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Case of the week 51/2021

Use of CytoSorb in a critically ill patient with COVID-19 developing postpartum ARDS and septic shock

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This case reports on a 37-year-old female with previous Lower Segment Cesarean Section (LSCS) and a history of gestational insulin-dependent diabetes mellitus, who was admitted to hospital at 32 weeks of pregnancy with a one week history of fever and myalgia present and a diagnosis of SARS-CoV-2 made 5 days before admission.

Case presentation

- At the time of admission, the patient was at pregnancy stage G2 P1 L1 (gravida 2, para 1, live 1)
- She was initially on oxygen support, but this had to be escalated to non-invasive ventilation due to worsening hypoxemia followed by an immediate transfer to the intensive care unit (ICU)
- The next day, her respiratory situation progressively deteriorated resulting in intubation and mechanical ventilation. Consequently, an emergency LSCS was planned to improve maternal hemodynamic status and to ensure good fetal outcome
- The patient gave birth to a healthy male newborn at 32 weeks of gestation, weighing 1.84 kgs with no complications
- Postpartum, she was transferred back to the ICU with a SpO_2 of 91-93% at a FiO_2 of 50%
- Antibiotic (combined drug cefoperazone + sulbactam) and steroid (Dexamethasone) therapy was initiated as per the COVID-19 protocol
- On day 3 day of hospitalization, inflammatory biomarkers started to increase while there was no evidence of a secondary infection. Thus, two dosages of tocilizumab were administered with a pause interval of 12 hours between them
- Two days later, the patient developed worsening hypoxia with endotracheal cultures suggesting budding yeast cells. Therefore, anti-infective therapy was prospectively escalated to meropenem, colistin, sulbactam and fluconazole
- The patient was prone positioned and sedated, maintaining an oxygen saturation of 85-87% while exhibiting severe acute respiratory distress syndrome (ARDS) with a PaO2/FiO2 ratio of 55 mmHg
- She further showed initial signs of Disseminated Intravascular Coagulopathy (DIC) with thrombocytopenia (61000/µl) and elevated D-Dimer levels (495 ng/ml)
- Additionally, due to increasing hemodynamic instability she was started on vasopressor therapy (norepinephrine 0.4 µg/kg/min plus vasopressin) while there were clear signs of a generalized hyperinflammatory state (leucocyte count 17,200/µl, procalcitonin 1.43 ng/ml and C-reactive Protein [CRP] 65.6 mg/L) accompanied by elevated lactate levels (3.41 mmol/L)
- Over the next 4 days, her clinical condition continued to worsen including incipient development of septic shock with multiple organ failure. With the rationale to improve oxygenation, while simultaneously hemodynamically stabilize the patient and to control the hyperinflammatory response, veno-venous (VV) extracorporeal membrane oxygenation therapy (ECMO) was started and a CytoSorb hemoadsorption device was additionally integrated into the circuit

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Treatment

- One CytoSorb adsorber was used for a total duration of 24 hours
- CytoSorb was integrated passively in the circuit in combination with VV ECMO
- CytoSorb blood flow rate: 360 ml/min and ECMO blood flow rate: 3 l/min
- Anticoagulation: Bivalirudin with a target ACT of 180-220 secs

Measurements

- Hemodynamics and vasopressor requirements
- Inflammatory biomarkers
- Markers of DIC
- Respiratory function
- Lactate

Results

- During the course of treatment, the hemodynamic condition improved significantly as reflected by a reduction in norepinephrine dose from 0.4 to 0.2 µg/kg/min and reduction of vasopressin dose
- Additionally, following the start of combined VV ECMO and CytoSorb therapy, a reduction in inflammatory biomarkers pointed towards a progressive improvement of her hyperinflammatory state with leucocyte counts reducing from 17,200 to 12,800/µl and procalcitonin reducing from 1.43 ng/ml to 0.1 ng/ml
- Also disseminated intravascular coagulopathy gradually improved under therapy. D-Dimer plasma concentrations were reduced by 22% to 384 ng/mL and platelet levels started normalizing from 60,000/µl to 124,000/µl with an aPTT of 31.6 seconds
- The PaO_2/FiO_2 ratio improved marginally from 55 to 85 mmHg post CytoSorb treatment and to 92 mmHg two days after CytoSorb therapy
- Moreover, a reduction in the serum lactate levels was noticed (from 3.41 mmol/L to 1.79 mmol/L)
- Also her overall clinical condition improved

Patient Follow-Up

- As the clinical condition improved further, VV ECMO was discontinued and the patient was extubated 5 days after the CytoSorb therapy
- Neonatal health was stable and it had been diagnosed COVID-19 negative on birth. Body temperature of the baby was maintained throughout, heart rate and breathing rate were normal and there were no episodes of convulsions. Moreover, post-natal care was ensured by infection prevention, immunization and nutritional support while follow-up medications for the mother included antibiotics and painkillers
- The patient was discharged from the ICU to the ward 12 days after ICU admission
- The patient and her baby were confirmed as COVID-19 negative before discharge

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Conclusions

- In this case of a critically ill patient with COVID-19 developing postpartum ARDS and septic shock the use of CytoSorb in combination with VV ECMO and standard therapeutic measures was associated with hemodynamic stabilization, control of the hyperinflammatory response as well as an improvement in lactic acidosis and her general clinical condition
- According to the authors, CytoSorb can be regarded as a safe therapy in post COVID-19 induced ARDS with pregnancy related complications helping to stabilize patients hemodynamically and to regain control via adsorption of excess inflammatory mediators
- The CytoSorb set-up with ECMO was easy and without technical problems despite a COVID-19 related coagulopathy