The first experience of cytokine adsorption in a patient with sepsis after cardiac surgery

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This case study reports on a 68-year old female patient with multiple morbidities who presented for elective cardiac surgery.

Case presentation
- The patient's history included rheumatic heart disease, biological prosthesis mitral valve replacement in 2003, primary bioprosthetic dysfunction, cardiac insufficiency NYHA Functional Class IV, pulmonary arterial hypertension, persistent atrial fibrillation. Known comorbidities were hypertension stage II grade 3; chronic atrophic gastritis; secondary chronic duodenitis; latent form of chronic pyelonephritis, Gilbert disease.
- After her chronic heart failure was stabilized, on-pump cardiac surgery (HLM time 200 mins, cross clamp time 110 mins) including mitral valve replacement and tricuspid annuloplasty was performed.
- Postoperatively low cardiac output syndrome with a cardiac index of 2.0 l/min/m² was confirmed along with severe pulmonary hypertension and cardiac cachexia.
- Low cardiac output syndrome required noradrenaline infusion (0.5 µg/kg/min) and cardiac index stabilized at 2.5 l/min/m² at the end of the 1st postoperative day.
- On day 2, noradrenaline dose requirements remained the same, cardiac index values were borderline, and therefore levosimendan infusion was started leading to catecholamine dose reduction, and stabilization of cardiac index and pulmonary hypertension.
- However, on day 2 creatinine values rose, hyperbilirubinemia was noted and blood gas analysis and X-ray suggested severe Acute Respiratory Distress Syndrome (ARDS).
- Initiation of mechanical ventilation, antibacterial therapy, nutritional support and hemodiafiltration.
- Due to the presence of sepsis with a suspected infection source, a procalcitonin level greater than 10 ng/ml, and multiple organ failure, it was decided to additionally install a CytoSorb adsorber into the CVVHDF circuit.

Treatment
- One treatment with CytoSorb for 24 hours.
- CytoSorb was used in conjunction with CRRT (PrismaFlex, Gambro, Sweden) performed in CVVHDF mode.
- Blood flow rate: 165 ml/min.
- Anticoagulation: heparin.
- CytoSorb adsorber position: post-hemofilter.

Measurements
- Hemodynamics and demand for norepinephrine
- Inflammatory parameters (IL-6)
- Renal function (creatinine, diuresis)
- Hepatic excretory function (bilirubin)
- SOFA score
- Blood composition (leucocytes, platelets)
Results

- Clear reduction in norepinephrine demand from 1.19 µg/kg/min before hemoadsorption to 0.27 µg/kg/min after cessation of CytoSorb therapy
- IL-6 levels could be decreased from 67,890 pg/ml to 45,000 pg/ml directly after cytokine adsorption with another drop to 12,000 pg/ml 24 hours after adsorption
- Improvement of renal function with a consistent increase in diuresis accompanied by normalization of creatinine levels
- Clear reduction in bilirubin levels during and after the course of the treatment
- SOFA score reduction from 10 to 6 the next day following CytoSorb cessation
- Immune balance recovered (increase in leukocytes count) as did platelet count which also rose to the lower normal range, INR returned to normal values (data not shown)
- No bleeding complications or hemodynamic adsorption-related adverse effects during CytoSorb therapy session were registered

<table>
<thead>
<tr>
<th>Lab values</th>
<th>Before adsorption</th>
<th>After adsorption</th>
<th>24 hours after adsorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noradrenaline, µg/kg/min</td>
<td>1.19</td>
<td>0.27</td>
<td>0.49</td>
</tr>
<tr>
<td>IL-6, pg/ml</td>
<td>67,890</td>
<td>45,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Diuresis, ml/kg/h</td>
<td>20</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Creatinine, µmol/l</td>
<td>129</td>
<td>100</td>
<td>110</td>
</tr>
<tr>
<td>Bilirubin, mmol/l</td>
<td>210</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>SOFA score</td>
<td>10</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Leucocytes, x 10⁹/l</td>
<td>1.5</td>
<td>4.7</td>
<td>5.9</td>
</tr>
<tr>
<td>Thrombocytes, x 10⁹/l</td>
<td>45</td>
<td>56</td>
<td>90</td>
</tr>
</tbody>
</table>

Patient Follow-Up

- Creatinine levels rose again after 24 hours, so that hemodiafiltration sessions had to be repeated
- Gradual regression of sepsis and multiple organ failure over the following days
- Total ICU stay of 21 days with transfer to normal ward after ICU discharge

CONCLUSIONS

- Treatment of this multi-morbidity patient resulted in the rapid stabilization of hemodynamics and a clear improvement in organ function
- According to the medical team this experience with CytoSorb raises optimism for systemic inflammation correction in the setting of sepsis with an additional positive effect being bilirubin adsorption
- Further studies are required to assess the indications, contraindications and outcomes for this method