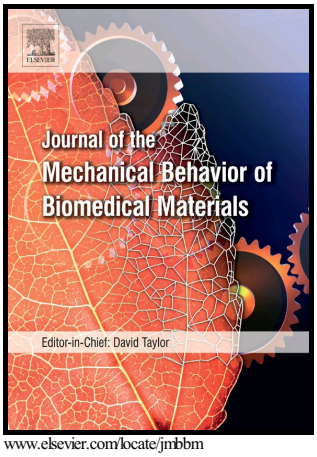
The Impact of Development of Atherosclerosis on Delamination Resistance of the Thoracic Aortic Wall

Marta Kozuń, Magdalena Kobielarz, Agnieszka Chwiłkowska, Celina Pezowicz



www.elsevier.com/locate/jmbbm

PII: S1751-6161(18)30011-0
DOI: https://doi.org/10.1016/j.jmbbm.2018.01.009
Reference: JMBBM2648

To appear in: *Journal of the Mechanical Behavior of Biomedical Materials*

Received date: 26 September 2017
Revised date: 22 December 2017
Accepted date: 9 January 2018

Cite this article as: Marta Kozuń, Magdalena Kobielarz, Agnieszka Chwiłkowska and Celina Pezowicz, The Impact of Development of Atherosclerosis on Delamination Resistance of the Thoracic Aortic Wall, *Journal of the Mechanical Behavior of Biomedical Materials,* https://doi.org/10.1016/j.jmbbm.2018.01.009

The Impact of Development of Atherosclerosis on Delamination Resistance of the Thoracic Aortic Wall

Abbreviated title: The impact of atherosclerosis on human aorta dissection

Marta Kozuń[1]*, Magdalena Kobielarz[1], Agnieszka Chwiłkowska[2], Celina Pezowicz[1]

[1] Wroclaw University of Science and Technology, Faculty of Mechanical Engineering, Department of Biomedical Engineering, Mechatronics and Theory of Mechanism, Lukasiewicza 7/9, 50-371 Wroclaw, Poland, marta.kozun@pwr.edu.pl, magdalena.kobielarz@pwr.edu.pl, celina.pezowicz@pwr.edu.pl

[2] Wroclaw Medical University, Department of Medical Biochemistry, Chalubinskiego 10, 50-368 Wroclaw, Poland, agnieszka.chwilkowska@umed.wroc.pl

*Corresponding author: Marta Kozuń, Wroclaw University of Science and Technology, Department of Biomedical Engineering, Mechatronics and Theory of Mechanism, Lukasiewicza 7/9, 50-371 Wroclaw, Wroclaw, Poland, email: marta.kozun@pwr.edu.pl, phone number: +48713202713, fax number: +48713202713

Abstract:

The aim of this work is to determine the impact of development of atherosclerosis on dissection of the human thoracic aorta on the basis of an analysis of the mechanical properties of the interfaces between its layers.

The research material consisted of 17 pathologically unchanged aortae and 74 blood vessels with atherosclerotic lesions, which were classified according to the histological classification by Stary. The subject of the analysis were the interfaces between the adventitia and the media-intima complex (A-MIC) and between the intima and the media-adventitia complex (I - MAC). The mechanical properties of the above interfaces were determined by the peeling test in the longitudinal and circumferential directions.

The results indicate that development of atherosclerosis reduces vessel wall resistance to delamination. The greatest risk of dissection occurs at stage IV of the disease. In this case, energy values are lower by about 28% for the I-MAC interface and by 39% for the A-MIC interface compared with normal tissues. Lower values of mean force and energy were