

PAEDIATRICS

CARPEDIEM—continuous renal replacement therapy for infants

A new continuous renal replacement therapy (CRRT) machine designed specifically for small infants—the Cardio-Renal Pediatric Dialysis Emergency Machine (CARPEDIEM)—has been used successfully to treat a 2.9 kg neonate with haemorrhagic shock, multiple organ failure and severe fluid overload. Study author Claudio Ronco and colleagues suggest that use of the CARPEDIEM could change clinical practice for infants with acute kidney injury.

Currently, peritoneal dialysis is the preferred renal replacement therapy for neonates and small infants. However, this approach is not suitable for patients with peritonitis, abdominal masses or bleeding, and solute clearance can be inefficient. “Until now, no renal replacement therapy machine, even adjusted, could be safely and adequately applied to babies who weigh less than 10 kg,” explains Ronco. “The neonate required a dedicated technology and every component of CARPEDIEM had to be designed and developed from scratch.”

CARPEDIEM has miniaturized components including circuits that enable a priming volume of <30 ml and roller pumps that can run continuously at flow rates as low as 5–50 ml/min. Ultrafiltration is finely controlled via precision scales. After *in vitro* laboratory testing, including simulated 24-h treatment sessions, the machine was approved for use in humans.

The first patient to be treated using CARPEDIEM was admitted to the neonatal intensive care unit (ICU) with severe thrombocytopenia, acidosis, hyponatraemia and oliguria. The researchers decided to begin post-dilution continuous venovenous haemofiltration 72 h after her birth. However, the neonate was so fluid overloaded

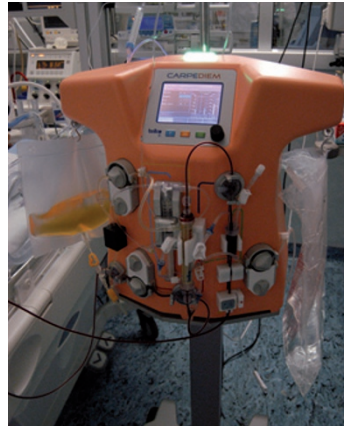


Image courtesy of Claudio Ronco.

that a jugular cannula could not be used as a vascular access. Instead, a 5 cm dual-lumen 22-gauge catheter was placed in her femoral vein. “Adjusted adult machines cannot function with such a small access, but CARPEDIEM worked perfectly with no alarms,” reports Ronco. After >400 h of extracorporeal therapy (haemofiltration, single-pass albumin dialysis, blood exchange and plasma exchange) the 25-day-old patient was in a stable haemodynamic and respiratory condition and the treatment was discontinued. She was discharged from the ICU with mild renal insufficiency at 39 days. The researchers believe that if the CARPEDIEM had not been used the patient would have died.

“This project has been emotionally and professionally rewarding,” says Ronco. “For me it has been like rediscovering why I do medicine.” The researchers hope to use the CARPEDIEM platform to implement a full portfolio of renal replacement therapies for neonates.

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