Rupture of Abdominal Aortic Aneurysms. What Matters Most: Geometry or Blood Pressure?

We read with great interest the article by Truijers et al. concerning the use of wall stress analysis in order to detect patients at high risk for small diameter abdominal aortic aneurysm (AAA) rupture. By using finite element analysis of reconstructed three-dimensional models the authors found that wall stress at maximal systolic blood pressure is significantly higher for ruptured compared to asymptomatic AAAs. At the same time, stress analysis at uniform blood pressure of 120 mmHg resulted in insignificant differences in wall stress between asymptomatic and ruptured small aneurysms.

Although this is an interesting finding, there are some points that need to be addressed. First, computational studies of the normal aorta have already shown that increased systolic blood pressure causes an elevation of peak wall stress. Second, we believe that the role of AAA geometry should not be underestimated even in AAAs with diameters of 5–5.5 cm. Raghavan et al. found that AAA volume appeared to have a stronger correlation with peak wall stress than systolic blood pressure. Other computational studies have well correlated the curvature and torsion of the AAA model with the peak wall stress and the resulting rupture risk. Third, as the authors correctly state AAA rupture could result in the formation of hematoma, thus distorting the original geometry. Therefore, we believe that stress analysis in ruptured AAAs should not be performed post-rupture because the geometry, loading conditions and outer-wall material properties are altered in these conditions. Finally, the authors could have emphasized that a dynamic fluid-structure interaction analysis incorporating the circadian fluctuations of blood pressure could be more realistic with regard to prediction of rupture risk.


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Computed wall stress depends upon the input of both blood pressure data and aneurysm geometry into a material model designed for finite element analysis. Both determinants therefore seem equally