

# Immediate Effects of Pneumatic Left Ventricular Unloading in High-risk Percutaneous Coronary Revascularization

Bastos MB, Daemen J, den Uil C, Schreuder J, Van Mieghem NM  
Interventional Cardiology, Thoraxcentrum, ErasmusMC, Rotterdam, The Netherlands

PULSE trial



## Case summary

High-risk PCI for severe coronary artery disease using a new pneumatic short-term left ventricular mechanical circulatory support device driven by an IABP console.

## History

a 72 years old male, dyslipidemic, former smoker with positive family history for cardiovascular diseases but no previous events, presented with anterior wall STEMI.

## Tests

The angiography revealed a thrombotic occlusion of the LAD that required ad hoc primary PCI and significant disease in the mid-RCA, ostium of the LCX, and an old ruptured plaque in the LM. The predicted SYNTAX II 4-year mortality risk was 7.6% for PCI and 11.9% for CABG.

## Procedure

After primary PCI of LAD there was heart team consensus for PCI of the RCA and LM-RCX bifurcation under mechanical circulatory support (MCS). Pressure-volume loops before and after activating the left ventricular assist device (PulseCath iVAC2L, PulseCath B.V., Amsterdam, The Netherlands) were recorded using a 7F conductance catheter and dedicated software (CDLeycom, Hengelo, The Netherlands). The average flow at 1:1 support was  $1.44 \pm 0.03$  L/min. MCS decreased the Pressure-volume Area (PVA:  $1.54 \pm 0.15$  vs  $1.34 \pm 0.09$  J), Stroke Work (SW:  $0.78 \pm 0.09$  vs  $0.63 \pm 0.07$  J) and Stroke Volume (SV:  $62.7 \pm 9.54$  vs  $58.60 \pm 4.5$ ). The Mean Arterial Pressure (MAP:  $100.4 \pm 12.34$  vs  $101.24 \pm 2.0$ ) and Heart Rate (HRate:  $68.9 \pm 4.86$  vs  $79.94 \pm 2.49$ ) increased. Left ventricular stiffness decreased ( $\beta$ :  $5.84 \pm 2.14$  vs  $4.38 \pm 0.22$ ) but also compliance ( $V_{30}$ :  $132.93 \pm 8.71$  vs  $107.94 \pm 3.85$ ). The pressure-volume loops shifted towards lower volumes relative to baseline.

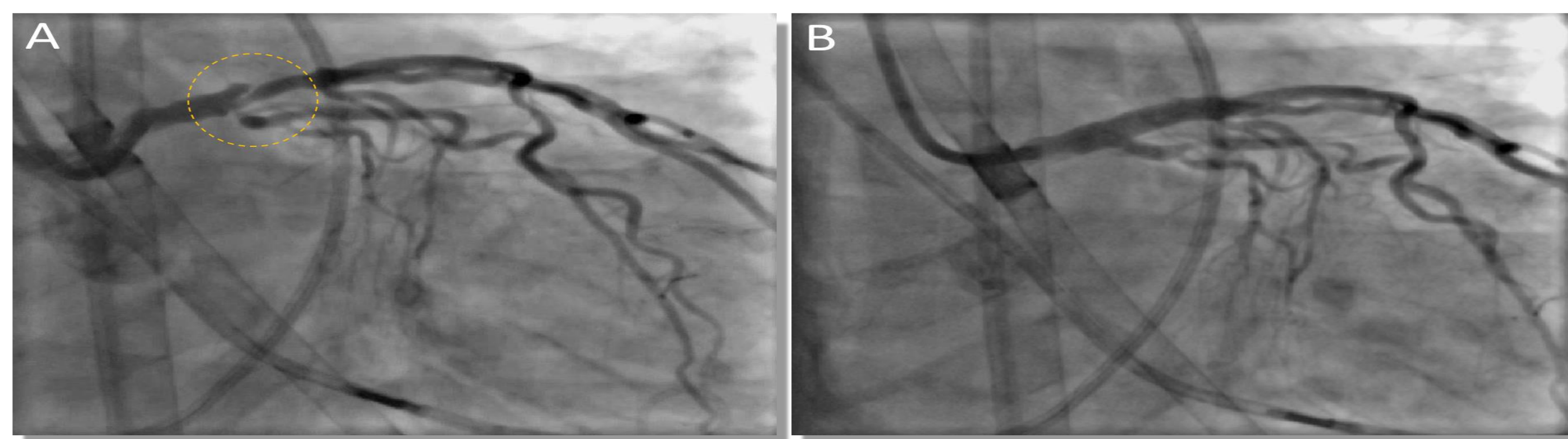


Figure 1: (A): Angiogram before the second intervention of the LM and RCX, and the final result (B).

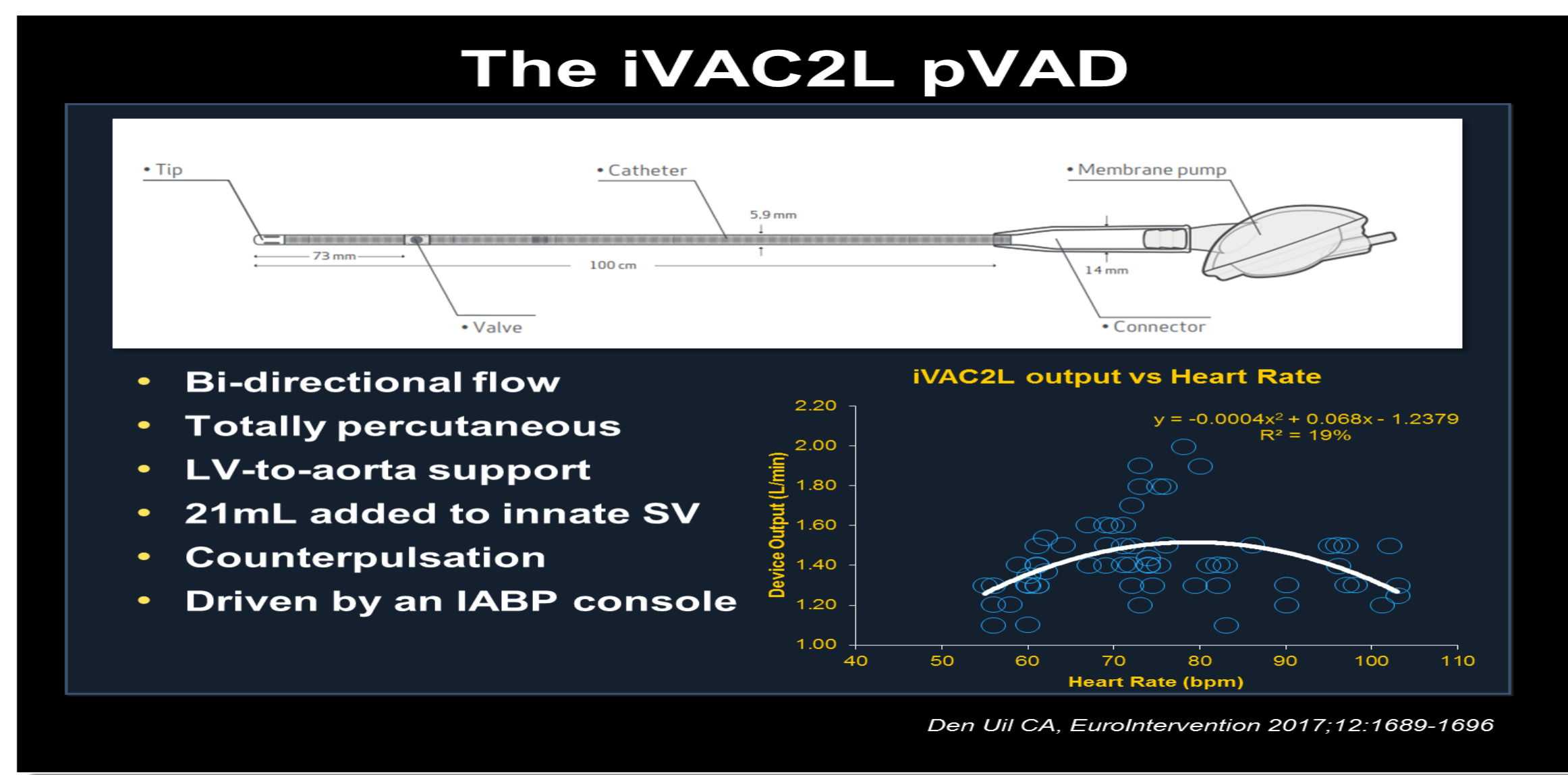


Figure 2: general information about iVAC2L.

	LVAD out	LVAD on
HRate	68.9 (66 to 71.8)	79.9 (78.9 to 81)
MAP	100.4 (93.1 to 107.7)	101.2 (100.4 to 102.1)
CO	4.3 (3.9 to 4.7)	4.7 (4.5 to 4.8)
SV	62.7 (57.1 to 68.3)	45.6 (43.8 to 47.4)
ESP	144.9 (142.8 to 147.1)	144 (142.7 to 145.2)
ESV	61.2 (59.8 to 62.6)	55.4 (54.1 to 56.7)
EDV	123.9 (119.3 to 128.5)	114 (112.5 to 115.5)
EDP	23 (21.8 to 24.1)	32.3 (31.6 to 33.1)
Ees	1.9 (1.7 to 2.1)	1.9 (1.9 to 2)
SW	0.8 (0.7 to 0.8)	0.6 (0.6 to 0.7)
PVA	1.5 (1.4 to 1.6)	1.3 (1.3 to 1.4)
Ea	2.4 (2 to 2.8)	2.5 (2.4 to 2.6)
Ea/Ees	1.3 (1 to 1.6)	1.3 (1.2 to 1.3)

Table 1. quantitative analysis of beat-to-beat haemodynamics 3 minutes before and 3 minutes after activating iVAC2L, prior to revascularization (Figure 3, B). Measurements separated by larger intervals account for the effect of compensatory responses. Values are reported as mean and 95% CI.

## Real-time Hemodynamic Changes After Activating iVAC2L

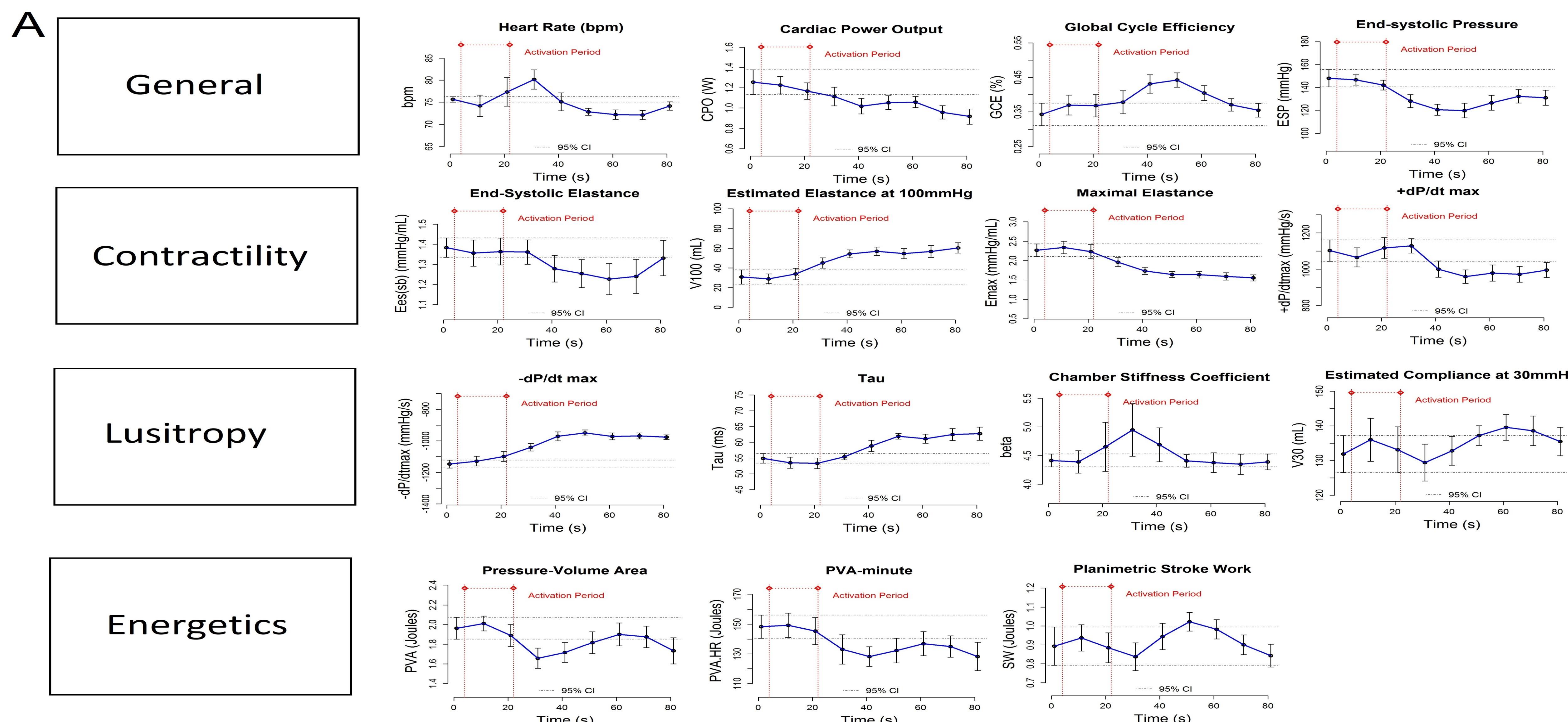


Figure 3: (A): Hemodynamic records measured with a conductance catheter as iVAC2L is activated. "Activation period" represents an interval of 20s during which the LVAD was activated. Blue lines represent the mean of successive 10-second intervals, with 95% confidence intervals. (B) PV loops 3 minutes before and 3 minutes after activating iVAC2L, prior to revascularization (top) and after it (bottom). The shift of the PV loops to lower volumes was more pronounced at the end-systole. Data is exposed in Table 1.

## Conclusion

Our case illustrates pressure and volume unloading with a new pneumatic left ventricular assist device manifested, with shifting of the PV loops towards lower volumes and decrease in the PVA. Consistency of these findings will be further assessed in the upcoming PULSE trial (Clinicaltrials.gov NCT03200990).

**Declaration of Interest:** Dr Van Mieghem is advisor for PulseCath and has received research grants from PulseCath BV. The other authors have no conflicts of interest to declare.