LV Unloading using Impella CP Improves LA Pressure, Function, and Stiffness

Shin Watanabe, MD, Kenneth Fish, PhD, Lauren Leonardson, LVT, Roger J. Hajjar, MD, Kiyotake Ishikawa, MD, Icahn School of Medicine at Mount Sinai, New York, U.S.A.

ABSCT
Background: LV (left ventricle) to aorta percutaneous left ventricular assist device (pLVAD), Impella, supports systemic hemodynamics by increasing cardiac output and unloading LV. However, the impact of Impella support on upstream of LV remains unclear.

Hypothesis: Unloading the LV with an Impella CP improves trans-mitral pressure gradient, leading to a reduction of LA pressure and improved LA function and stiffness.

RESULTS

MV Closure

ABSTRACT
LV (left ventricle) to aorta percutaneous left ventricular pressure gradient, leading to a reduction of LA pressure and improved LA function and stiffness.

3. Results:

LV end-diastolic pressure (27.5 ± 10.1 to 17.9 ± 4.5 mmHg, P = 0.06) without significant mitral regurgitation. LV end-systolic volume: 24.55 ± 16.3 mL, P = 0.04) without significant mitral regurgitation. LV end-diastolic pressure (27.5 ± 10.1 to 17.9 ± 4.5 mmHg, P = 0.06) without significant mitral regurgitation.

Figure 6. Representative LA pressure-volume relations in pig with HF. The linear regression line of the diastolic part of the pressure–volume relation, corresponding to the period between the nadir of the x wave (Arrow head) and the peak of the pressure–wave (Arrow) of the LA pressure was used as an estimate of LA stiffness. These points were determined from LA pressure curve and 3D echocardiography.

Figure 7. LA stiffness assessed by pressure-volume coordinates was improved with Impella support.

METHODS
HF is induced by percutaneously occluding the proximal LAD for 90 minutes in Yorkshire pigs (n = 4, 40-50 Kg). Two-weeks after the MI, animals underwent LV unloading with an Impella CP for 150 minutes. LA pressure was directly measured by a trans-septal approach and LA volumes were assessed by 3-dimensional echocardiography. LA stiffness was approximated as the slope of minimal and maximal LA pressure–volume coordinates as described previously (Circ Heart Fail. 2015;8:295-303).

Protocol

Figure 1. LV ejection fraction, LV end-diastolic volume and total LA-ejection fraction (Pre-LA-EF) at baseline, passive LAEF was significantly increased.

Figure 2. LV unloading with maximal pump support (P8) resulted in an increase in total cardiac output and reduced LV end-diastolic pressure.

Figure 3. LV unloading reduced Left atrial (LA) pressure (mean LA, A wave and V wave).

Figure 4. LV unloading reduced left atrial (LA) pressure (maximal, diastasis and minimal volume).

Figure 5. While the total LAEF was not altered from the baseline, passive LAEF was significantly increased.

Figure 6. Representative LA pressure-volume relations in pig with HF. The linear regression line of the diastolic part of the pressure–volume relation, corresponding to the period between the nadir of the x wave (Arrow head) and the peak of the pressure–wave (Arrow) of the LA pressure was used as an estimate of LA stiffness. These points were determined from LA pressure curve and 3D echocardiography.

Figure 7. LA stiffness assessed by pressure-volume coordinates was improved with Impella support.

CONCLUSIONS
LV unloading using an Impella CP improves passive LA function and reduces mean LA pressure in a recent MI setting. Along with improved LA stiffness, these data implicate a beneficial impact of LV unloading on relieving HF symptoms.

REFERENCES