COUPLE PLASMA FILTRATION ADSORBTION (CPFA) IN A PATIENT WITH CRUSH SYNDROME

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Abstract: *We used CPFA to treat a rhadbomyolysis syndrome in a-48 year old male, victim of a train accident. CPFA procedure was done for four sessions, every 24 hours. CPFA has been shown to restore immune function, organ function and haemodynamic stability. The evolution was favourable.*

INTRODUCTION

Coupled plasma filtration adsorption (CPFA) is an extracorporeal blood purification therapy for sepsis which adsorbs nonselective both proinflammatory and anti-inflammatory mediators.(1,2,3)

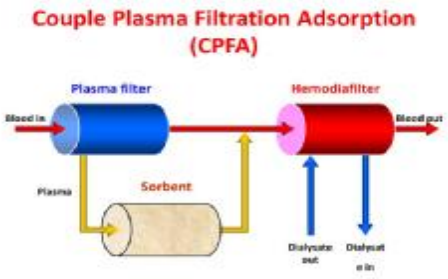
Indications are those which request clearance of small or medium molecules as well as some specific larger one (severe sepsis, septic shock, acute liver failure, bridge to liver transplant).

CPFA consists in three steps: filtration, adsorption and hemofiltration. During the first phase, filtration, plasma is separated from blood using a plasma filter (e.g. Granopen plasmafilter). This separated plasma passes, then, through a sorbent cartridge (e.g. Secoloc) where a specific resin allows nonspecific adsorption of pro-inflammatory and anti-inflammatory mediators and endotoxins. Adsorption is the retention of molecules on the surface of a sorbent material depending on the characteristics of the sorbent cartridge (pH, membrane material, pore size). The plasma filtrate is restored and submitted to combine with blood, avoiding undesirable losses.(1,3)

This technique allows the removal of low to medium weight molecules by the haemofiltration process and another specific removal of large molecules such as inflammatory mediators and bilirubin by absorption. Treatment duration: 4-8 hours (1 or 2 pro- and anti-inflammatory cycles).

The treatment can be repeated every 24 hours.

Figure no. 1. CPFA concept



- The effectiveness of CPFA in adsorbing inflammatory mediators and tumour necrosis factor α amongst others.
- Molecules adsorbed by Secoloc resin are: blirubin, Interleukin 1β, Interleukin 6, Interleukin 8, Interleukin 10, macrophage inflammatory proteins (MIP-α, MIP-β), tumor necrosis factor (TNF-α), endotoxin, peptidoglycan, bradykinin, angiogenin, leptin, retinol binding protein, prostanoids, complement factors, coagulation components, nitric acid, oxygen radicals.

CPFA has been shown to improve early hemodynamic stability, decrease inotropic support requirement, and enhance the immune response in septic patients.(4,5,6)

CPFA is applied in:

- Severe sepsis,
- Septic shock,
- Acute liver failure,
- ABO blood group system incompatible renal transplant.

CPFA is a safe and well tolerated method with no treatment-related hypersensitivity adverse reaction.(7)

The CPFA kit contents:

- Tubing set,
- Pecopen hemofilter,
- Granopen plasmafilter,
- Secoloc.

Figure no. 2. Hemofilter, plasmafilter and secoloc

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CPFA sessions in the patient with rhadbomyolysis syndrome were performed every 24 hours.

Figure no. 3. CPFA in practice

CASE REPORT

We used CPFA to treat a rhadbomyolysis syndrome in a 48-year old male, victim of a train accident, known to be epileptic, with traumatic amputation of the inferior 1/3 of the left thigh and inferior 1/3 of the right thigh, with extensive muscular dilacerations. The patient was admitted in the Intensive Care Unit (ICU) of the Emergency Clinical Hospital Sibiu in May 2016. He had active bleeding and was hemodynamic unstable. Surgical hemosthasis was necessary immediately.

The patient was diagnosed with traumatic and hemorrhagic shock and severe anemia (Hb=5,4g/dl).

In postoperative recovery, the general health was getting worse with cardiac arrhythmias (atrial flutter), metabolic acidosis, hyperkaliemia, hypocalcemia, hypotension, oliguria, severe anemia.

The objective of treatment was to sustain the vital functions and correct hypotension, renal failure, hepatic failure, anemia, acidosis, hyperkalemia and hypocalcemia, appropriate analgeasia. Intravenous hydration was established to correct hypotension and to maintain a urinary output. A surgical appropriate treatment with debridement, antibiotics and tetanus toxoid was established.

Final diagnosis:

- Polytraumatism by train accident,
- Both legs amputated,
- Traumatic shock,
- Crush syndrome,
- Hemorrhagic shock,
- Severe anemia,
- Septic shock.

Multisystem Organ Failure (MSOF) (Acute liver failure – bilirubin=14mg/dl, ASAT=1970 U/L, ALAT=2192 U/L, Acute kidney failure creat=5,28mg/dl, urea=200mg/dl)

Disseminated intravascular coagulopathy.

So, our patient fits perfectly in CPFA applications:

- Temperature ≤ 36° and ≥ 38°,
- Heart Rate≥ 90/min,
- Medium blood pressure < 65mmHg,
- Leukocytosis ≥1200 m3,
- Creatinine >1,5 mg/dl,
- Diuresis < 0,5 ml/kg/h x 6h,
- Bilirubin >2 mg/dl,
- ASAT >90 UI,
- ALAT > 90UI,
- Lactate >2 mmol/l,
- C-reactive protein > 10mg/dl.

CPFA procedure was initiated in four sessions, every 24 hours. CPFA has been shown to restore immune and organ function and haemodynamic stability. At the end of the treatment, there was a notable improvement with the possibility to weaning from the ventilator and suspend pressor suppor, there was an improvement in diuresis and renal and hepatic function established.

The evolution was favourable with extubation after six days and discharge from the ICU after 3 weeks.

DISCUSSIONS

Crush syndrome is a severe systemic manifestation described by major shock and renal failure caused by trauma and ischaemia of skeletal muscle.

The acute renal failure is secondary to hypotension and acute tubular necrosis secondary to rhabdomyolysis.(8,9)

These systemic effects are caused by a traumatic rhabdomyolysis. The mechanism is considered to be the release into the bloodstream of muscle breakdown products of rhabdomyolysis (myoglobin, phosphate, potassium, creatine, creatine kinase, thromboplastin). The muscle cells dies and absorb water, sodium, and calcium. Secondary to Crush syndrome, the compartment syndrome it can be installed. The reperfusion syndrome is a serious devastating complication with severe systemic effects.(8,9)

CPFA improves haemodynamics during septic shock. This improvement may be related to the reduction of IL-6 and first of all of procalcitonin. Procalcitonin clearance during CPFA may have a role in the improvement of septic shock. CPFA is a indication as the extracorporeal treatment in patients with severe sepsis.(10)

Indications of CPFA in our clinical situation:

- septic shock,
- acute hepatic failure ,
- remove products of rhabdomyolysis and reperfusion syndrome from the blood.

CONCLUSIONS

We have demonstrated that CPFA is a well tolerated and safe procedure and this method improves the hemodynamic stability in this case.

CPFA reduces these mediators pro- and anti-inflammatory in the circulation by nonselective adsorption.

CPFA has been shown to restore immune and organ function and haemodynamic stability.

The evolution was favourable and the patient was discharge after 3 weeks.

Although our experience is limited, we can conclude that the treatment with CPFA for a traumatic rhabdomyolysis and Crush syndrome help the clinical situation.

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