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Local analysis of aneurism rupture using full-field measurements

Aaron Romo[1], *Stéphane Avril[1], Pierre Badel[1], Ambroise Duprey[2] and Jean-Pierre Favre[2]

[1] Center for Biomedical and Healthcare Engineering, Ecole Nationale Supérieure des Mines de Saint-Etienne, CNRS UMR 5307 LGF, Saint-Etienne, France.
[2] Cardiovascular Surgery Service, Hôpital Nord, Saint-Etienne, France

*Corresponding author: avril@emse.fr

Ascending thoracic aortic aneurysms (ATAA) is a relatively common but lethal pathology. Several mechanical tests or approaches can be carried out for characterizing the mechanical behaviour of ATAA but, to our knowledge, none of them has ever analysed the rupture locally. Our objective is to quantify the local stress distribution to detect the causes of rupture initiation in ATAA. A digital image stereo-correlation (DIS-C) system was used to record the deformation fields of 15 ATAA inflated gradually until rupture. Throughout the test, at each material point, the membrane strain and stress tensors were deduced. The stress field was derived by solving the local elastostatic equilibrium equations. It is observed that thinned regions appear early before the rupture as oblique bands. Our results are the first to show the existence of weakened zones in the aneurismal tissue before rupture. Even though these weakened zones have not been observed *in vivo* yet, they represent potentially an indication of the risk of rupture.

Keywords: biomechanics, aneurism, rupture, full-field measurements, material parameter identification.