



Log in

Register



Home ▶ All Journals ▶ Structural Heart ▶ List of Issues ▶ Volume 5, Issue sup1
▶ Late-stage Calcific Aortic Valve Disease



Structural Heart >

The Journal of the Heart Team

Volume 5, 2021 - Issue sup1: HVS 2021 Abstracts Supplement

2 | 0

Views | CrossRef citations to date | Altmetric

On Demand

Late-stage Calcific Aortic Valve Disease Within an Aortic Valve-on-a-chip Model

Melissa Mendoza, Mei-Hsiu Chen, Bruce Murray, Peter Huang & Gretchen Mahler

Pages 69-70 | Published online: 09 Apr 2021

 Download citation

 <https://doi.org/10.1080/24748706.2021.1900702>

 Check for updates

Sample our  Medicine, Dentistry, Nursing & Allied Health Journals
>> [Sign in here](#) to start your access to the latest two volumes for 14 days

EDITINGSERVICES
Need language editing?  Click for a quote today!

Introducing  

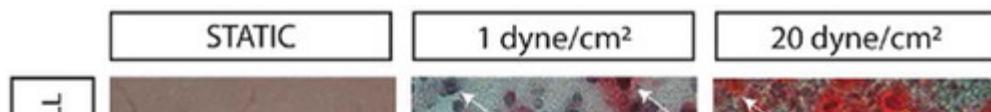
[Citations](#)[Metrics](#)[Reprints & Permissions](#)[Get access](#)

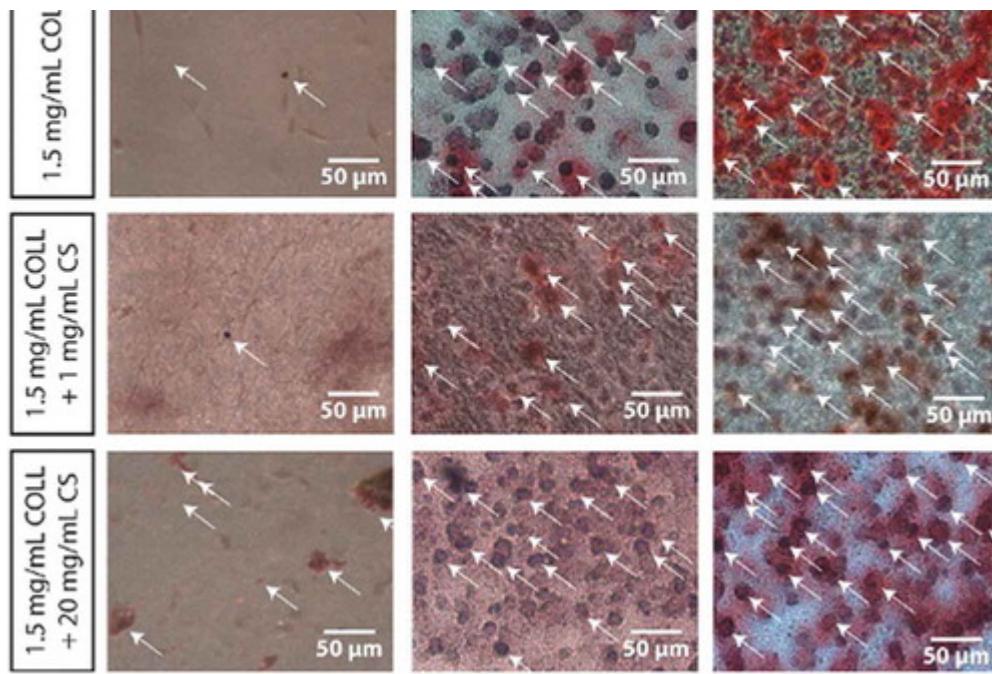
Abstract

Objective: Calcific aortic valve disease (CAVD) is a progressive disease ranging from aortic sclerosis to severe aortic stenosis. Current treatments include total valve replacement and drug interventions tailored to other cardiovascular diseases. In late-stage CAVD, glycosaminoglycans (GAGs), such as chondroitin sulfate (CS), deposit in the fibrosa layer. Here we utilize 3D microfluidic devices to study the effects of shear stress, CS, and endothelial cells on calcification in an aortic valve fibrosa model to understand CAVD progression.

Methods: Valve-on-a-chip devices were fabricated utilizing a wafer mold, soft lithography, and corona discharge. Devices have a flow channel and 3D matrix reservoir of collagen-only healthy controls or with 1mg/mL or 20mg/mL CS. Porcine aortic valve interstitial cells (PAVIC) are embedded within and endothelial cells (PAVEC) seeded onto the matrix. Steady shear stress at 1dyne/cm² and 20dyne/cm² was applied using a peristaltic pump at 37°C and 5%CO₂. Alizarin Red S (ARS) was used to assess calcific nodule formation after 14-day cultures.

Results: PAVIC/PAVEC co-cultures with increasing shear stress and GAGs exhibit increased calcification compared to static controls (Figure 1). Quantitatively, ARS increased as shear stress increased, regardless of GAGs. In the presence of CS, analysis of nodules indicated that nodule size decreased with shear stress, however it increased the total average percent area stained. Valve-on-a-chip models with PAVIC-only show decreased calcium deposition when compared to co-cultures.





[Display full size](#)

Conclusions: *In vitro* calcification increases in the presence of shear stress, PAVEC, and increased concentrations of GAGs. Further studies will identify the chemical composition of nodules and to understand early-CAVD pathophysiology. Given that CAVD has no targeted therapies, the creation of a physiologically-relevant test-bed of the aortic valve will lead to contributions in new therapeutics.

[◀ Previous article](#)

[View issue table of contents](#)

[Next article ▶](#)

Disclosure Statement

The authors do not declare any conflict of interest.



Related research

[People also read](#)

[Recommended articles](#)

[Cited by](#)

Endothelial to Mesenchymal Transformation-derived Activated Fibroblast Behavior in a 3D Culture Environment >

Jonathan Alejandro Bramsen et al.

Structural Heart

Published online: 9 Apr 2021

Information for

Authors

Corporate partners

Editors

Librarians

Societies

Opportunities

Reprints and e-prints

Advertising solutions

Accelerated publication

Corporate access solutions

Open access

Overview

Open journals

Open Select

Dove Medical Press

F1000Research

Keep up to date

Register to receive personalised research and resources
by email



Sign me up



Help and information

Help and contact

Newsroom

All journals

Books

Copyright © 2021 Informa UK Limited [Privacy policy](#) [Cookies](#) [Terms & conditions](#)

[Accessibility](#)

Registered in England & Wales No. 3099067
5 Howick Place | London | SW1P 1WG

Dove Medical Press
www.dovepress.com