Supplementary Information

Development of in vitro microfluidic models to study the endothelial responses to pulsatility with different mechanical circulatory support devices

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The specific structure and function of the bubble remover

The interior of the bubbler remover contains the Teflon membrane, which can eliminate air bubbles in a leak-free manner when the solution with air bubbles enters the bubble remover. The bubble remover has two operation modes as active and passive. In the active mode, a vacuum pump can be connected to the rear outlet of the bubble remover to increase its performance of bubble capture; in the passive mode, the vacuum pump is not connected, but the bubble remover is still able to show excellent ability of bubble removal in most cases. Furthermore, in the passive mode, the bubble remover was typically used in the range of 0.5-2.0 mL/min, which was up to 60 mL/min in the active mode. In this study, the use of bubble remover was necessary to prevent the bubbles from crushing the cells at the bottom of the channel, or subjecting the cells to uncontrolled pressure and shear stress as the bubbles entered the channel. The inclusion of bubble remover ensures the accuracy of the experiment as much as possible.

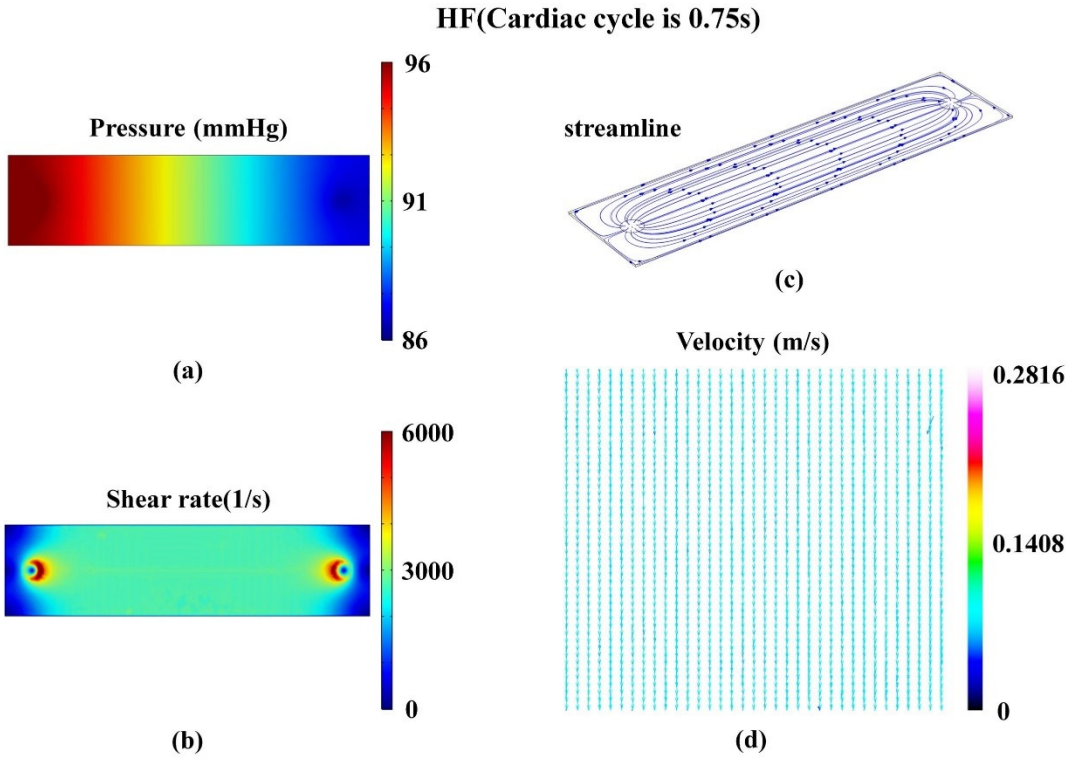

Fig. S1 The distribution of (a) pressure and (b) shear rate at the bottom of the cell culture chamber in the proposed microfluidic system; (c) the streamline diagram in the cell culture chamber; (d) the spatial distribution of the flow velocity near the top of the ROI at the peak time of the cardiac cycle for heart failure condition.

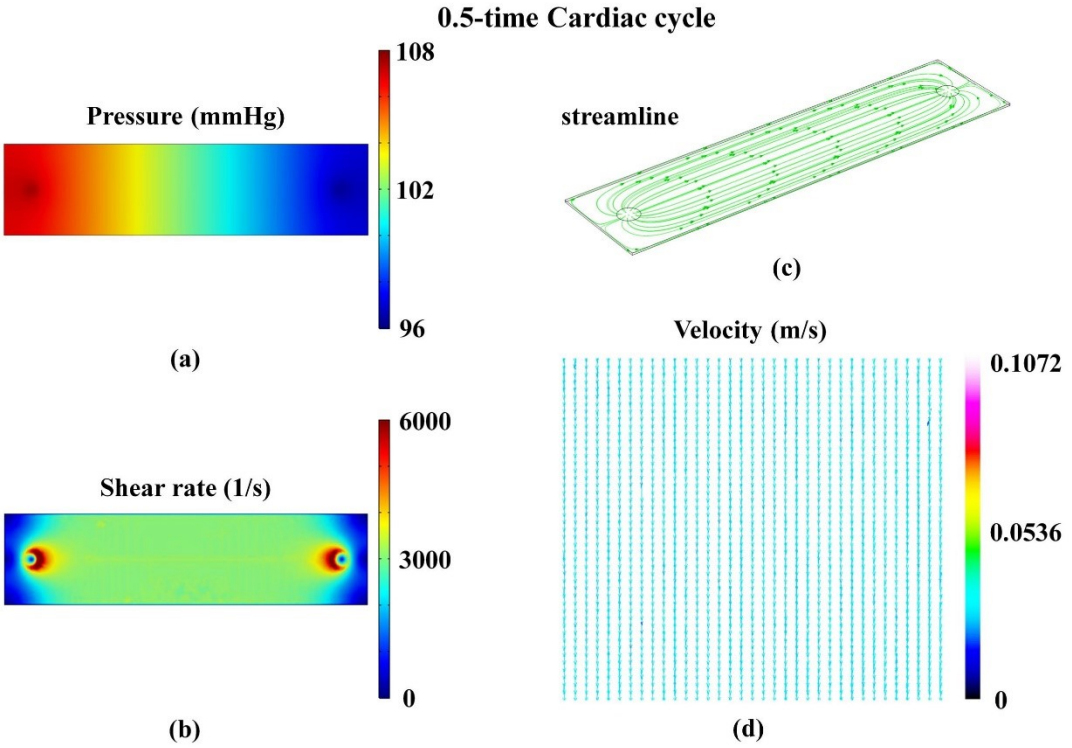

Fig. S2 The distribution of (a) pressure and (b) shear rate at the bottom of the cell culture chamber in the proposed microfluidic system; (c) the streamline diagram in the cell culture chamber; (d) the spatial distribution of the flow velocity near the top of the ROI at the peak time of the cardiac cycle under pulsatile working mode with 0.5-time cardiac cycle of CFVAD.

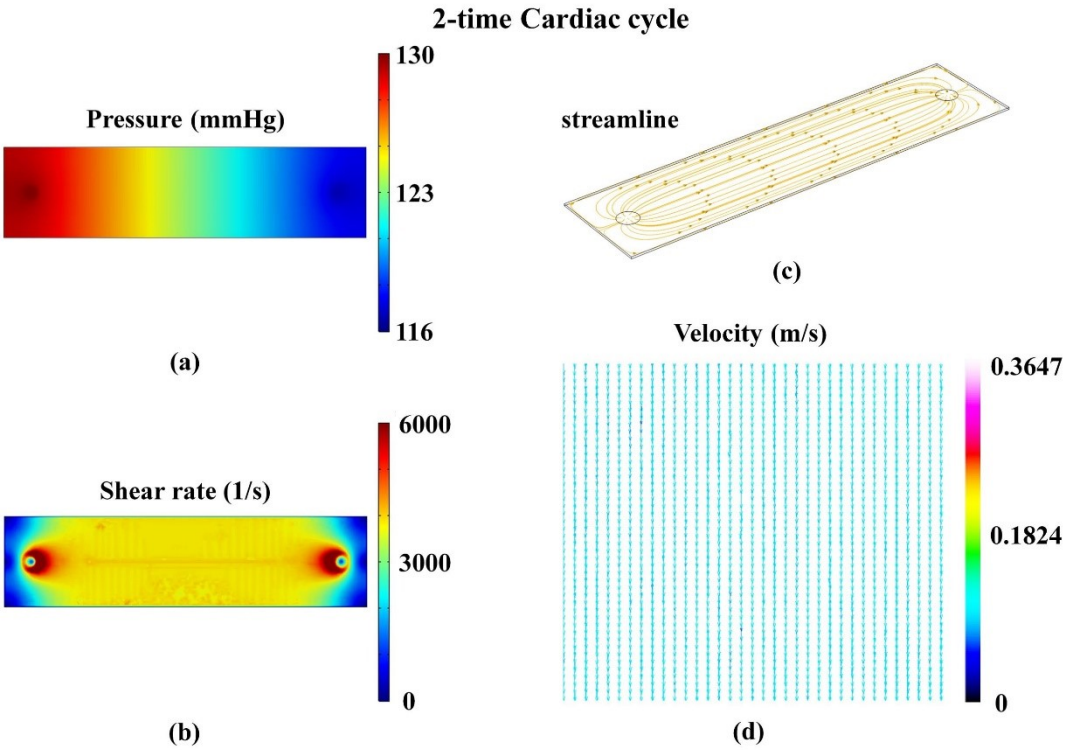

Fig. S3 The distribution of (a) pressure and (b) shear rate at the bottom of the cell culture chamber in the proposed microfluidic system; (c) the streamline diagram in the cell culture chamber; (d) the spatial distribution of the flow velocity near the top of the ROI at the peak time of the cardiac cycle under pulsatile working mode with 2-time cardiac cycle of CFVAD.