Successful Reduction of Creatine Kinase and Myoglobin Levels in Severe Rhabdomyolysis Using Extracorporeal Blood Purification (CytoSorb®)

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This case reports on a 56-year-old male patient with no previous medical conditions, who suffered a severe traumatic rhabdomyolysis of the lower extremities and abdominal wall due to a crush injury.

Case presentation:

- At the trauma scene, the patient was awake and his hypotension and tachycardia were treated with intravenous fluids
- Examination in the Emergency Department revealed a hematoma in the pelvic region and ischemic lower extremities without any arterial pulse signals
- Abdominal computed tomography showed traumatic dissection of the distal aorta and both arteria-iliaca as well as bilateral transection of the vena femoralis
- Also, laboratory diagnostics showed severe rhabdomyolysis, as indicated by myoglobin levels of 79,931 µg/L and creatinine kinase (CK) levels of 15,032 U/L
- Subsequently, the patient was transferred to the operating room in an attempt to re-establish arterial supply to the lower extremities
- Left arteria femoralis communis and arteria iliaca externa were reconstructed with a synthetic graft while femoral-femoral crossover construction with a graft from left to right was performed after unsuccessful recanalization of the left iliac artery
- Although technically successful, there was ongoing lack of function due to persistent ischemia of >6 h (lactate was 6 mmol/L) so that bilateral guillotine amputation above the patella was performed
- Postoperatively, the patient was transferred to the intensive care unit (ICU) and managed with mechanical ventilation, broad-spectrum antibiotics and administration of high-dose norepinephrine ranging between 0.6 and 0.8 µg/kg/min
- Continuous renal replacement therapy (CRRT) with a High-Cut Off EMIC-2 dialysis filter was initiated to remove excess myoglobin from the bloodstream
- His fluid balance for the first day was +14,000 mls and average norepinephrine demand was 1 µg/kg/min
- Continuous PiCCO® monitoring was applied to guide fluid and vasoactive drug therapy
- Six packs of red blood cells were transfused
- Sublingual microcirculation measurement showed a rich and mostly perfused vessel density
- As the patients’ status did not improve and as neither myoglobin nor potassium levels could be lowered, re-exploration surgery was performed during which the vitality of the tissues was assessed, revealing sigmoid ischemia, and in response, a proctosigmoidectomy was performed
- As the EMIC-2 filter alone was not able to prevent progressive myoglobin increase following this procedure, the filter was replaced by a CytoSorb adsorber, which was added to the circuit instead, on the second day of the ICU stay

**Treatment**

- 3 consecutive CytoSorb treatments for a total treatment period of 46 hours
- CytoSorb was used in combination with CRRT (Multifiltrate, Fresenius Medical Care) run in continuous veno-venous hemodialysis mode (CVVHD) mode
- Blood flow rate: 200 ml/min
- Dialysate flow rate: 4000 ml/h
- Anticoagulation: No anticoagulation was employed due to severe shock and deranged coagulation parameters (INR >10 and aPTT >180 s)
- CytoSorb adsorber position: pre-hemofilter

**Measurements**

- Myoglobin and CK levels
- Hemodynamics and norepinephrine requirements
- Fluid balance

**Results**

- During the course of CytoSorb treatment, myoglobin levels were lowered significantly from 110,000 to 90,000 µg/L and CK levels from 115,000 to 65,000 U/L within 4 h of CytoSorb treatment. After change of the 1st adsorber, myoglobin levels again were reduced from 110,000 to 70,000 µg/L within 12 h. Following another adsorber change and despite the ongoing source of the ischemia, myoglobin levels were reduced from 90,000 to 50,000 µg/L and CK from 65,000 to 40,000 U/L
- During the first application cycle of CytoSorb, norepinephrine requirements remained unchanged, while another peak in catecholamine dosages of up to 1.75 µg/kg/min could be lowered to a minimum of 1.15 µg/kg/min with the help of a renewed CytoSorb adsorber
- Under CytoSorb the fluid balance of +9,900 mls on day 2 could be reduced to +2,300 mls on day 3

**Patient Follow-Up**

- During CytoSorb application, re-exploration surgery revealed rectal stump ischemia
- Enoximone 1 µg/kg/min and amiodarone 600 mg over 24 h were initiated
- Another laparotomy showed total avital rectus abdominis muscles. No further treatment was possible and the patient finally died
Conclusions

- This report indicates that the use of CytoSorb in this severe rhabdomyolysis patient was successful in reducing plasma concentrations of myoglobin and CK despite an unresolved bowel ischemia and undiagnosed abdominal wall ischemia.
- Furthermore, the CytoSorb adsorber was shown to be more successful at eliminating myoglobin than conventional EMiC-2 filter.
- Treatment with CytoSorb improved the microcirculatory perfusion on day 2 of the ICU stay, despite abnormal macrohemodynamic parameters that indicated loss of hemodynamic coherence.
- An adsorber change per 12 hrs or even earlier seems plausible in severe cases to ensure continuous mediator reduction.
- The case shows that the timing of CytoSorb application may have been critical and that in such conditions early application of CytoSorb may be indicated to avoid the progression from normal to abnormal microcirculation.