

EuroValve

March 27 - 28, 2015

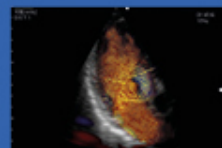
Comparison of aortic growth rate in bicuspid aortic valve, Marfan syndrome and degenerative aortopathy

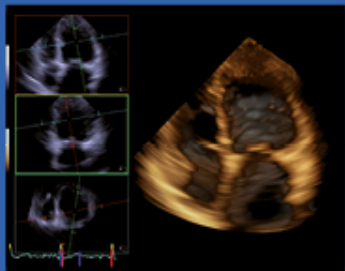
Agnès Pasquet, MD, PhD

Pôle de Recherche Cardiovasculaire

Institut de Recherche Expérimentale et Clinique

Université catholique de Louvain





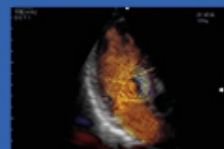
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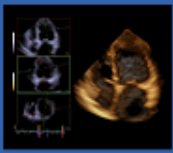
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Faculty disclosure

Agnes Pasquet

I have **no financial relationships** to disclose.

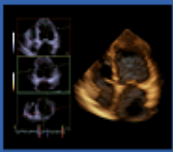




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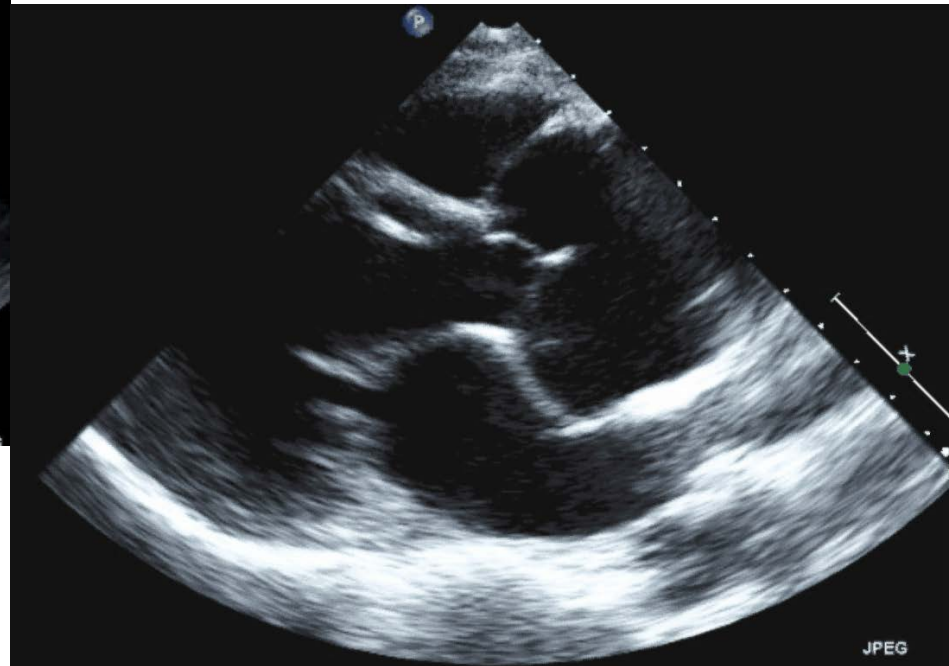
Aortic dissection



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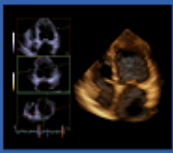
Aortic dissection



Aortic dilatation

Asymptomatic !

By hazard discovery during MRI, CT ECHO For other purpose



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TAAD: Thoracic Aortic Aneurysm and Dissection ?

Syndromic TAAD

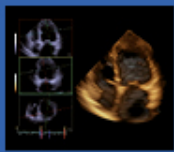
- Marfan
- Loey-Dietz Syndrome
- Turner
- Ehlers Danlos IV
- Arterial tortuosity
- Aneurysm arthritis syndrome

non syndromic TAAD

- Familial TAAD

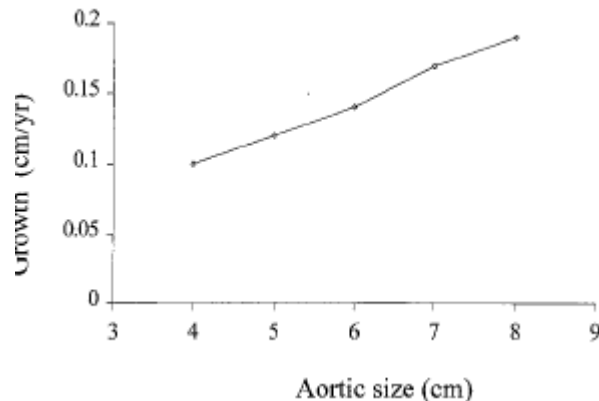
• *Bicuspid aortic valve*

• *Sporadic form*



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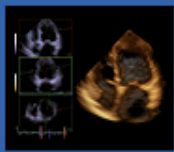
Dilatation rate in aortic aneurysm:



Annual growth rate according to initial aneurysm size*

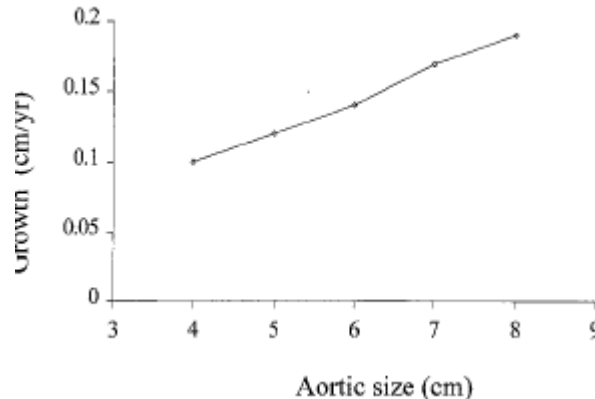
Patient category	4.0 cm	5.0 cm	6.0 cm	7.0 cm	8.0 cm	5.2 cm (sample mean)
All (n = 79)	0.10 cm/yr (0.05-0.14)	0.12 cm/yr (0.06-0.18)	0.14 cm/yr (0.07-0.21)	0.17 cm/yr (0.09-0.25)	0.19 cm/yr (0.10-0.28)	0.12 cm/yr (0.06-0.18)
Dissection status						
Chronic dissection (n = 16)	0.28 cm/yr (0.10-0.47)	0.35 cm/yr (0.13-0.59)	0.42 cm/yr (0.15-0.70)	0.49 cm/yr (0.18-0.82)	0.56 cm/yr (0.20-0.94)	0.37 cm/yr (0.13-0.61)
No dissection (n = 63)	0.07 cm/yr (0.02-0.11)	0.08 cm/yr (0.03-0.14)	0.10 cm/yr (0.03-0.17)	0.12 cm/yr (0.04-0.20)	0.14 cm/yr (0.04-0.23)	0.09 cm/yr (0.03-0.15)
Location of aneurysm						
Ascending or arch (n = 54)	0.08 cm/yr (0.03-0.12)	0.10 cm/yr (0.04-0.15)	0.11 cm/yr (0.05-0.18)	0.13 cm/yr (0.06-0.21)	0.15 cm/yr (0.06-0.24)	0.10 cm/yr (0.04-0.16)
Descending or thoracic aorta (n = 25)	0.23 cm/yr (0.07-0.39)	0.28 cm/yr (0.08-0.49)	0.34 cm/yr (0.10-0.59)	0.40 cm/yr (0.12-0.69)	0.45 cm/yr (0.13-0.79)	0.29 cm/yr (0.09-0.51)

*95% Confidence interval is given in parentheses.



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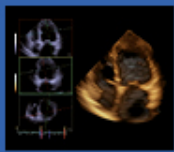
Dilatation rate in aortic aneurysm:



Annual growth rate according to initial aneurysm size*

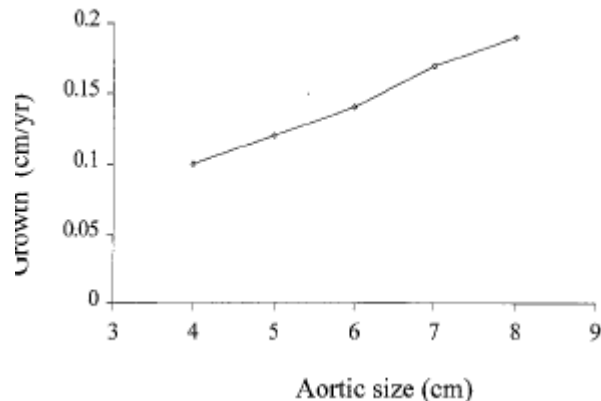
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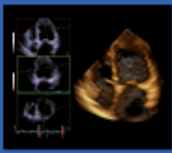
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Dilatation rate in aortic aneurysm:



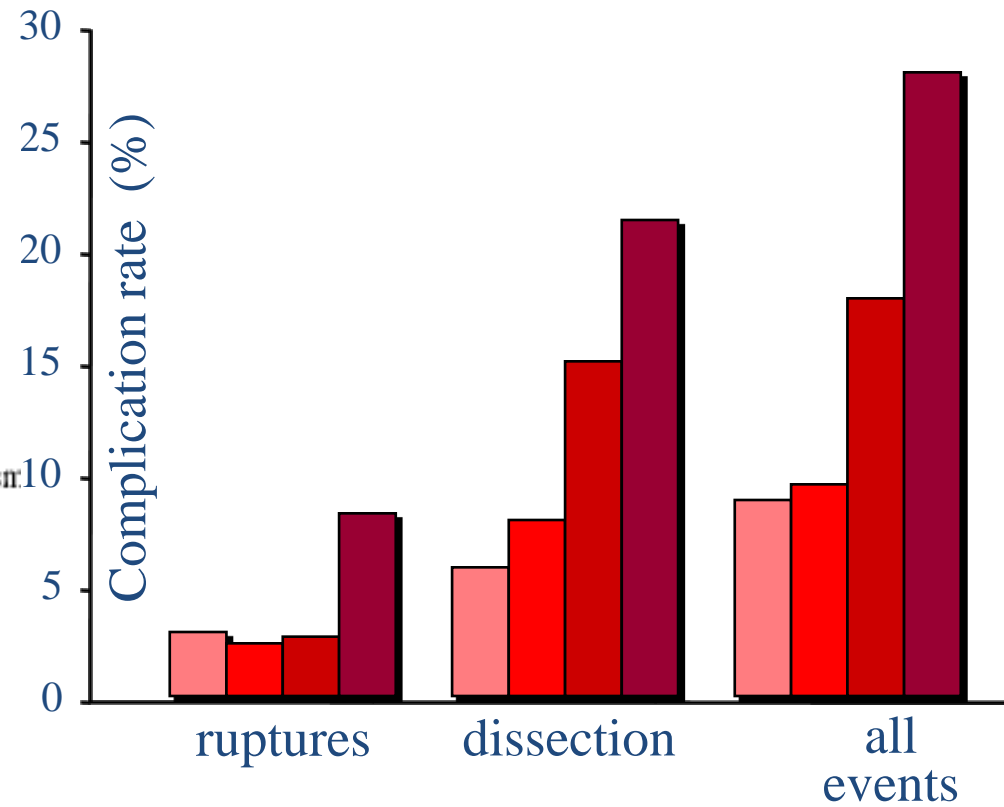
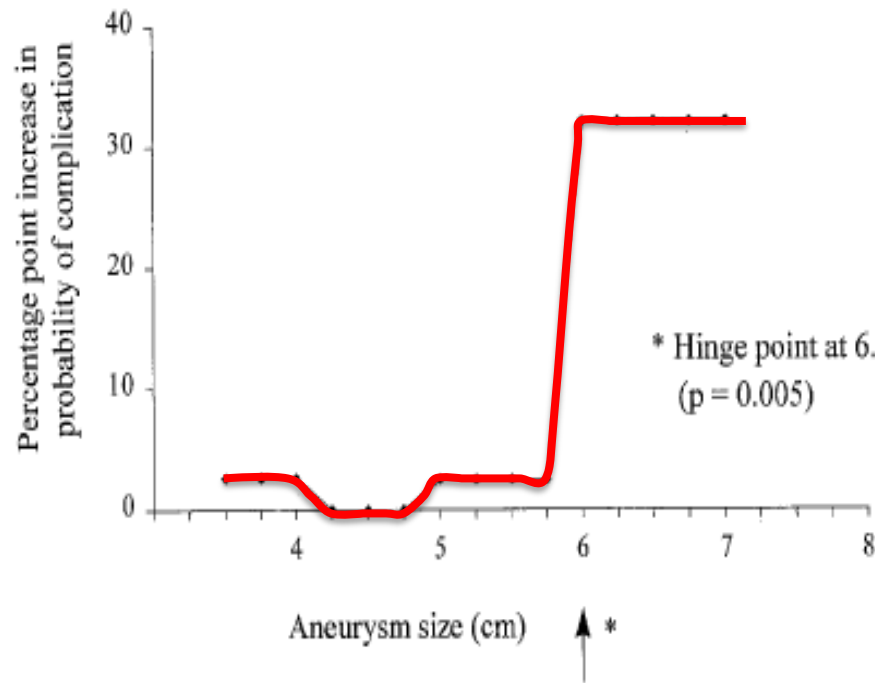
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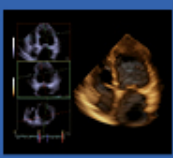
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Dilatation and risk of dissection

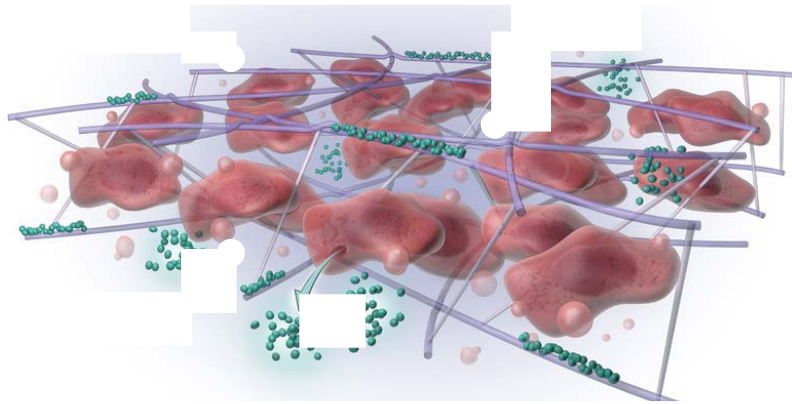




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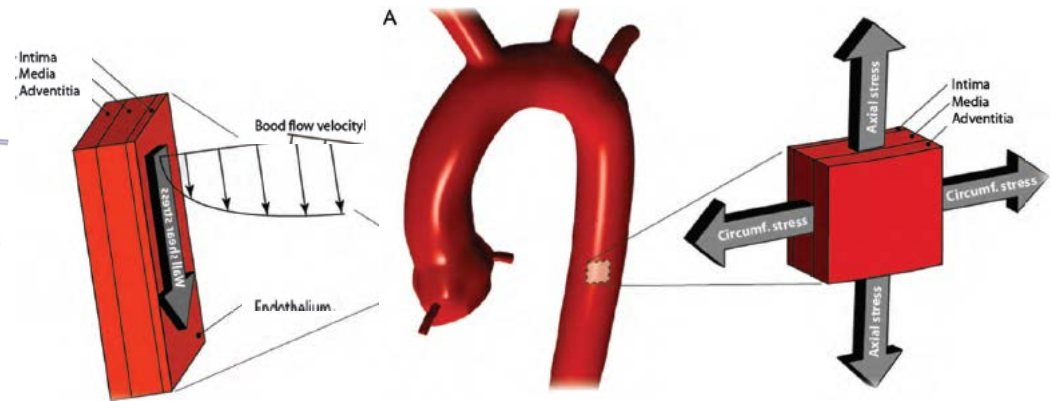
Risk factors for dilatation :

« *media disease* »



Collagen disease:
Marfan,
Ehlers Danlos IV,
Loeyz –Dietz.....

Increase in wall stress



HYPERTENSION

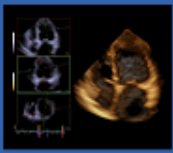
Smoking

Age

Atheroma

History of cardiac surgery (15%)

.....



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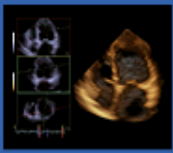


Syndromic TAAD : Marfan Disease

- FBN1 Fibrillin 1 (TGFRB2) (Loets-Dietz)
- Growth rate:
0,1 cm/year
Loets-Dietz : up to 1cm/y)

Mainly sinuses



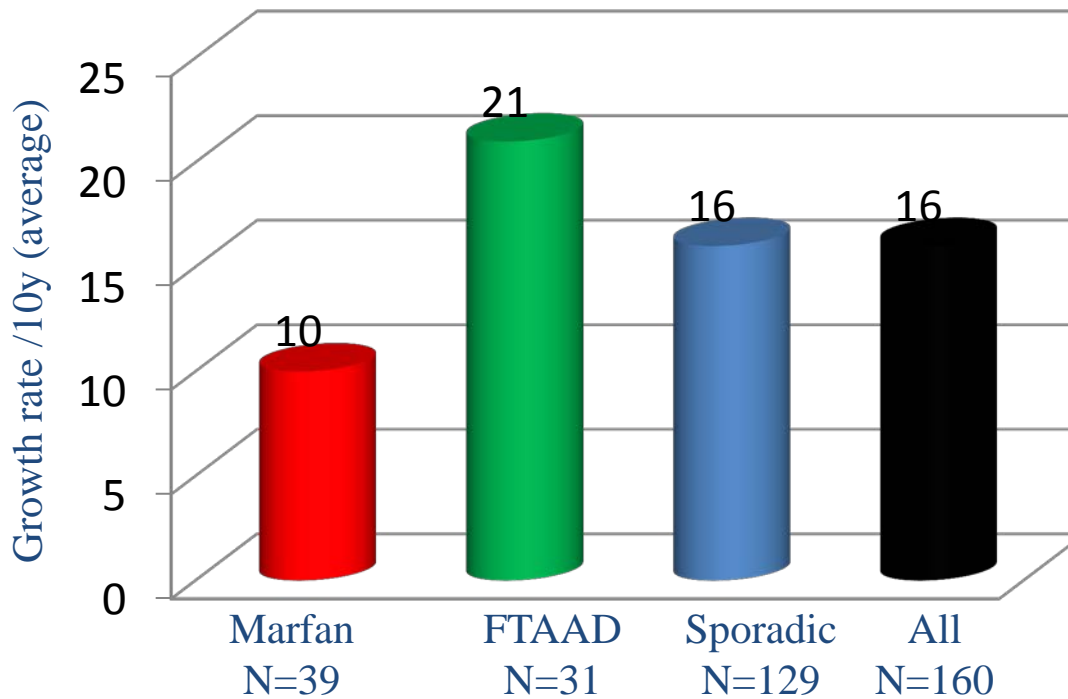


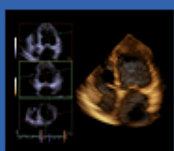
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Non syndromic TAAD:

- Up to 20% of patients with TAAD have a first degree relative with TAAD => familial TAAD !





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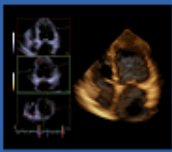
Bicuspid valve: ?

Progression Rate of Ascending Aortic Dilatation in Patients With Normally Functioning Bicuspid and Tricuspid Aortic Valves

Giovanni La Canna, MD^{a,*}, Eleonora Ficarra, MD^a, Elefteria Tsagalau, MD^a, Matilde Nardi, MD^b, Antonella Morandini, MD^b, Alaide Chieffo, MD^a, Francesco Maisano, MD^a, and Ottavio Alfieri, MD^a

Am J Cardiol 2006;98:249-253

Diameters	BAV (n = 27)	TAV (n = 86)	p Value
SV			
Baseline (mm)	41.3 ± 5.3	42.3 ± 6.3	NS
Follow-up (mm)	43.2 ± 4.9	44.6 ± 6.7	NS
Rate of progression (mm/yr)	0.86 ± 0.81	0.82 ± 1.1	NS
STJ			
Baseline (mm)	37.8 ± 5.2	38.7 ± 5.5	NS
Follow-up (mm)	40.2 ± 5.9	40.3 ± 5.5	NS
Progression rate (mm/yr)	1.06 ± 1.6	0.63 ± 1.1	NS
Proximal ascending aorta			
Baseline (mm)	47.3 ± 5.4	45.9 ± 5.1	NS
Follow-up (mm)	49.4 ± 6.1	47.7 ± 5.9	NS
Progression rate (mm/yr)	0.81 ± 1.1	0.75 ± 1.1	NS



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Bicuspid valve: ?

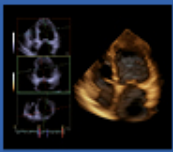
Progression Rate of Ascending Aortic Dilation in Patients With Normally Functioning Bicuspid and Tricuspid Aortic Valves

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Am J Cardiol 2006;98:249-253

Diameters	BAV (n = 27)	TAV (n = 86)	p Value
SV			
Baseline (mm)	41.3 ± 5.3	42.3 ± 5.3	NS
Follow-up (mm)	43.7 ± 5.3	43.7 ± 5.3	NS
Rate of progression (mm/yr)	1.06 ± 1.6	0.63 ± 1.1	NS
STJ			
Baseline (mm)	40.2 ± 5.9	38.7 ± 5.5	NS
Follow-up (mm)	40.3 ± 5.5	40.3 ± 5.5	NS
Progression rate (mm/yr)	1.06 ± 1.6	0.63 ± 1.1	NS
Proximal ascending aorta			
Baseline (mm)	47.3 ± 5.4	45.9 ± 5.1	NS
Follow-up (mm)	49.4 ± 6.1	47.7 ± 5.9	NS
Progression rate (mm/yr)	0.81 ± 1.1	0.75 ± 1.1	NS

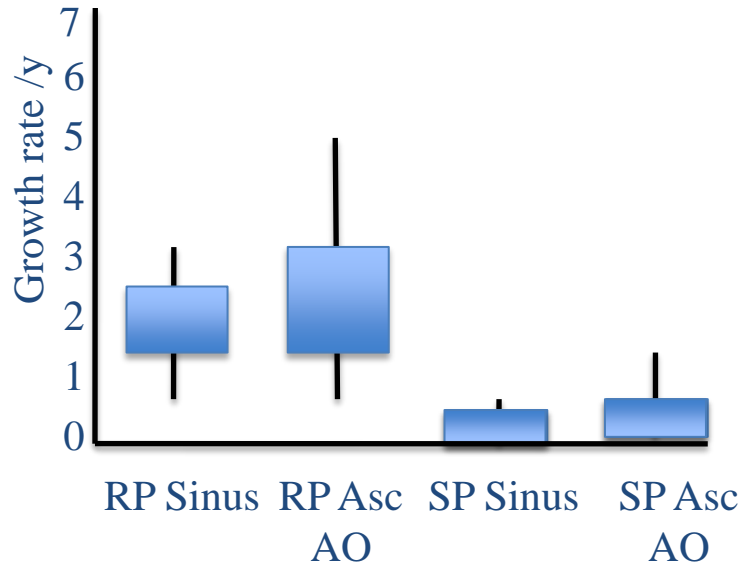
the rate of progression of AA aneurysms was similar in patients with BAVs and in those with TAVs. Furthermore, patients with BAVs did not have increased rates of AA related complications compared with patients with TAVs.



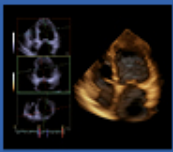
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Bicuspid valves ?



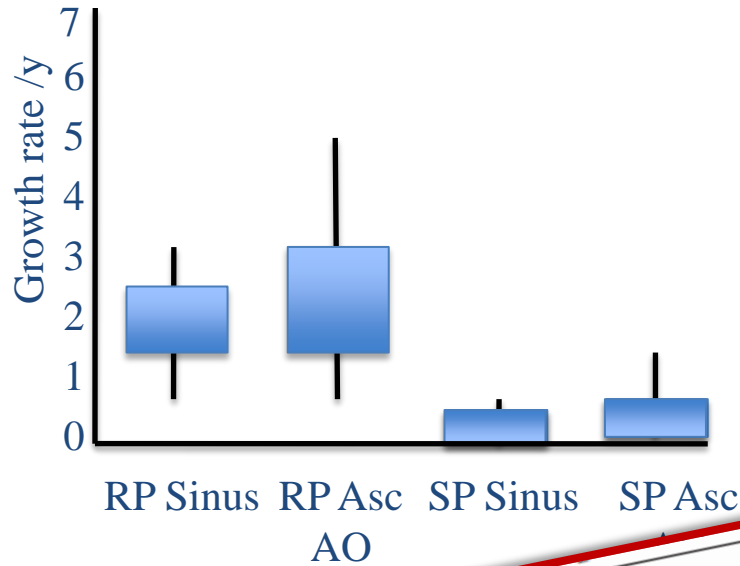
Parameter	Rapid progressors			Slow progressors			p-value ⁺
	Baseline (mm)	Follow up (mm)	Dilatation rate* (mm/year)	Baseline (mm)	Follow up (mm)	Dilatation rate* (mm/year)	
LVOT	24.2 ± 3.6	24.9 ± 3.6	0.4 ± 0.9	24.4 ± 2.8	25.2 ± 2.9	0.4 ± 0.7	0.94
Sinuses of Valsalva	35.8 ± 5.8	38.5 ± 5.7	1.5 ± 1.5	36.5 ± 4.8	36.9 ± 4.9	0.2 ± 0.3	<0.001
STJ	32.0 ± 6.1	33.2 ± 6.0	0.9 ± 0.4	31.4 ± 4.6	32.0 ± 4.6	0.3 ± 0.6	0.01
Ascending aorta	37.2 ± 6.8	39.9 ± 6.9	1.6 ± 1.4	36.4 ± 6.2	36.9 ± 6.0	0.2 ± 0.3	<0.001



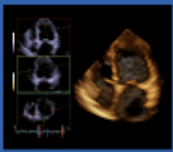
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Bicuspid valves ?



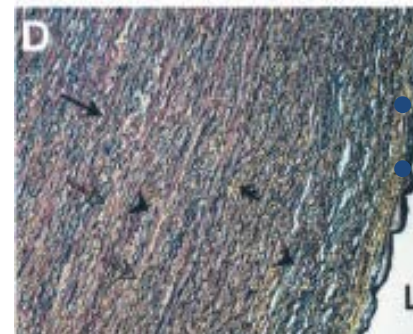
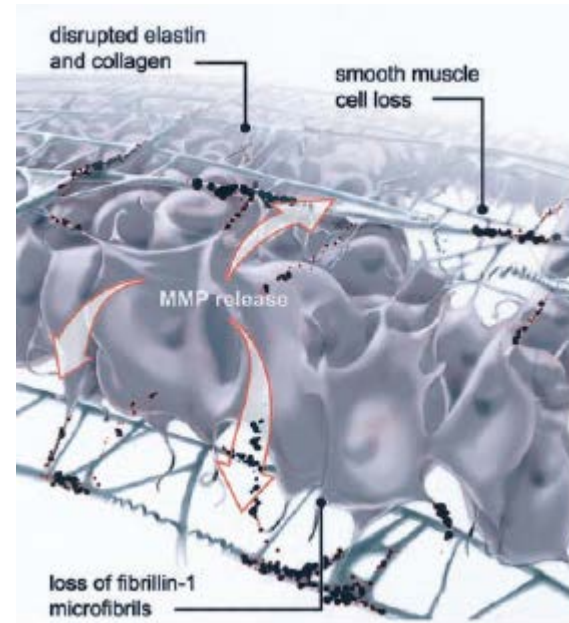
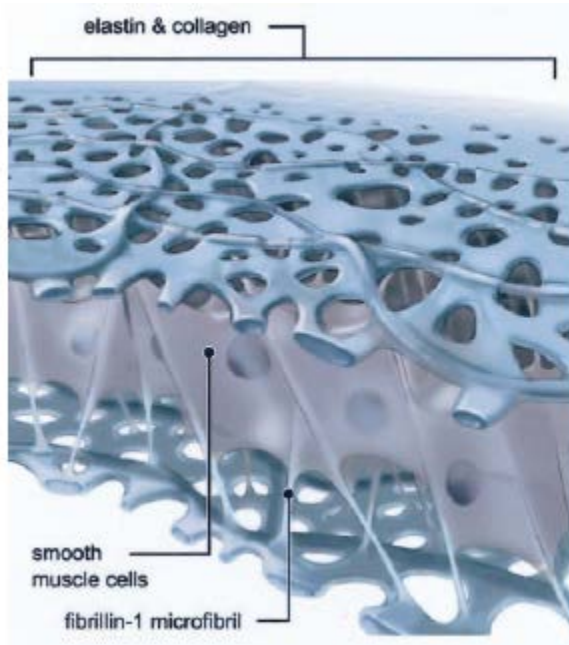
Parameter	Rapid progression				Dilatation rate* (mm/year)	p-value*
	Baseline (mm)	Variable	Odds ratio	95% CI		
LVOT	24.2 ± 3.0	10-year risk ≥7%	4.54	1.92-10.73	0.4 ± 0.7	0.94
Sinuses of Valsalva	35.8 ± 5.8	Tobacco use	5.05	1.51-16.86	0.2 ± 0.3	<0.001
STJ	32.0 ± 6.1	Elevated blood glucose	1.01	1.002-1.03	0.3 ± 0.6	0.01
Ascending aorta	37.2 ± 6.8				0.2 ± 0.3	<0.001



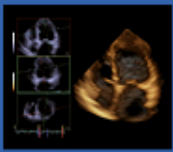
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Dilatation with BAV a structural problem ?

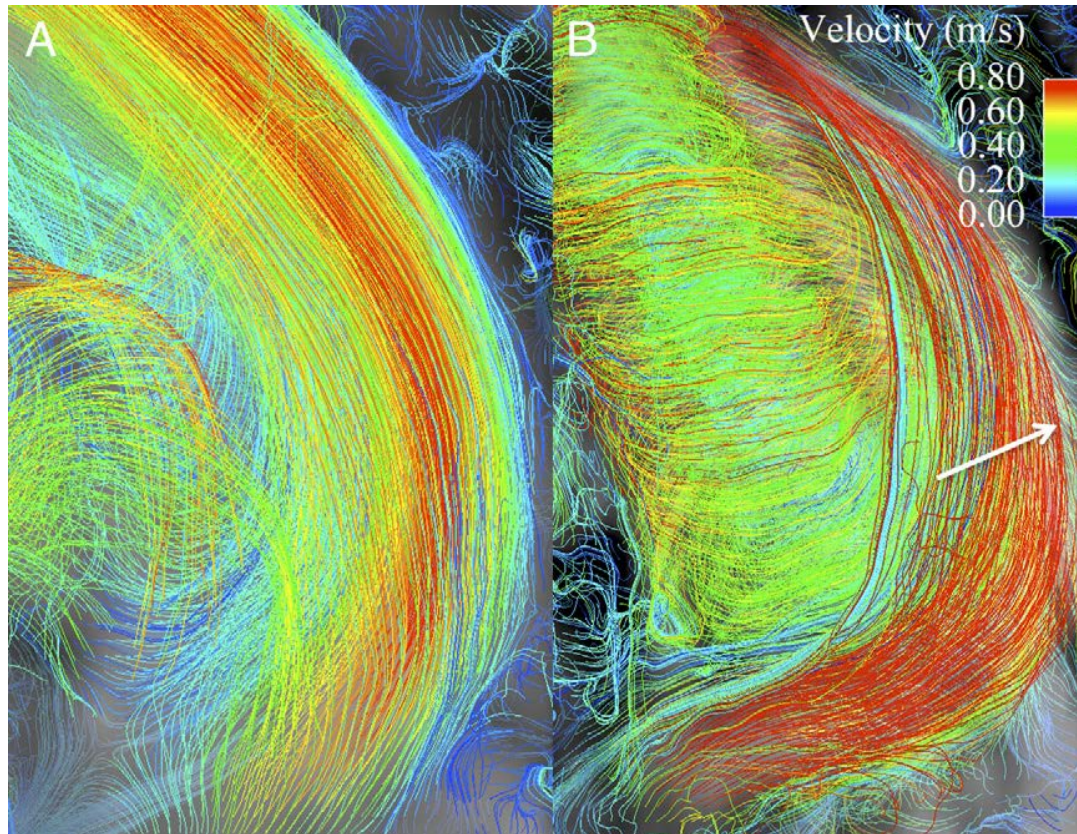


- Loss smooth muscle
- Disarray elastic fibers



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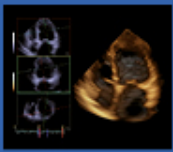
Dilatation with BAV an hemodynamic problem ?



BAV nl root

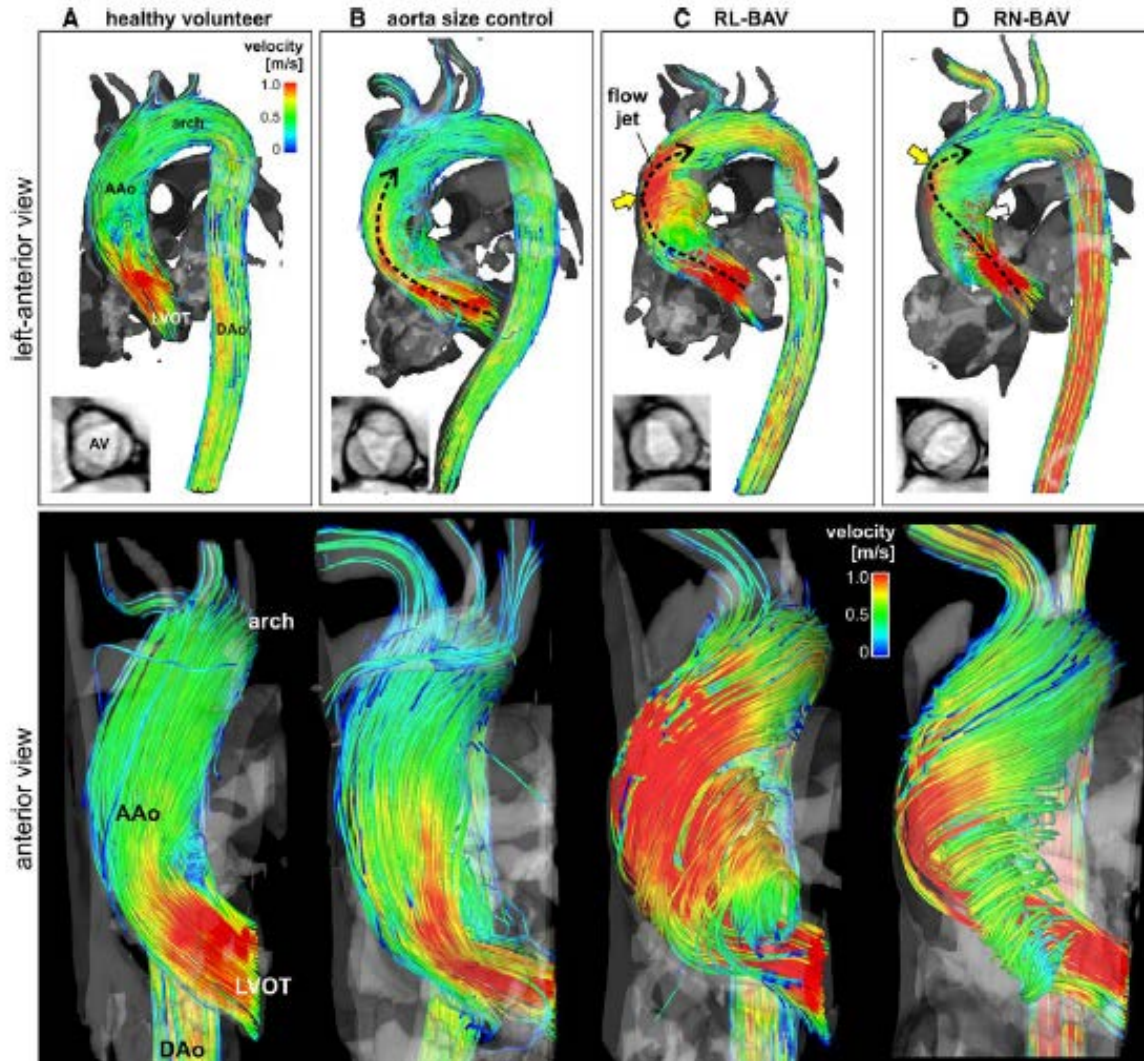
BAV with rapid dilatation

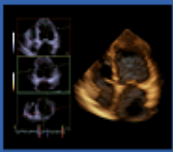
Growth
Maximal shear stress



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Dilatation with BAV an hemodynamic problem ?





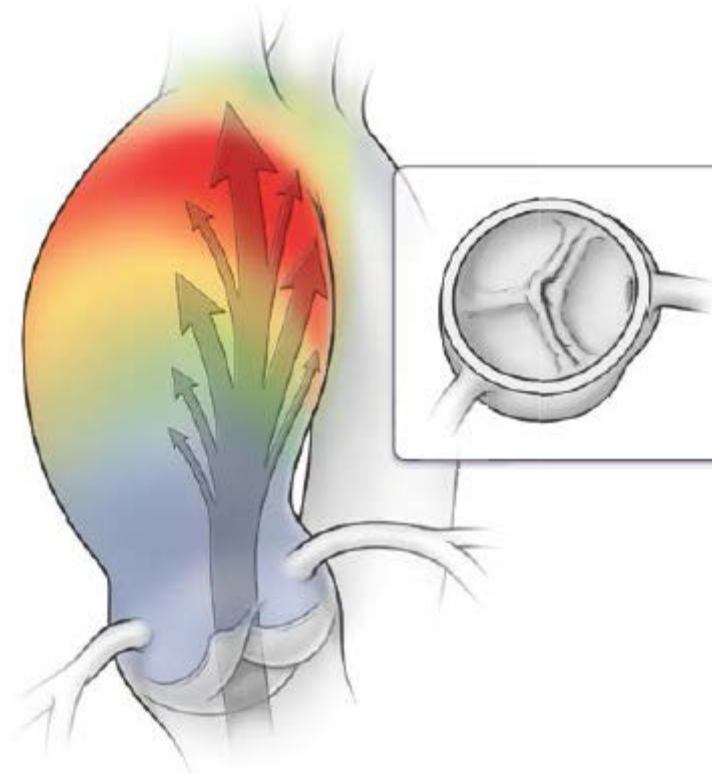
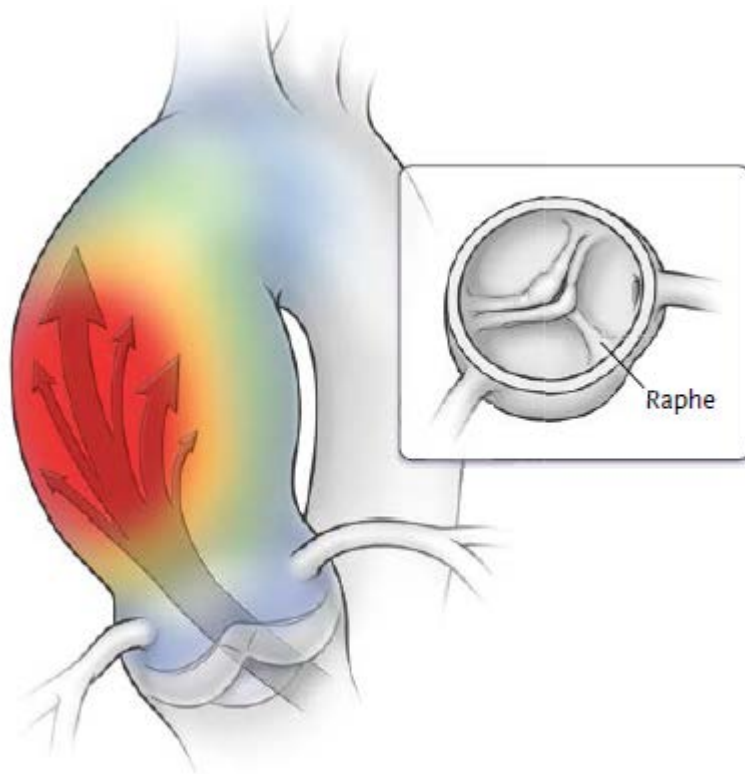
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Pattern of dilatation related to type of BAV ?

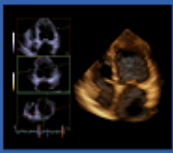
R-L (Right to left) fusion pattern

R-N (Right to non coronary) fusion pattern



Dilatation of the ascending aorta

Dilatation of the proximal arch



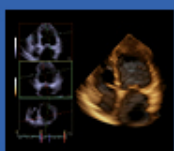
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Relative growth in aortopathy ?

- Retrospective study comparing ao growth in patients with
BAV n= 35
marfan n=50
Degenerative Aortopathy=51

2 echo > 2 years interval



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Relative growth in aortopathy ?

Table 1 Baseline aortic diameters and yearly aortic dilatation rates in patients with BAV, DA, and MFS

	BAV N=353	DA N=51	MFS N=50	p Value
Age, year	48±15	71±11	35±11	<0.0001
Gender, male n (%)	254 (72%)	40 (78%)	36 (72%)	0.60
Systolic BP mm Hg (baseline)	124±17	124±16	128±19	0.59
Ejection fraction, %	59±8	55±11	63±9	<0.0001
AR ≥2, n (%)	123 (35%)	9 (18%)	1 (2%)	<0.0001
Aorta diameter at baseline				
Aortic annulus, mm	25.0±3	24.6±3	24.6±2	0.49
Sinuses of Valsalva, mm	37.1±6	41.5±6	41.8±6	<0.0001*†
Sinotubular junction, mm	31.5±5	37.5±5	33.3±5	<0.0001*†‡
Ascending aorta, mm	37.9±6	44.5±4	32.4±5	<0.0001*†‡
Dilatation rate, mm/year				
Aortic annulus	0.05±0.2§	0.005±0.2	0.04±0.7	0.51
Sinuses of Valsalva	0.21±0.4§	0.09±0.2§	0.49±0.5§	<0.0001*†‡
Sino-tubular junction	0.18±0.5§	0.10±0.2§	0.10±1.2	0.50
Ascending aorta	0.42±0.6§	0.20±0.3§	0.12±1.0§	0.0005*†
Maximal dilatation rate	0.42±0.6	0.20±0.3	0.49±0.5	0.02*‡

*Indicates significant differences between BAV and DA.

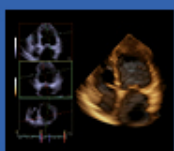
†Indicates significant differences between BAV and MFS.

‡Indicates significant differences between MFS and DA.

§Indicates significant differences between baseline and follow-up diameters.

Larger baseline aortic diameters in DA patients reflect the inclusion criteria of 40 mm for these patients versus 37 mm for BAV and MFS.

AR, aortic regurgitation; BAV, bicuspid aortic valve; BP, blood pressure; DA, degenerative aortopathy; MFS, Marfan syndrome.



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Relative growth in aortopathy ?

Table 1 Baseline aortic diameters and yearly aortic dilatation rates in patients with BAV, DA, and MFS

	BAV N=353	DA N=51	MFS N=50	p Value
Age, year	48±15	71±11	35±11	<0.0001
Gender, male n (%)	254 (72%)	40 (78%)	36 (72%)	0.60
Systolic BP mm Hg (baseline)	124±17	124±16	128±19	0.59
Ejection fraction, %	59±8	55±11	63±9	<0.0001
AR ≥2, n (%)	123 (35%)	9 (18%)	1 (2%)	<0.0001
Aorta diameter at baseline				
Aortic annulus, mm	25.0±3	24.6±3	24.6±2	0.49
Sinuses of Valsalva, mm	37.1±6	41.5±6	41.8±6	<0.0001*†
Sinotubular junction, mm	31.5±5	37.5±5	33.3±5	<0.0001*†‡
Ascending aorta, mm	37.9±6	44.5±4	32.4±5	<0.0001*†‡
Dilatation rate, mm/year				
Aortic annulus	0.05±0.2§	0.005±0.2	0.04±0.7	0.51
Sinuses of Valsalva	0.21±0.4§	0.09±0.2§	0.49±0.5§	<0.0001*†‡
Sino-tubular junction	0.18±0.5§	0.10±0.2§	0.10±1.2	0.50
Ascending aorta	0.42±0.6§	0.20±0.3§	0.12±1.0§	0.0005*†
Maximal dilatation rate	0.42±0.6	0.20±0.3	0.49±0.5	0.02*‡

*Indicates significant differences between BAV and DA.

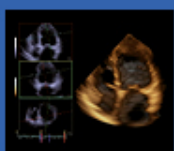
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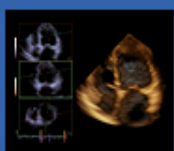
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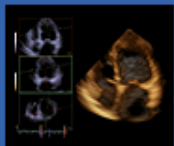
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Relative growth in aortopathy ?

Table 3 Baseline characteristics and yearly aortic dilatation rate according to BAV subtype

	R-L Typical, no raphe N=57	Atypical, no raphe N=56	R-N Typical, with raphe N=204	Atypical, with raphe N=29	p Value
Clinical characteristics					
Age, years	43±15	46±15	50±14	48±15	0.004
Male gender, n (%)	41 (72%)	34 (61%)	155 (76%)	20 (69%)	0.15
Echocardiographic characteristics					
Ejection fraction, %	59.4±8	57.2±8	59.9	61.3	0.64
AR≥moderate	20 (35%)	11 (20%)	84 (41%)	8 (28%)	0.02*
AS≥moderate	6 (12%)	10 (20%)	30 (16%)	4 (15%)	0.69
Baseline aortic dimension					
Annulus	25±3.6	25±3.5	25±2.9	25±1.9	0.77
Valsalva sinuses	37.7±5.7	34.7±5.7	38.1±5.4	34.1±3.3	0.0001*
Sinotubular junction	31.1±5.2	31.1±5.2	32.2±5.3	29.1±3.6	0.02†
Ascending aorta	36.5±6.3	36.8±7.5	39.1±6.1	35.8±6.5	0.005‡
Yearly rate, mm/year					
Annulus	0.05±0.3	0.02±0.1	0.06±0.2	0.05±0.1	0.49
Valsalva sinuses	0.24±0.3	0.25±0.5	0.19±0.3	0.20±0.4	0.61
Sinotubular junction	0.24±0.6	0.12±0.4	0.21±0.5	0.05±0.3	0.29
Ascending aorta	0.39±0.5	0.51±0.8	0.40±0.5	0.33±0.6	0.54

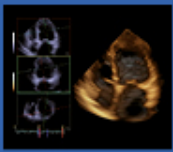
*Significant difference between typical and atypical, regardless of raphe.

†Significant difference between typical and atypical with raphe.

‡Significant difference between typical with raphe and other subgroups.

AR, aortic regurgitation; AS, aortic stenosis; BAV, bicuspid aortic valve.

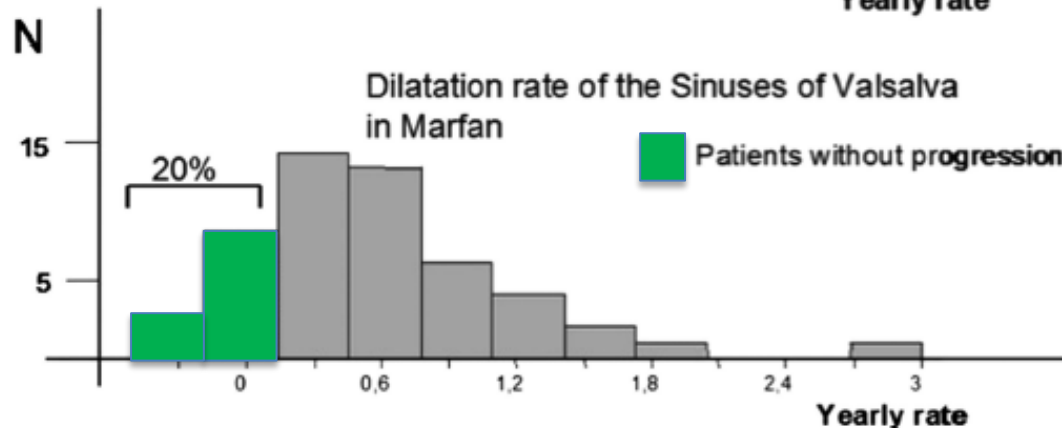
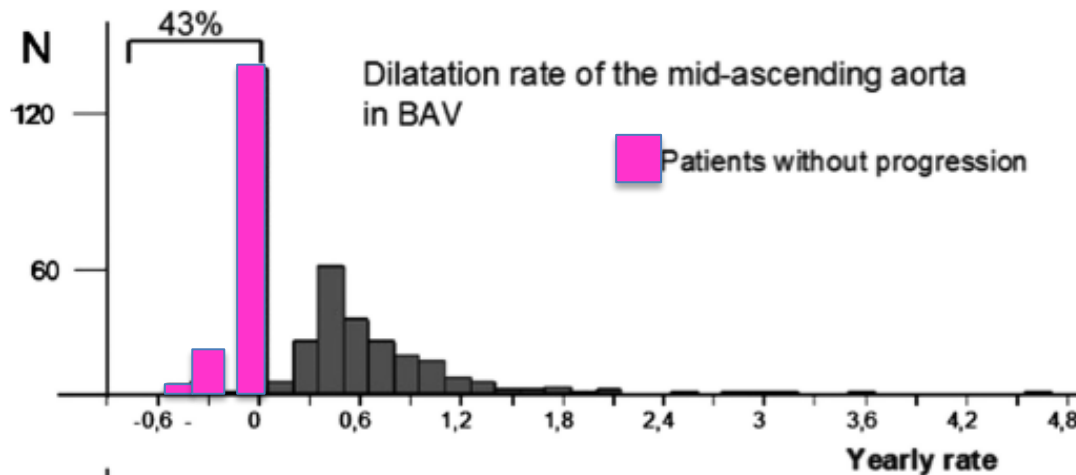
No relation to BAV pattern !



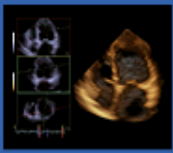
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Greater proportion of patient without change in Ao dimension in the BAV group !

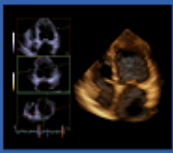


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Conclusion:

- Growth rate is related to type of aortopathy and could be influenced by risk factors such hypertension
- FTAAD seems to have a greater potentiel of growth compared to Marfan patients.
- Dilatation in BAV is frequent but the not the absolute rule !
- BAV morphology maybe related to different pattern of aortopathy
- Despite some structural defect similarity, BAV and Marfan show different patterns for aortopathy. Growth is similar in both population but the number of unaffected patients is greater in BAV.



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Thank you for your attention