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Titel des Beitrags: A comparison of diameter, wall stress and rupture potential index for abdominal aortic aneurysm rupture risk prediction
Abstract: An abdominal aortic aneurysm (AAA) is a balloon-like dilation of the aorta, which is potentially fatal in case of rupture. Computational finite element (FE) analysis is a promising approach to a more accurate and patient-specific rupture risk prediction. AAA wall strength and rupture potential index (RPI) calculation are implemented in our FE software. Static structural FE simulations are performed on n = 30 non-ruptured asymptomatic, n = 9 non-ruptured symptomatic, and n = 14 ruptured AAAs. We calculate maximum values for diameter, wall displacement, strain, stress, and RPI as well as minimum wall strength for every AAA. All investigated quantities, except minimum strength, show statistically significant differences between non-ruptured asymptomatic and symptomatic/ruptured AAAs. Maximum wall stress and especially the RPI are notably increased for symptomatic and ruptured AAAs. The biggest difference is found to be the RPI (D = 44.9%, p = 8.0e25). Lowest RPI obtained for symptomatic or ruptured AAAs is RPI of more than 55% of the investigated asymptomatic AAAs falls below this value.
Maximum wall stress and maximum RPI criteria enable a reliable rupture risk evaluation for AAAs. Especially in the diameter range where surgical indication is not obvious, the RPI holds great potential for improvement of clinical decisions.

Stichworte:
abdominal aortic aneurysm, diameter criterion, finite elements, rupture potential index, wall stress.

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