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A Computational Fluid Dynamic Study of Blood Flow Within the Coiled Umbilical Arteries DAVID WILKE, The University of Adelaide, JAMES DENIER, The University of Auckland, TRENT MATTNER, YEE KHONG, The University of Adelaide — The umbilical cord is the lifeline of the fetus throughout gestation. In a normal pregnancy it facilitates the supply of oxygen and nutrients from the placenta via a single vein, in addition to the return of deoxygenated blood from the developing embryo or fetus via two umbilical arteries. Despite the major role it plays in the growth of the fetus, pathologies of the umbilical cord are poorly understood. In particular, variations in the cord geometry, which typically forms a helical arrangement, have been correlated with adverse outcomes in pregnancy. Cords exhibiting either abnormally low or high levels of coiling have been associated with pathological results including growth-restriction and fetal demise. Despite this, the methodology currently employed by clinicians to characterize umbilical pathologies can misdiagnose cords and is prone to error. In this talk a computational model of blood flow within rigid three-dimensional structures representative of the umbilical arteries will be presented. This study determined that the current characterization was unable to differentiate between cords which exhibited clinically distinguishable flow properties, including the cord pressure drop, which provides a measure of the loading on the fetal heart.

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