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Device specific analysis of neonatal aortic outflow cannula jet flows for improved cardiopulmonary bypass hemodynamics PRAHLAD MENON, Carnegie Mellon University, FOTIS SOTIROPOULOS, University of Minnesota, AKIF UNDAR, Penn State Milton S. Hershey Medical Center, KEREM PEKKAN, Carnegie Mellon University — Hemodynamically efficient aortic outflow cannulae can provide high blood volume flow rates at low exit force during extracorporeal circulation in pediatric or neonatal cardiopulmonary bypass repairs. Furthermore, optimal hemolytic aortic insertion configurations can significantly reduce risk of post-surgical neurological complications and developmental defects in the young patient. The methodology and results presented in this study serve as a baseline for design of superior aortic outflow cannulae based on a novel paradigm of characterizing jet-flows at different flow regimes. *In-silico* evaluations of multiple cannula tips were used to delineate baseline hemodynamic performance of the popular pediatric cannula tips in an experimental cuboidal test-rig, using PIV. High resolution CFD jet-flow simulations performed for various cannula tips in the cuboidal test-rig as well as *in-vivo* insertion configurations have suggested the existence of optimal surgically relevant characteristics such as cannula outflow angle and insertion depth for improved hemodynamic performance during surgery. Improved cannula tips were designed with internal flow-control features for decreased blood damage and increased permissible flow rates.

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