

Device-Induced Alterations of Neutrophil Structure and Function by Clinical Mechanical Circulatory Support Devices

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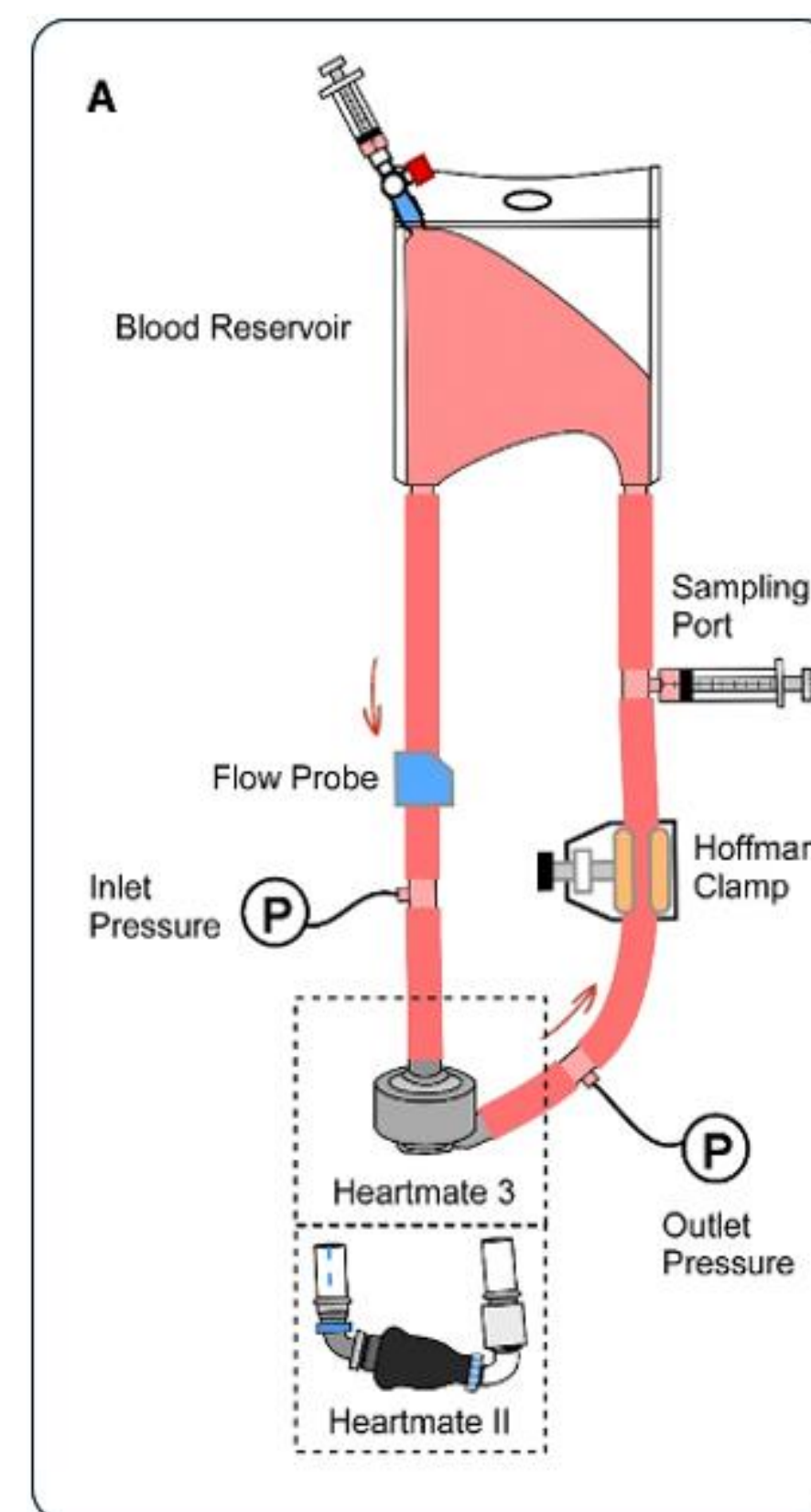
INTRODUCTION

Infectious complications are among the most common complications in patients on mechanical circulatory support (MCS). Any physical, chemical and biological injury on leukocytes by artificial pumps has the potential to cause adverse health effects, leading to increased susceptibility to infections. The aim of this work is to gain a better understanding of clinical MCS device-induced neutrophil structural and functional alterations.

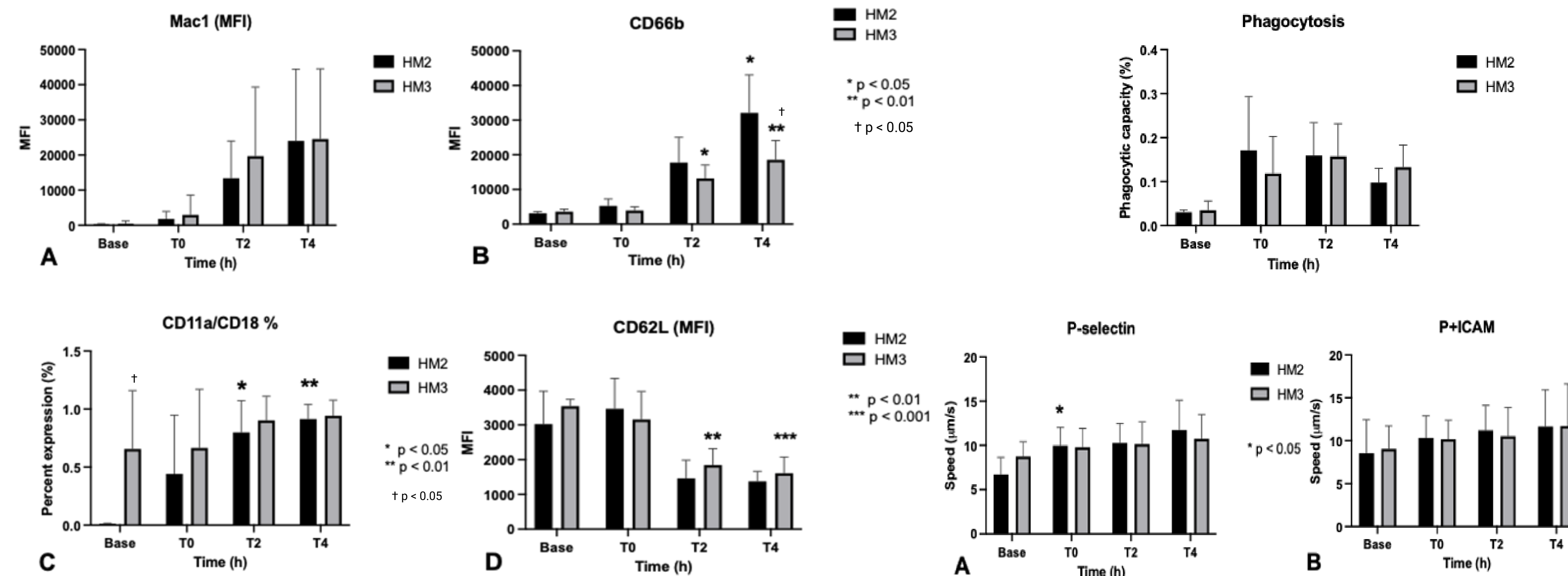
METHODS

Two clinical centrifugal pumps (HeartMate 2 (HM2), HeartMate 3 (HM3)) were used in in-vitro flow loops using fresh, healthy human blood at a flow rate of 4.5 L/min under a pump pressure head of 75 mmHg for 4 hours.

Blood samples were collected at baseline, at the start of the loop experiment (T0), two hours in (T2), and four hours in (T4) to measure biomarkers.



RESULTS



* significant as compared to baseline † significant as compared between HM2 and HM3

- There is an increasing trend in mean fluorescence intensity (MFI) levels of Mac1 and CD66b as well as an increasing trend in the percent expression of CD11a/CD18 for both HM2 and HM3.
- CD62L showed a decreasing trend in MFI levels across time for both HM2 and HM3. When comparing between devices, at T4, HM2 has significantly more CD66b expression as compared to HM3.
- The phagocytotic capacity of neutrophils began with an upward trend as compared to that of base line, followed by a drop at 4h, more so in HM2 than in HM3. Neutrophil rolling speeds on P-selectin and P-selectin + ICAM trended upward with longer circulation times.

DISCUSSION

- There are increasing trends in neutrophil activation markers in both HM2 and HM3.
- HM2 showed significantly higher levels of neutrophil activation markers at later timepoints as compared to baseline, particularly in CD66b and CD11a/CD18.
- In comparison, HM3 showed either insignificant changes over time in key neutrophil activation markers or even significantly lower levels, as shown in CD62L at T2 and T4 as compared to baseline

CONCLUSION

Our study showed that fully magnetically levitated HM3 centrifugal blood pump may have potential advantages over the HM2 axial pump during long-term MCS. The contact-free support of the impeller and optimized impeller's geometry may improve biocompatibility and performance.