

Appendix:

To calculate average aortic arch curvature we expressed each point R as a function of the arc length s given by $R=x(s)i + y(s)j + z(s)k$, where x, y, and z are the lateral, medial, and longitudinal directions; i, j, and k are unit vectors. Curvature k at each point along the curve was defined by:

$$k = \sqrt{\left(\frac{d^2x}{ds}\right)^2 + \left(\frac{d^2y}{ds}\right)^2 + \left(\frac{d^2z}{ds}\right)^2}$$

and the average curvature AC, an estimate of global aortic arch tortuosity was given by: (n : number of points on the curve):

$$AC = \left(\sum_{j=1}^n |k| \right) / n$$