New technology for: CRRT, Plasma Exchange and Blood Exchange in Infants

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Background -Aim

Acute kidney injury (AKI) is an independent risk factor for morbidity and mortality in critical ill children. Renal replacement therapy (RRT) is a cornerstone of therapy to correct uremia and fluid overload. Provision of maintenance dialysis to neonatal and infants implicate many challenges: blood flow rate, UF settings and accuracy, catheter size and length, extracorporeal circuit volume, circuit functional survival and the anticoagulation strategy. CRRT is becoming the treatment of choice to support critical pediatric patients with AKI and fluid overload (FO). This therapy is usually performed with machines designed for adults thus necessarily with an over-dimensioned catheter. This is a case of a newborn with severe FO who received CRRT primarly to remove fluid excess

Material and Methods

Patient 3.165 Kg was a 39 gestational week female, born with dystocic delivery and Apgar score 2-5-5(1-5-10m).Patient was immediately intubated and transferred to the pICU with hemorrhagic shock and MOFS due to subgaleal hemorrhage. A total of 18 transfusions of blood product was done during the first 48h. Oligoanuric despite continuous diuretic infusion and the need of fluid intake to preserve the hemodynamic, result in a 63%FO.

CVVH was performed, PRISM2=32, using a double lumen 4FR(2in) catheter placed in the femoral vein. A total of 401 hours of CRRT was done. Mean blood flow was 11±2ml/m and Net UF 20.2± 5.6ml/h. Infusion was setting to maintain the Filtration Fraction<20%.

Hyperbilirubinemia due to hematoma adsorption suggests the need of SPAD. We also perform, 4 plasma exchange (PE) and 2 exchange transfusion (ET) done successfully with our development of these new tecniques on the CARPEDIEM machines. Figure 1

Table of prescription and main parameters

Qb	9-13 ml/min	Treatment Duration	18.1±3.7
Total Net UF	200-500 ml	Net UF max	20 ml/kg/h
Total Infusion	1000-1500 ml	Filtration Fraction	<20% *(HCT 29-37.7)
Dialyzer	D50	Surface	0.075m²
Priming Volume	27 ml	Heparin	5 UI/Kg/h

Blood flow and pressures

Qb	10 ml/min	12 ml/min	13 ml/min
Arterial Pressure (mmHg)	-88±5.7	-129±12.7	-132±8.7
Venous Pressure (mmHg)	93.0±14.8	113±10.3	125.4±8.4

Table. 1 *Flows and Pressures*

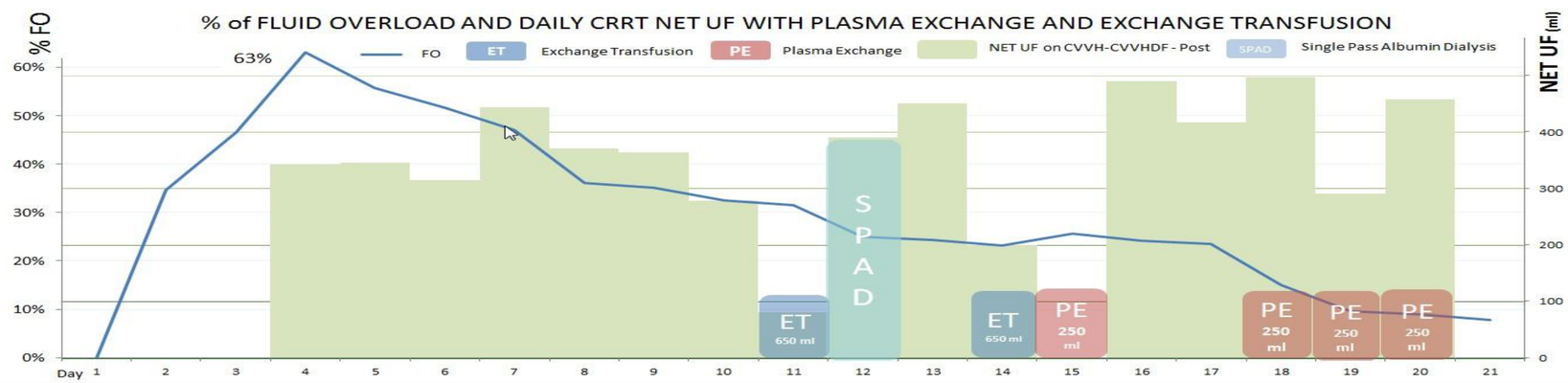

Table. 1 *The Carpediem configurations*

Results

For the first time we were able to use a small and adequate double lumen catheter to perform CRRT in newborn with excellent circuit survival 18.1±3.7.Tab1 shows arterial and venous pressures at different blood flows, during the first phases of the 37 treatments performed.

There was no need of catheter relocation in any of the treatments. In order to maintain patency of the catheter, lumens were flushed and locked (1 hour) with urokinase before each CRRT treatment.

We also were able to perform plasma Exchange settings the Net UF = 0 and Qinf = Net UF = 1 ml/min with blood flow = 12 ml/min. Using 2 pumps at 5 ml/min, scales, and 2 pressure transducers (Figure 1) we perform the Blood Exchange treatment.

Discussion

Nowadays the need for Blood Exchange (BE) are categorized into 4 categories: hyperbilirubinemia, hyperammonemia, to remove bacterial toxin and to correct life-threatening imbalance. Usually the exchange volume is twice the infant blood volume. To minimize pressure changes in the arterial and venous circulatory system blood withdrawn and infused must be done simultaneously during the entire procedure. The procedures described in literature are complex and dangerous due to the manually management of the exchanges. Taking advantage of the precision scale of the machine we perform a safe Blood Exchange avoiding hemodynamic perturbations.

Conclusions

Conclusions: New CRRT,Plasma Exchange, Exanguino Transfusion device is safe and effective to treat newborn with small and adequate catheter.

References

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Keywords: Pediatric, Fluid Overload, CRRT, Blood Exchange, Plasma Exchange.

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