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Case of the week 42/2020

Use of CytoSorb in a patient with severe COVID-19

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This case reports on a 31-year-old male patient with no significant medical history, who was hospitalized following several days of non-quantified fever associated with odynophagia.

Case Presentation

- Previously, based on his symptoms, an outpatient RT-PCR test was performed, which proved positive for SARS-CoV-2 infection
- Due to the persistence of his fever despite the administration of acetaminophen, he decided to consult the Emergency Department and he was subsequently transferred to the hospital
- On admission, he was tachycardic (120/min) and febrile (37.8°C), however he was hemodynamically stable (blood pressure 122/78 mmHg) and with good respiratory function (O_2 saturation 95%)
- Laboratory tests revealed leukocytosis (without neutrophilia), moderate hypokalemia, and elevated levels of creatinine and C-reactive protein (CRP)
- Specific treatment with ivermectine was initiated
- Subsequently, his oxygenation deteriorated with O_2 sat levels persistently below 92% despite high-flow oxygen therapy with an FiO_2 of 0.5, and arterial gases showing a mixed picture of acidosis and moderate hypoxemia (pH 7.35; $PaCO_2$ 64 mmHg; PaO_2 75 mmHg; HCO_3 16 mmol/L; BE -5; PaO_2/FiO_2 226 mmHg)
- Consequently, steroid therapy (dexamethasone at a dose of 6 mg/day) was initiated
- Because of a high probability of developing respiratory failure, he was transferred to the intensive care unit (ICU) for further medical management (even though the patient did not ultimately require invasive mechanical ventilation)
- After two days of admission to the ICU, his clinical situation worsened further, including development of hemodynamic instability requiring initiation of norepinephrine therapy
- This was accompanied by an increase in retention parameters (urea 47.6 mg/dL; creatinine 2.11mg/dL) and D-dimer plasma levels (2960 ng/ml), followed by optimization of the intravenous fluid regimen
- Due to the poor response to the above therapies, the present hemodynamic instability, as well as persistently elevated inflammatory markers (C-reactive protein 112 mg/l, D-dimer 7050 ng/ml, ferritin 2200 ng/ml) with a worsening metabolic state and oxygenation (pH 7.31; lactate 3.2 mmol/L, $PaCO_2$ 69 mmHg; PO_2 71 mmHg; HCO_3 14mmol/L; PaO_2/FiO_2 120 mmHg), the decision was made to start prolonged intermittent renal replacement therapy in combination with adjuvant CytoSorb hemoadsorption therapy

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Treatment

- One CytoSorb treatment was performed for 10 hours
- CytoSorb was used in conjunction with the dialysis machine (Genius90, FX60 dialysis filter, Fresenius Medical Care)
- Anticoagulation: heparin was used with a 70 IU/kg bolus dose and 10-15 IU/kg/hour infusion
- Blood flow rate: 140ml/min

Measurements

- Hemodynamics and catecholamine requirements
- Arterial blood gas analysis
- CRP, D-dimer and ferritin
- Renal parameters
- Need for invasive mechanical ventilation

Results

- Four hours after the start of CytoSorb therapy, norepinephrine infusion could be completely stopped
- Metabolic parameters and oxygenation indexes normalized throughout the treatment session (pH 7.48; lactate 1.6 mmol/l, $PaCO_2$ 34.2mmHg; PaO_2 107mmHg; HCO_3 25mmol/L; PaO_2/FiO_2 335 mmHg)
- D-dimer decreased by more than 70% to 1899 ng/ml, ferritin to 140ng/ml, and CRP to 96 mg/l
- Combined renal replacement and CytoSorb therapy further resulted in a decrease in creatinine (1.31 mg/dl) and urea plasma levels (17.8 mg/dl)
- The need for invasive mechanical ventilation (IMV) could be avoided

Patient Follow-up

- At the time of documentation, the patient is in a satisfactory clinical state, hemodynamically stable without requirement for vasopressor support, with preserved diuresis without the need for further renal replacement therapy
- Furthermore, his need for supplemental oxygen has been progressively decreasing

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Conclusion

- In this case with severe COVID-19, the use of CytoSorb therapy in combination with intermittent renal replacement and standard of care therapy resulted in a rapid improvement in the patient's clinical state
- Treatment was associated with hemodynamic stabilization within hours, control of the hyperinflammatory condition as well as improvement in oxygenation, which prevented the need for invasive mechanical ventilation
- According to the authors, treatment should be instituted early, ideally within the first 24 hours after the onset of septic shock, as the probability of success progressively decreases after 48 hours
- Therefore, hemoadsorption therapy using the CytoSorb technology appears to be a promising treatment strategy for the management of patients with severe COVID-19 and hyperinflammation