

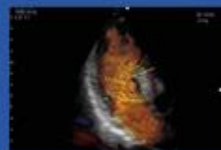
EuroValve

November 8-9, 2013

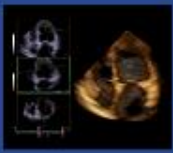


Bicuspid Aortic Valve Epidemiology

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www.eurovalvecongress.com



Faculty Disclosure

Bernard lung

I disclose the following financial relationships:

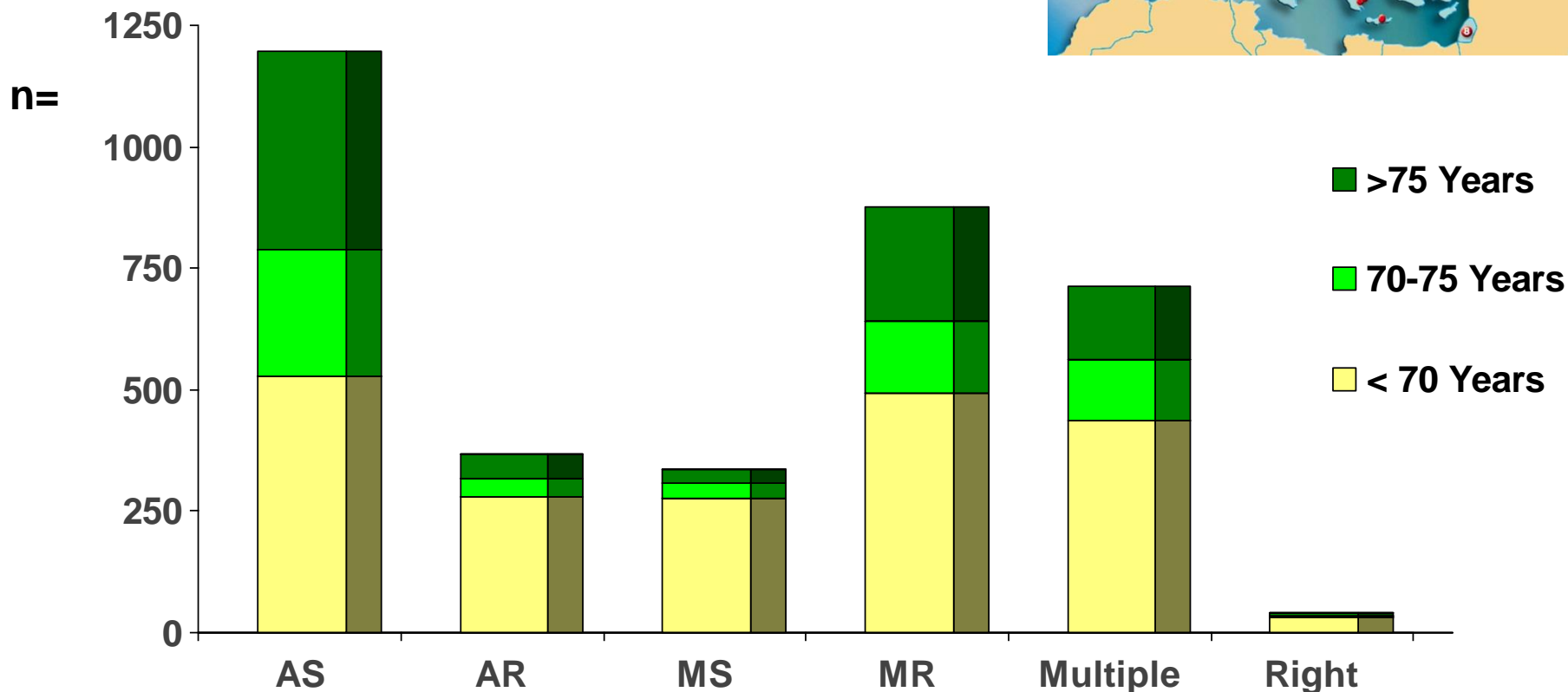
Consultant forr Abbott, Boehringer Ingelheim, Valtech

Paid speaker for Edwards Lifesciences

Euro Heart Survey on Valvular Diseases

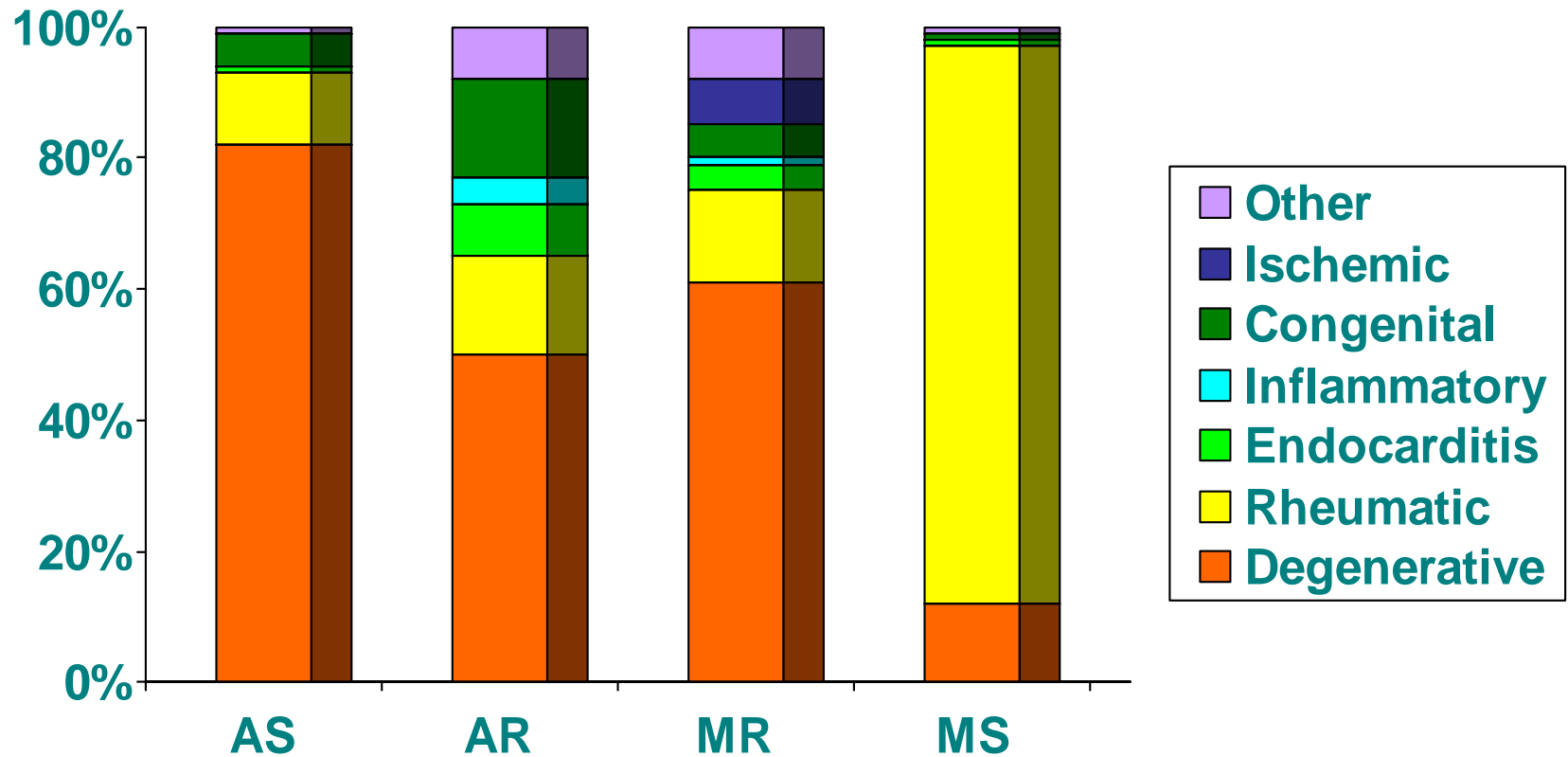


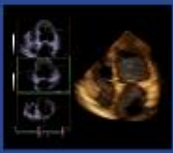
3547 Patients with Native Valve Disease



(Iung et al. *Eur Heart J* 2003;24:1244-53)

Single Native Valve Disease Etiology





Prevalence of BAV

- Systematic echocardiographic screening in children:

- 0.6-0.8% in males
- 0.2% in females

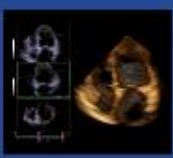
(Tutar et al. Am Heart J 2005;150:513-5)

(Nistri et al. Am J Cardiol 2005;96:718-21)

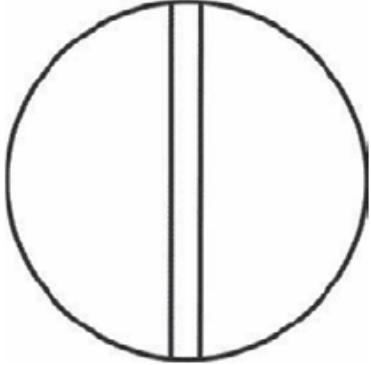


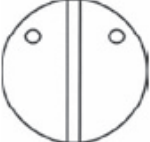
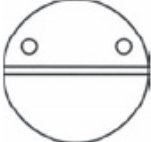




- Estimations in the USA

- Prevalence 1.4%
- Incidence of new cases estimated at 54 800 per year in the USA

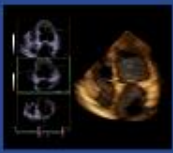
*(AHA Heart Disease and Stroke Statistics--2012 Update
Circulation 2012; 125:e2-e220)*



Prevalence According to Anatomy

<p><u>main category:</u> number of raphes</p>	<p>0 raphe - Type 0</p>  <p>21 (7)</p>		<p>1 raphe - Type 1</p>  <p>269 (88)</p>			<p>2 raphes - Type 2</p>  <p>14 (5)</p>	
<p><u>1. subcategory:</u> spatial position of cusps in Type 0 and raphes in Types 1 and 2</p>	<p>lat 13 (4)</p> 	<p>ap 7 (2)</p> 	<p>L - R 216 (71)</p> 	<p>R - N 45 (15)</p> 	<p>N - L 8 (3)</p> 	<p>L - R / R - N 14 (5)</p> 	

(Sievers et al. J Thorac Cardiovasc Surg 2007;133:1226-33)



Aortic Stenosis and BAV in Childhood

- 1135 children with bicuspid aortic valve
Median age 3 years [1-18]
- 569 (50%) had isolated BAV
- BAV morphology and valve dysfunction



R-L

59%

10%

R-N

39%

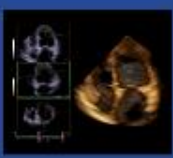
26%

L-N

2% Prevalence

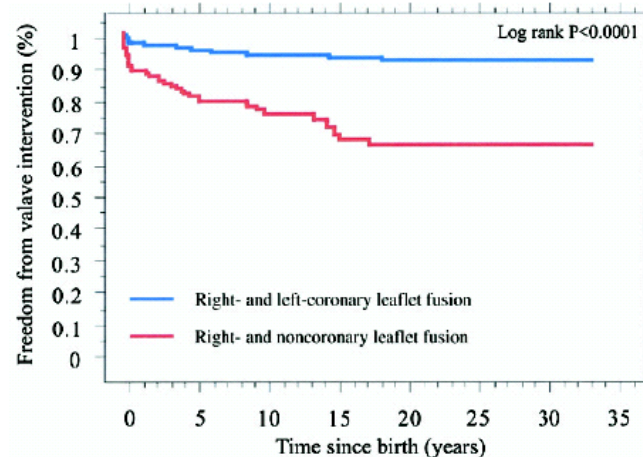
0% *V.max* 3.5 m/sec.

- Age- and sex-adjusted link between AS and valve morphology: OR 2.3 [1.6-3.6] $p < 0.001$

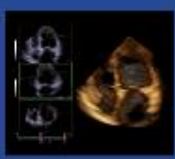


Progression of Aortic Stenosis

- 310 patients with BAV
 - 202 (65%) with R-L fusion
 - 108 (35%) with R-N fusion
- Mean follow-up 14 ± 7 yrs
Median age at end of follow-up: 16 years

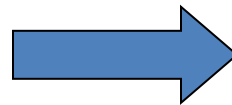
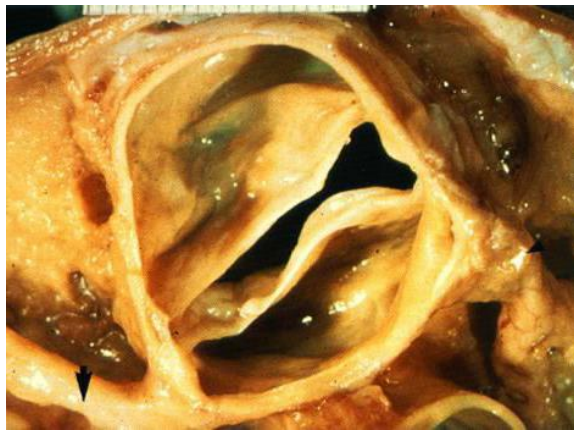


(Fernandes et al. J Am Coll Cardiol 2007;22:2211-4)



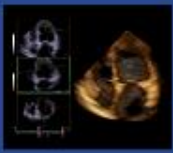
Aortic Stenosis on BAV in the Adult

- In most cases, aortic stenosis is the consequence of a superimposed « degenerative » process

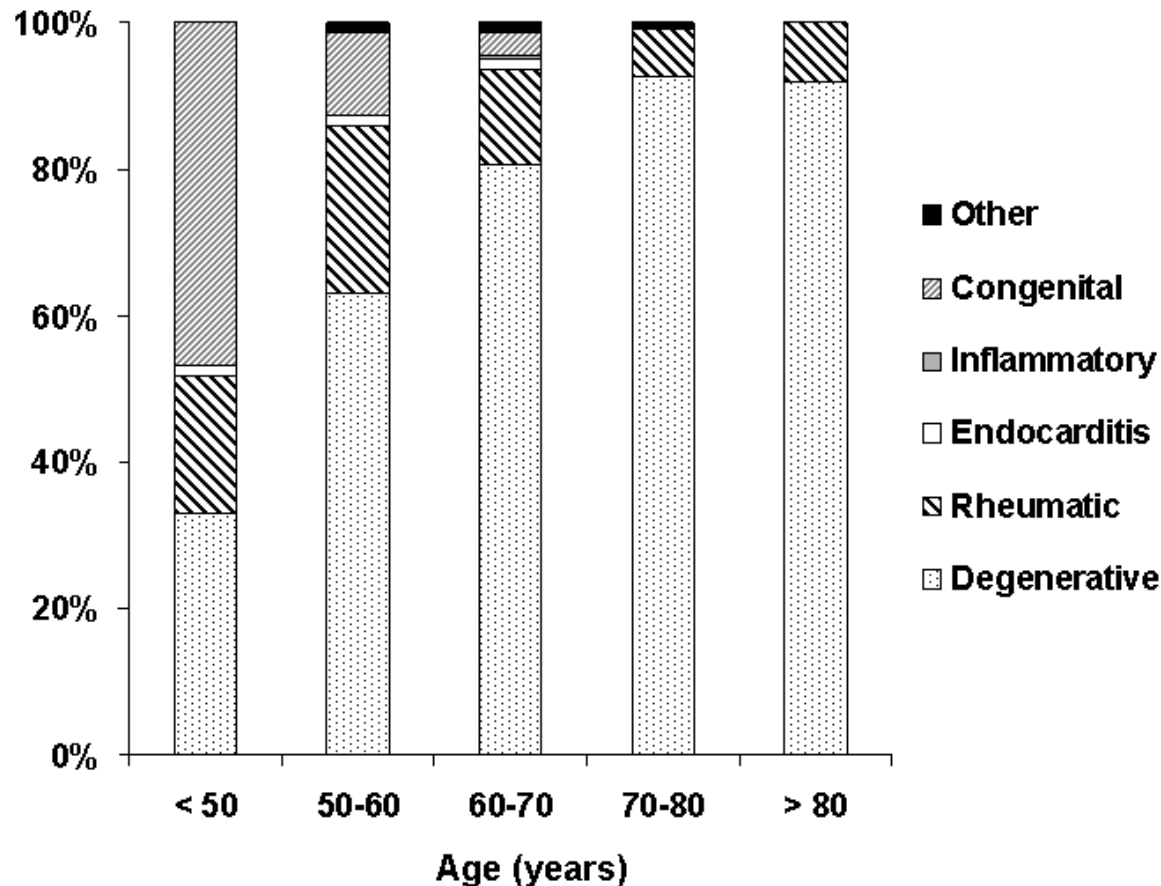


- Development of AS is also linked to cardiovascular risk factors in patients with BAV
 - Hypercholesterolemia OR 1.8 [1.1-2.8]
 - Hypertension OR 2.6 [1.1-6.6]

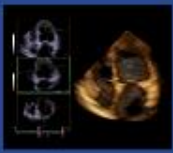
(Chan et al. Am J Cardiol 2001;88:690-3)



Etiologies of Aortic Stenosis



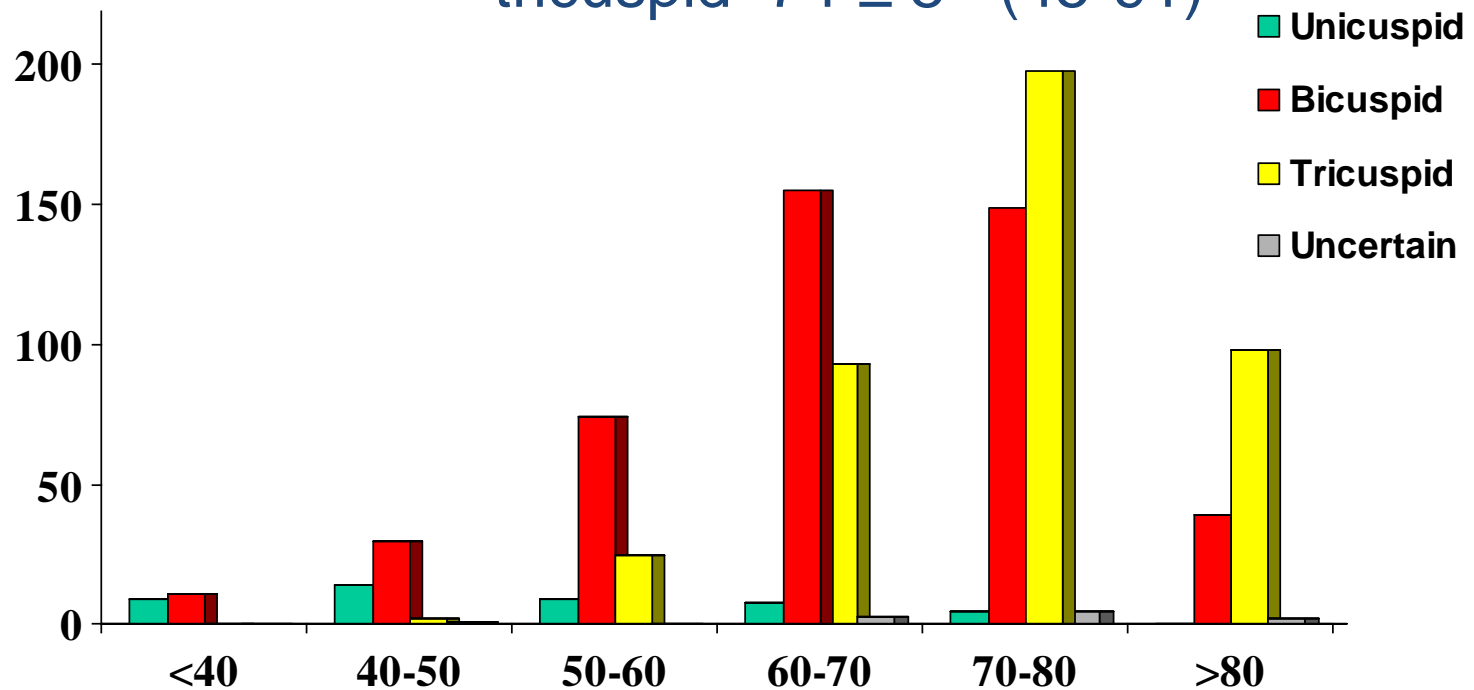
(Iung et al. Curr Prob Cardiol 2007;32: 609-61)



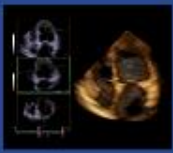
AS and Valve Morphology

932 aortic valves excised during AVR for AS (1993-2004)

- 49% had bicuspid aortic valves
- Age at intervention
 - bicuspid 67 ± 11 (27-91)
 - tricuspid 74 ± 8 (45-91)

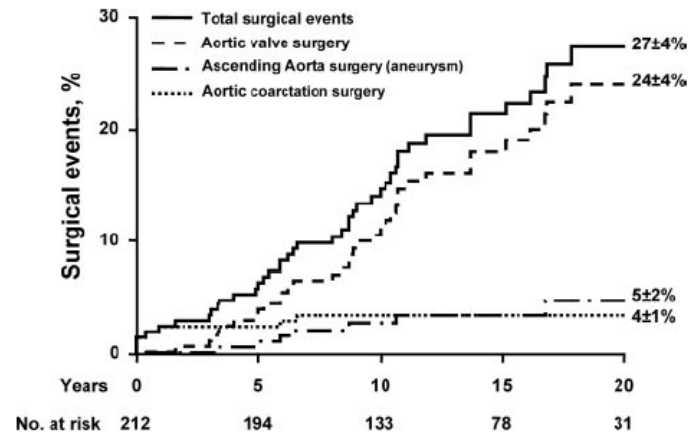


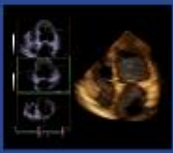
(Roberts et al. Circulation 2005;111:920-5)



BAV and Valve Dysfunction

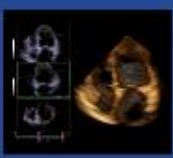
- Aortic valve surgery in 39 patients
 - 27 for severe AS
 - 6 for severe AR
 - 2 for severe mixed valve disease
 - 3 for moderate valve dysfunction and aortic dilatation
 - 1 for acute endocarditis
- Surgery for aortic coarctation in 8 patients
- Surgery for ascending aortic dilatation in 8 patients





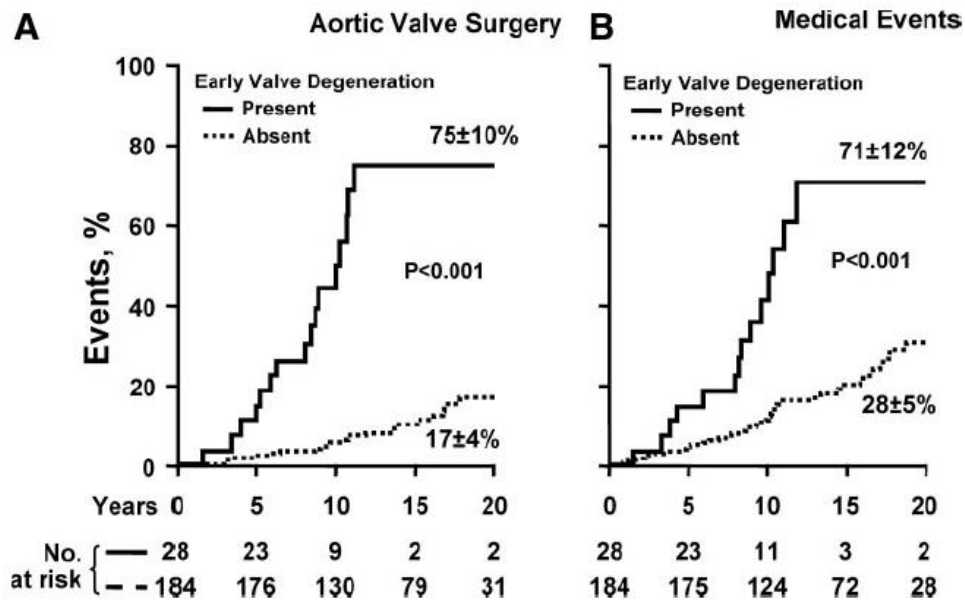
AVR in Bicuspid/Tricuspid Valves

- Incidence of AVR (\pm CABG) in Olmsted County (1990-1999)
 - 19 / 100 000 pts/yrs for all patients
 - 1370 / 100 000 pts/yrs in patients with bicuspid aortic valves
- Age at AVR
 - 67 \pm 16 yrs in patients with tricuspid aortic valves
 - 49 \pm 20 yrs in patients with bicuspid aortic valves
($p < 0.0001$)

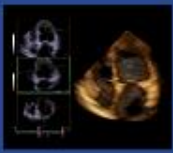


The Impact of Degenerative Disease

With age, valve degeneration (thickening, calcification, or mobility) was a strong independent predictor of all events

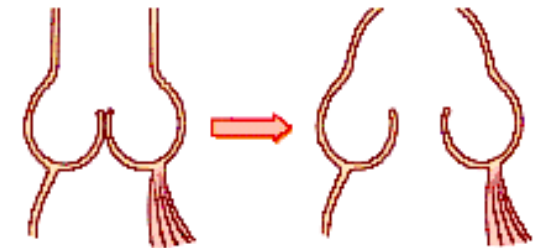
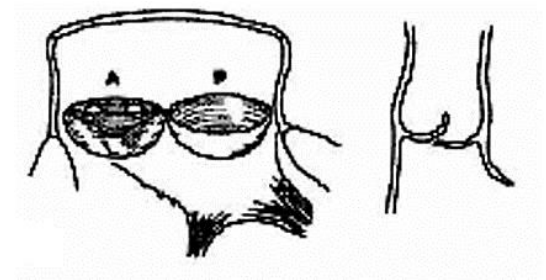


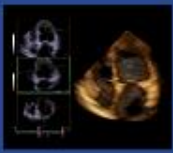
(Michelena et al. *Circulation* 2008;117:2776-84)



Aortic Regurgitation and BAV

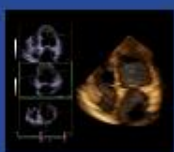
- Less frequent occurrence than aortic stenosis on bicuspid valves
- Mechanisms
 - Valve prolapse
 - Dilatation of sinotubular junction
 - Endocarditis





AR and BAV

- 268 aortic valves excised during isolated AVR for AR (1993-2005)
 - 122 related to valve disease
 - 146 related to disease of ascending aorta
- 77 (29%) bicuspid aortic valves
 - 74/122 (61%) among valve-related AR
 - 59 without endocarditis
 - 15 with signs of healed or active endocarditis
 - 3/146 (2%) among aorta-related AR (all aortic dissection)



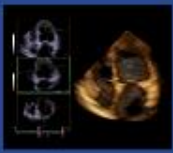
AR and BAV in Childhood

- 164 children with BAV and serial echocardiographic examinations

AR \geq moderate (%)	R-L (n=103)	R-N (n=61)	p
At first echo	11	33	0.004
At last echo	26	64	<0.001

- Progression of ≥ 1 grade of AR in 44% of patients with R-N fusion vs. 27% with R-L fusion

(Fernandes et al. J Am Coll Cardiol 2007;22:2211-4)



BAV and Ascending Aorta

More frequent dilatation of ascending aorta with bicuspid vs. tricuspid aortic valves independently of valve function

(Nistri et al. Heart 1999;82:19-22)

(Keane et al. Circulation 2000;102suppl.:III-35-9)

R-L Fusion
(n=144)

R-N fusion
(n=37)

60%

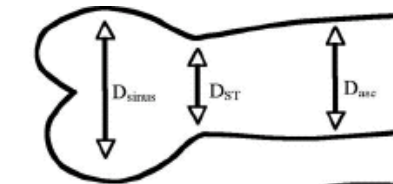
32%

35%

54%

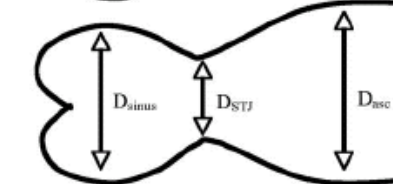
5%

14%



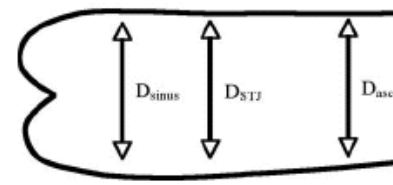
Type N
 $D_{sinus} > D_{STJ}$
 $D_{sinus} \geq D_{asc}$

Normal



Type A
 $D_{sinus} > D_{STJ}$
 $D_{sinus} < D_{asc}$

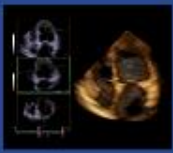
Supra-coronary dilatation



Type E
 $D_{sinus} \leq D_{STJ}$

Cylindric (sinus effacement)

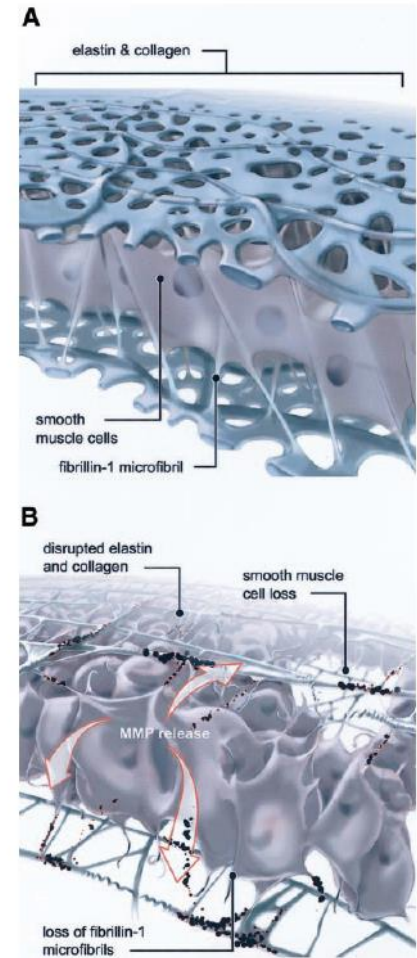
(Schaefer et al. Heart 2008;94:1634-8)



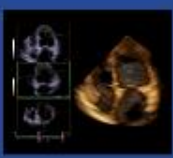
BAV and Ascending Aorta

- Histological abnormalities of the aortic wall
- Maximal aortic dilatation rate does not differ between BAV and Marfan syndrome (0.42 ± 0.6 vs 0.49 ± 0.5 mm/yr.)

(Detaint et al. Heart, in press)



(Fedak et al. Circulation 2002;106:900-4)



EuroValve

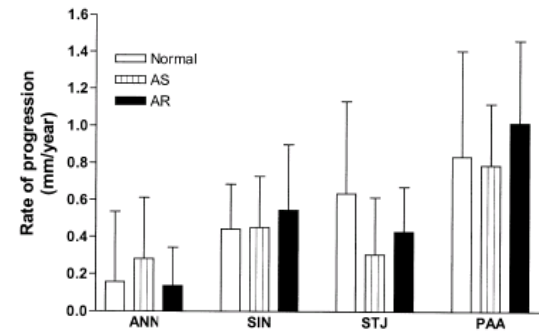


Aortic Dilatation and Valve Function

The rate of progression of ascending aorta diameters

- Does not depend on aortic valve function

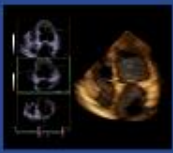
*(Ferencik et al.
Am J Cardiol 2003;92:43-6)*



- Does not differ in patients with or without AVR

Progression (mm/m ² /yr.)	No AVR	AVR
Valsalva sinuses	0.02±0.13	0.03±0.06
Ascending aorta	0.08±0.06	0.10±0.06

(Yasuda et al. Circulation 2003;108suppl.II:II291-4)



Aortic Dissection and BAV

- Necropsy

186 patients with aortic dissection

14 (7.5%) had a bicuspid aortic valve

(Roberts et al. J Am Coll Cardiol 1991;17:712-6)

- IRAD registry

951 patients from 18 centres (1996-2001)

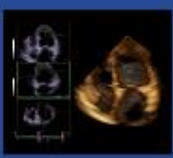
Aortic valve morphology was available in 516

18 (3.5%) had a bicuspid aortic valve

- 9% before 40 years

- 1% after 40 years

(Januzzi et al. J Am Coll Cardiol 2004;43:665-9)

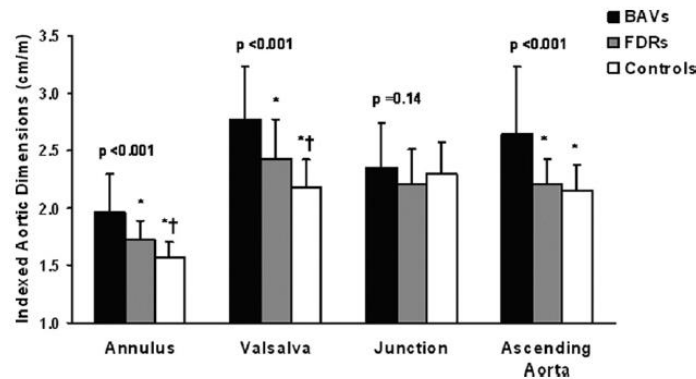


Genetic Component in BAV

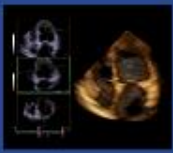
- High heritability of BAV (75-89%)
 - 50 probands with BAV
 - 259 first-degree relatives: 24% with BAV

(Cripe et al. J Am coll Cardiol 2004;44:138-43)

- Prevalence of aortic root dilatation of 32% in first-degree relatives of subjects with BAV



(Biner et al. J Am Coll Cardiol 2009;53:2288–95)

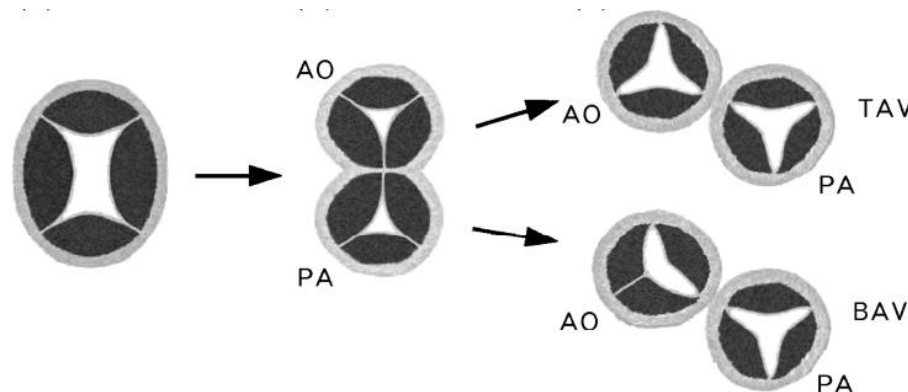


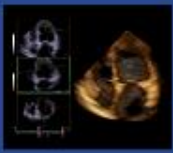
Genetic Component in BAV

- Association between mutations of NOTCH-1 gene and BAV in a family comprising 11 case of congenital heart disease (6 with BAV)

(Garg et al. Nature 2005;437:270-4)

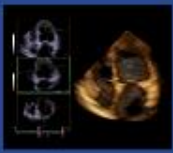
NOTCH-1 signalling pathway is involved in the septation of the common arterial trunk





Conclusion (I)

- Bicuspid aortic valve is frequent in the population.
- It seldom causes aortic valve dysfunction during childhood and adolescence.
- Aortic valve dysfunction occurs progressively in the adult and is most often aortic stenosis, due to superimposed degenerative valve remodelling.
- Aortic stenosis occurs more frequently and at a younger age on bicuspid than on tricuspid valve.



Conclusion (II)

- Aortic dilatation
 - is due to structural abnormalities of the aortic wall
 - follows different patterns which are linked to aortic valve morphology
 - does not depend on valve function
- Growing evidence suggests a genetic component in bicuspid aortic valve.