FINITE ELEMENT ANALYSIS OF TWO NEW STENT MODELS FOR THE TREATMENT OF AORTA COARCTATION IN CHILDREN

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SUMMARY

Coarctation of the Aorta (CoA) is a congenital heart disease in which stenosis (narrowing) occurs in a section of the aorta vessel. One of the options for treatment is the use of metallic stents. Their use in young children is still challenging due to the child's growth and the need for new stent surgery corrections. One alternative for the metallic stents is the use of bioabsorbable stents, in which their polymeric material will degrade over time and disappear after their implantation. In this type of stent, the geometry design plays an important role: as its material is less stiff than the metallic ones, the geometry has to provide resistance to support the stresses arising from the aorta artery, while having the flexibility to adapt to the complex aorta geometry. Moreover, another important characteristic for this type of stent is its longitudinal shortening, or foreshortening, as it opens to a large-diameter vessel, the aorta. Therefore, this study aims to analyse, via the Finite Element Method (FEM), two new bioabsorbable stent geometries made of PLLA (poly-L-lactide acid) for the treatment of aortic coarctation in children. These geometries were developed by Dante Pazzanese Institute of Cardiology. The geometries were created using CAD software. To assess their performance and to adjust the modelling parameters, the stents alone were initially expanded from 6.75 mm to a maximum external diameter of 15.00 mm. A model of an aorta with coarctation was inserted and the opening was again simulated. Radial displacement, von Mises stress on the artery, and longitudinal shortening for both stent geometries were measured. The von Mises stress was greater in the centre of the stent for both geometries and that the maximum foreshortening ranged from 3.3% to 3.8%. The results obtained in this study are encouraging

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for the next phase of development of new bioabsorbable stents as both structures achieved an optimal opening with a little shortening.