Peripheral Vascular Measures May Not Reflect Blood-Brain Barrier Integrity

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Background

- The blood-brain barrier (BBB) is a selective layer that surrounds the blood vessels inside the brain, consisting mainly of endothelial cells, pericytes, and astrocytes
- Damage to the BBB correlates with neurological disorders, including Alzheimer's disease (AD)
- As part of the vascular system, impaired BBB health may correlate with arteriole stiffness
- Increased arterial stiffness, as indicated by higher PWV value, is associated with white matter hyperintensities and lacunar infarctions
- There is a possible connection between vascular dysfunction and brain health that is potentially mediated by BBB integrity.
- Additionally, racial disparities exist in vascular health and AD risk, with Black adults showing higher arterial stiffness and AD prevalence but lower levels of CSF tau and biomarkers of BBB damage

Purpose

- The purpose of the study is to assess the relationship between blood-brain barrier damage and arterial stiffness as well as how this correlation varies across racial groups

Methods

- Cross-sectional analysis explored the relationship between brain pericyte damage and systemic arterial stiffness
- Soluble platelet-derived growth factor receptor β (sPDGFRβ) concentration in the cerebrospinal fluid (CSF) was used as a biomarker for pericyte damage, and pulse wave velocity was used to measure arterial stiffness
- Participants included 43 Black Americans and 43 non-Hispanic White healthy adults (45-80 yrs). CSF and cardiovascular measurements were collected as part of the E2 study.

Results

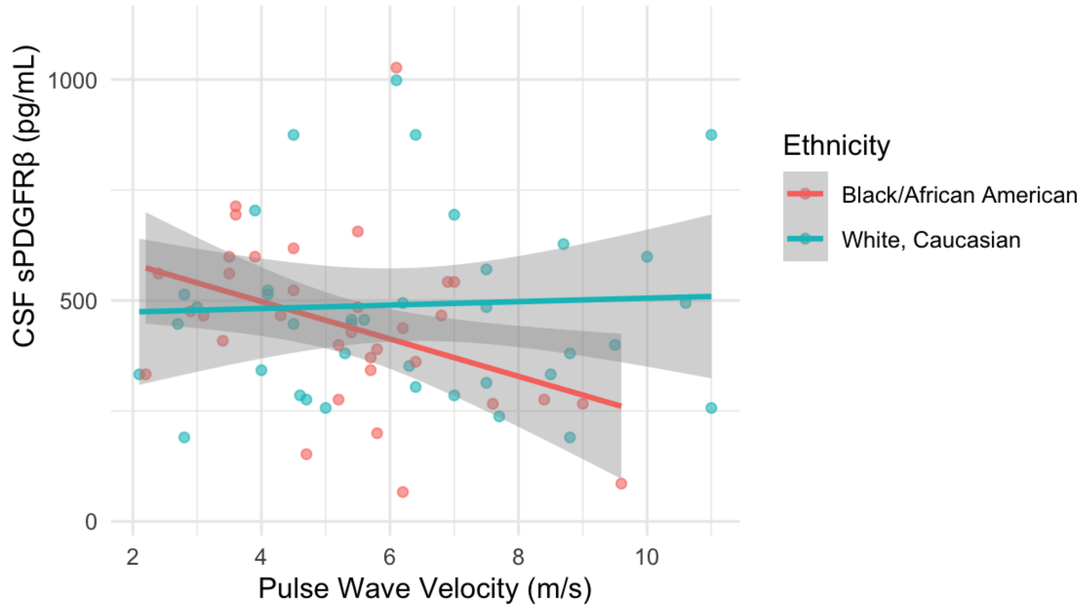

Figure 1. Relationship between PWV and sPDGFRβ by race, with linear regression model visualized.

Associations Between PWV and sPDGFRβ

Characteristic	Beta	Std. Error	Std. Beta	p-value
Ethnicity				
African American	-44	21.8	-0.425	0.0475*
PWV*Ethnicity				
PWV: White	43.2	27.0	0.337	0.115
Age	2.34	3.46	0.087	0.502
Gender				
Male	26	63.1	0.049	0.682

R-squared = 0.074 Adj. R-squared = 0.005

Table 1. Relationship between PWV and sPDGFRβ by race. Arterial stiffness is negatively associated with sPDGFRβ in African American but not non-Hispanic White participants.

- CSF sPDGFRβ concentrations were significantly lower in AAs compared to NHWs
- sPDGFRβ levels were negatively associated with PWV in AAs ($p = 0.0475$; $\beta = -0.425$) but not NHW participants ($p = 0.115$; $\beta = -0.337$) with moderate effect sizes
- Age and gender are not significant covariates ($p = 0.502$ and $p = 0.682$)

Demographics

Demographics, Vascular Measures, and CSF Biomarker Summary

	African American	Non-Hispanic White
Characteristic	N = 43	N = 43
Age	64 (8)	64 (9)
Gender		
female	33	34
male	10	9
PWV (m/s)	5.3 (1.81)	6.23 (2.41)
Systolic BP (mm Hg)	140 (19)	138 (17)
Diastolic BP (mm Hg)	83 (10)	79 (10)
CSF sPDGFRβ (ng/mL)	410 (192)	513 (264)

Mean (SD)

Discussion

- Although a relationship between BBB integrity and arterial stiffness may exist, systemic vascular measures may not correlate with BBB function in the way we hypothesized
- For cognitively normal, middle-aged participants, a positive correlation between BBB damage and arterial stiffness was not observed for either NHWs or Aas
- However, there may be a negative association between CSF sPDGFRβ and PWV values in AA participants
- Peripheral vascular health should not be assumed to infer BBB health, particularly for AAs; higher AD incidence in AAs may not be simply attributed to systemic vascular health

Funding

- This study was supported by NIH grant number R01AG0662034. I would like to thank Dr. Wharton, Dr. Butts, Dr. Verble, and Jordan Pelkmans for their support.