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Pressure-volume Profiles In Heart Failure With Reduced Ejection Fraction And Heart Failure With Preserved Ejection Fraction

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INTRODUCTION

- Congestion and volume overload are the key clinical manifestation of both heart failure with reduced ejection fraction (HFrEF) and heart failure with preserved ejection fraction (HFpEF) regardless of the underlying etiology and remain a key challenge in the management of HF.
- Although the underlying pathophysiological mechanisms are thought to be distinctive, differences between HF phenotypes in pressure-volume profiles and correlation have not been well characterized.

MATERIAL & METHODS

- This is prospective two-center study (Duke University Hospital, NC and Baptist Memorial Hospital, TN) enrolling consecutive patients with chronic ambulatory HF undergoing initial implantation of an implantable pulmonary artery pressure monitor (CardioMEMS).
- Patients were categorized into 2 groups using left ventricular ejection fraction (LVEF) cut-off of 40% (HFrEF <40%, HFpEF ≥40%).
- All patients underwent blood volume analysis (BVA) using the indicator dilution technique with an I131-tagged albumin tracer. The BVA report provides absolute values and percent deviation from ideal values. Estimated stressed blood volume (eSBV) were presented as mL/70 kg body weight to account for differences in patient sizes. Diastolic pulmonary artery pressure (PADP) was obtained from CardioMEMS device.
- Baseline characteristics and hemodynamics were compared between HFrEF and HFpEF. Linear regression was performed to assess correlation between volume and pressure measures based on HF phenotypes.

RESULTS

- A total of 20 (12 HFrEF and 8 HFpEF) patients were included. There were no statistical differences in age (56.8 ± 13.0 vs. 68.0 ± 11.1 years), female sex (25% vs. 50%), black race (46% vs. 14%) and BMI (31.5 ± 4.6 vs. 28.3 ± 4.7 kg/m2) between HFrEF and HFpEF, respectively.
- Compared to HFpEF, HFrEF had higher PADP (23.9 ± 7.5 vs. 16.0 ± 5.3 mmHg, p=0.019), total blood volume (TBV) (5985 ± 1371 vs. 4682 ± 1293 mL, p=0.047) and higher eSBV (2301 ± 441 vs. 1763 ± 369 mL/70 kg, p=0.01). A trend toward higher TBV percent deviation in HFrEF (6.6 ± 16.5 vs. -8.7 ± 15.6%, p=0.053) was observed.

HFrEF has higher **pressure** (*diastolic pulmonary pressure*) and **volume** (*total and stressed blood volume*) compared to HFpEF. However, the **pressure-volume discordance** exists across both HF phenotypes

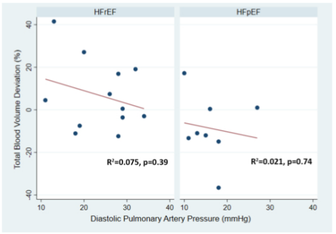
RESULTS *(continued)*

- There was lack of correlation between PADP and TBV percent deviation (R^2= 0.075 and 0.021) as well as eSBV (R^2= 0.037 and 0.26) in both HFrEF and HFpEF, respectively.
- In multivariate models adjusted for differences in PADP, there were significant differences in TBV percent deviation between HFrEF and HFpEF (p=0.036) but not in eSBV (p=0.083).

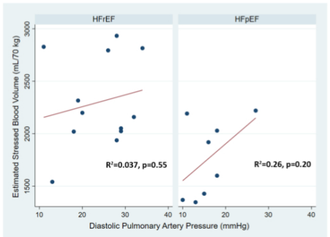
BASELINE CHARACTERISTICS

Variables	Whole Cohort (n=20)	Sex		
		HFrEF (n=12)	HFpEF (n=8)	p-value
Age (year)	61.2 ± 13.2	56.8 ± 13.0	68.0 ± 11.1	0.06
Black race	7 (35%)	6 (46%)	1 (14%)	0.16
Female sex	7 (35%)	3 (25%)	4 (50%)	0.25
BMI (kg/m^2)	30.2 ± 4.8	31.5 ± 4.6	28.3 ± 4.7	0.15
LVEF (%)	34.2 ± 14.6	23.3 ± 3.9	50.5 ± 7.1	<0.01*
NT-ProBNP (pg/mL)	3711 ± 5533	5411 ± 6650	1161 ± 1101	0.09
PADP (mmHg)	20.8 ± 7.7	23.9 ± 7.5	16.0 ± 5.3	0.02*
TBV (mL)	5464 ± 1461	5985 ± 1371	4682 ± 1293	0.04
TBV deviation (%)	0.5 ± 17.5	6.6 ± 16.5	-8.7 ± 15.6	0.05
eSBV (mL/70 kg)	2086 ± 486	2301 ± 441	1763 ± 369	0.01*

PRESSURE-VOLUME CORRELATION STRATIFIED BY LVEF PHENOTYPE



TBV % deviation vs. PADP



eSBV vs. PADP

SUMMARY / CONCLUSION

- Patients with HFrEF had higher PADP, higher TBV, higher percent excess of TBV and higher eSBV than HFpEF. Yet, there was lack of correlation between PADP and volume measures (TBV and eSBV) in both HF phenotypes.
- These findings suggest that the pressure/volume relationship might not be consistent across LVEF groups. Further investigations to identify appropriate decongestion strategies for each HF phenotypes are needed.

Questions or correspondence please email **veraprapas.kittipibul@duke.edu**