First successful combination of ECMO with cytokine removal therapy in cardiogenic septic shock: A case report

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This case study reports on a 39-year-old patient presenting at a hospital with fulminant ARDS and cardiogenic septic shock.

Case presentation

- A 39 year old male with a history of dilated idiopathic cardiomyopathy (LV-EF 20 %) was scheduled for regular ambulatory check up in the hospital from 2006 to 2012
- Medical history included secondary pulmonary hypertension, mitral valve insufficiency grade II – III, chronic renal failure, hypothyroidism and nicotine- and anabolic abuse
- A dual-chamber implantable cardioverter- defibrillator (ICD) was implanted already in 2006 and the patient was planned for heart transplant as from January 2007
- In early January 2013 the patient had been at the HDZ Bad Oeynhausen for a 3-day routine check and presented one week later at an external hospital with complaints of dyspnea
- After a short period of primary non-invasive ventilation the patient drastically deteriorated, was intubated and further ventilated mechanically
- Subsequent chest X-ray confirmed massive bilateral infiltrates
- Within several hours the patient developed a fulminant ARDS and cardiogenic septic shock
- Implantation of a veno-arterial ECMO on site and transport back to HDZ
- Patient developed an acute renal failure on top of his chronic renal insufficiency making CVVH necessary while the need for vasopressors increased drastically
- Due to a global cardiac akinesia and high risk of intracardial thrombosis, decision was made for implantation of a left ventricular assist device (LVAD) in combination with a right ECMO (rECMO) in exchange for the va-ECMO
- Operation was carried out despite full-blown sepsis with poor post-operative clinical condition
- As last resort decision, a CytoSorb hemoadsorption device was installed into the CVVH circuit

Treatment

- CytoSorb was installed into the CVVH circuit (AK200; Gambro)
- Sessions were run on the first day as well as on day 2 and 4 after the operation over periods of 18 to 21 h each
- Blood flow rates were between 155 ml/min and 240 ml/min
- Anticoagulation was achieved using heparin, targeting a partial thromboplastin time (PTT) of 60 to 80, monitored every 4 h

Measurements

- Inflammatory markers (IL-6, CRP, PCT) as well as need for vasoactive substances (norepinephrine, epinephrine, vasopressin) were determined

Results

- With start of the CytoSorb therapy in combination with ECMO, inflammatory markers IL-6, procalcitonin, and CRP markedly decreased during treatment and continued to decrease further in the following days
- Also vasopressors could be reduced significantly and were stopped during (for norepinephrine and vasopressin) and shortly after (for epinephrine) the last treatment
- No negative effects on platelet count were observed
- During the entire treatment period (4 days in total) the patient received Linezolid, Meropenem, Moxifloxacin, Voriconazol and Acyclovir as boluses with no adaptation of dose at any time
**Patient Follow-Up**

- The rECMO was explanted 19 days and ventilation stopped 27 days after the treatment.
- For regeneration of the kidney, the patient received CVVH for another 21 days and could be discharged from ICU 38 days and from the hospital 76 days after the last CytoSorb session with the LVAD Heartware system.
- The patient is still listed for transplantation.

**CONCLUSIONS**

- This is the first clinical case report in a patient treated with LVAD, rECMO, CVVH, and CytoSorb in a combined fashion.
- The combination was practical, technically feasible and highly beneficial for the patient.
- After commencement of CytoSorb treatment, the patient’s inflammatory status improved and vasopressor support could be reduced and tapered out.
- No adverse or any device-related side effects were documented during or after the treatment.
- Taken together, CytoSorb could be simply used in combination with ECMO, resulting in considerable benefits for the patient, thus representing a reasonable approach to improve survival in patients with several organ dysfunctions and the need for multiple organ supportive techniques.