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A new technique to restore shape and pattern of flow in hypoplastic aortic arch

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Background

There is no agreement about the best method for correcting hypoplastic aortic arch in infancy. Residual abnormalities in shape can cause late complications.

Patients and Methods

We have developed and applied a new method of direct anastomosis of the descending to the ascending aorta to allow for restoration of shape, function and growth. 12 infants undergoing this technique at the age of 61±3months (range 6-28 months) underwent repeat CT 4-15 months after operation.

Pre- and post-operative arch width, height and height to width ratio were recorded for all cases. Computerized shape analysis using an in-house tool (developed in MATLAB) was used for processing the 3D segmented shapes of the aortic arch, and assessing changes in the cross-sectional area at different levels. Computational Fluid Dynamics (CFD) was used to simulate aortic flow propagation and pattern after surgery, using patient specific geometry and flow boundary conditions.

Results

The pre- and post-operative cross-sectional area along the centerline of the aorta and arch was almost normalized, Figure 1.

The pattern of flow during the cardiac cycle with a retrograde helix in the aortic arch, similar to normal, was observed in all cases with peak velocities of 1.1±0.2m/s.

Conclusion

We here describe a new technique, which at least in the short term appears to normalize the size, shape and pattern of flow in the arch. Long term studies are required to establish the value of this technique.
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