



# Can We Predict Aortic Size PRIOR To Dissection? Yes!

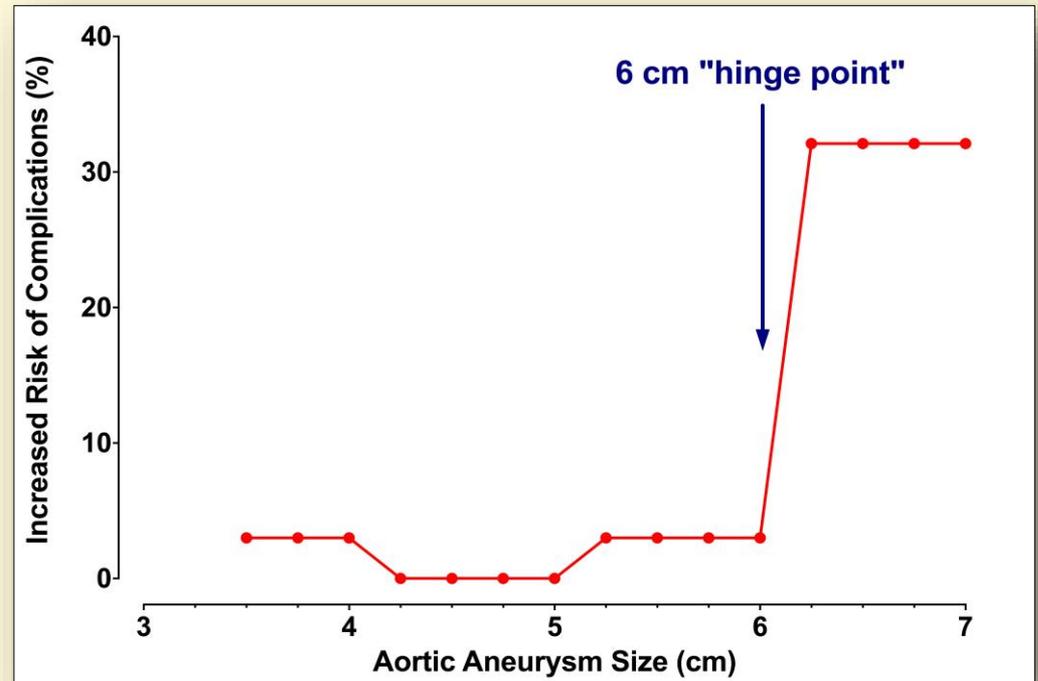
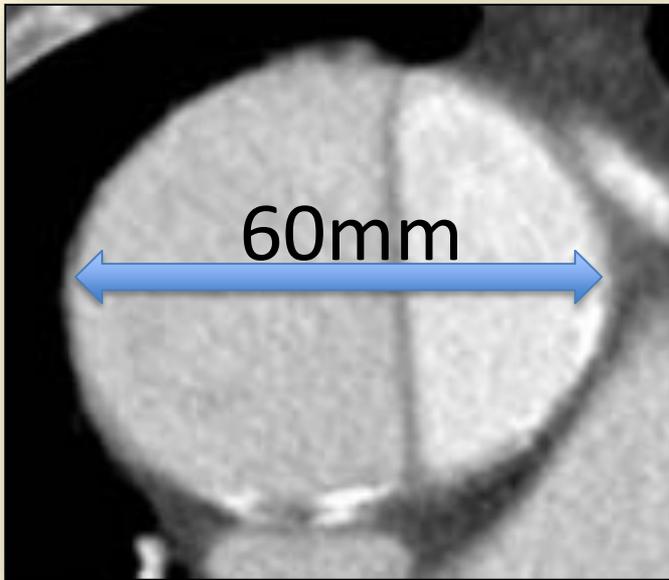
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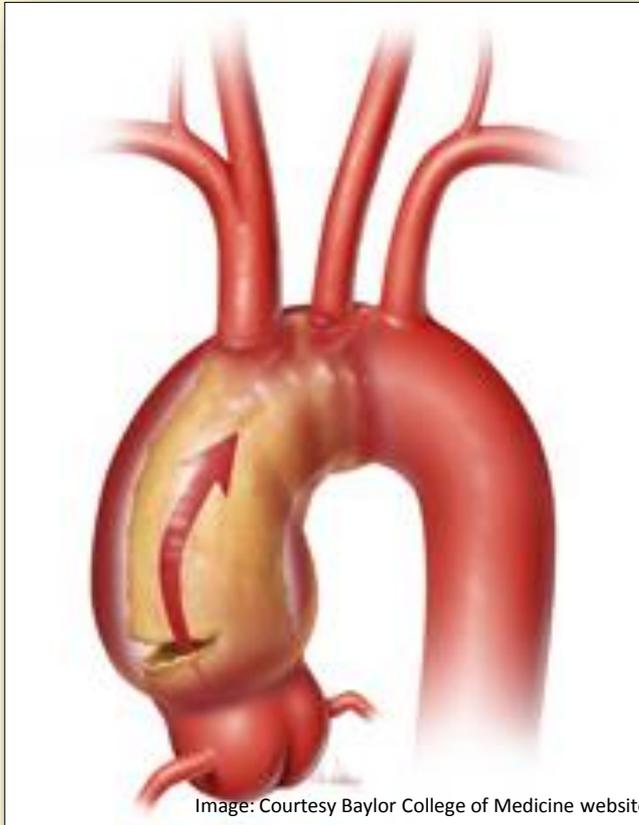
*Presented at the 5th International Meeting on Aortic Diseases  
Liège, Belgium*

*September 16<sup>th</sup>, 2016*

# What is the Basis of Current Criteria?

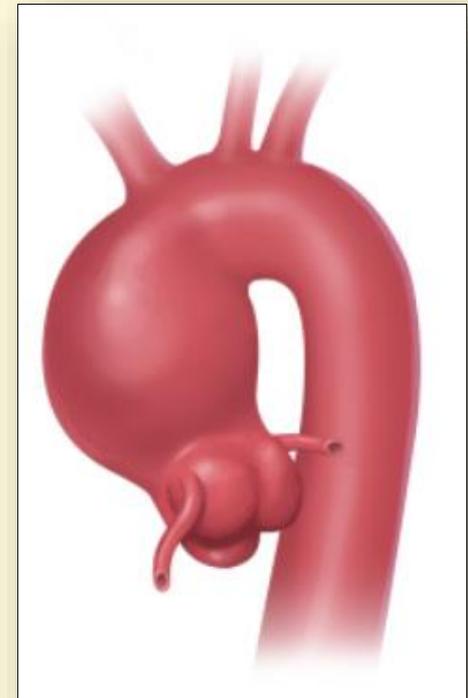


# What is the Basis of Current Criteria?



**Type A Dissection**

WHAT WAS THE  
AORTIC SIZE  
BEFORE  
DISSECTION?



**Ascending Aortic Aneurysm**

# The Issue: Are we using the correct criteria for surgery for TAA?

- Size criteria for intervention for TAA (~ 5 cm) are based on observed aortic size *at the time of dissection*.
- But, *dissection acutely changes the size of the aorta*.
- Can we determine what the size of the aorta was *before aortic dissection*?
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- ① Take advantage of *chance patients* who have had CT *shortly before suffering aortic dissection*.
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# Current Literature

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## Diseases of the Aorta

### How Does the Ascending Aorta Geometry Change When It Dissects?



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<b>Objectives</b>	The purpose of this study is to delineate changes in aortic geometry and diameter due to dissection.
<b>Background</b>	Aortic diameter is the major criterion for elective ascending aortic replacement for dilated ascending aortas to prevent aortic dissection. However, recommendations are made on the basis of clinical experience and observation of diameters of previously dissected aortas.
<b>Methods</b>	Six tertiary centers on 2 continents reviewed their acute aortic dissection type A databases, which contained 1,821 patients. Included were all non-Marfan patients with nonbicuspid aortic valves who had undergone computed tomography angiography <2 years before and within 12 h after aortic dissection onset. Aortic geometry before and after dissection onset were compared.
<b>Results</b>	Altogether, 63 patients were included (27 spontaneous and 36 retrograde dissections, median age 68 [57; 77] years; 54% were men). In all but 1 patient, maximum ascending aortic diameter was <55 mm before aortic dissection onset. The largest increase in diameter and volume induced by the dissection were observed in the ascending aorta (40.1 [36.6; 45.3] mm vs. 52.9 [46.1; 58.6] mm, +12.8 mm; $p < 0.001$ ; 124.0 [90.8; 162.5] cm <sup>3</sup> vs. 171.0 [147.0; 197.0] cm <sup>3</sup> , +47 cm <sup>3</sup> ; $p < 0.001$ ). Mean aortic arch diameter increased from 39.8 (30.5; 42.6) mm to 46.4 (42.0; 51.6) mm (+6.6 mm; $p < 0.001$ ) and descending thoracic aorta diameter from 31.2 (27.0; 33.3) mm to 34.9 (30.9; 39.5) mm (+3.7 mm; $p < 0.001$ ). Changes in thoracic aorta geometry were similar for spontaneous and retrograde etiology.
<b>Conclusions</b>	Geometry of the thoracic aorta is affected by aortic dissection, leading to an increase in diameter that is most pronounced in the ascending aorta. Both spontaneous and retrograde dissection result in similar aortic geometry changes. (J Am Coll Cardiol 2014;63:1311-9) © 2014 by the American College of Cardiology Foundation

-**ONLY 1 Study** currently available  
(published April 8<sup>th</sup>, 2014)

-Multicenter (6 centers)

-Included pts who had aortic  
imaging before dissection and  
at the time of dissection

-Sample Size=63

-Showed mean increase of  
+12.8mm (+32%) in ascending  
aorta

# 1. (Incidental) Prior CT Scan Analysis

- Between 1991 and 2015, consecutive patients admitted with the **acute aortic dissection** were retrospectively reviewed (n=423)
- Dissection patients (AD) were **included** if there was **(1)** at least ONE aortic measurement by CT/MR/ECHO **at dissection** (n=231) AND **(2)** at least ONE measurement **before dissection** (n=55).



## 2. Regression Model

**Regression Model** to isolate the true impact of dissection on aortic size.



$$\text{Diameter}_t = \alpha_0 + \alpha_1(\text{Dissection}) + \alpha_2(\text{Diameter}_{t-1}) + \alpha_3(\text{Time}) + \alpha_4(\text{Age}) + \alpha_5(\text{Gender})$$

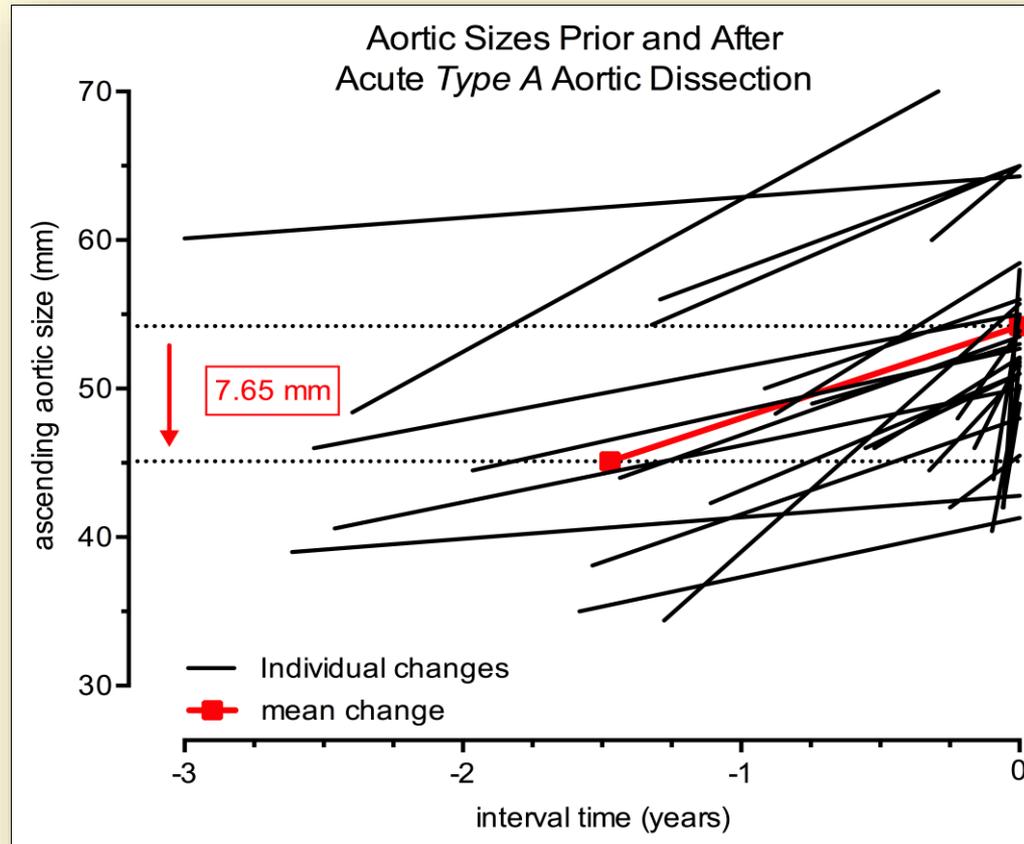
**Coefficient  $\alpha_1$**  provides an estimate of the **additional increase in aortic size** for the **dissector study group** relative to the TAA control group

# Results – Regression Model

Measure	Coefficient	Ascending aorta	Descending aorta
Constant	$\alpha_0$	-0.63 ( $p = .06$ ; 95%-CI:-2.26-2.14)	-2.32 ( $p < .02$ ; 95%-CI:-4.15-0.48)
Dissection	$\alpha_1$	7.65 ( $p < .001$ ; 95%-CI:5.91-9.40)	6.38 ( $p < .001$ ; 95%-CI:4.74-8.01)
Diameter <sub>t-1</sub>	$\alpha_2$	1.02 ( $p < .001$ ; 95%-CI:0.97-1.07)	1.04 ( $p < .001$ ; 95%-CI:1.01-1.08)
Time	$\alpha_3$	0.002 ( $p < .001$ ; 95%-CI:0.001-0.003)	0.002 ( $p < .001$ ; 95%-CI:0.001-0.004)
Age	$\alpha_4$	-0.006 ( $p = .56$ ; 95%-CI:-0.027-0.149)	0.001 ( $p = .90$ ; 95%-CI:-0.016-0.018)
Gender	$\alpha_5$	-0.34 ( $p = .86$ ; 95%-CI:-1.11-0.44)	0.28 ( $p = .37$ ; 95%-CI:-0.33-0.88)

Multivariate analysis reveals that only  $\alpha_1$  (onset of **acute aortic dissection**) **influences** the ultimate diameter--very **powerfully**.

# Results – Type A Dissections

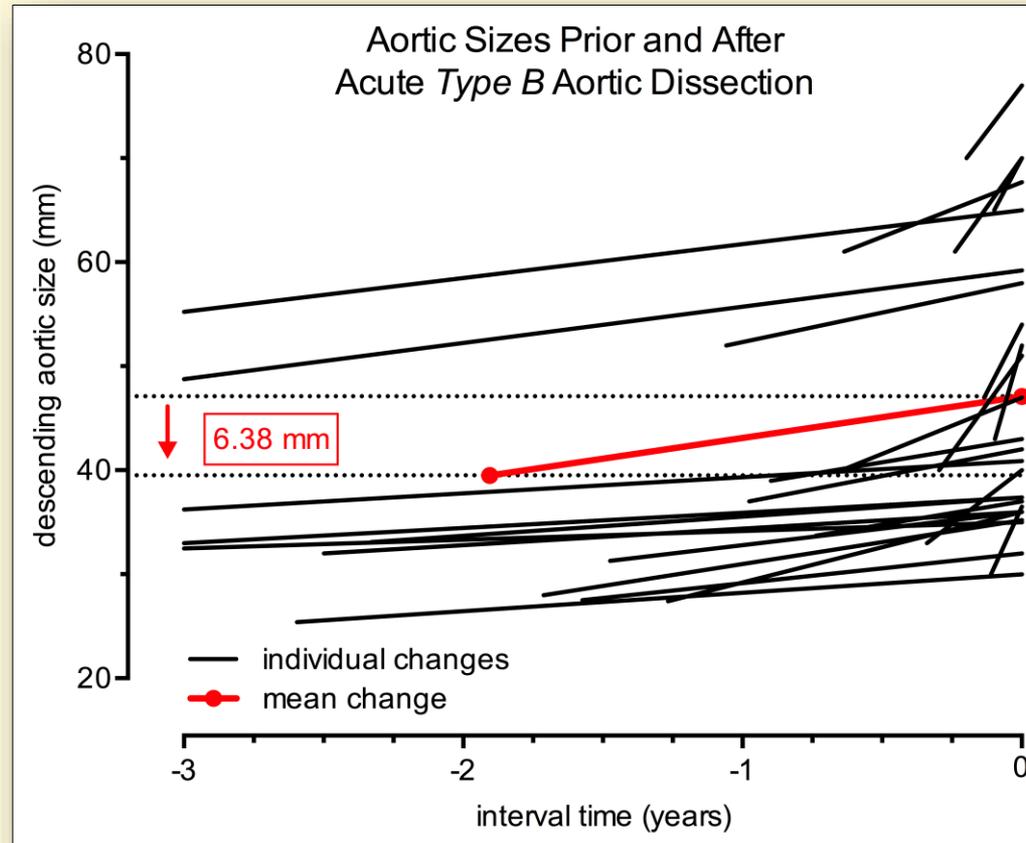


- Mean diameter at dissection :  $54.2 \pm 7.0$  mm
- Mean diameter prior to dissection :  $45.1 \pm 5.7$  mm  

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 $= 9.1\text{mm (+20.2\%)}$
- $\Delta$  size consequent to dissection (from regression model) :  $7.65$  mm (+17.0%) 15

# Results – Type B Dissections

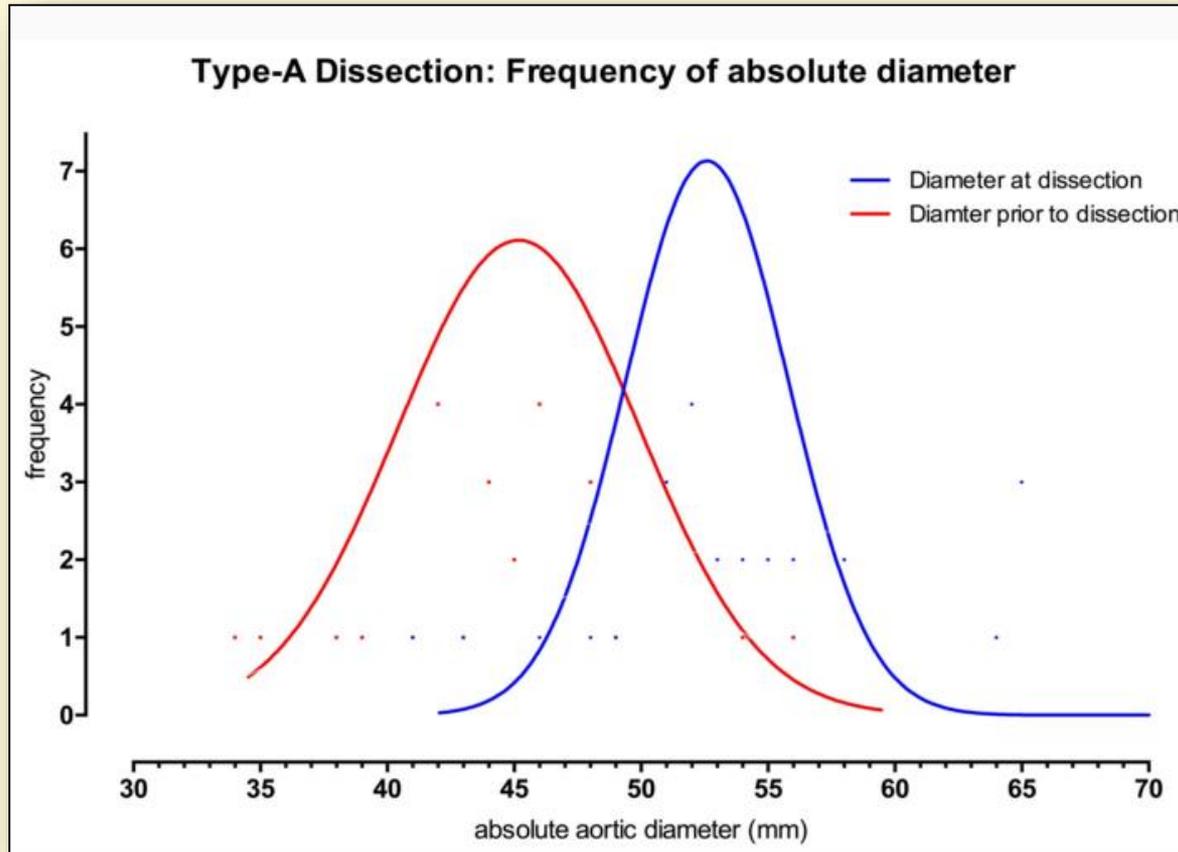


- Mean diameter at dissection :  $47.1 \pm 13.8$  mm
- Mean diameter prior to dissection :  $39.5 \pm 13.1$  mm  


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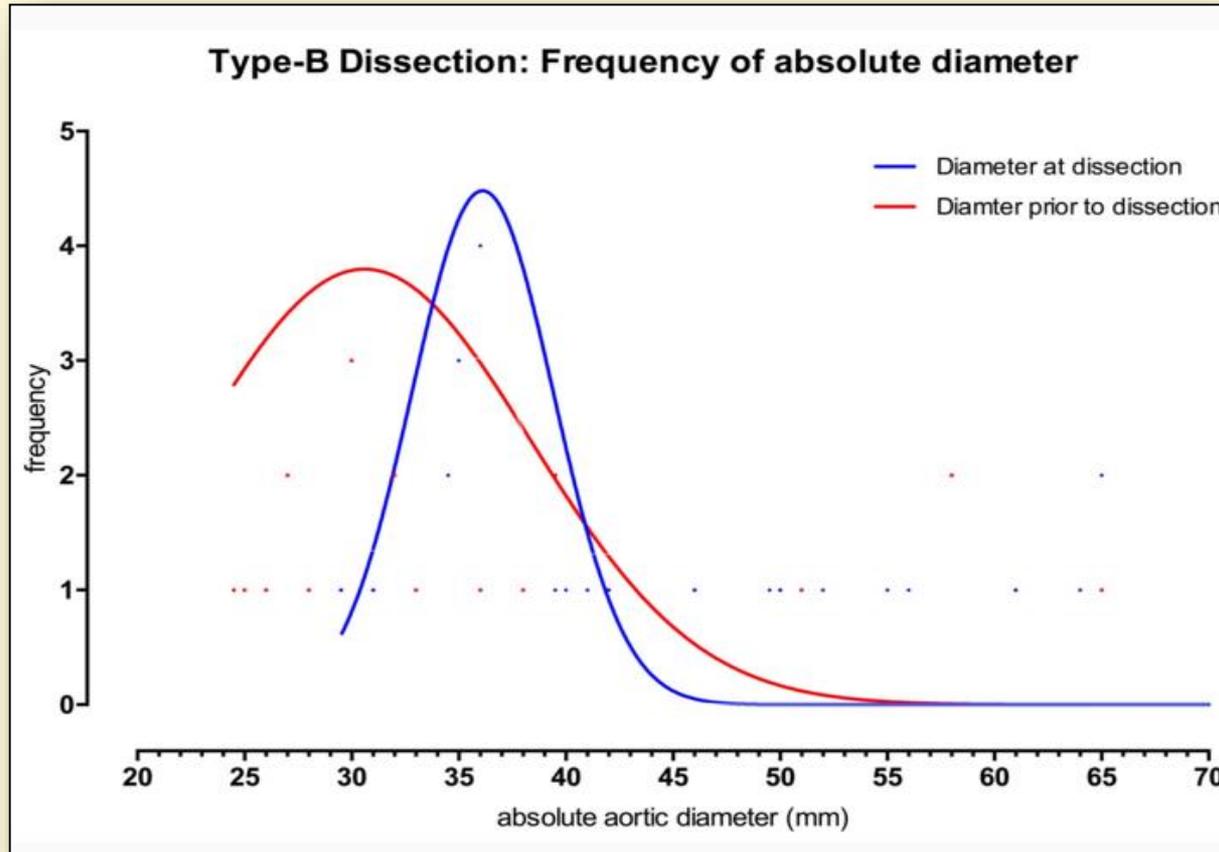
 = 7.6mm (+19.2%)
- $\Delta$  size consequent to dissection (from regression model) : **6.38 mm (+16.2%)** 16

# Results – Type A Dissections



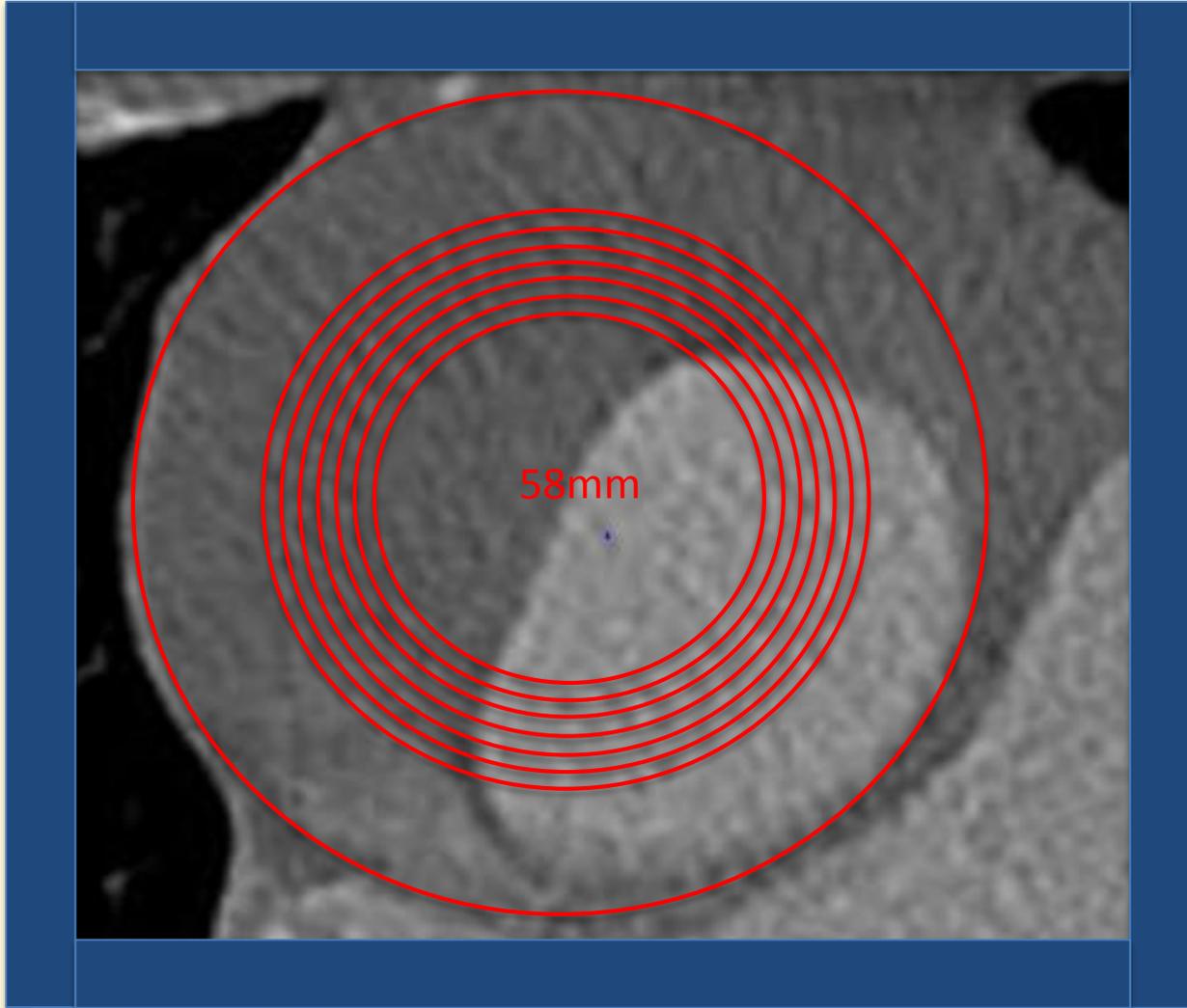
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# Patient 220

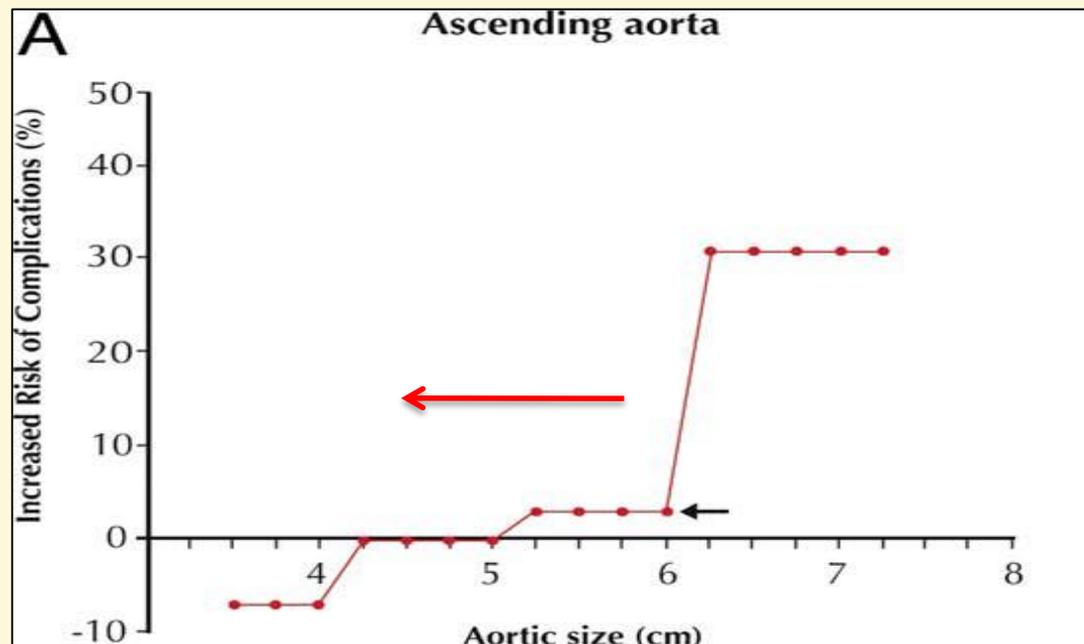


-8years: 45mm → -7years: 46mm → -6years: 47mm → -5years: 48mm → -4years: 48mm → -3years: 49mm → -2years: 50mm → -1years: 51mm → @dissection: 58mm

# Conclusions

- Aortic diameter increases **substantially** from the **aortic dissection** itself!
- Thus, aortas are **dissecting** at substantially **smaller sizes** than natural history analyses have previously suggested.
- This finding has important implications regarding **when to surgically intervene:**

**Leftward shift of “risk of dissection” curve required?**



# Time for a Left-ward Shift in Guidelines?

