

## **Abstract**

**Introduction:** Left-ventricular (LV) distension and consequent pulmonary congestion are complications frequently discussed in patients with severe LV dysfunction treated with veno-arterial extracorporeal membrane oxygenation (VA ECMO). The goal of this study was to describe the influence of high VA ECMO flows to LV distension, lung hemodynamics, and lung fluid accumulation. Methods of LV decompression were studied to prevent lung edema.

**Methods:** In all experiments porcine models under general anesthesia were used. The effects of high extracorporeal blood flow (EBF) on LV heart work were assessed in a chronic heart failure model. The effects of LV afterload on lung fluid accumulation were evaluated by electrical impedance tomography (EIT) on acute heart failure models. Phase and frequency filtration and mathematical analysis were applied to the raw EIT data. Subsequently, mini-invasive techniques of LV decompression were evaluated for LV work.

**Results:** The stepwise increases of VA ECMO flow improved both hemodynamic and oxygenation parameters. Nevertheless, it also caused distension and increased work of LV. The rise in EBF led to increased pulmonary capillary wedge pressure and lung fluid accumulation assessed by EIT in heart failure. The methods for LV decompression (Impella pump, atrial septostomy, and pulmonary artery drainage) positively affected cardiac work or lung hemodynamics.

**Conclusion:** The study proved, that the increase in VA ECMO flow rises LV afterload, causes LV distension, and increases heart work. We newly demonstrate that the decrease in electrical impedance of functional lung regions could be interpreted as lung fluid accumulation. Therefore, analysis of the EIT signal seems to be a promising method to monitor lung fluid changes in patients with VA ECMO therapy and could prevent pulmonary edema.

**Key words:** extracorporeal membrane oxygenation, heart failure, electrical impedance tomography, hemodynamic, VA ECMO, EIT