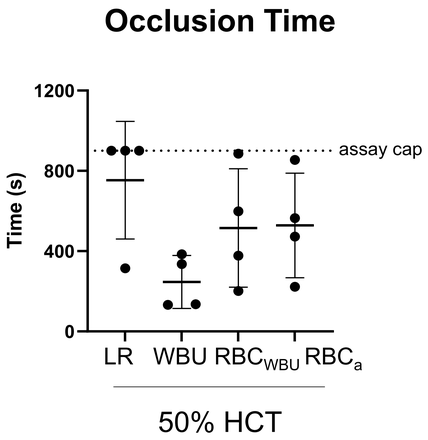


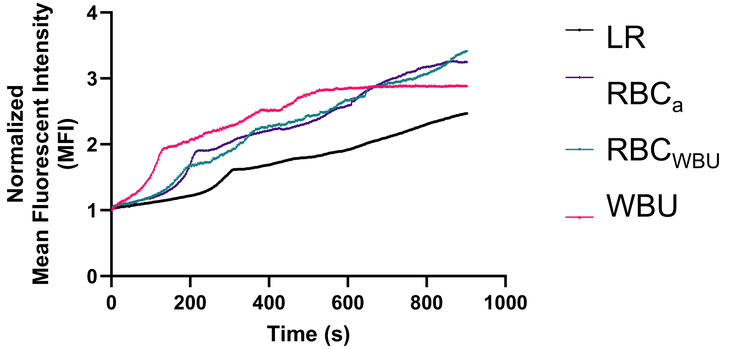












Conclusions

- PPH may be exacerbated by an acute platelet dysfunction that is yet to be fully investigated, potentially involving a pathology of platelet adhesion mechanisms.
- In an anemia model, microfluidic assays indicate better hemostatic resuscitation with intact whole blood compared to isolated RBC groups and LR, potentially due to RBC dysfunction during isolation or dilution of mechanistically critical hemostatic factors at high shear.
- Upcoming studies will continue to study acute platelet dysfunction in PPH and will further investigate platelet receptors and plasma mediators, including von Willebrand Factor activity.

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Thank you!

Emily Mihalko

epm35@pitt.edu

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