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Three Dimensional Quantification of Angiotensin II-Induced Murine Abdominal Aortic Aneurysms Using High Frequency Ultrasound

Amelia R. Adelsperger¹, Hilary D. Schroeder¹, Alexa A. Yrineo¹, Katherine E. Wilson², Evan H. Phillips¹, Fredrick W. Damen¹, A. Nicole Blaize³,
Craig J. Goergen¹

¹Weldon School of Biomedical Engineering, Purdue University

²Department of Biomedical Engineering, University of Arkansas

³Department of Health & Kinesiology, Purdue University

ABSTRACT

Abdominal aortic aneurysms (AAAs), a localized dilation of the vessel wall of 50% or more above normal, claims approximately 14,000 U.S. lives yearly due to aortic rupture. This commonly asymptomatic disease can only be treated by endovascular stent grafts or invasive surgery, usually after the AAA diameter reaches 5 cm. Because these treatment methods carry serious risk, stem cell therapy is being explored in order to provide a low risk option for managing smaller AAAs. To determine if stem cell therapy, once administered, could stabilize or reduce AAA growth, baseline 3D ultrasound measurements in a control group were first needed. High frequency ultrasound was used on apolipoprotein E-deficient (apoE^{-/-}) mice given angiotensin II (AngII) from subcutaneously implanted osmotic mini pumps. This mouse model developed dissecting AAAs, containing a false and true lumen, which were clearly visualized and quantified using 3D ultrasound imaging. With this ultrasound technique, we found that aneurysm diameter, total volume, and false lumen volume all increased steadily over a period of 28 days once AAAs formed. These data suggest our noninvasive, 3D ultrasound technique can be used to monitor the progression of aneurysms that may be delayed once stem cell therapy is administered.

KEYWORDS

abdominal aortic aneurysms, mesenchymal stem cells, high frequency ultrasound, imaging, angiotensin II, dissecting aneurysm

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