

Pre-emptive use of CytoSorb during orthotopic cardiac transplantation

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This case study reports on a 50-year-old male patient who was hospitalized while awaiting elective orthotopic heart transplantation due to rapidly progressing end stage heart failure, after he had been treated for non-ischemic dilated cardiomyopathy for four years.

Case presentation

- More than 30 days continuous hospitalisation pre-transplantation due to decompensated heart failure.
- Pulmonary artery catheterization confirmed elevated PA pressure: 53/32(42) mmHg, PA wedge pressure: 31 mmHg, CO: 3.6L/min, CI: 1.73L/min/m² and PVR: 3.05WU.
- Despite maximally advanced conservative treatment, rapid progression of the heart failure developed 20 days before transplantation, including severely increased total body water content, reduced creatinine clearance of 56.0 mL/min/1.73m² (creatinine: 127 µmol/L), elevated gamma-glutamyl transpeptidase of 107 U/L and markedly limited exertion tolerance (New York Heart Association class D).
- Dobutamine infusion was started (up to 10 µg/kg/min) and the patient was referred to the Eurotransplant 'High Urgent' waiting list.
- After a period of 20 days on the 'High Urgent' waiting list a donor heart from a 52-year-old male beating-heart donor was offered (estimated transfer distance 1200 km), which was accepted for the patient.
- In spite of the negative results on the preoperative infection screening (white blood cell count: 8.0 Gpt/L, procalcitonin: 0.16 µg/L, C-reactive protein: 13 mg/L, negative microbiological tests and no clinical sign of active infection) a high perioperative inflammatory response was presumed based on factors such as the presence of immune priming (slightly elevated CRP caused by end stage heart failure), expected reperfusion injury due to prolonged low cardiac output state (>20days), possible increased cold ischemic time of the donor heart (long transfer distance) and cardiopulmonary bypass time.
- To minimize the anticipated perioperative organ injury, as a consequence of the high inflammatory response and also potentially high dose of vasopressor requirements and to enhance the postoperative recovery of the patient, the pre-emptive intraoperative use of the CytoSorb was indicated.

Treatment

- One treatment cycle with CytoSorb during cardiopulmonary bypass (SORIN-Stöckert S5 Perfusion System, Sorin Group USA Inc).
- Blood flow: 400-500mL/min
- Anticoagulation: unfractionated heparin
- CytoSorb adsorber position: post-oxygenator

Measurements

- Postoperative inflammatory response: Procalcitonin (PCT), C-reactive protein, white blood cell count (first three days)
- Hemodynamic state: MAP, CI, SVRI, PVR (four time points in first 24 hours)
- Oxygenation: SvO₂, lactate (four time points in first 24 hours)
- Vasopressor requirements (first 72 hours) and the time of discontinuation
- Cardiac function: ejection fraction, LV, RV, TR, TAPSE (first five days)
- Renal and liver function: creatinine, bilirubin, INR, fibrinogen, AST, ALT (first 72 hours)
- Postoperative complications
- Clinical outcome parameters: time of extubation, length-of-ICU-stay, length-of-hospital-stay, 30-day-mortality
- Immunological outcome: rejection (first four endomyocardial biopsies)

Results

- The cold ischemic time of the donor heart was 288 minutes, the CPB time was 187 minutes.
- Patient required urgent reoperation within four hours after the transplantation due to surgical bleeding.
- The inflammatory response was remarkably mild as observed in the change in PCT, CRP and WBC during the first 72 hours (1.45-0.97-0.52 µg/L; 9.0-75.0-100.0 mg/L; 8.0-13.0-14.8 Gpt/L, respectively).
- There was a marked vasoplegia (SVRI: 1271±228 dyn*s/cm5*m2) during the first 24 hours, however, the vasopressor requirements were only moderate (noradrenaline: 0.11 µg/kg/min and terlipressin 0.9 µg/kg/h on average) to keep mean arterial pressure in the range of 72±5 mmHg. CI (4.0±0.7 L/min/m2) and PVR (1.46±0.46 WU) remained in the normal range.
- While lactate peaked at 6.5 mmol/L within 12 hours and normalized in the next 12 hours (2.5 mmol/L), SvO2 values confirmed sufficient oxygen delivery (72.0±2.6 %) in the first 24 hours.
- Noradrenalin and terlipressin could be reduced by 50% over the next 24 hours (0.05 µg/kg/min and 0.55 µg/kg/h, respectively) and were discontinued by the fourth postoperative day.
- There was no relevant decrease in cardiac function: EF: 62-65%; LV diameter: 44-47mm; RV diameter: 30-40; TAPSE: 7-11mm (min-max) based on the series of echocardiography performed during the first five postoperative days.
- Renal function remained well preserved (creatinine: 116-102-142 µmol/L), however, the biochemical parameters showed a moderate but transient reperfusion injury of the liver: bilirubin: 25-25-20 µmol/L; AST: 156-123-60 U/L; ALT: 92-45-36 U/L; INR: 1.7-1.3-1.3; fibrinogen: 2.1-2.5-3.3.

Patient Follow-Up

- Apart from a transient early cognitive dysfunction which delayed the patient's extubation, we did not observe any severe organ dysfunction or infection in the postoperative period.
- Patient was ready for extubation after 38 hours of mechanical ventilation.
- An uneventful ICU treatment was completed on the ninth postoperative day and the patient was discharged to home relatively fit and well on post-transplant 22th day.
- The first four endomyocardial biopsies performed weekly excluded any grade of rejection.

CONCLUSIONS

- The pre-emptive intraoperative use of CytoSorb® resulted in considerably reduced inflammatory response and vasopressor requirements in contrary to expectations based on perioperative factors.
- Despite the patient's poor preoperative condition, he experienced an uneventful postoperative course, free from any significant organ dysfunction.
- The unexpected ability to rapidly wean the vasopressors due to the stable hemodynamic state facilitated a fast recovery of the patient after heart transplantation.
- Safe and easy application of CytoSorb