

The aim of this study was to characterize both the operating conditions and performance of three different central vascular catheters sizes (4F, 5F, and 7F) connected to two different extracorporeal blood circulation models (adult and pediatric)” Garzotto et al (2018).

Abstract:

OBJECTIVES: Renal replacement therapy in infants and small children is the treatment of choice for severe oligoanuric renal dysfunction, with an increasing consensus that early initiation might contribute to preventing acute kidney injury complications. Safer renal replacement therapy devices specifically designed for neonates may contribute to ameliorating outcomes and increasing chances of survival. One of the crucial factors to achieve an effective renal replacement therapy in small infants is adequate vascular access. The interaction of small size central vascular catheters with renal replacement therapy devices has never been investigated. The aim of this study was to characterize both the operating conditions and performance of three different central vascular catheters sizes (4F, 5F, and 7F) connected to two different extracorporeal blood circulation models (adult and pediatric). The rheologic performance of each vascular access size in combination with the adult and pediatric renal replacement therapy models was described.

DESIGN: Series of experimental extracorporeal circulation circuit tests were conducted with different setups. A two-roller pump was used to simulate a standard adult dialysis machine, whereas a small three-roller pump served as pediatric renal replacement therapy device.

SETTING: A pressure-flow setup aimed to collect pressure and flow values under different test conditions. A second experiment focused on hemolysis estimation induced by the extracorporeal system. Hemolysis exclusively induced by the 4F catheter was also evaluated. Finally, our data were applied to estimate the optimal catheter size theoretically capable of delivering adequate doses basing on anthropometric data (patient weight and cannulation site) in absence of direct ultrasound vessel measurement.

SUBJECTS: In vitro tests conducted on simulated extracorporeal circuit models of continuous pediatric and neonatal renal replacement therapy.

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: When 4F and 5F catheters are used, maximal blood flows within safe circuit pressures can be set at the values of 13 and 29 mL/min, respectively, when a small pump is used. Differently, when using adult roller pumps, only maximal flows of 10 and 20 mL/min are reached. However, hemolysis is higher when using a three-roller pump compared with the two-roller. The clinical impact of this increased hemolytic burden is likely not relevant.

CONCLUSIONS: Small size central vascular catheters display optimal rheologic performances in terms of pressures and flows particularly when the renal replacement therapy device is equipped with pumps proportional to central vascular catheters sizes, and even when relatively high blood flows are set. This is achieved at the risk of a higher hemolysis rate.

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Reference:

Garzotto, F., Zaccaria, M., Vidal, E., Ricci, Z., Lorenzin, A., Neri, M., Murer, L., Nalesso, F., Ruggeri, A. and Ronco, C. (2018) Choice of Catheter Size for Infants in Continuous Renal Replacement Therapy: Bigger Is Not Always Better. *Pediatric Critical Care Medicine*. December 7th. .

doi: 10.1097/PCC.0000000000001825.