

CytoSorb, a novel therapeutic approach for patients with septic shock: a case report

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This case study reports on a 72-year-old male patient with periodically recurring infectious episodes who was admitted with the suspicion of urosepsis. In the following hours his hemodynamic situation deteriorated markedly, exhibiting respiratory-metabolic acidosis, elevated inflammatory marker plasma levels, a severely disturbed coagulation, increased retention parameters, liver dysfunction, and confirmation of bacteria and leucocytes in urine. After admission to the ICU in a state of septic shock the patient received renal support with additional hemoadsorption using CytoSorb. Three CytoSorb sessions were run during the following days. The first and consecutive second session resulted in a reduction of procalcitonin, C-reactive protein and bilirubin and a markedly reduced need for vasopressors while hemodynamics improved significantly (i.e. cardiac index, extravascular lung water). Due to a recurring inflammatory "second hit" episode, another session with CytoSorb was run, resulting in a marked decrease in leukocytosis and liver (dys)function parameters. The rapid hemodynamic stabilization with reduction of vasopressor needs within hours and reduction of the capillary leakage as well as a quick reduction in infection markers were the main conclusions drawn from the use of CytoSorb in this patient. Additionally, treatment appeared to be safe and was well tolerated.

Case presentation

- 72-year-old male patient was admitted with suspicion of urosepsis
- Condition: progressing hemodynamic instability, elevated inflammatory marker plasma levels, severely disturbed coagulation, increased retention parameters, liver dysfunction, as well as a proof of bacteria and leucocytes in the patients' urine
- Upon take over to ICU, patient was in septic shock with increasing need for fluids + vasopressors
- Due to a further increase of retention parameters and decreasing spontaneous diuresis the patient received continuous renal replacement therapy
- Ultrafiltration was performed to counteract massive volume overload and an increase of extravascular lung water
- As inflammatory markers remained high, the decision was made to additionally install a CytoSorb hemoadsorption column into the CVVHD circuit

Treatment

- Three CytoSorb sessions were run during the following days (1st session 24 hours, an immediately following 2nd session for 6 hours, 3rd session was 5 days later for 24 hours due to a recurring inflammatory second hit episode with increasing infection markers)
- Blood flow rate was kept at 180 ml/min and anticoagulation was achieved using heparin targeting a partial thromboplastin time (PTT) of 60 – 80 seconds controlled every 8 hours
- The CytoSorb adsorber was placed in a pre- dialyzer position

Measurements

- Laboratory: leucocytes, platelets, PCT, CRP, urea, creatinine, ALT, AST, bilirubin
- Clinical: Cardiac index, extravascular lung water index, noradrenaline dose, mean arterial pressure, fluid balance, urine output

Results

- Drop of PCT, C-reactive protein and bilirubin
- MAP stabilized and the need for norepinephrine could be reduced from 0.8 down to 0.13 µg/kg*min and was tapered out 48 hours after termination of the second treatment
- Dobutamine infusion (10 mg/h) could be stopped straight after the second treatment
- Hemodynamics improved significantly with a cardiac index increasing from 3.22 before the first to 4.5 l/min/m² after the second treatment while extravascular lung water improved from 18.5 to 7.8 ml/kg in the course of the two treatments
- Albumin levels measured before and during both CytoSorb treatments did not change
- No adaptation of antibiotic dosage (daptomycin, clarithromycin and ceftazidim) at any time

CVVH was started on day 3. CytoSorb treatments (consecutive treatments 1 and 2) were performed on days 5 and 6, as shown in the table

Markers of inflammation and organ dysfunction throughout the treatment period:

	reference	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Leucocytes (x10 ⁹ /μl)	4.6 - 10.2	12.6	16.7	18.2	16.5	17.7	18.8	20.5	20.4
Platelets (x10 ³ /μl)	150 - 400	72	57	43	41	28	47	56	85
Procalcitonin (μg/l)	0 - 0.5	N/A	>200	>200	46.87	N/A	26.37	19.25	11.61
C-reactive protein (mg/l)	0 - 5	92.7	157.1	245.6	203.2	N/A	133.4	90.9	74.9
Urea (mmol/l)	5.3 - 8.9	13.5	17.2	10.4	6	N/A	5.7	5.5	5.8
Creatinine (μmol/l)	71 - 106	297	324	225	156	N/A	158	150	143
ALT (μmol/l*s)	0 - 0.85	3.15	7.37	4.21	1.79	N/A	1.68	1.56	1.52
AST (μmol/l*s)	0 - 0.85	3.43	7.53	3.15	1.34	N/A	1.46	1.41	1.21
Bilirubin (μmol/l)	0 - 19	42.5	61.3	98.4	112.6	N/A	100.6	76.4	59

Mean arterial pressure, vasopressor dose and fluid balance over time:

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Peak noradrenaline dose (μg/kg/min)	0.8	0.7	0.19	0.3	0.29	0.15	0.12	0.02
Corresponding MAP (mmHg)	57	75	85	75	76	77	85	77
Fluid balance (ml/day)	+9,026	+7,645	+1,459	+19	+1,070	+980	+57	+2,559
Total fluid supply (ml/day)	10,050	8,250	6,400	3,850	4,350	4,300	4,150	5,065
Urine output (ml/day)	229	805	561	61	122	0	96	307
Average ultrafiltration rate (ml/hour)	-	-	250	160	100	150	175	100
Ultrafiltrate withdrawal (ml/day)	-	-	4,380	3,870	2,350	3,320	4,000	2,200

Patient Follow-Up

- 3rd CytoSorb session resulted in a marked decrease of leukocytosis, CRP, and liver dysfunction parameters (ALT, AST, bilirubin)
- After regaining clinical stability the patient was transferred to the University Hospital of Greifswald (Germany) due to more advanced diagnostic testing methods for the yet not accomplished focus search and because of their experience in the use of CytoSorb hemoadsorption, in case the patient should develop further complications
- Diagnostic testing revealed a spondylodiscitis and the focus was surgically eradicated
- Probably due to the long previous antimicrobial therapy, no underlying germ could be detected
- During the next days, organ functions and inflammatory status improved further, accompanied by a considerable improvement of the patients' general condition
- After discharge, the patient showed no further infectious episodes in the follow-up period

CONCLUSIONS

- In this patient CytoSorb therapy appeared to contribute to regain control over the patients' inflammatory response
- Treatment appeared to be safe and was well tolerated
- Main effects of CytoSorb: rapid hemodynamic stabilization with reduction of vasopressor needs within hours and reduction of the capillary leakage as well as a quick reduction of infection markers
- Further studies are necessary to elucidate to what extent these favorable consequences are attributable to the adsorber itself