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Impaired arterial elastic properties and endothelial glycocalyx in patients with embolic stroke of undetermined source

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Topic(s):
Stroke – Pathophysiology and Mechanisms

Citation:

Background and Purpose: Cardioembolism is a postulated mechanism of embolic stroke of undetermined source (ESUS). We investigated endothelial glycocalyx, aortic elastic properties, oxidative stress, and their association left atrial (LA) function in ESUS and healthy individuals.

Methods: In 90 ESUS patients (age 50.4±13.2) and 90 controls with similar risk factors, we measured: a) perfused boundary region (PBR) of the sublingual arterial microvessels (range 5-25 micrometers), a marker inversely related with glycocalyx thickness, b) pulse wave velocity (PWV), central systolic blood pressure (cSBP) and augmentation index (AIx), c) LA volume and strain using speckle-tracking imaging, d) Malondialdehyde (MDA) and protein carbonyls (PC), as oxidative stress markers.

Results: Compared to controls, ESUS had higher PWV, PBR MDA, and PC levels as well as higher LA volume and reduced reservoir LA strain (p<0.05). PBR>1.18 µm of microvessel ranging from 5-9µm and PWV>10.2m/s were associated with ESUS on multivariable analysis (odds ratio: 2.374 and 5.429, p<0.05 respectively) and increased the c-statistic of the initial model from 0.54 to 0.71. In ESUS, glycocalyx damage (increased PBR) was related with increased PWV (p<0.01) which was linked with LA reservoir strain after controlling for age, sex, and risk factors [p=0.03]. Increased MDA and PC were related with glycocalyx damage, increased PWV (r=0.67 and r=0.52) AIx, central SBP and aortic atheroma (p<0.01).

Conclusions: Arterial function and endothelial glycocalyx are severely impaired in ESUS and are linked to LA dysfunction suggesting their contribution to ESUS pathogenesis.
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Figure 1: Predictive models for the presence of ESUS. The blue line indicates the area under the curve AUC of the multivariable model including sex, age, smoking, hyperlipidemia, hypertension, diabetes and medications by logistic regression analysis (c-statistic: 0.54). The red line indicates the model’s predictive accuracy after including PBR >1.2µm and PWV>10.2 m/sec, in the previous multivariable model by logistic regression analysis (c-statistic: 0.71 p for change=0.007).