The anatomical differences in the aorta in men and women & associated complications.



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I have the following potential conflicts of interest to report :

Consulting – Medtronic, Gore

Grant funding – Medtronic, Gore

Imperial College London: Institutional level funding from Orzone



RESEARCH TEAM



Anna Pouncey



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And the brilliant students....Alharahsheh B, Khan A



Women Greater Risk of 30-Day Mortality for Elective AAA Repair



Meta-Analysis: 26 studies - 371,215 men, 65,465 women, little heterogeneity

Pouncey AL, David M, Morris RI, Ulug P, Martin G, Bicknell C, Powell JT. Editor's Choice - Systematic Review and Meta-Analysis of Sex Specific Differences in Adverse Events After Open and Endovascular Intact Abdominal Aortic Aneurysm Repair: Consistently Worse Outcomes for Women. Eur J Vasc Endovasc Surg. 2021 Sep;62(3):367-378. Key characteristics differ in women:

- Neck length <15 mm
 - 47% of men

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- 63% of women.
- Neck angulation exceeding 60 degrees
 - 12% of men
 - 26% of women.

Women are significantly less likely to meet device IFU criterion for EVAR even after adjustment for age, AAA size



The influence of gender and aortic aneurysm size on eligibility for endovascular abdominal aortic aneurysm repair Sweet et al J Vasc Surg 2011;54:931-7 Key characteristics differ in women:

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ILIAC ARTERY CHARACTERISTICS

N= 144 2:1 matched M:F

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Access Vessel Size and Tortuosity

 Females were significantly smaller across all measures access vasculature (P<0.001) and were more likely to have less tortuous access vessels but more tortuous AAAs



Figure 5. Box-and whisker plots illustrating sex-specific differences in vessel tortuosity



Figure 6. Box-and whisker plots illustrating sex-specific differences in lower-limb vessels

Male Female

EIA

Male Female

CFA

Male

e Female CIA

N= 144 2:1 matched M:F

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Extent of Access Vessel Disease

- Higher proportion of females with TASC II disease severity, significantly more diseased EIA's
- Most common amongst both sexes were bulky calcifications, no significant differences in length or circumference of calcification



TASC II Grade

Figure 6. TransAtlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II) aortoiliac



Figure 7. Box-and whisker plots illustrating sex-specific differences in calcification of access vasculature

ILIAC ARTERY CHARACTERISTICS



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AAA Morphology

- Females were significantly smaller across all measures of AAA-morphology (P< 0.05)
- Females had more Irregular and fissured AAA thrombi (14.6% vs 4.2%, (P= 0.019)
- Higher % of females with larger thrombi (>50% of AAA area)
- Females were more likely to have anterolateral and circumferential AAA thrombi (P < 0.05)



Figure 8. Box-and whisker plots illustrating sex-specific differences in AAA morphology

CONSEQUENCES OF ANATOMICAL DIFFERNCES

Increased type 1 endoleak rate and access complication

Less female patients are treated with standard EVAR and more turned down

Rupture rate higher in women

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Differing patterns of haemodynamic strain that may translate into higher rupture risk at smaller diameter VQI initiative data shows women undergoing EVAR:

- More likely to undergo aortic extensions (21.9% vs 16.0%)
- More likely to receive higher contrast volume.
- Had a 2-fold increased odds of developing type 1 endoleak.

Locham S, Shaaban A, Wang L, Bandyk D, Schermerhorn M, Malas MB. Impact of Gender on Outcomes Following Abdominal Aortic Aneurysm Repair. Vasc Endovascular Surg. 2019 Nov;53(8):636-643.

CONSEQUENCES OF ANATOMICAL DIFFERNCES



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cey AL, David M, Morris RI, Ulug P, Martin G, Bicknell C, anaiysis Sex Spe Repair: Consistently Worse Adverse Outcomes Events Powell JT. Editor's Choice After Open and for Women. Eur J Endovascular Systematic Review Endovasc Surg. Intact

More in women →

← More in men

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Differing patterns of haemodynamic strain that may translate into higher rupture risk at smaller diameter

- Women lose eligibility for EVAR at smaller diameters
- Greater proportion higher-risk open surgery or no repair at all.



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Brown LC, Powell JT. Risk factors for aneurysm rupture in patients kept under ultrasound surveillance. UK Small Aneurysm Trial Participants. Ann Surg. 1999 Sep;230(3):289-96





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Differing patterns of haemodynamic strain that may translate into higher rupture risk at smaller diameter





Turn down rate for EVAR, EVAR related complications and perhaps mortality during EVAR may be addressed by graft design:

- Smaller profiles, but we need to be more intelligent than "smaller"
- Tortuous so more conformable

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- More diseased so more intelligent access options
- Angulated so accurately placed
- "Fragile" thrombus so pre-op statin/aspirin and less traumatic devices
- Presenting as rupture and symptomatic so off the shelf
- More complications so adjuncts to treat these
- ?Repair women at a smaller size?



DEVICE DESIGN AND ADJUNCTS

Hostile Neck EVAR Technology





Increased Risk For Women Has Not Reduced With Time



Association between log odds of 30day/in-hospital mortality for women & mid-point of study



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REDUCING INEQUALITY IN AAA

Abdominal Aortic Aneurysm Repair Future needs

- Device design
- Design gender specific pathways for repair, understanding how best prepare women for surgery
- Perhaps EVAR for women at a smaller size
 - rupture at a smaller size
 - unsuitable for EVAR at a lower size,
 - have a 6% mortality for open repair