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COMPUTATIONAL FLOW DYNAMICS IN THE PULMONARY TRUNK IN ADULTS WITH REPAIRED TETRALOGY OF FALLOT

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Pulmonary regurgitation is the most common clinically important complication that affects adult patients with repaired tetralogy of Fallot. Without intervention, pulmonary regurgitation can lead to abnormal dilation of the right ventricle, arrhythmias, heart failure and even death. Pulmonary valve replacement is the most common reoperations performed to amend these adverse symptoms [1]. A variety of recommendations exist associated with the optimal timing for this operation [2]. Nevertheless, there is no common consensus on the reliability of these criteria and further studies are needed to help improve the outcome of the operations performed. This work aims to heamodynamically characterize the pulmonary artery on adult patients with congenital heart disease. The altered environment of the pulmonary trunk will be investigated pre- and post- operatively. In this study, we present computational fluid dynamic results in simplified pulmonary artery geometries with the scope to establish a novel metric for pulmonary valve replacement to aid clinicians with surgical planning.

Physiological vessel dimensions and boundary condititons were used to implement simplified models of the pulmonary trunk. Blood flow simulations were performed by solving the incompressible Navier-Stokes equations and local velocities and wall shear stress values were calculated.

In this work, we analyzed the relation between the blood flow, the geometry and the heamodynamic conditions within the pulmonary artery. An increase in the angle of the bifurcation resulted in increased flow separation, demonstrating the effect of the geometrical characteristics on velocity and shear stress developed on the vessel wall. Future studies will involve the reconstruction of 3-D patient specific computational models of the pulmonary artery pre- and post- operative, from CT and MRI image data of adult patients with repaired tetralogy of Fallot, that need or have undergone pulmonary valve replacement.

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REFERENCES

[1] Kogon B.E, et al. (2015). *Seminars in Thoracic and Cardiovascular Surgery*. **27** p5
[2] Geva T. (2011). *Journal of Cardiovascular Magnetic Resonance*. **19**