CytoSorb®

Case of the week 35/2020

Use of CytoSorb in a patient with sepsis and acute liver failure following C-section in the 38th week of pregnancy

Dr. Robert Breitkopf, MSc., MSc., DESA
Department for Anesthesia and General Intensive Care Medicine, Innsbruck State Hospital - University Hospitals, Austria

This case reports on a 40-year-old female patient who was transferred from a peripheral district hospital to Innsbruck State Hospital following emergent C-section with subsequent acute liver failure of unclear origin with the option of a high urgency liver transplantation.

Case presentation:

- One week earlier the patient had been admitted to the peripheral hospital in her 38th week of pregnancy with signs of fatigue, abdominal pain, nausea/vomiting and jaundice after an otherwise mainly uneventful course of primigravida and nullipara pregnancy (apart from asymptomatic cholecystolithiasis). She had a previous history of hypothyroidism
- On admission to the peripheral district hospital, a moderate increase in liver transaminases <500 U/l (GOT>GPT), hyperbilirubinemia (>10 mg/dl), Coombs-negative hemolytic anemia with positive fragments and haptoglobin <10 mg/dl, coagulopathy (INR >1.5, factor V <30%) and thrombocytopenia (<100,000/µl) were detected. Until then, there has been no evidence of pre-/eclampsia (no edema, hypertension, proteinuria)
- Shortly afterwards, the patient developed grade 2 hepatic encephalopathy with a Glasgow Coma Scale (GCS) Score of 13, resulting in the diagnosis of a HELLP syndrome (hemolysis, elevated liver enzymes, low platelet count) and the patient underwent a cesarian section 3 days after admission under general anesthesia (antibiotic therapy with tazobactam/piperacillin)
- Following surgery, the patient rapidly developed fulminant multiple organ failure including circulatory failure with metabolic acidosis, acute lung failure (ARDS), acute renal failure with hyperuricemia and acute liver failure, hypoglycemia, hypothermia and hypalbuminemia
- On the 6th day after admission (3rd postoperative day), she was transferred to Innsbruck State Hospital primarily for the treatment of her liver failure with the option for a high urgency liver transplantation
- On admission to Innsbruck State Hospital, she exhibited grade 2 encephalopathy with hyperammonemia (ammonia 140 µmol/l), significantly increased liver markers (bilirubin 13.6 mg/dl, GOT 99 U/L, GPT 59 U/L), pronounced metabolic acidosis (pH 7.27; lactate 32 mg/dl) and impaired coagulation (factor V 29 %, INR 1.85 with substitution)
- Furthermore, she required moderate catecholamine therapy (norepinephrine <0.1 µg/kg/min) and showed clearly increased inflammatory parameters (IL-6 1612 ng/l, leukocytes 24000/µl)
- Extensive diagnostics including X-ray thorax, CT, echocardiography and laboratory diagnostics were performed
- Slight congestion of the lung was confirmed in chest X-ray, however without evidence of infiltrates or effusions
- Sonography and CT examinations excluded liver infarction, hematoma, liver rupture, cirrhosis and portal hypertension given there was homogeneous liver perfusion with unrestricted venous outflow. A blunt cholecystolithiasis without inflammation was confirmed and skull CT excluded higher grade cerebral edema or bleeding

- Echocardiography showed hyperdynamic left ventricular function, however without valve insufficiency or pericardial effusion
- Serology was also negative for viral hepatitis, CMV, EBV, HIV as were autoimmune diagnostics
- The patient received non-invasive ventilation (CPAP mask) and catecholamine (norepinephrine) and fluid therapy were continued
- In addition, therapy for hepatic encephalopathy was initiated with lactulose, rifaximin, L-ornitine L-aspartate, mannitol and hypertonic saline
- For the treatment of the coagulopathy, vitamin K, tranexamic acid, plasma and platelet concentrates as well as coagulation factors (fibrinogen and factor XIII) were administered
- To support liver function, an acetylcysteine perfusor (150 mg/kg for 1 hour, then 12.5 mg/kg per hour for 4 hours and finally 6.25 mg/kg for 67 hours) was started and cholecytolithiasis was treated with ursodeoxycholic acid (20 mg/kg/d)
- Due to acute renal failure, combined continuous renal replacement therapy (CRRT) and CytoSorb hemoadsorption therapy were started to control the inflammatory reaction, to decrease catecholamine dosages and to reduce elevated plasma levels of ammonia and thus to prevent brain edema

Treatment

- Two consecutive treatments with CytoSorb for 24 h each
- CytoSorb was used in combination with CRRT (Multifiltrate, Fresenius Medical Care) run in CVVHD mode
- Blood flow rate: 100 ml/min
- Dialysate flow: 2000 ml/min
- Anticoagulation: Citrate
- CytoSorb adsorber position: pre-hemofilter

Measurements

- Hemodynamics and catecholamine requirements
- Inflammatory reaction
- Metabolic status
- Liver parameters
- Grade of hepatic encephalopathy
- Renal function

Results

- Upon CytoSorb initiation, there was an immediate stabilization of the hemodynamic situation and norepinephrine requirements could be completely stopped during the first treatment
- A clear control of the hyperinflammatory reaction could also be achieved during the treatment (leukocytes after 24 hours was 9200/µl and after 48 h 11,100/µl, IL-6 after 24 hours at 166 ng/l and then consistently lower)

- As early as 6 hours after therapy start, i.e. still during the first treatment, there was a recompensation of metabolic acidosis with pH and lactate values back in the normal range
- Treatment was further associated with a significant improvement in liver function. Hepatic encephalopathy improved significantly during the course of treatment. Already after the first 24 hours, severity was reduced to grade 1 with a GCS of 14, after another 24 h a GCS of 15 was reached. This was accompanied by a significant drop in ammonia plasma concentrations (reduction of ammonia from initially 140.8 µmol/l to 75 µmol/l after 24 hours and to 30 µmol/l after another 24 h)
- Kidney function was also completely restored after the treatment

Patient Follow-Up

- Discontinuation of CRRT together with CytoSorb therapy
- Escalation of antibiotic therapy to meropenem with detection of gram-negative bacteria in blood culture (later confirmed detection of Bacteroides)
- Genetic testing for 3-hydroxyacyl-CoA dehydrogenase (LCHAD) deficiency in the newborn was negative
- Transfer back to the peripheral hospital 5 days later with recompensated organ functions and no need for a liver transplant

Conclusions

- In this patient with gram-negative sepsis and acute liver failure, the combined treatment of standard therapy, CRRT and CytoSorb resulted in an extremely rapid and sustained improvement in hemodynamics and her metabolic status, control of the hyperinflammatory response and a significant improvement in liver function and hepatic encephalopathy
- According to the medical team, CytoSorb is now routinely used as a standard therapeutic procedure for patients with acute liver failure. The adsorber appears to be an extremely effective tool for the reduction of high ammonia levels and in encephalopathy. The use of CytoSorb helps to achieve hemodynamic stabilization with a concomitant rapid reduction of the catecholamine dosages
- CytoSorb was safe and easy to use in combination with CRRT