

Low shear stress at baseline is associated with aortic expansion and AAA-related events

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No conflicts of interest



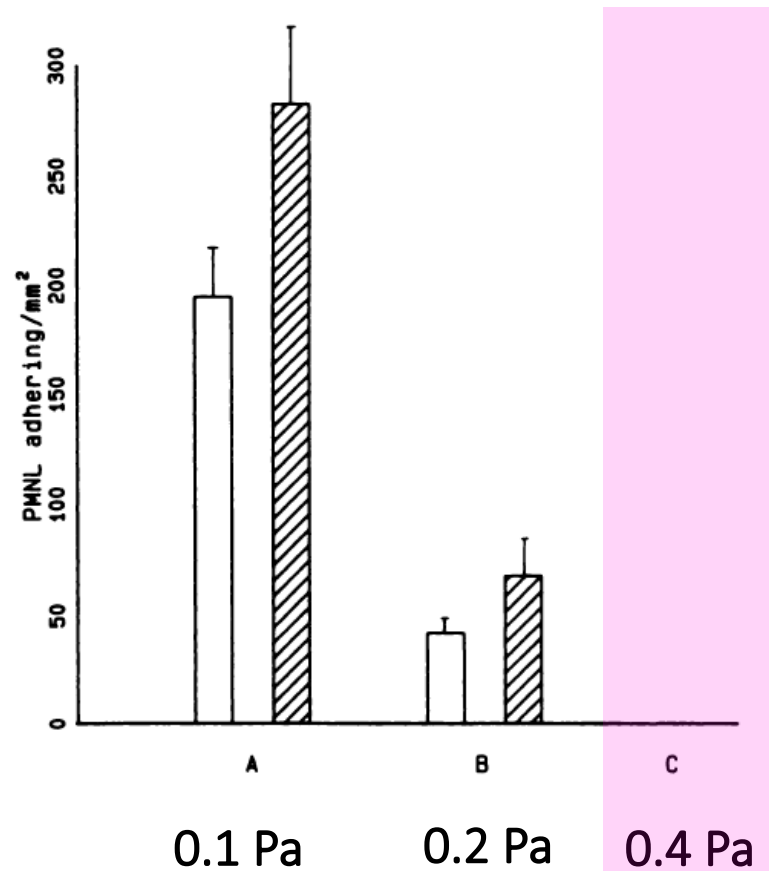
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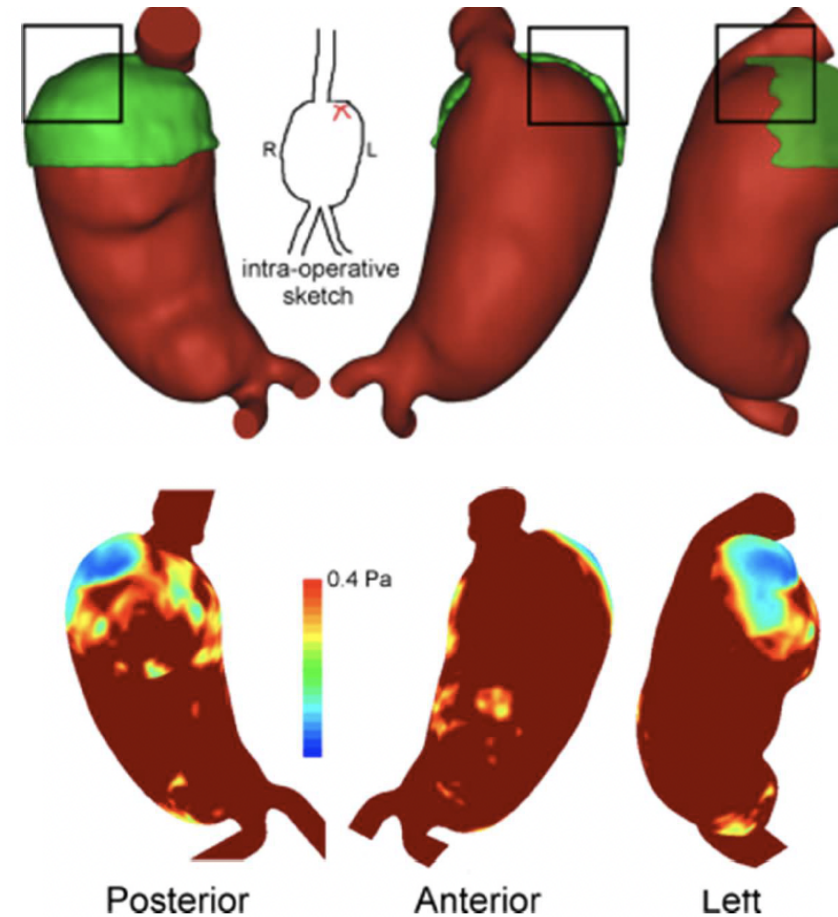


Background: low shear, inflammation and rupture

Leukocytes do not adhere to the endothelium at shear stress > 0.4 Pa



Lawrence et al. Blood 1987;70:1284-90



AAAs expand & rupture in regions of low shear stress

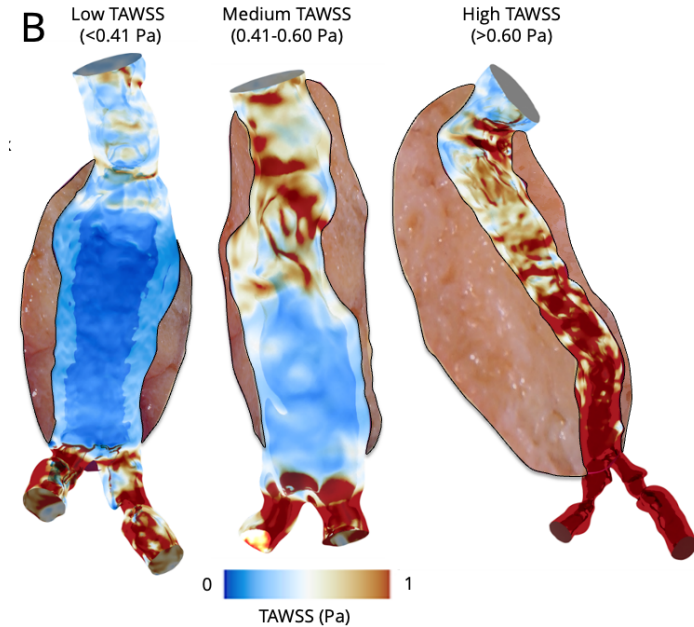
Boyd et al. JVS 2015;63:1613-9

Hypothesis: low shear stress at baseline is associated with aortic expansion and AAA-related events

Aim: assess relationship between low shear stress and outcomes in patients from the MA³RS Study

Methods

- Cohort of 295 patients
- Baseline routine CTA used for 3D reconstructions and Computational Fluid Dynamic simulation
- Association between estimated shear stress and AAA expansion and outcomes assessed
- Statistical analyses based on tertiles of TAWSS and adjusted for age, sex, diameter, BP and smoking.



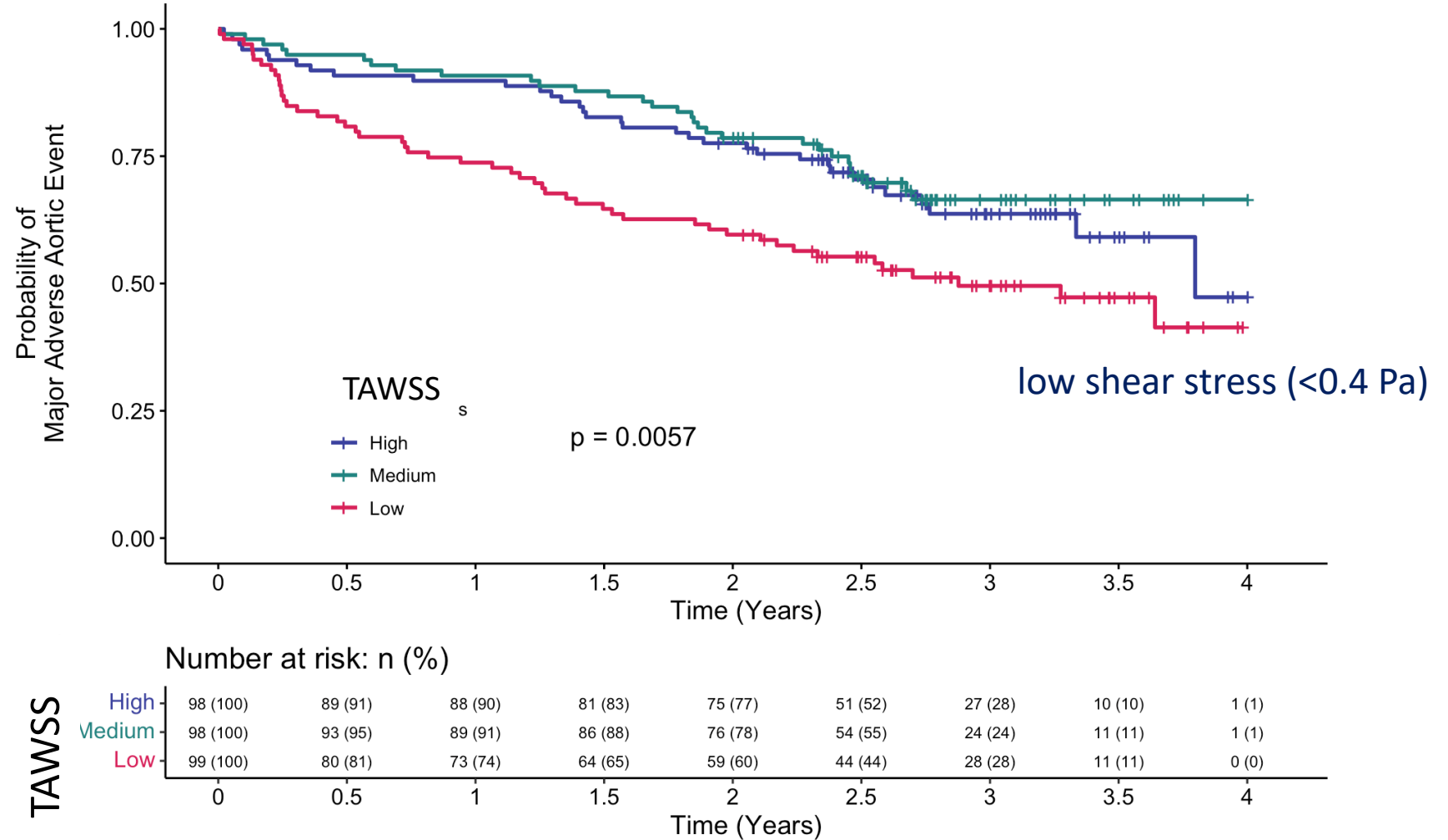
Shear stress and expansion

	All cases (n=295)	Tertile 1 low TAWSS (n=99)	Tertile 2 medium TAWSS (n=98)	Tertile 3 high TAWSS (n=98)	<i>P</i> value
Median (IQR)					
AAA diameter mm	49 (44–53)	50 (48–54)	47 (44–51)	46 (42–51)	<0.001
Expansion mm/y	2.5 (1.0–4.0)	2.9 (1.9–4.9)	2.5 (01.0–3.8)	2.4 (1.0–3.9)	0.06

Low shear stress was associated with aortic expansion
Linear regression $\beta=+0.28$ mm/y (95% CI 0.02–0.53) $P=0.04$

Cases with low shear stress at baseline are more likely to have a future AAA-related event

AAA events:
13 ruptures
102 elective repairs



Low shear stress is independently associated with AAA-related events

	HR (95%CI)
Shear stress: High (tertile 3)	1.00
Medium (tertile 2)	0.76 (0.46-1.26)
Low (tertile 1)	1.63 (1.03-2.56)
Baseline aortic diameter (per 5 mm)	1.53 (1.37-1.71)
Diastolic blood pressure (per 5 mm Hg)	1.13 (1.04-1.24)

Summary

- AAAs with low shear stress (<0.4 Pa):
 - expand faster than those with higher shear stress
 - are more likely to go on to need repair or rupture
- Limitations:
 - CFD assumptions (aortic compliance and material properties, patient-specific flow data)
 - Not enough ruptures to assess independently
 - Aortic diameter remains a dominant confounder

Thanks to all the co-authors



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Age-standardised rates of AAA in Australia

