ELSA Publication Brief: (ELS10569ARuß)

Optimization of V-V ECMO circuit determined by blood recirculation measurements improved systemic oxygenation in a 10-year-old patient

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BACKGROUND

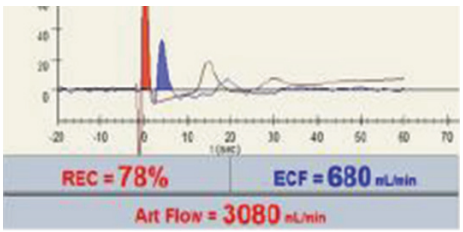
During veno-venous extracorporeal membrane oxygenation (V-V ECMO) used to treat life threatening acute respiratory distress syndrome (ARDS), the fraction of ECMO blood flow (Q_{EC}) that recirculates directly into the drainage cannula does not support systemic oxygenation. Therefore, measurement of recirculation is critical in identifying effective ECMO blood flow (Q_{EFF}).

CASE REPORT

- A 10-year-old patient weighing 44 kg and 132 cm tall suffering from extra-pulmonary ARDS caused by postoperative sepsis and massive transfusion was placed on V-V ECMO in the hospital's pediatric ICU.
- After femoro-jugular cannulas were inserted and ECMO was initiated, pulmonary arterial oxygen levels only increased from 44 mmHg to only 66 mmHg.
- The child was then transferred to Charité's intensive care unit. There, recirculation was measured with the Extracorporeal Life Support Assurance (ELSA) Monitor using saline dilution ultrasound technique.
- The position of the two cannulas was also visualized by CT-scans.
- Together, the high recirculation fraction (Rf = 78%, 65%) with corresponding low effective ECMO blood flows (Q_{EFF} = 680 mL/min, 1260 mL/min) results with the visualization of the cannulas, lead the clinicians to postulate that the depth of the drainage cannula's insertion caused direct jetting of blood towards the inferior vena cava which cause high recirculation.
- In response, they pulled the cannula back approximately 2 cm in an attempt to reduce recirculation.
- Recirculation dropped dramatically to 25% and effective ECMO blood flow increased to 1800 mL/min.

CONCLUSION

From this experience, the team concluded that, when initiation of high flow V-V ECMO did not sufficiently support systemic oxygenation in the child, measurements of recirculation, imaging techniques and applied ECMO physiology did lead to optimization of systemic oxygenation and lung protective ventilation.



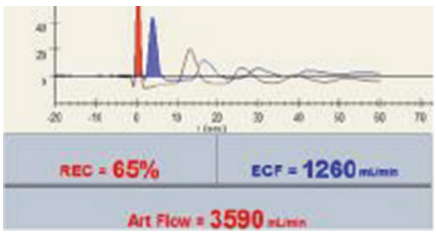
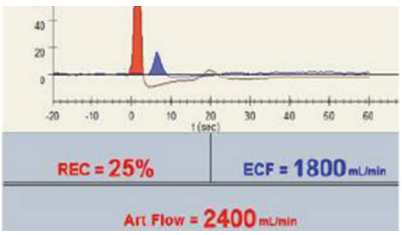


Fig. 1a, 1b: Two recirculation measurements after ECMO was initiated. Recirculation was 78% and 65% respectively. Effective flow was 680 mL/min and 1260/min.



After the outflow cannula was repositioned recirculation dropped to 25% and effective flow increased to 1800 mL/min.

TAKE HOME:

This poster demonstrates how recirculation measurements with the ELSA informs clinicians and is used to optimize ECMO flow.

REFERENCE

Russ M, Weber-Carstens S, Skrypnikov V, Taher M, Francis RCE, BoemkeW, Pickerodt PA, "Optimization of V-V ECMO circuit determined by blood recirculation measurements improved systemic oxygenation in a 10-year-old patient," 5th Annual Symposium on ARDS, Berlin, Germany, June 2019 (Transonic Reference: ELS10569A)

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