The isovolumetric circuit exchange during CRRT in small children

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Introduction: Continuous renal replacement therapy (CRRT) is the treatment of choice for supporting critically ill pediatric patients. It allows continuous and programmed fluid and toxin removal. However in very small children, at the time of initiation of the therapy, as well as, during multiply circuit exchanges, many life threatening complications may occur like hypotension, cardiac instability and bradykinin release phenomenon.

Circuits exchanges may also lead to blood loss, over- or dehydration which may further negatively influence final patient survival. In small children, the programmed circuit exchange is accompanied by full or partial blood return which may lead to acute overhydration, hypertension, cardiac arrest or pulmonary oedema. Shortly after the following reconnection the situation reverses, and is characterized by acute hypotension, dehydration or hemodilution. It may lead to blood loss and will require more blood transfusion or circuit priming with blood.

The aim: To reduce previously mentioned complications we recommend the isovolumetric circuit exchange protocol, which is of great importance especially in small children on CRRT.

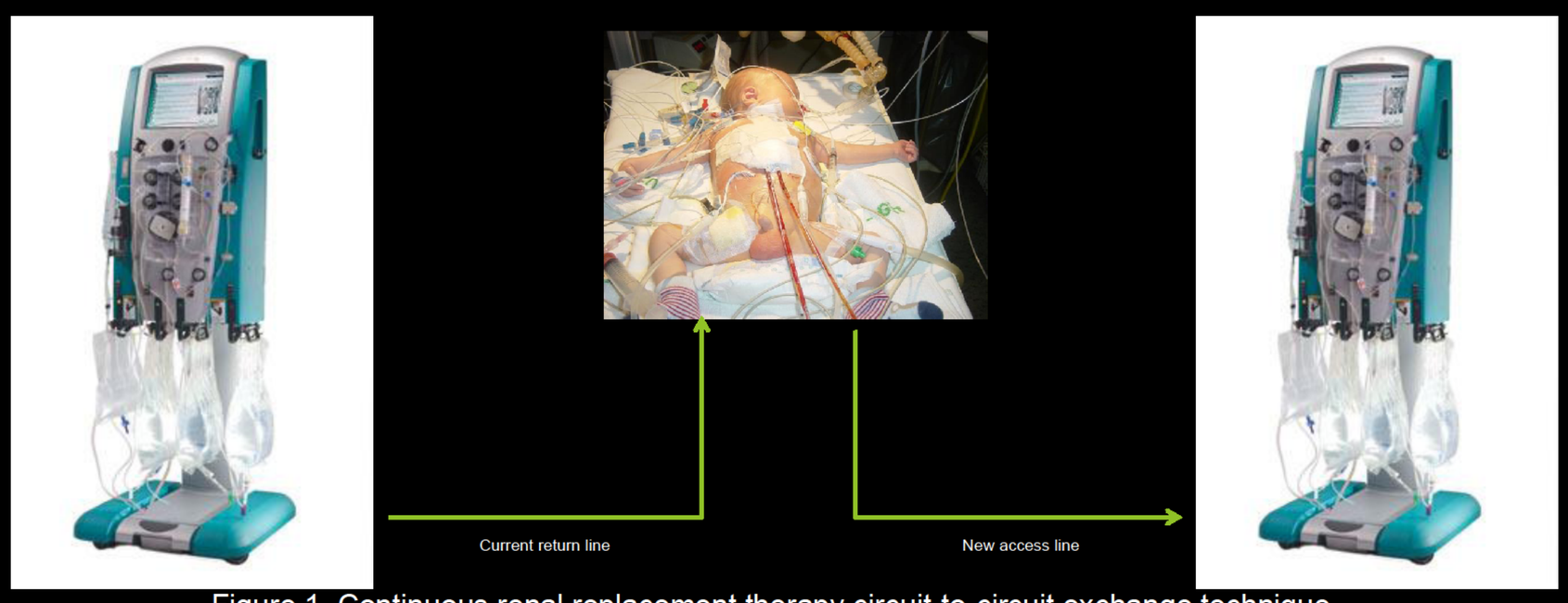

Figure 1. Continuous renal replacement therapy circuit-to-circuit exchange technique.

Materials and methods: The isovolumetric circuit exchanges, which implemented the simultaneous blood return and new circuit refilling (Prismaflex, Gambro), was performed in our Pediatric Dialysis Center in almost 15 children for a total of 40 exchanges.

The patients were from 6 days to 12 months old, with body weights less than 10 kg. In neonates weighing less than 5kg, the two central catheters were used with minimum size 20G for arterial access, and 18G for venous access. In elder patients the double-lumen accesses were used.

The circuit-to-circuit exchange technique was achieved by transferring blood from the patient to a new CRRT system while blood from the current CRRT system was returned to the patient. Both machines are started simultaneously with identical blood flow rates and identical circuit volumes, which results in a isovolumetric exchange.

The data are reported as the mean ± standard deviation (SD). Normally distributed continuous variables were tested using the analysis of variance (ANOVA) with Tukey post-hoc test.

Results: The complete exchange was occurred in several minutes, with the longest duration amounting to 3 minutes, depending on total circuit volume and catheter flow capabilities. The mean arterial pressure (MAP) during circuit-to-circuit exchange are shown in table 1.

There were not any significant changes in MAP values before and after CRRT starting. The heart rate was also stable. No patient required additional dministration of catecholamines. The additional blood transfusion was not needed.

	initial	after circuit exchange starting				
		1 min	3 min	5 min	10 min	15 min
MAP (mmHg)	38±15	37±21	38±19	37±25	40±18	39±16
HR / min	127±56	126±77	127±83	125±45	128±44	127±37

Conclusion:

1. The circuit-to-circuit exchange procedure is very smooth, easy and safe and has no influence of patient cardiac stability and does not require any increase in vasoactive drug dose.

2. This exchange method limits the time the patient is without hemofiltration, prevents the need for additional exposure to donor red blood cells, and reduces hemodynamic instability at the initiation of CRRT.

3. We recommend the isovolumetric circuit exchange protocol as a method of choice in programmed circuit exchange procedure during CRRT in small children.

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