

Abnormal Collagen in Abdominal Aortic Aneurysm

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ABSTRACT

Abdominal aortic aneurysm (AAA) is a vascular disease characterized by abnormal dilatation of the infra-renal aorta, which can be fatal when ruptured. AAA involves extensive remodeling of the extracellular matrix (ECM) due to breakdown of elastin and excess deposition of collagen fibrils. Using a combination of atomic force microscopy (AFM) and transmission electron microscopy (TEM), we elucidate how AAA comprises of both normal as well as structurally abnormal collagen fibrils, lacking their characteristic periodic structure. These abnormal collagen fibrils resist platelet adhesion, which can impact the thrombogenicity of the vessel wall. AFM analysis revealed that the surface adhesion of abnormal fibrils is compromised as compared to normal fibrils and elucidated the spatial heterogeneity in tissue modulus. TEM and histological staining further revealed how abnormal collagen fibrils could serve as locales for calcific deposits in AAA tissue. Our investigations suggest that the quality of collagen fibrils can have important functional manifestations in vascular (and other) diseases.

ABOUT THE SPEAKER

Dr. Gunjan Agarwal is a Professor in the Department of Mechanical and Aerospace Engineering at the Ohio State University. She received her PhD in Biophysics from the Tata Institute of Fundamental Research in Mumbai, India and came to the US for her post-doctoral training at the Albert Einstein College of Medicine (Bronx, NY) and at Procter and Gamble Pharmaceuticals (Cincinnati OH). After a brief period as a scientist at the Wright Patterson Air Force Base, she joined the Ohio State University in 2003.

Prof. Agarwal's research interests lie "outside the cell" on extracellular matrix remodeling, with a particular focus on the collagen receptors discoidin domain receptors (DDR). Like integrins DDRs are ubiquitously expressed and are understood to be important for several diseases such as cancers and fibrosis. Dr. Agarwal has been a pioneer in the field of DDRs and her laboratory has yielded seminal work on collagen fibrillogenesis and cell-matrix interactions. Her ongoing research is directed to unravel the causes and consequences of an altered collagen fibril structure with a particular emphasis in age related vascular and bone diseases. In another line of research, she is investigating magnetic behavior of nanoparticles at the microscale level.

Prof Agarwal extensively employs atomic force microscopy (AFM) and other microscopy approaches for her research. She directs a multiuser AFM core facility and is the co-director of the interdisciplinary Biophysics graduate program at the Ohio State University. She has published 4 book chapters and over 60 journal articles in well-reputed journals like Acta Biomaterialia, J. Mol. Biol, Small etc. Her research has been continuously funded by the NSF, NIH and the American Heart Association. Dr. Agarwal has also been recognized for her efforts in diversity and inclusion.



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