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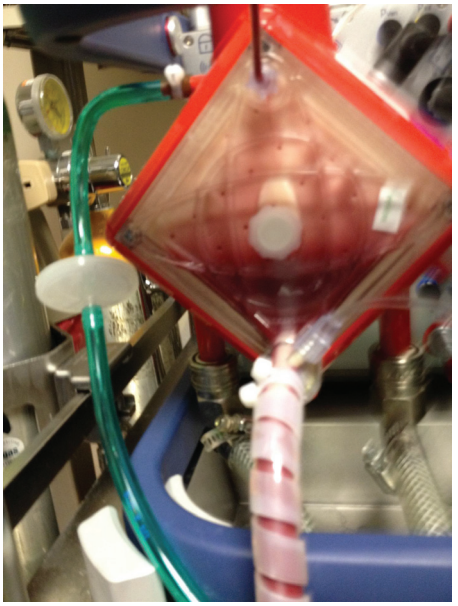
Propofol Use in Patients Supported with Extracorporeal Membrane Oxygenation is Associated with an Increased Risk of Adverse Events.

A. Venado, P. Acosta-Lara, S. C. Bellot, K. Wille, E. Diaz-Guzman. *University of Alabama at Birmingham, Birmingham, AL.*

Study: Sedative agents are commonly used in critically ill patients requiring ECMO support. Sedation practices vary widely and a recent international survey reported that up to 35% of ECMO centers use propofol during ECMO therapy. The purpose of this study is to investigate if the use of propofol is associated with an increased risk of adverse events in patients receiving ECMO.
Methods: Retrospective chart review of all adult patients supported with ECMO at the University of Alabama at Birmingham between January 2013 and December 2013.
Results: A total of 50 patients underwent ECMO during the study period. Demographics were: Age 44.3±16.9 years, Gender (Male 56%), Weight 86.6±27.8 kg, BMI 29.7 ± 9.5. Indications were: Respiratory (n=26), Cardiac (n=18), Bridge to Transplant (n=6). Configuration was: Veno-Venous (VV) 55%, Veno-Arterial (VA) 41%, Other 4%. Mean duration of ECMO was 9.2 ± 9.7 days (Median 7). Propofol was used in the majority of patients (n=40, 80%). Cumulative propofol dose was 19,352±31,046 mg, and mean dose was 14.8±18.8 mcg/kg/min. Patients receiving propofol had higher levels of triglycerides (TG) (645.5 vs. 154.2 mg/dL, p=0.007). Similarly, peak plasma free hemoglobin (PFHb) was higher among patients receiving propofol (303 vs. 166 mg/dL, p=0.09). Five patients that received propofol had triglyceride levels of ≥ 1,000 mg/dL and required multiple oxygenator membrane changes, with three patients requiring plasmapheresis. Propofol use was not associated with increased bleeding complications (p=0.5) or an increased risk of mortality (p=0.3).
Conclusions: Propofol use in patients supported with ECMO is associated with increased levels of TG and PFHb, and may be associated with an increased risk of oxygenator failure.



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Computational Study of Blood Damage Potential in Three Types of Hollow Fiber Membrane Bundles

J. Zhang, J. Ding, B. P. Griffith, Z. J. Wu. *Surgery, University of Maryland School of Medicine, Baltimore, MD.*

Study: Blood damage in hollow fiber membrane based medical devices is still a significant problem, which can affect devices' performance and cause clinical complications. Computational fluid dynamics (CFD) has been used to understand hemodynamics, estimate and help to reduce or eventually eliminate blood trauma in these devices. In this study, blood flow through three representative types of arrays, square, diagonal and random, with the porosity of 0.55, were simulated, and blood damage potential were estimated.
Methods: Computational domains were meshed with Ansys, and Fluent 14.0 was used to solve the flow fields. Interstitial shear stress fields between hollow fibers were derived from the interstitial flow velocity fields; hemolysis and platelet activation were then estimated by solving a set of convection-diffusion-reaction equations with shear stress as a source term.
Results: For simulated flow rates, hemolysis is negligible since the maximum shear stresses in these arrays are well below 150 Pa, which is considered the threshold causing hemolysis. On the other hand, shear induced platelet activation and deposition are essential. Specifically, significant amounts of platelets were activated by shear. Although the diagonal array had higher shear stress than the square array, fewer platelets were activated in the diagonal array than in the square array. Areas with high activated platelet concentration coincide with recirculation areas, which indicated that longer exposure time in recirculation areas caused more shear induced platelet activation. Since flow velocities were low in recirculation areas, more platelet adhesion and aggregation were expected in the square array. In conclusion, exposure time plays an important role in platelet activation in hollow fiber bundles; the square array has the highest blood damage potential.