The Use of the ADVanced Organ Support (ADVOS) Hemodialysis System in Cardiosurgical Patients with End-Stage Shock Helps to Correct Acidosis and to Reduce Vasopressor Needs

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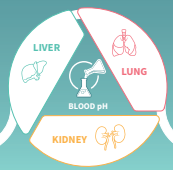
Main Results

In 22 cardiac surgery patients with end-stage shock and a median SOFA Score of 15, the following results were achieved:

- Acidosis was corrected significantly (p=0.001), with pH increasing from 7.33 to 7.44 (Table 1).
- Significant reduction in median noradrenaline dose (p=0.009) and Vasoactive Inotropic Score (VIS) (p=0.007), with noradrenaline dose decreasing from 0.470 to 0.180 µg/ml/kg and VIS dropping from 59 to 21 (Figure 1).
- SOFA Score standardized mortality ratio 28 days of 0.63 (CI 95% 0.27-0.99), an absolute risk reduction of 33% and a number needed to treat of 3 (Figure 2).



Background

End-stage shock in cardiosurgical patients often leads to metabolic disruption, refractory acidosis, and vasoplegia despite established therapies like renal replacement therapy (RRT) or extracorporeal life support (ECLS).

The ADVOS system aims to address these challenges by correcting acidosis and reducing the dependence on vasopressors.

Study Design

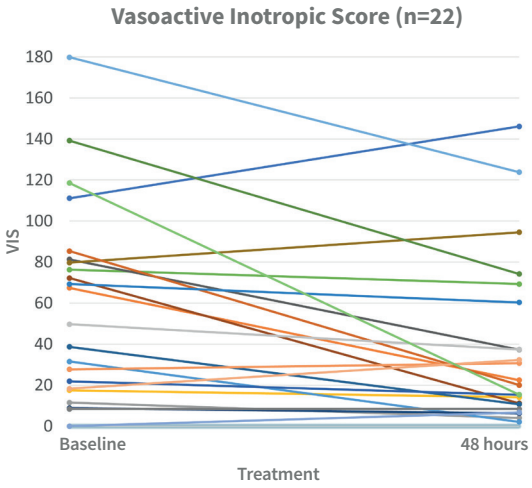
- **Diagnosis:** Multi-organ failure & refractory shock post-cardiac surgery
- **Clinical Site:** Universitätsklinikum Schleswig-Holstein, Campus Kiel, Germany
- **Recruitment Period:** November 2021 – September 2023
- **Intervention:** ADVOS hemodialysis system, at least two consecutive 24-hour sessions
- **Primary Outcome:** Reduction of Vasoactive Inotropic Score (VIS) after 48 hours
- **Secondary Outcomes:** Changes in blood gas values and SOFA Score standardized 28-day mortality

Results

- **Patients:** 22 patients (77% male, median age 59) with a median SOFA Score of 15
- **Intervention:** 110 ADVOS sessions (median blood flow and duration of 150 ml/min and 23 hours, respectively)
- **Findings:** Significant improvements in blood pH, bicarbonate, and base excess were observed at 48 hours. There was a significant reduction in median noradrenaline doses and VIS. No device-related adverse events were noted. 28-day and ICU mortality rates were 55% and 59%, respectively.

	Treatment	Median	IQR 25	IQR 75	p vs. Baseline			
Lactate (mmol/l)	Baseline	2.3	1.7	4.7	Mean dif	Lower	Upper	Sig.
	24 h	1.9	1.4	3.1	-1.6	0.2	-3.3	0.083
	48 h	1.8	1.2	2.2	-1.7	0.2	-3.5	0.077
	Last treatment	1.6	1.1	2.7	-1.9	0.1	-3.8	0.056
Blood pH	Baseline	7.33	7.29	7.40	Mean dif	Lower	Upper	Sig.
	24 h	7.41	7.38	7.44	0.08	0.11	0.04	0.000
	48 h	7.44	7.38	7.44	0.08	0.13	0.04	0.001
	Last treatment	7.44	7.40	7.44	0.08	0.13	0.04	0.001
Bicarbonate (mmol/l)	Baseline	22.6	20.5	24.5	Mean dif	Lower	Upper	Sig.
	24 h	27.3	25.2	28.7	4.9	7.1	2.8	0.000
	48 h	26.8	25.5	27.8	4.2	6.2	2.3	0.000
	Last treatment	26.1	24.2	27.8	3.3	5.3	1.3	0.002
Base Excess (mmol/l)	Baseline	-3.2	-5.0	-1.5	Mean dif	Lower	Upper	Sig.
	24 h	2.0	0.4	4.6	6.0	8.5	3.5	0.000
	48 h	2.4	0.6	3.1	5.5	7.9	3.1	0.000
	Last treatment	1.5	-0.5	2.7	6.3	10.5	2.1	0.005

Table 1: Development of pH value, serum bicarbonate, base excess and lactate during the ADVOS treatments.



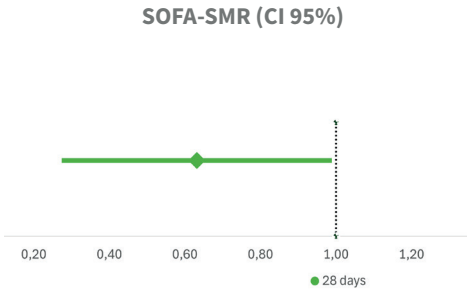


Figure 1 (left): Change in VIS after two consecutive 24-hour ADVOS sessions. Each line represents one patient.

Figure 2 (above): SOFA Score standardized mortality ratio (SOFA-SMR), based on observed vs. expected deaths according to the publication by Ferreira et al.*

Conclusion

The ADVOS therapy was deemed safe and feasible in cardiosurgical patients with end-stage shock, demonstrating significant hemodynamic improvements.

* Ferreira FL, et al. JAMA. 2001; 286(14): 1754-8