Objectives: The aim of the study was to detect interrelations between mechanical conditions and material properties of abdominal aortic aneurysm (AAA) wall with the underlying local gene expression of destabilising inflammatory, proteolytic, and structural factors. Methods: 51 tissue samples from 31 AAA patients were harvested during open surgery. Gene expression of collagen I and III, inflammatory factors CD45, MSR1, and proteolytic MMP-2, -9, and their inhibitor TIMP-1 were analysed by RT-PCR. Material properties of corresponding AAA tissue samples were assessed by cyclic sinusoidal and destructive testing. Local mechanical conditions of stress and strain were determined by advanced nonlinear finite element analysis (FEA) based on patient specific 3D AAA models derived from preoperative CT data. Results: In the AAA wall, all histological parameters analysed were significantly expressed at mRNA level. With respect to mechanical properties of the aneurysmatic arterial wall, expression of collagen III correlated with the stiffness parameter $\alpha$ ($r=0.348$, $p=0.017$), MMP-2 correlated with the stiffness parameter $\beta$.
and wall strength (r=-0.438 and -0.593; p=0.005 and <0.001). Furthermore, significant relationships were observed between local AAA diameter and the expression of CD45, MSR1, and TIMP-1 (r=0.285, 0.551, 0.328; p<0.05). However, we found no interrelation of local wall stresses and strains with gene expression. Conclusion: Our results show for the first time that gene expressions of destabilizing factors within AAA arterial tissue might be correlated to geometrical and mechanical properties of the AAA wall. However, we found no influence of local mechanical conditions on gene expression of these factors. Therefore, these preliminary results are still ambiguous.

Stichworte: AAA, proteolytic degradation, gene expression, mechanical properties

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