CytoSorb®

Case of the week 06/2022

Use of CytoSorb in a patient with septic shock and multiple organ failure following combined mitral and aortic valve replacement

Dr. Marcin Fischer
Department of Cardiac Surgery and Cardiac Intensive care Unit, Regional Specialist Hospital, Grudziądz, Poland

This case reports on a 58-year-old male patient who presented to the hospital for an elective cardiothoracic surgical procedure.

Case presentation

- Known pre-existing conditions included a trans-ischemic attack (TIA) in 2007. Additionally, he had been hospitalized for symptoms of heart failure in the course of complex heart disease (severe mitral regurgitation, moderate regurgitation and mild aortic stenosis) one year previously
- Following his current admission, coronary angiography was performed before the scheduled operation
- The surgical procedure included combined mitral and aortic valve replacement in combination with a cardiopulmonary bypass machine (machine time 191 min, cross clamp time 153 min)
- On postoperative admission to the intensive care unit (ICU), the patient already exhibited evidence of severe circulatory failure with markedly pronounced vasoplegia (SVRI 1100 dyn*s*cm^{-5}*m², cardiac index 2.4 l/min/m²) and increased catecholamine requirements (norepinephrine 1.8 µg/kg/min, epinephrine 0.063 µg/kg/min, dobutamine 5.3 µg/kg/min, milrinone 0.06 µg/kg/min). Fluid balance within the first 24 hours following surgery was 5.3 liters
- Additionally, metabolic acidosis (pH 7.23, lactate 7.4 mmol/l, HCO3 18 mmol/l) progressed accompanied by clearly increased inflammatory markers (procalcitonin [PCT] 5.6 ng/ml), resulting in the diagnosis of septic shock
- Empirical broad spectral antibiotic therapy with meropenem, vancomycin and fluconazole was commenced
- Subsequently, the patient's clinical condition deteriorated dramatically including the development of acute renal failure, marked hyperinflammation (PCT 11 ng/ml, leukocytes 17/nl) and up to extremely elevated catecholamine requirements (norepinephrine 6.0 µg/kg/min, epinephrine 0.09 µg/kg/min, dobutamine 6.8 µg/kg/min, milrinone 0.03 µg/kg/min)
- Due to uttermost hemodynamic instability, combined therapy consisting of continuous renal replacement therapy (CRRT) and CytoSorb hemoadsorption was started 24 hours after admission to the ICU with the rationale to reduce high-dose catecholamine therapy and to control the hyperinflammatory response

Treatment

- Three treatments with CytoSorb were performed for a total of 48 hours
- CytoSorb was used in combination with CRRT (Prismaflex, Baxter) run in CVVHD mode
- Blood flow rate: 200 ml/min
- Anticoagulation: citrate
- CytoSorb adsorber position: post-hemofilter

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Measurements

- Hemodynamics and dosages of vasoactive substances
- Metabolic status
- Inflammatory parameters

Results

- Under combined CRRT and CytoSorb treatment, vasoplegia slightly improved and cardiac index transiently increased to 7 l/min/m², followed by a decrease to initial levels (2.7 l/min/m²) during CytoSorb treatment sessions 2 and 3. Catecholamine dosages could be kept constant, however there was no clear improvement in the hemodynamic parameters over time
- Three hours from the initiation of hemoadsorption therapy, a trend of improvement in metabolic parameters was observed and after 10 hours from the start of the therapy, acidosis was corrected. Three days after initiation of CytoSorb, the pH (7.42), lactate (1.9 mmol/l) and HCO3 (25 mmol/l) were back to within the normal range
- Moreover, PCT levels were reduced to 3.5 ng/ml by the end of combined treatment, while leukocytes were still elevated (16/nl)

Patient Follow-Up

- Over the next 3 days, the patient condition was still critical, but norepinephrine, epinephrine and dobutamine doses could be significantly reduced
- On the 7th day, there was a sudden circulatory collapse caused by a severe impairment of heart muscle contractility. Despite application of all available last resort measures, the patient remained refractory and finally died

Conclusion

- The combined use of CRRT and CytoSorb in this case resulted in intermittent stabilization in the patient's critical situation, mainly through stabilization in hemodynamics, control of the inflammatory response and improvement in metabolic status
- According to the medical team, the use of CytoSorb enabled a rapid improvement in metabolic parameters, but unfortunately only a short-term improvement in the hemodynamic parameters, after which the patient's condition rapidly deteriorated. In their opinion, and as a conclusion of this particular case, the start of CytoSorb therapy should be considered earlier, even intra-operatively
- CytoSorb was easy and safe to use in this setting