A computational study of the effects of different left ventricular assist device configurations on heart functions

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Background

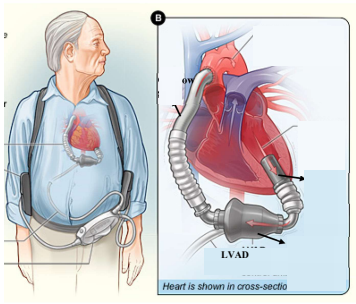
Implant of left ventricular assist devices (LVADs)

- Improve LV functions;
- May affect right ventricular (RV) functions.

Two types of LVADs:

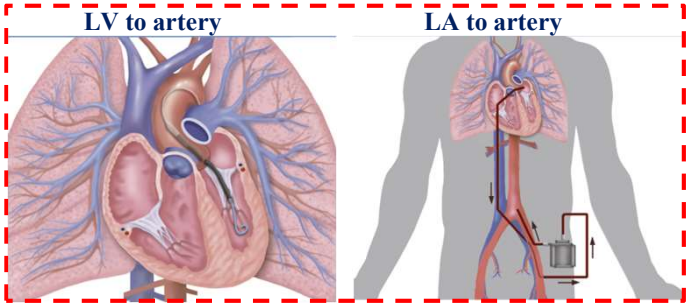
I. Blood pumps from LV to artery through LVADs;

II. Blood pumps from left atrium (LA) to artery through LVADs.



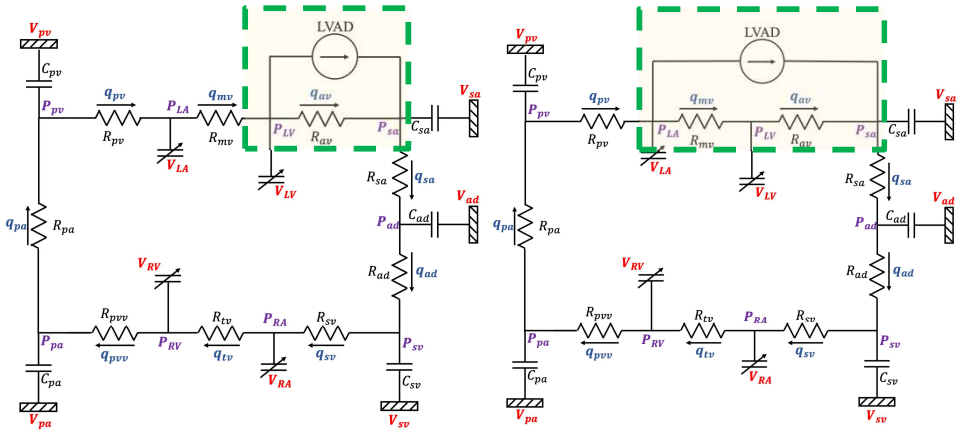
Key questions

- Effects of two types of LVADs on LV and RV functions remain unclear with different pump speed.



Method

Lumped parameter model that couples systemic and pulmonary circulations with LVAD

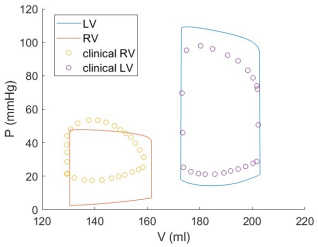


LV to artery LA to artery

Results

Model calibration in terms of the LV and RV PV loops for heart failure patients

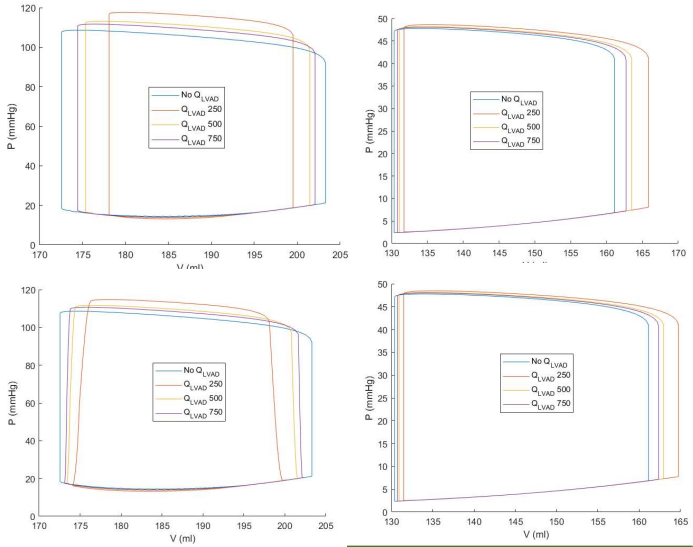
- LV and RV end-systolic (ES) and end-diastolic (ED) volumes are higher than normal range;
- EF for heart failure patient is lower than normal value (50%).



Comparing two different types of LVADs with different pump speed

When pump speed increases,

- LV-artery: LV EDV reduces but LV ESV increases;
- LA-artery: LV isovolumic phase reduces;
- RV EDV increases.



Conclusion

- Two types of LVADs have different effects on LV functions.

Future Plan

- Couple the coronary flow network to investigate the effects of LVADs on flow

References

Hemodynamics of Mechanical Circulatory Support, Daniel Burkhoff et al.

Acknowledgements

- Meyerhoff
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