



Improving left ventricular unloading following prolonged cardiac arrest using a minimally invasive left ventricular assist device: a prospective animal study in pigs

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BACKGROUND

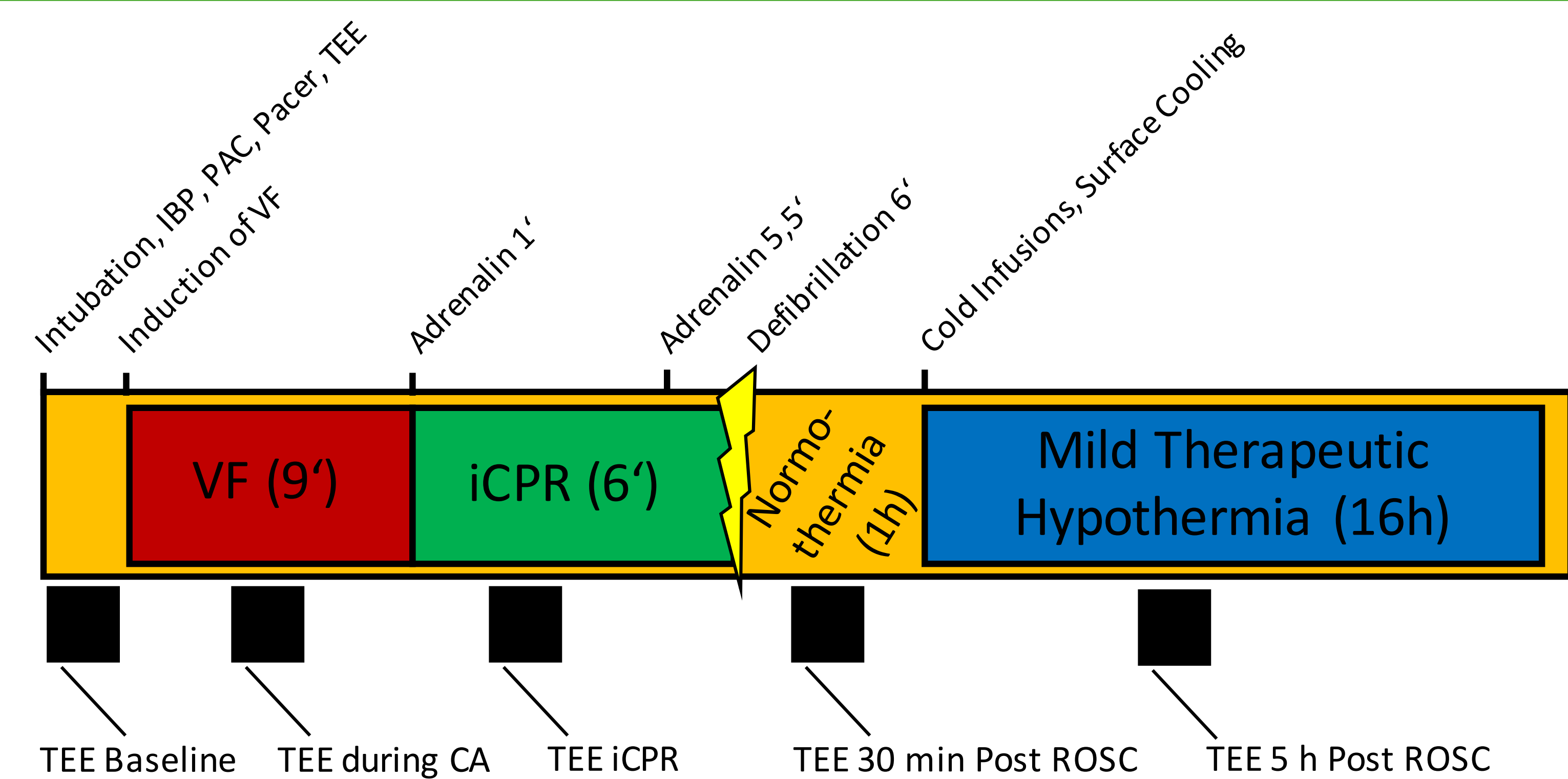
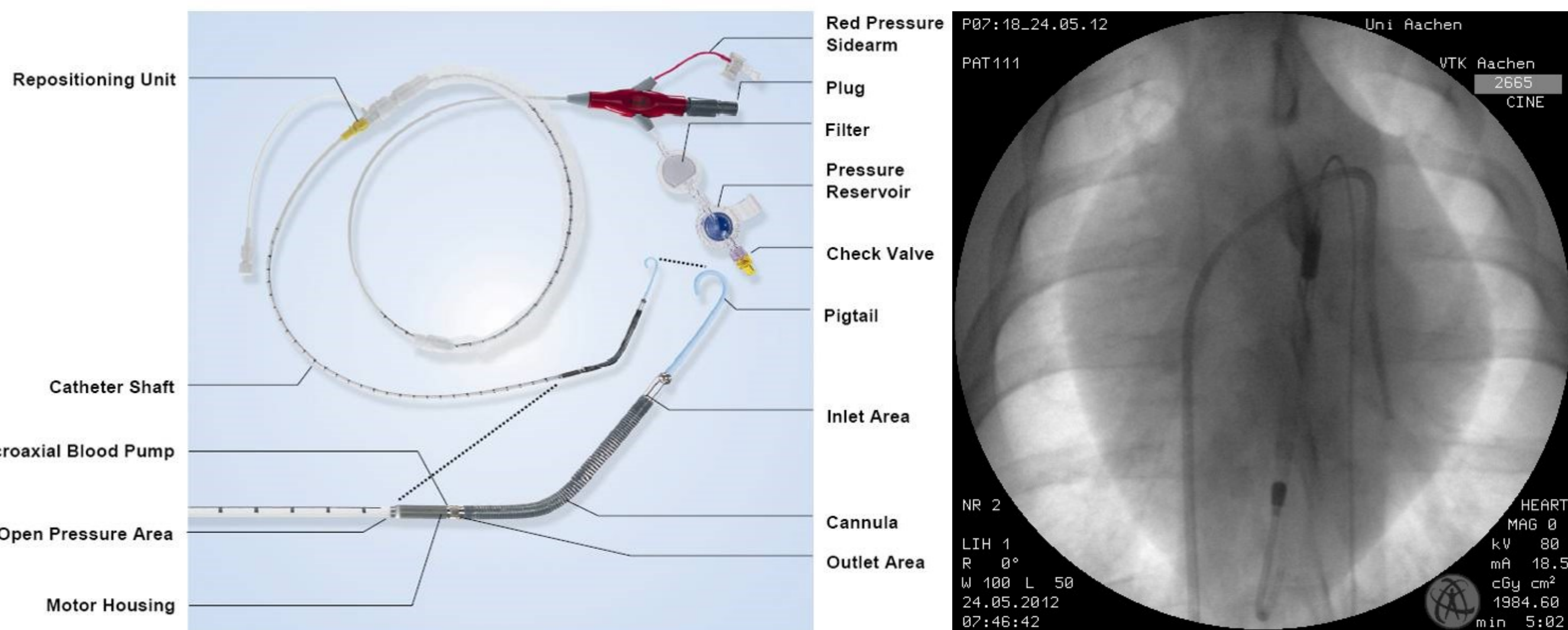
Compared to chest compression CPR, improved survival is observed when CPR is conducted using a minimally invasive left ventricular assist device, Impella 2.5 (iCPR). However, data on myocardial function during and following iCPR are lacking.

AIM

To assess cardiac functional parameters during and following iCPR.

METHODS

- Five pigs (55.2 ± 2.4 kg) were anesthetized, intubated, and implanted with an Impella 2.5.
- Ventricular fibrillation (VF) was electrically induced and left untreated for 9 minutes before defibrillation was attempted following 6 minutes of iCPR.
- During iCPR, the Impella device was set to the maximally achievable flow. 1 hour following return of spontaneous circulation (ROSC), mild therapeutic hypothermia was induced for 16 hours using a total of 4 liters of 6°C cold saline infusions and surface cooling.
- To assess myocardial recovery, we used 2-D-echocardiography, tissue Doppler (TDI), and Speckle-tracking.
- All animals received transesophageal echocardiography (TEE) at baseline, during untreated cardiac arrest, at the initiation of iCPR, 30 minutes, and 5 hours following ROSC.



RESULTS

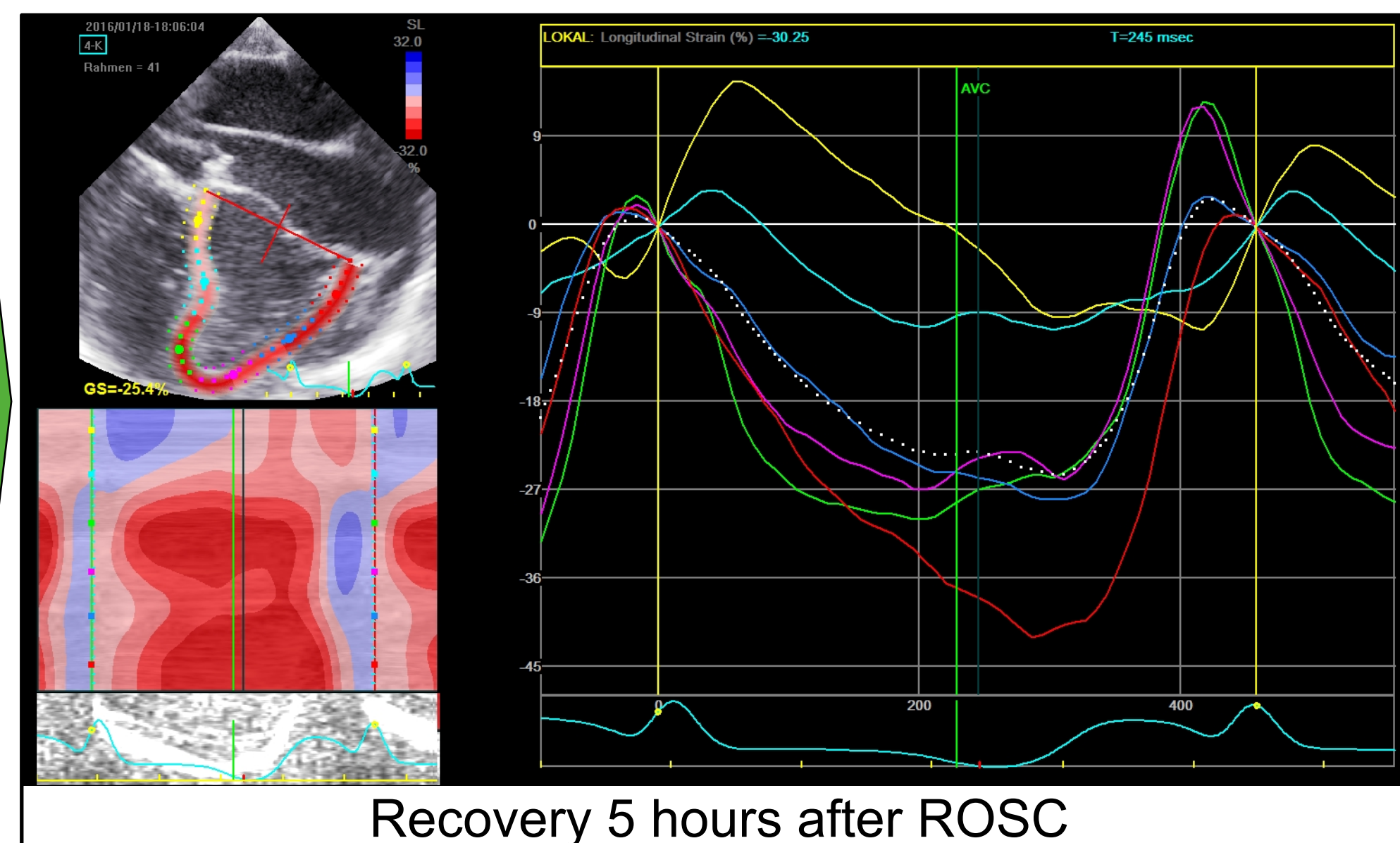
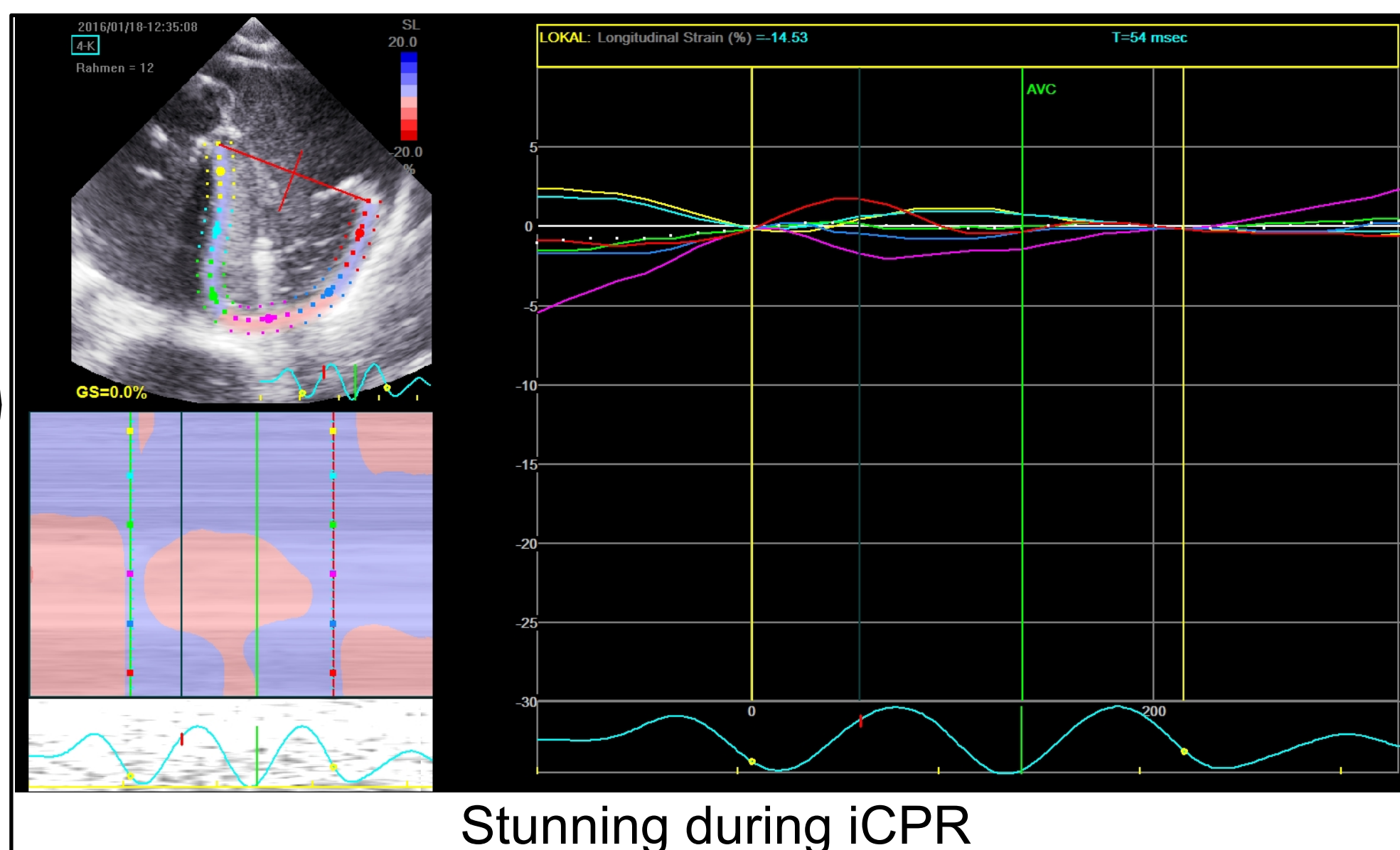
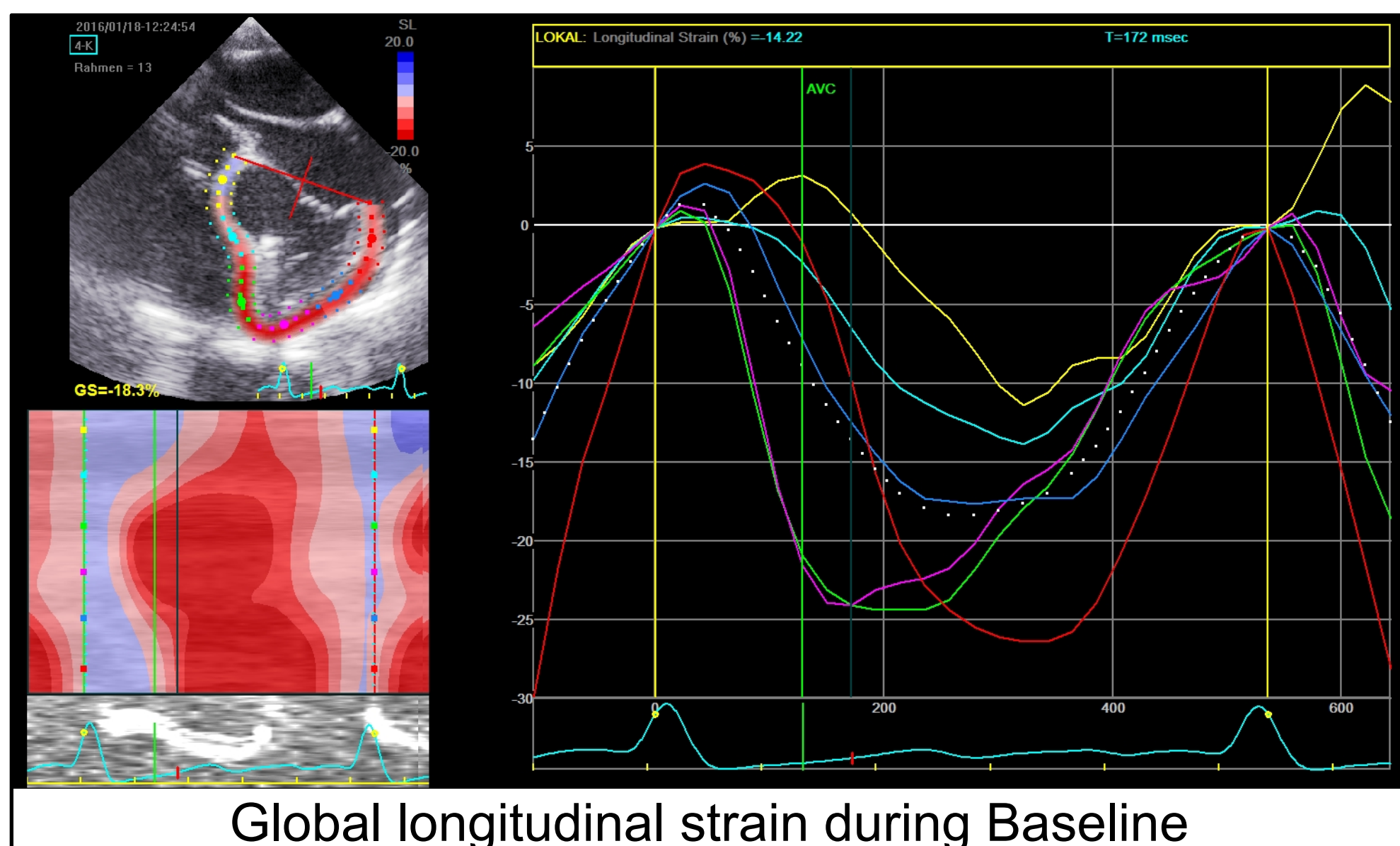
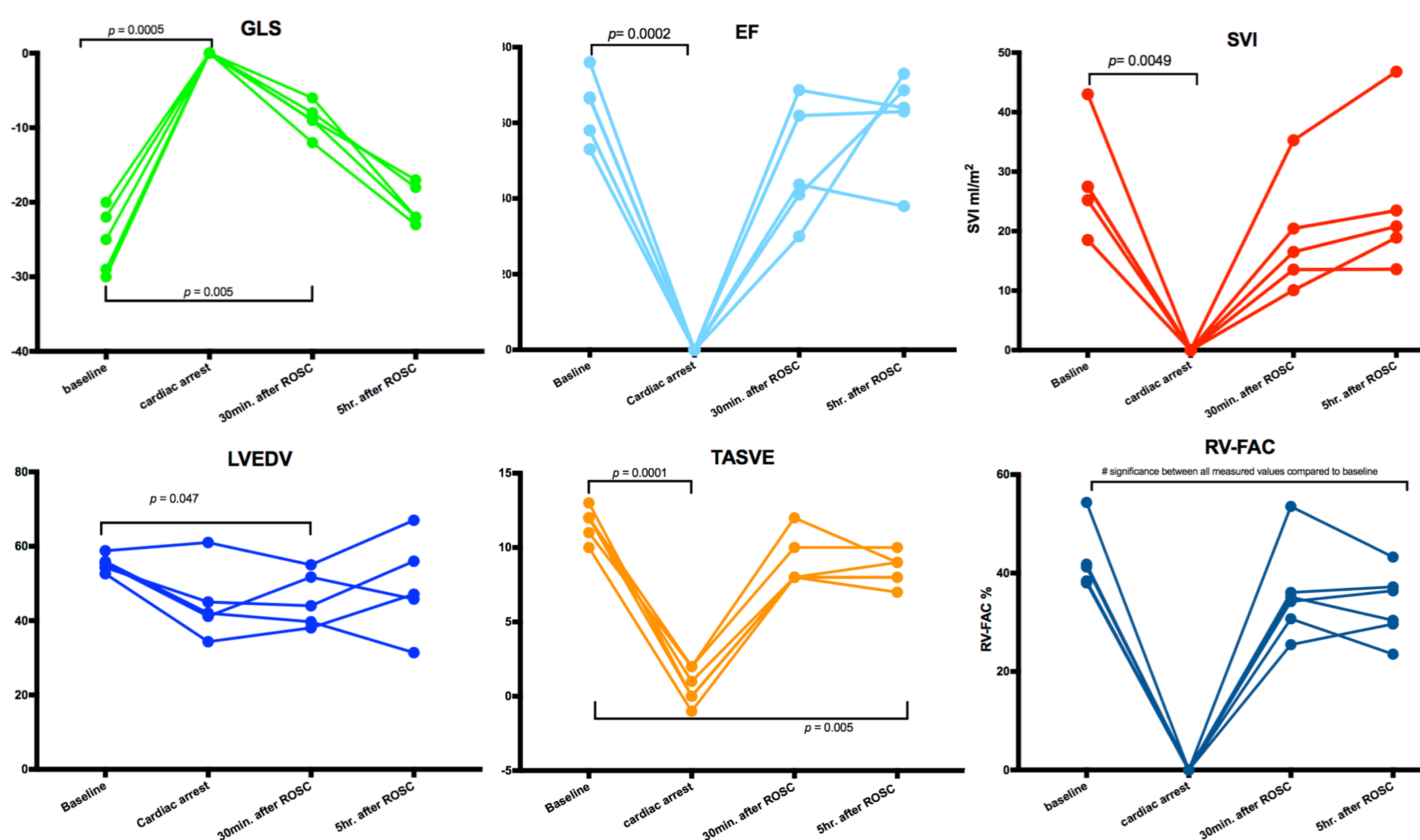
Left ventricular (LV) systolic parameters returned to baseline values 5 hours after ROSC:

- Global longitudinal strain: -25 ± 4.3 % vs. -20 ± 2.7 %; p=0.388
- Ejection Fraction: 64 ± 8.8 % vs. 61.3 ± 10.3 %, p=0.971
- Stroke volume index: 28.3 ± 8.9 mL/m² vs. 24.7 ± 12.9 mL/m², p=0.545

LV end-diastolic volume was 55.38 ± 2.8 mL at baseline, peaked after CA at 64.7 ± 9.9 mL, fell to 45.69 ± 7.4 mL 30 minutes after initiation of iCPR, and was maintained at 49.46 ± 13.9 mL 5 hours after ROSC.

Recovery of the RV systolic parameters was not observed during the first 5 hours following ROSC:

- TDI derived TASV: 11.6 ± 1 cm/s vs. 8.5 ± 1 cm/s, p=0.005
- RV-FAC: 42 ± 6.2 % vs. 33 ± 6.9 %, p=0.006



CONCLUSIONS

iCPR is able to achieve a full recovery of LV systolic parameters and provides sufficient LV volume unloading. The observed RV distension is likely attributable to extensive volume loading. Further studies are needed to analyze long term LV and RV function following CA and iCPR support.