

Heart Failure with Reduced Ejection Fraction Patients Supported by Left Ventricular Assist Devices Suffer From Impaired Blood Pressure Response During Exercise



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Background

Heart failure with reduced ejection fraction (HFrEF) patients supported by left ventricular assist devices (LVAD) suffer from severe impairments in objective metrics of exercise. The purpose of this study was to characterize blood pressure (BP) responses to submaximal and peak exercise among HFrEF patients prior to and following device implantation.



Figure 1. HeartMate 3 LVAD Schematic¹

Methods

Eleven HFrEF patients (58 years, 9 male) completed submaximal and symptom-limited cardiopulmonary exercise testing (CPET) on three separate visits on upright cycle ergometry.

- Visit 1: CPET ~2-4 weeks prior to LVAD implantation
- Visit 2 : CPET ~3 months post-LVAD at a constant speed
- Visit 3: ~4-5 months after LVAD implantation but involved progressive increases in pump speed during exercise. BP was monitored continuously via arterial catheterization. Exercise involved two levels of submaximal exercise below the ventilatory threshold (steady-states 1-2), as well as peak exercise.

Results

- As expected, prior to LVAD implantation, patients demonstrated a severely reduced BP response to exercise, with minimal increase from rest to submaximal and peak workloads.
- Following LVAD implantation, resting BP was numerically higher than pre-LVAD levels, but during exercise, patients demonstrated limited increases in BP, with the magnitude of change being numerically similar to pre-LVAD changes. Surprisingly, BP during exercise was also similar to pre-LVAD levels, despite the increase in pump speed.

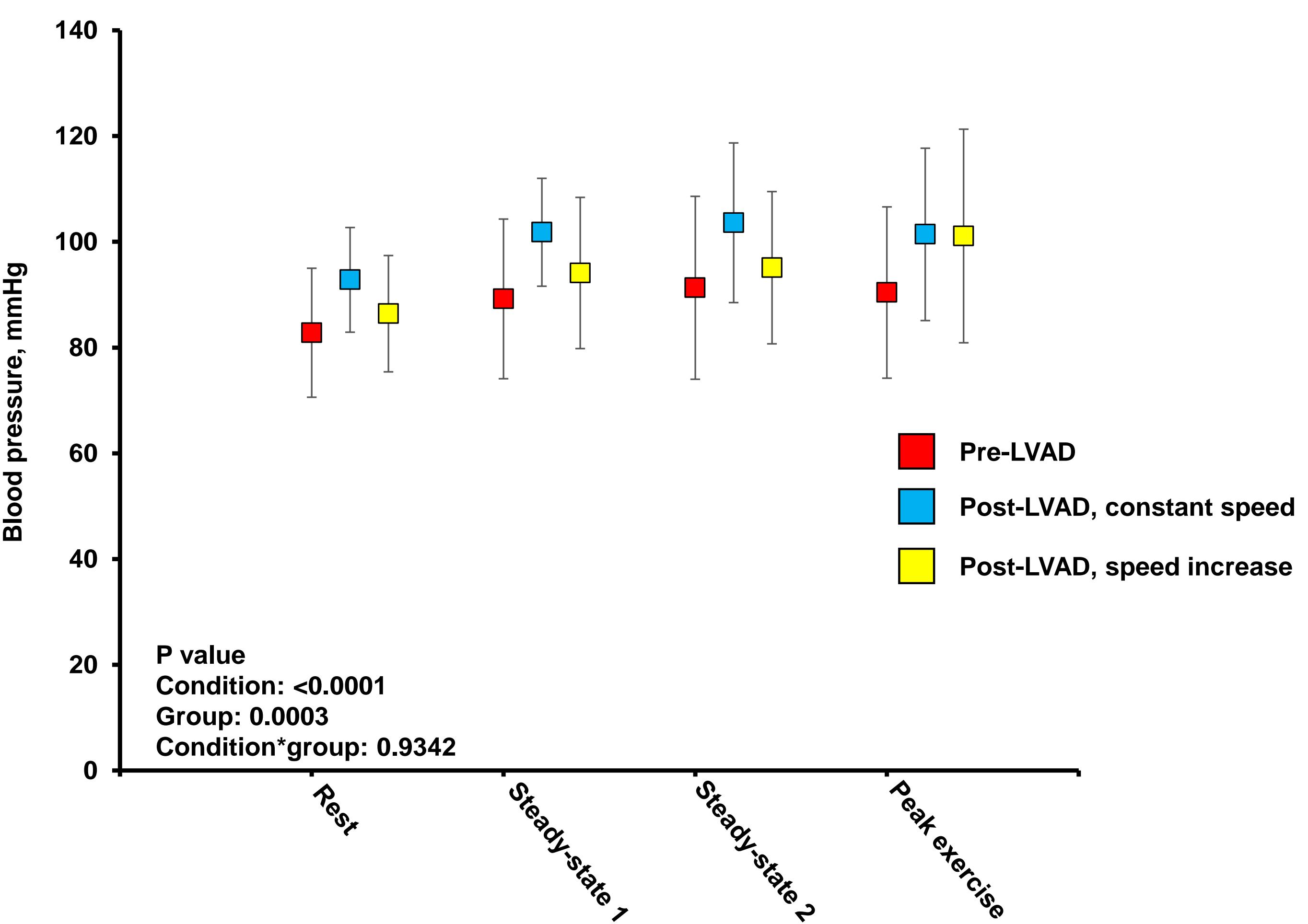


Figure 2. Changes in Blood Pressure During Exercise in Pre-LVAD, Post-LVAD groups

Acknowledgments

Many thanks to Dr. Cornwell and his research team for letting me participate in the process.

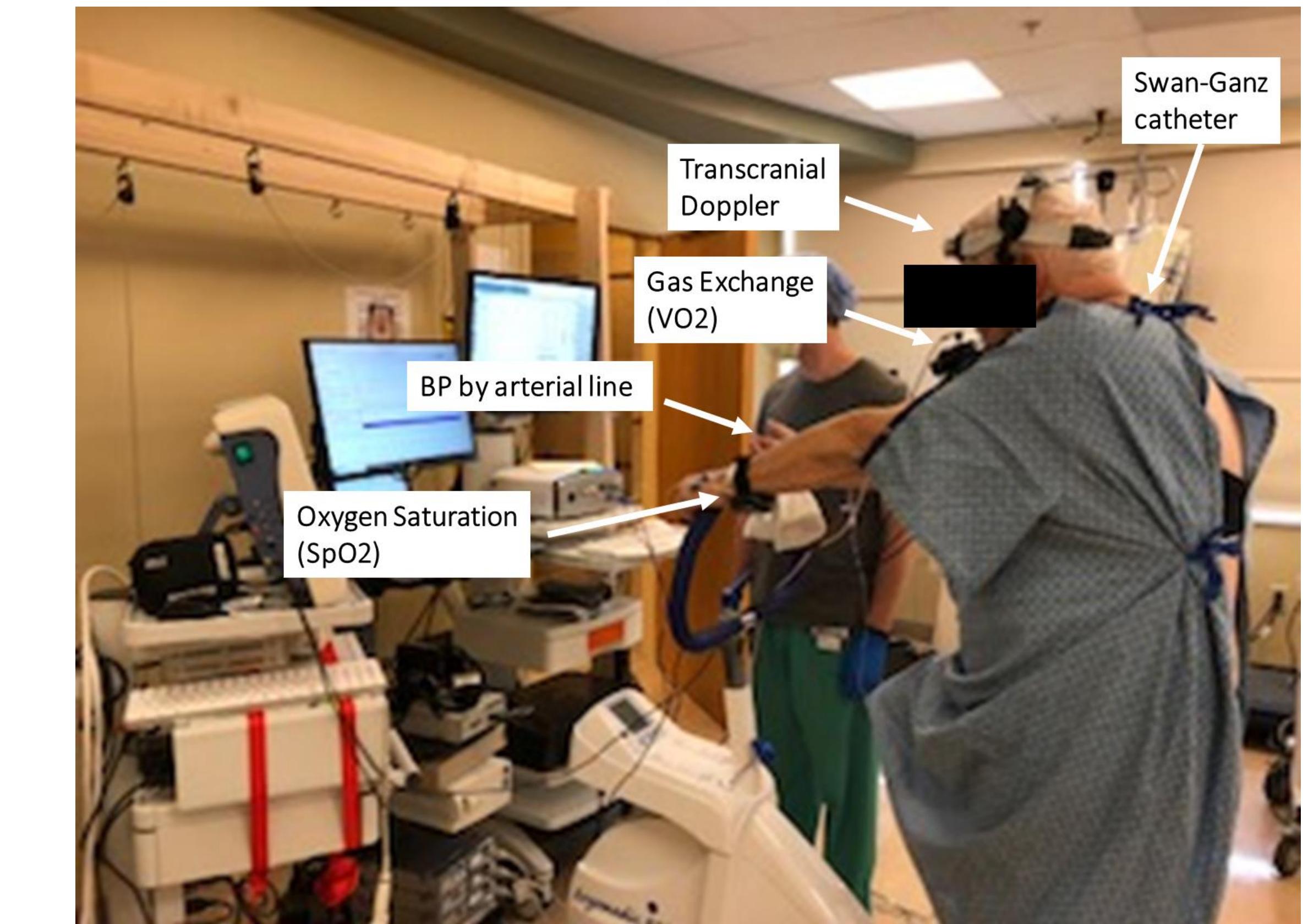


Figure 3. Patient on ergometric bike

Conclusions

HFrEF patients supported by LVADs exhibit severely abnormal BP responses to exercise with no clinically meaningful increase from rest to submaximal and peak workloads. This finding suggests that the LVAD contribution to blood flow during exercise is severely limited and arterial perfusion among these patients depends primarily on contractile reserve of the left ventricle, as opposed to the device itself. This data provides new explanations for the observed reductions in functional capacity among HFrEF patients supported by LVADs.

References

1. HeartMate 3 Heart Pump Approved for Patients Not Eligible for Transplant. (2019, January 7). Retrieved from <https://www.medgadget.com/2018/10/heartmate-3-heart-pump-approved-for-patients-not-eligible-for-transplant.html>