Video Article

Erratum: Controlled Microfluidic Environment for Dynamic Investigation of Red Blood Cell Aggregation

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Abstract

An erratum was issue for Controlled Microfluidic Environment for Dynamic Investigation of Red Blood Cell Aggregation. The introduction section was updated.

Protocol

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The introduction was updated from:

Few studies have attempted to study RBC aggregation and determine the degree of aggregation in controlled flow conditions[15-17]. However, these studies indirectly investigate RBC aggregate sizes by determining the ratio of the occupied space in a shearing system measured based on microscopic blood images providing information on the degree of aggregation as well as the local viscosity.

We therefore present a new procedure to directly quantify RBC aggregates in microcirculation, dynamically, under controlled and constant shear rates. RBC-suspensions are entrained, in a double Y-microchannel (as illustrated in **Figure 1**), with a Phosphate Buffered Saline (PBS) solution hence creating a shear flow in the blood layer. Within this blood layer a constant shear rate can be obtained. The RBC-suspensions are tested at different hematocrit (H) levels (5%, 10% and 15%) and under different shear rates (2-11 sec^{-1}). The blood velocity and shear rate are determined using a micro Particle Image Velocimetry (μPIV) system while the flow is visualized using a high speed camera. The results obtained are then processed with a MATLAB code based on the image intensities in order to detect the RBCs and determine aggregate sizes.

to:

Few studies have attempted to study RBC aggregation and determine the degree of aggregation in controlled flow conditions[15-17]. However, these studies indirectly investigate RBC aggregate sizes by determining the ratio of the occupied space in a shearing system measured based on microscopic blood images providing information on the degree of aggregation as well as the local viscosity. Chen *et al.*[18] presented a direct measurement technique for RBC aggregate sizes and provided RBC aggregate size distribution for different shear stresses by varying the flowrate of the suspensions while monitoring the pressure drop across a flow chamber. The shear stresses are calculated based on the monitored pressure using Stokes equation[18].

We therefore present a new procedure to directly quantify RBC aggregates in a controlled microfluidic environment, dynamically, under specific, constant and measurable shear rates. The blood flow in the shear system is directly observed (perpendicularly to the flow direction), providing a different angle on flow investigation compared to previous studies[15,18] and a visualization of the full domain of interest. RBC-suspensions are entrained, in a double Y-microchannel (as illustrated in **Figure 1**), with a Phosphate Buffered Saline (PBS) solution hence creating a shear flow in the blood layer. Within this blood layer a constant shear rate can be obtained. The RBC-suspensions are tested at different hematocrit (H) levels (5%, 10% and 15%) and under different shear rates (2-11 sec^{-1}). The blood velocity and shear rate are determined using a micro Particle Image Velocimetry (μPIV) system while the flow is visualized using a high speed camera. The results obtained are then processed with a MATLAB code based on the image intensities in order to detect the RBCs and determine aggregate sizes.

Reference 18 was updated to:

18. Chen, S., Barshtein, G., Gavish, B., Mahler, Y., Yedgar, S. Monitoring of red blood cell aggregability in a flow chamber by computerized image analysis. *Clin. Hemorhol. Microcirc.* **14**, (4), 497-508 (1994).

All subsequent citations were also updated.

Disclosures

No conflicts of interest declared.

