Aortic Valve Disease: Catheter-based Therapies for Now and in the Future

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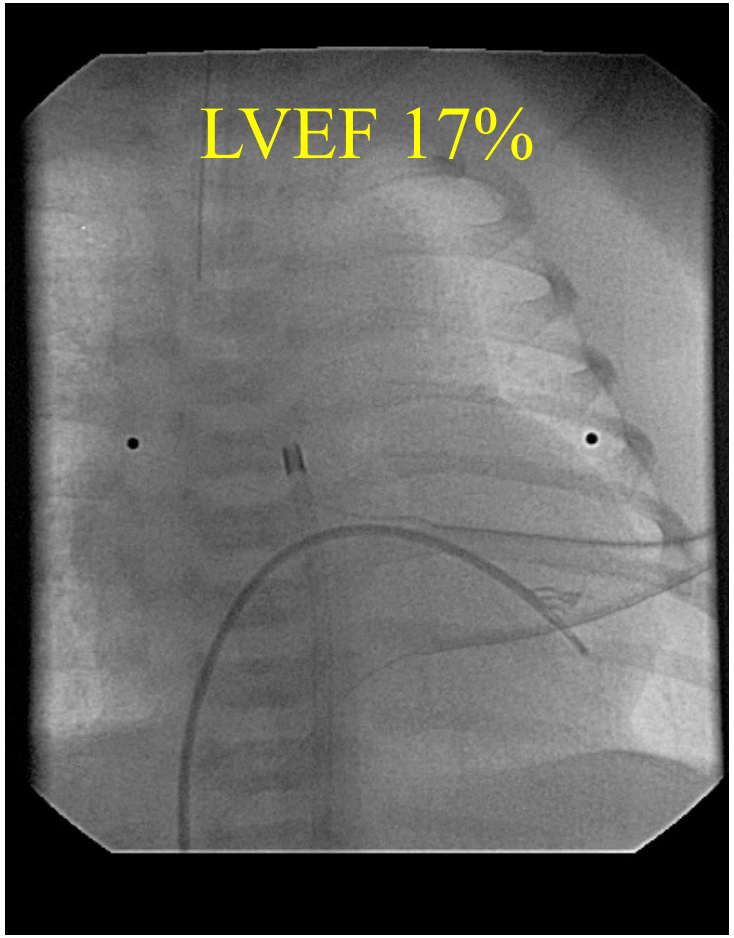
Disclosures

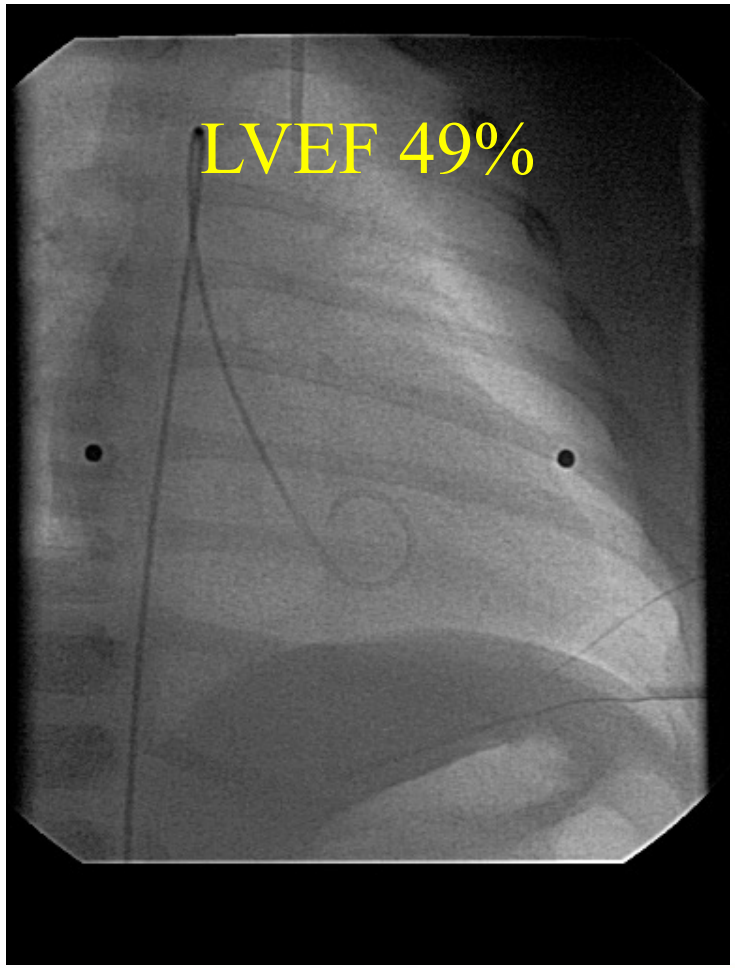
None

Classic Dogma

- “Critical AS is a disaster”
- “BAV results in severe AI”
- *“Dysplastic* valves”
- “Balloons don’t work”

LV Function Pre-BAV





Anatomy Dictates Physiology

$$\Delta P = \frac{Cardiac\_Output^2}{AVA^2 * SEP^2 * 44.3 * HR^2}$$

Natural History

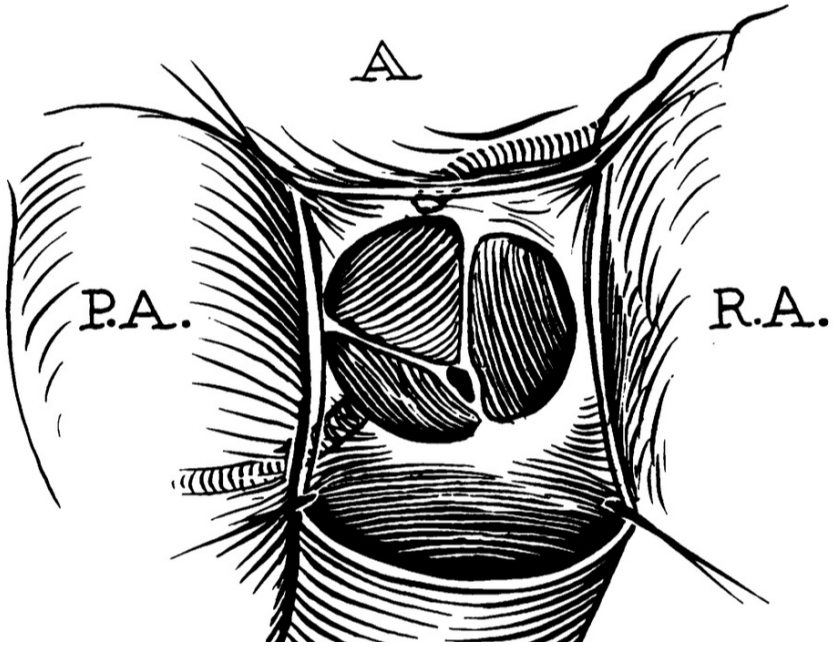
Decade	No. of patients	Patient years of follow-up	Sudden deaths	All deaths
1st	24*	93	2	2 (8)†
2nd	20+15	213	2	3 (8)
3rd	12+17	182	0	2 (7)
1–3rd	56+32	488	4	7 (8)
4th	12+9	124	1/0	2/1 (14)
5th	15+9	125	0/2	3/3 (25)
6th	4+4	45	1/0	3/3 (75)
Total	87	782	8	22 (25)

14/39 infants (36%) died in the first 1-2 years of life

Campbell Br Heart J 1968

Un-Natural: Surgical Aortic Valvotomy

- Described by Mustard in 1963
- Incision of fused commissures
- Increase in opening area reduces gradient



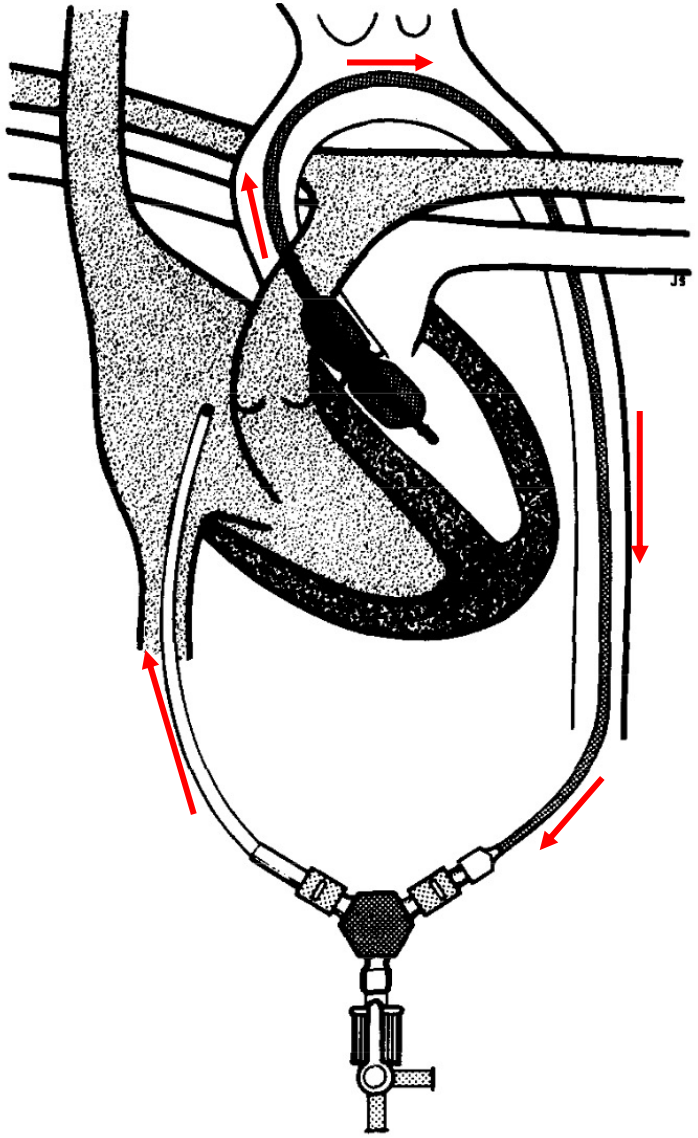
W.T. Mustard, Can Med As J 1963

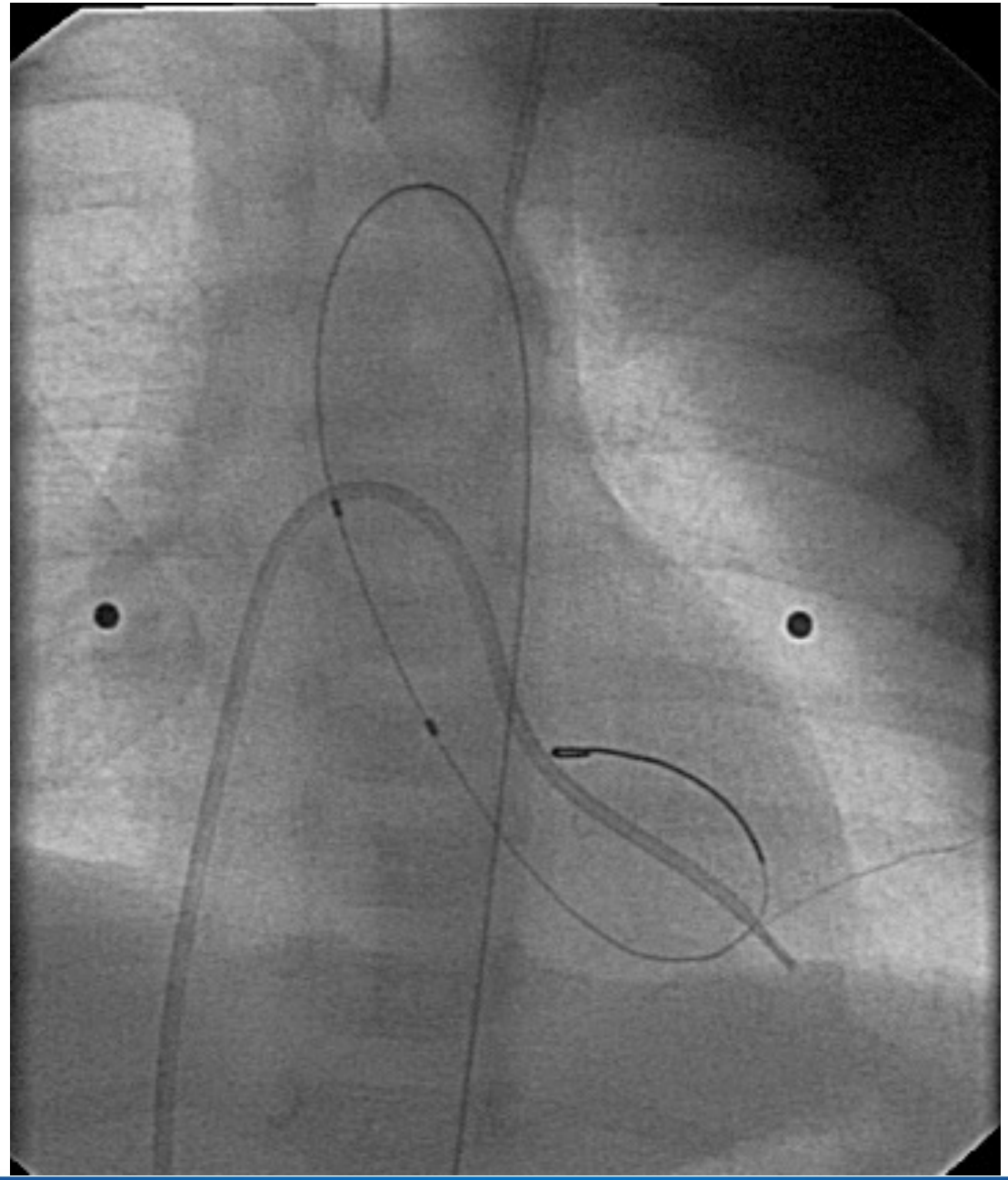
“Un-Natural” Cath

- Balloon aortic valvuloplasty (BAV) introduced in 1983
- 9 French balloon catheters

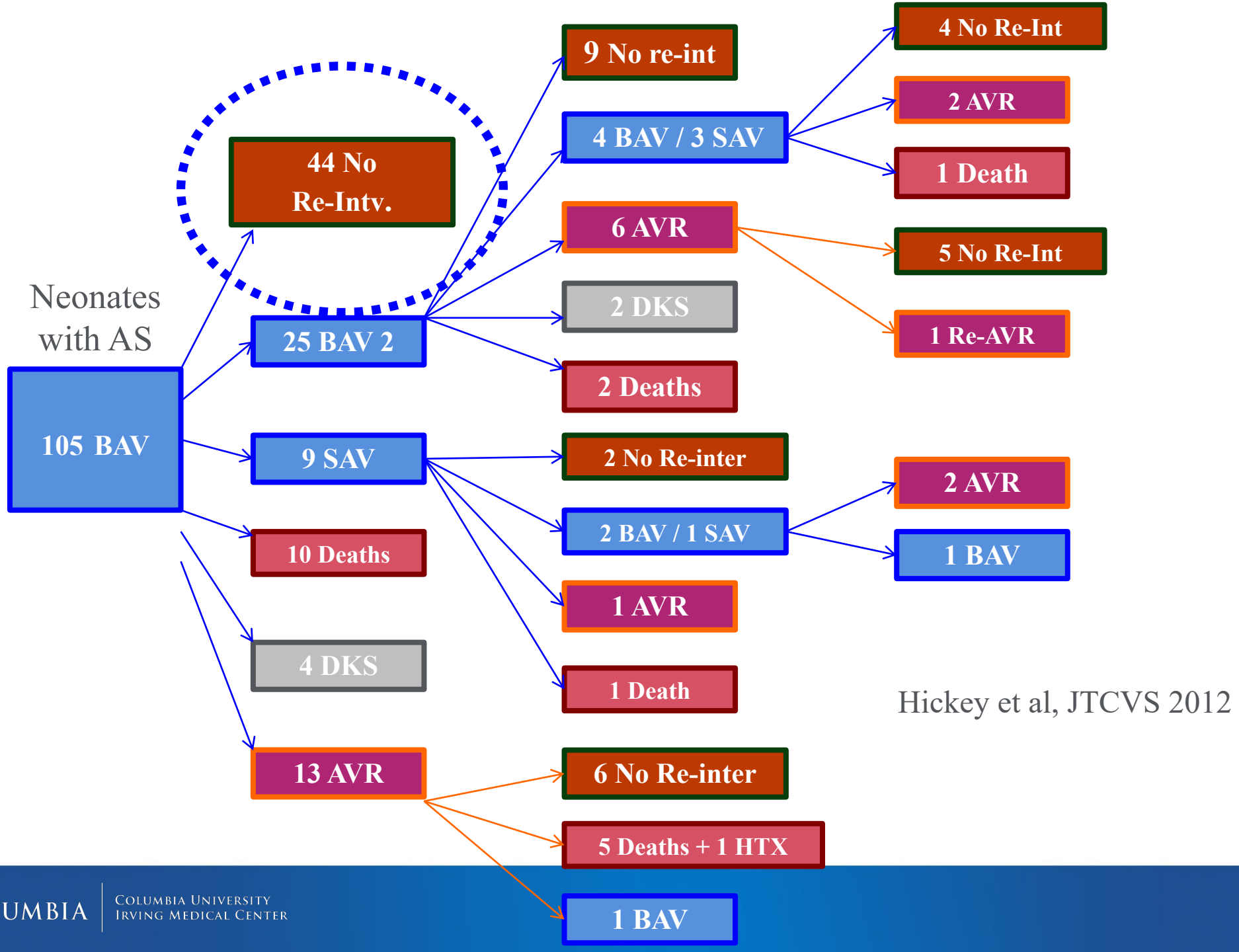
		Before Valvuloplasty		
Case No.	Age (yr)	LV (mm Hg)	Aorta (mm Hg)	psg (mm Hg)
1	10	200/8	115/84	85
2	4	161/12	84/63	77
3	13	240/10	78/54	162
4	9	230/8	100/75	130
5	2	165/5	115/40	50
6	16	270/4	112/67	158
7	2	165/6	92/56	73
8	2	155/4	100/52	55
9	19	170/4	99/70	71
10	8	180/3	118/72	62
11	12	300/8	115/64	135
12	12	320/20	101/67	219
13	3	270/8	160/72	110
14	7	210/20	100/67	110
15	17	192/20	120/86	72
16	4	190/22	86/46	104
17	11	212/5	101/52	132
18	8	330/16	107/72	223
19	16	284/15	138/99	146
20	14	199/10	115/75	84
21	4	264/7	106/68	158
22	8	170/12	73/50	97
23	10	180/8	87/49	93
Mean ±SD	9 ±5	220/10 ±54/6	105/65 ±19/14	113 ±48

Lababidi, AHJ 1984



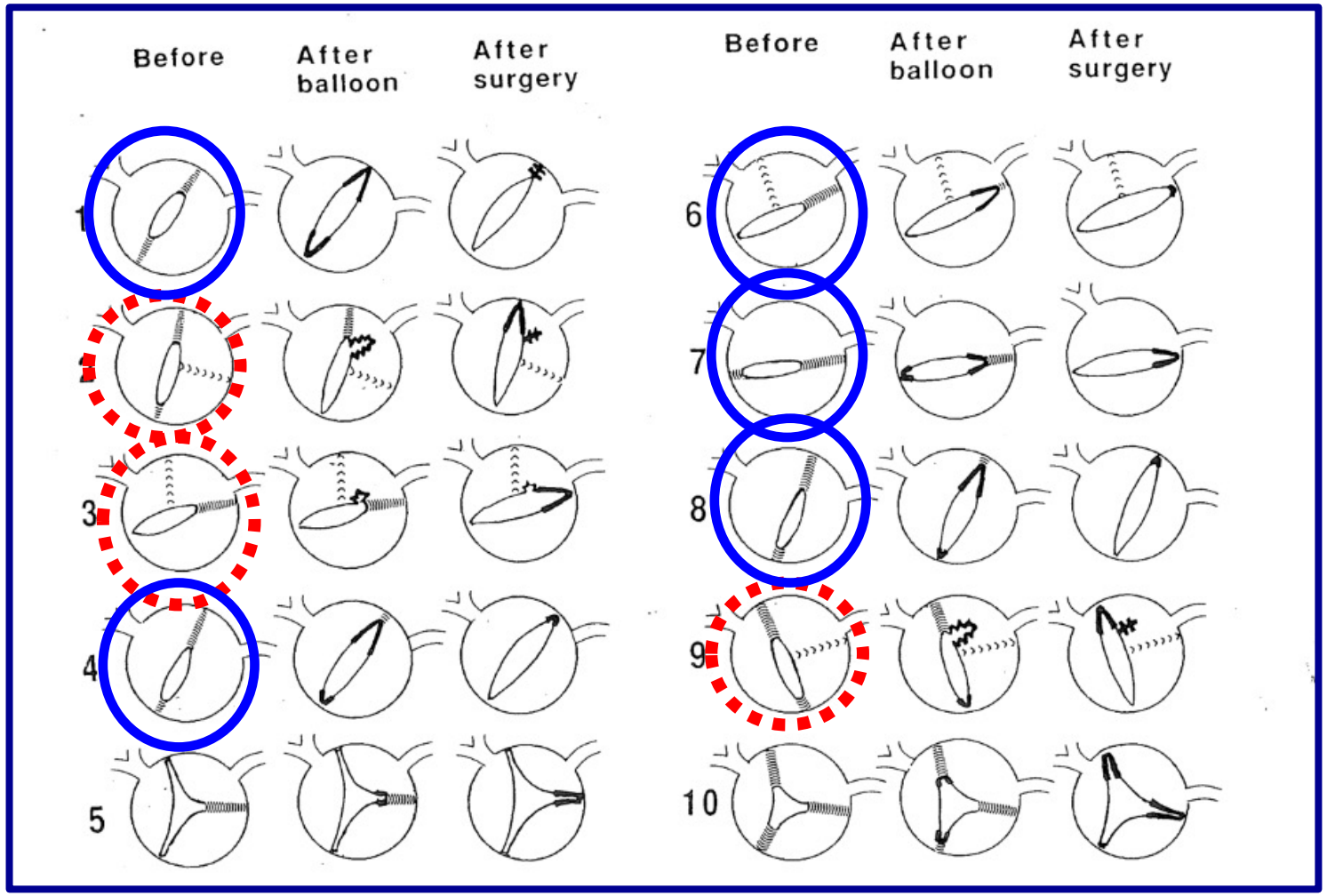


Neonatal BAV Works



Hickey et al, JTCVS 2012

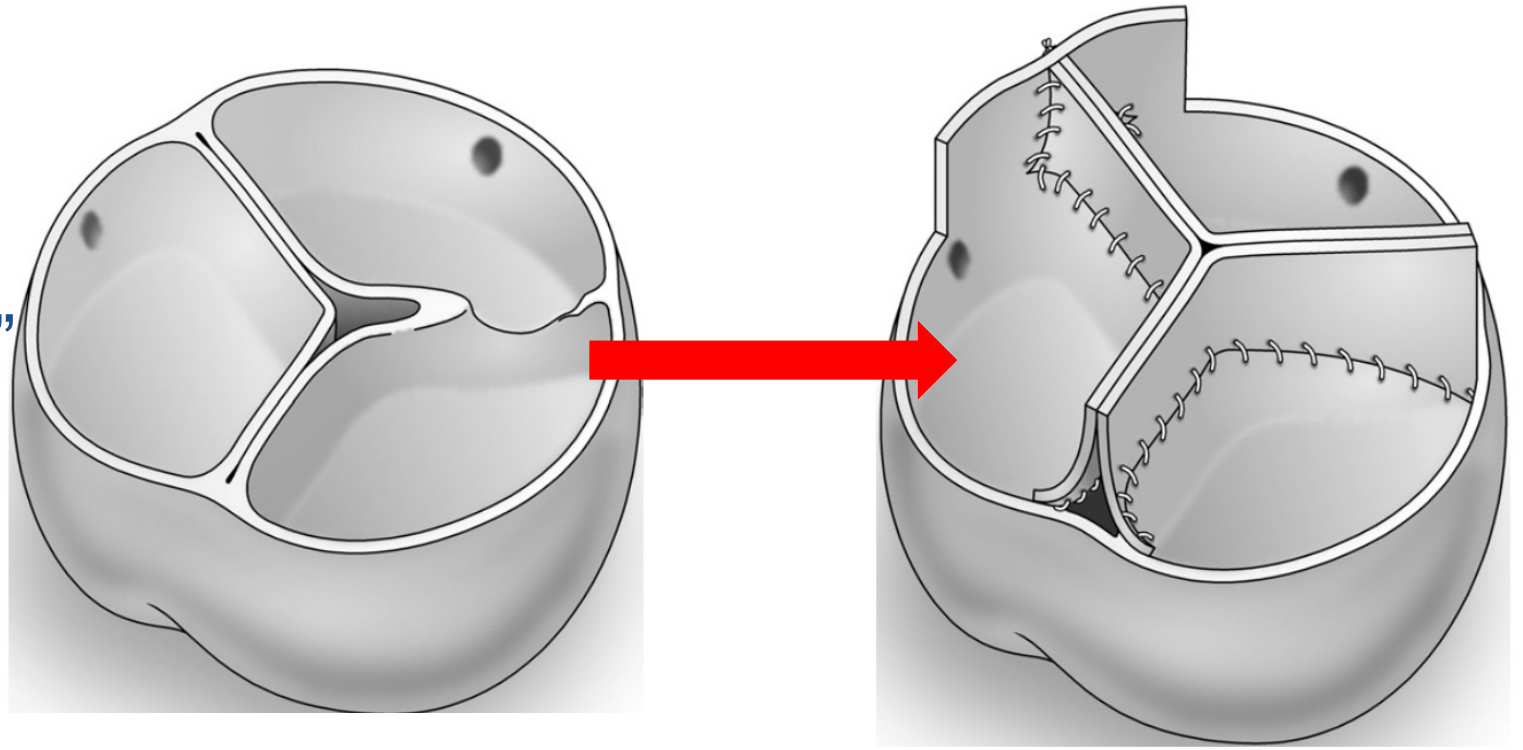
Balloons tear



Solymar et al, JTCVS 1992

Surgical Interest in Neonatal AS

- Technical skillset
- “tricuspidization”
- “leaflet augmentation”
- “shaving/thinning”

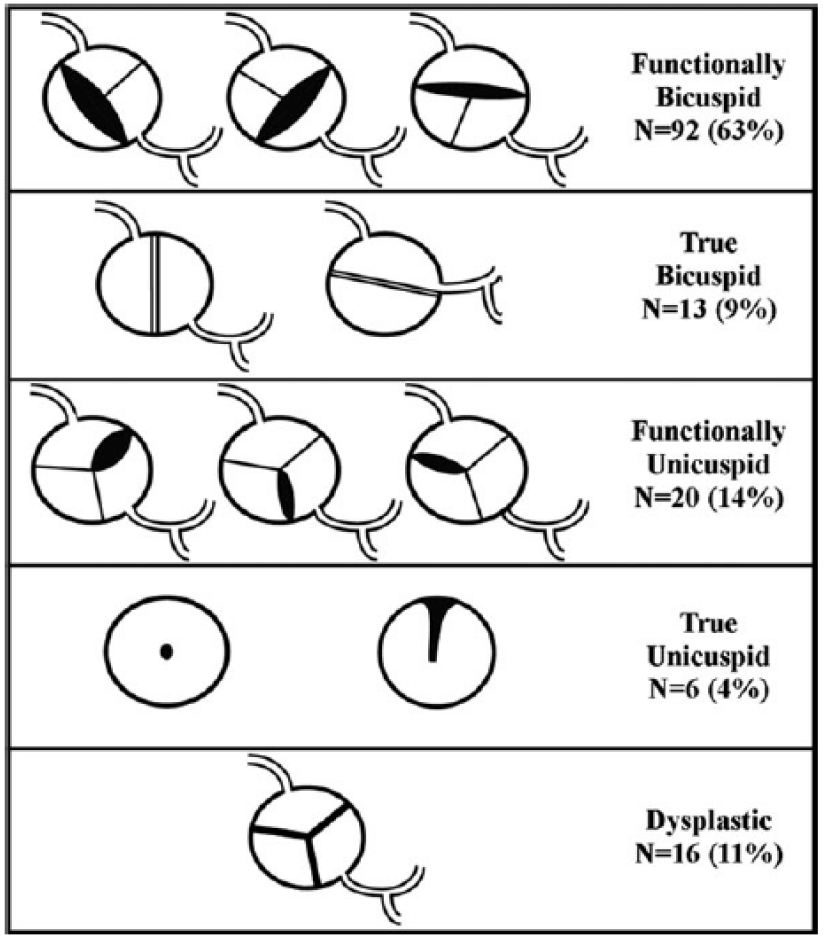


McMullan JTCVS 2010


5 mm

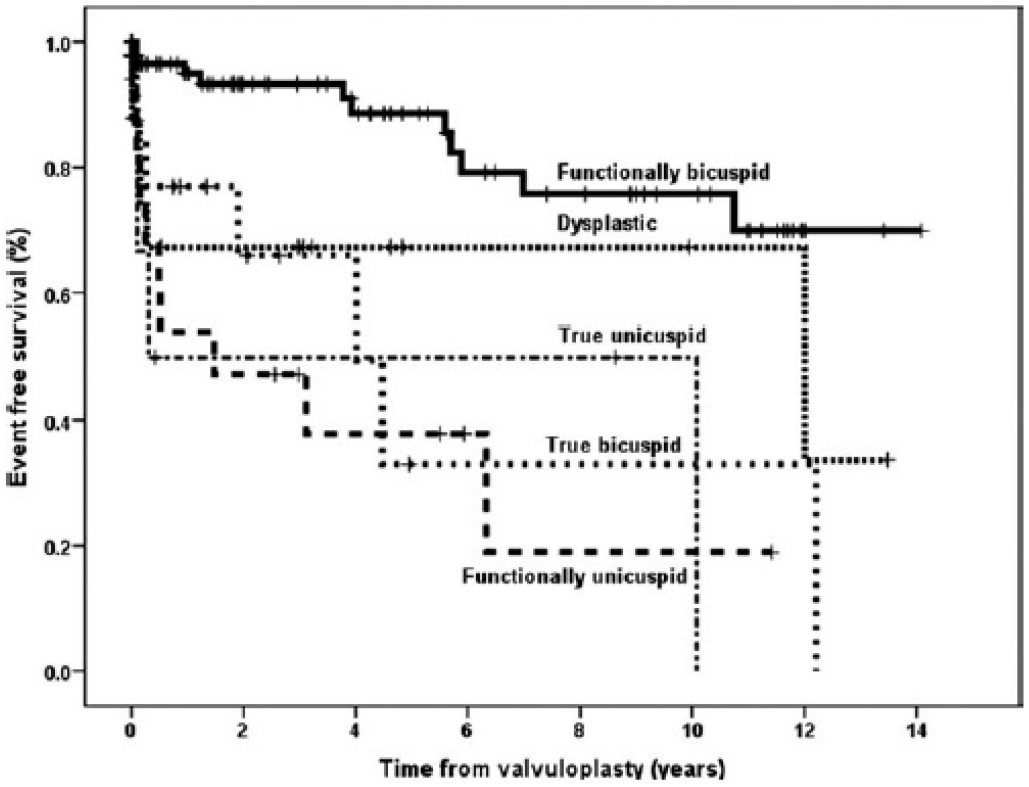
What about valve morphology?

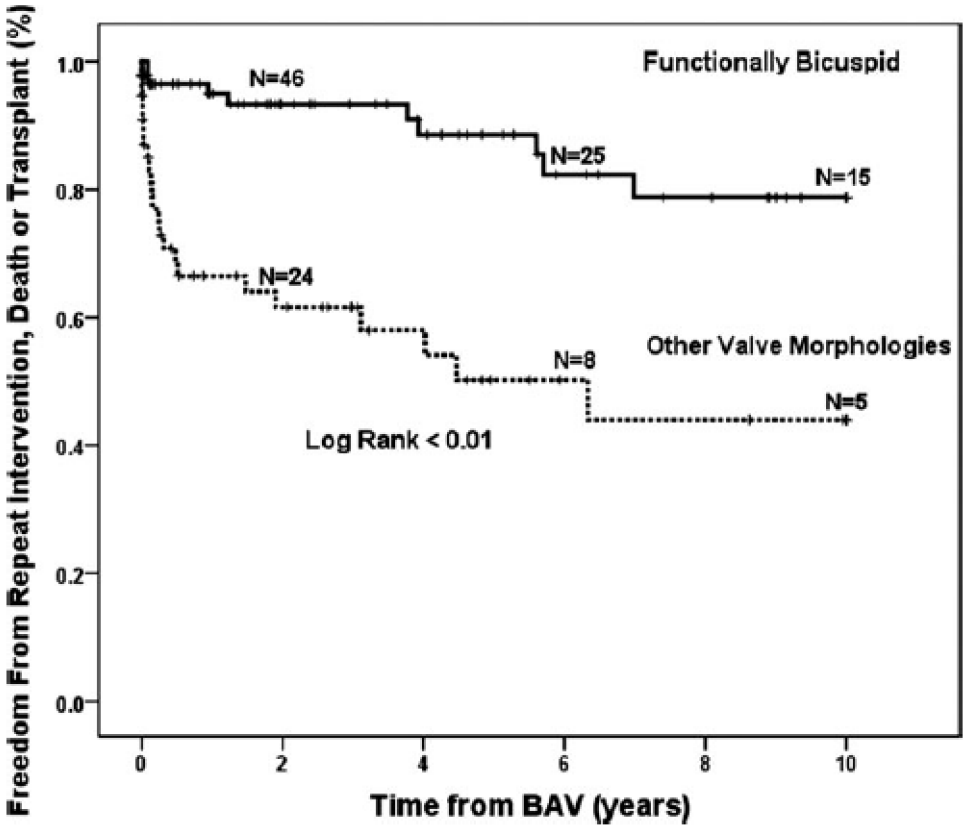
- Reviewed 27 years of BAV
- Categorized morphology
- Reviewed long term outcomes (5-15 years)
- Valve factors:
  - Number of leaflets
  - Thickness of leaflets
  - Orientation of fusions



Maskatia CCI 2013

Functionally Bicuspid Valves Have Best Outcomes





Maskatia et al, CCI 2013

Something (48%) is missing

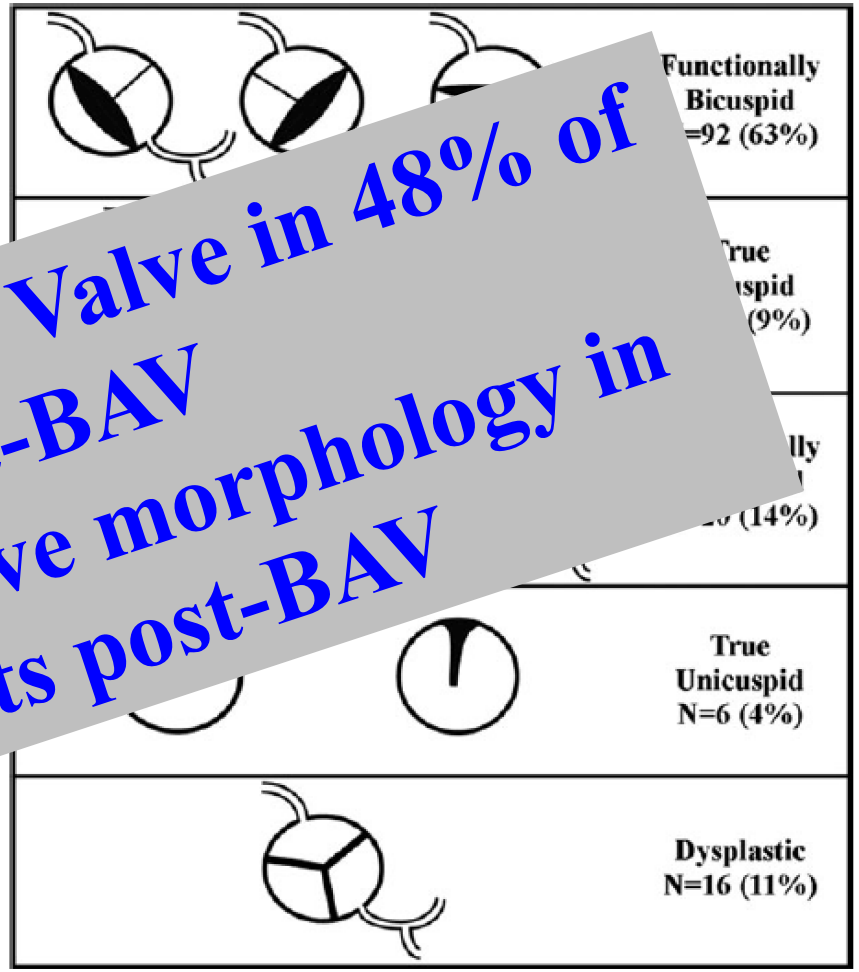
Reviewed 27 years of BAV

Categorized morphology

Reviewed long term outcomes (5-15 years)

Valve factors:

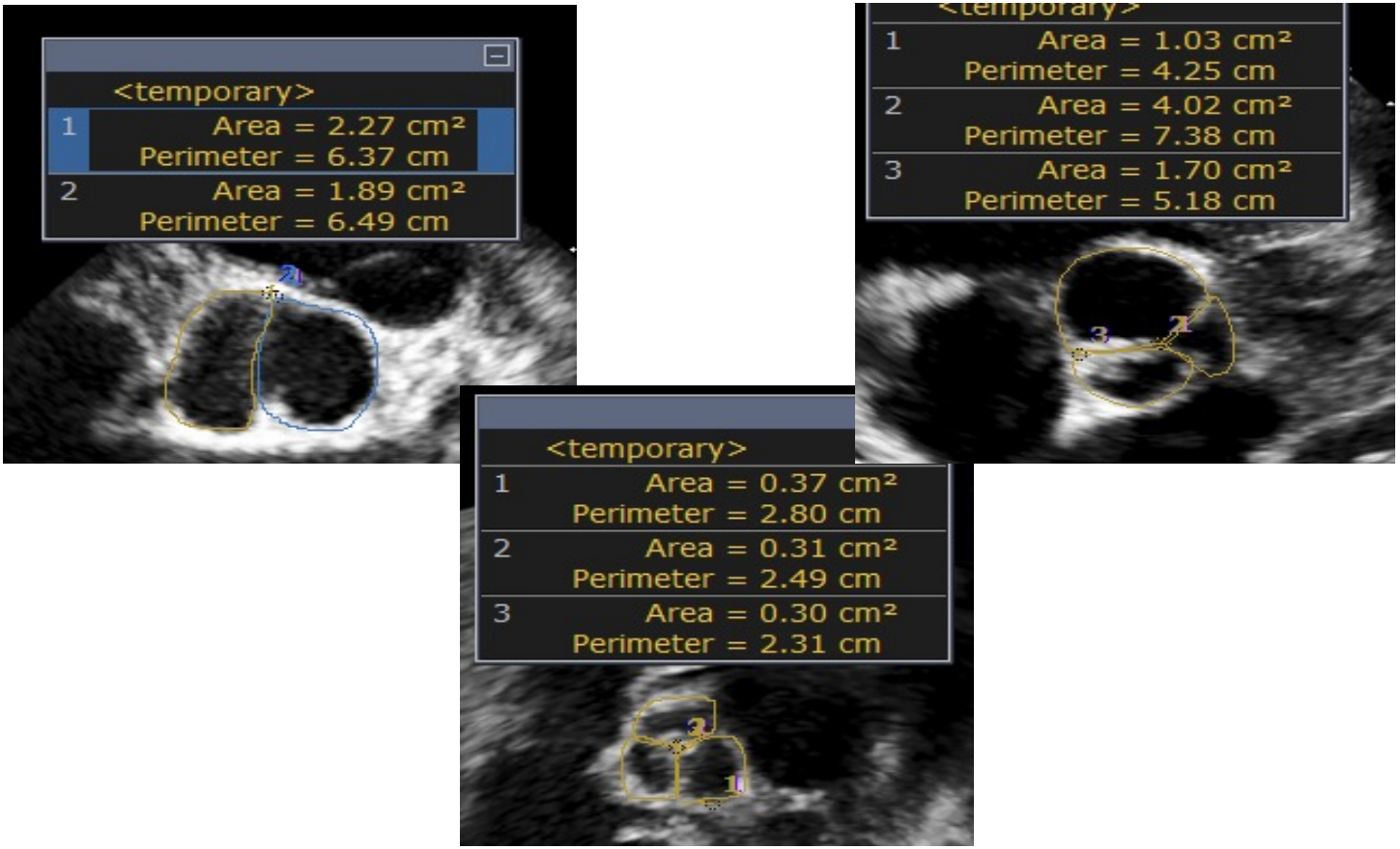
- Number

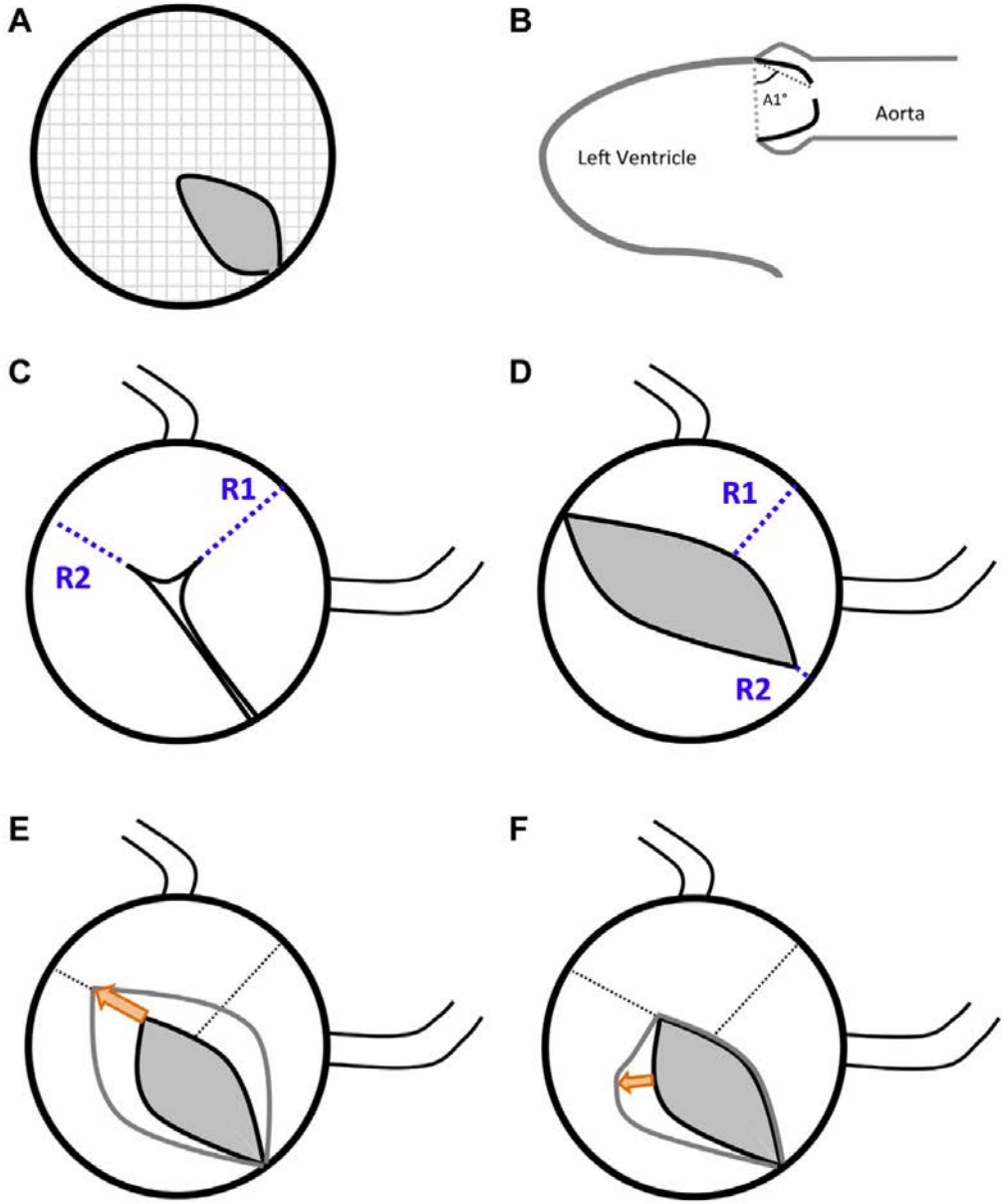


No Description of Aortic Valve in 48% of patients pre-BAV

No Description of Valve morphology in 90% of patients post-BAV

Torture your imaging colleagues



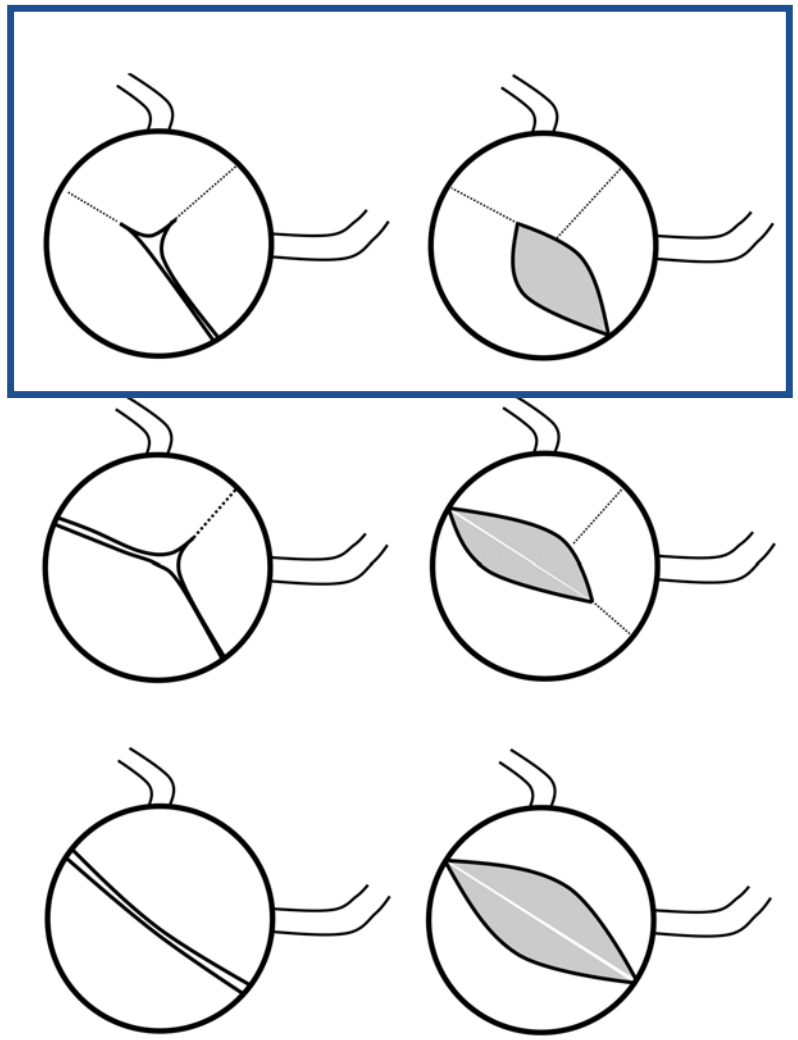


Aortic Valve Classification

Functionally Unicuspid

Functionally Bicuspid

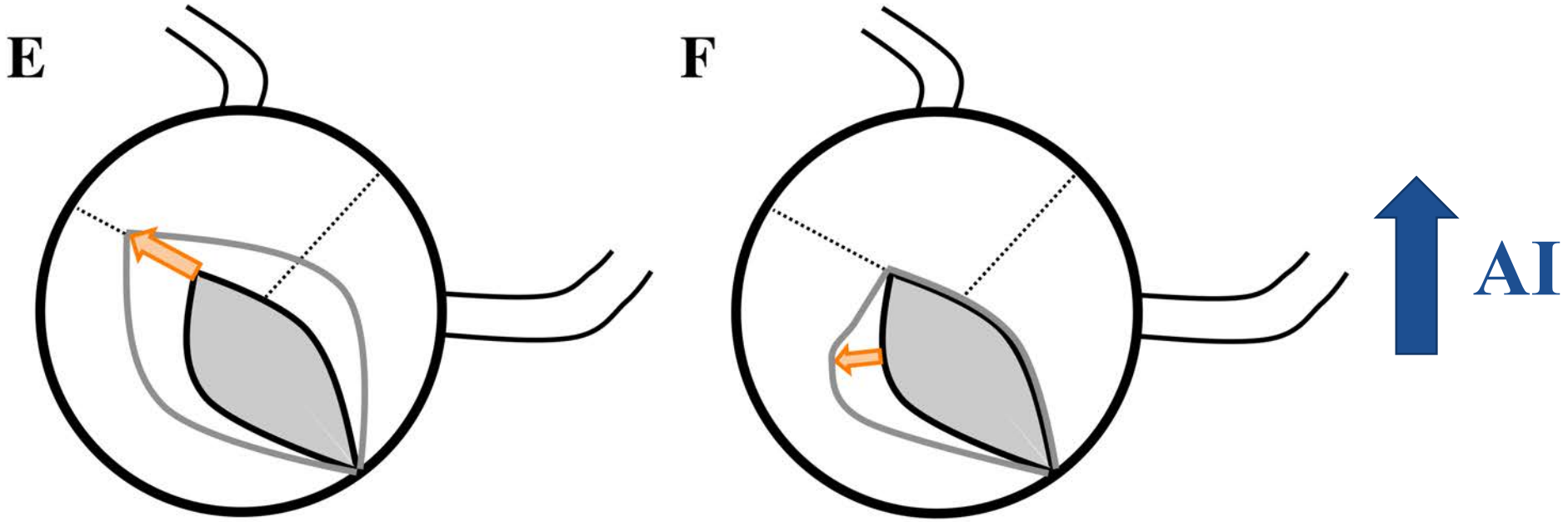
True Bicuspid



Petit, AJC 2016

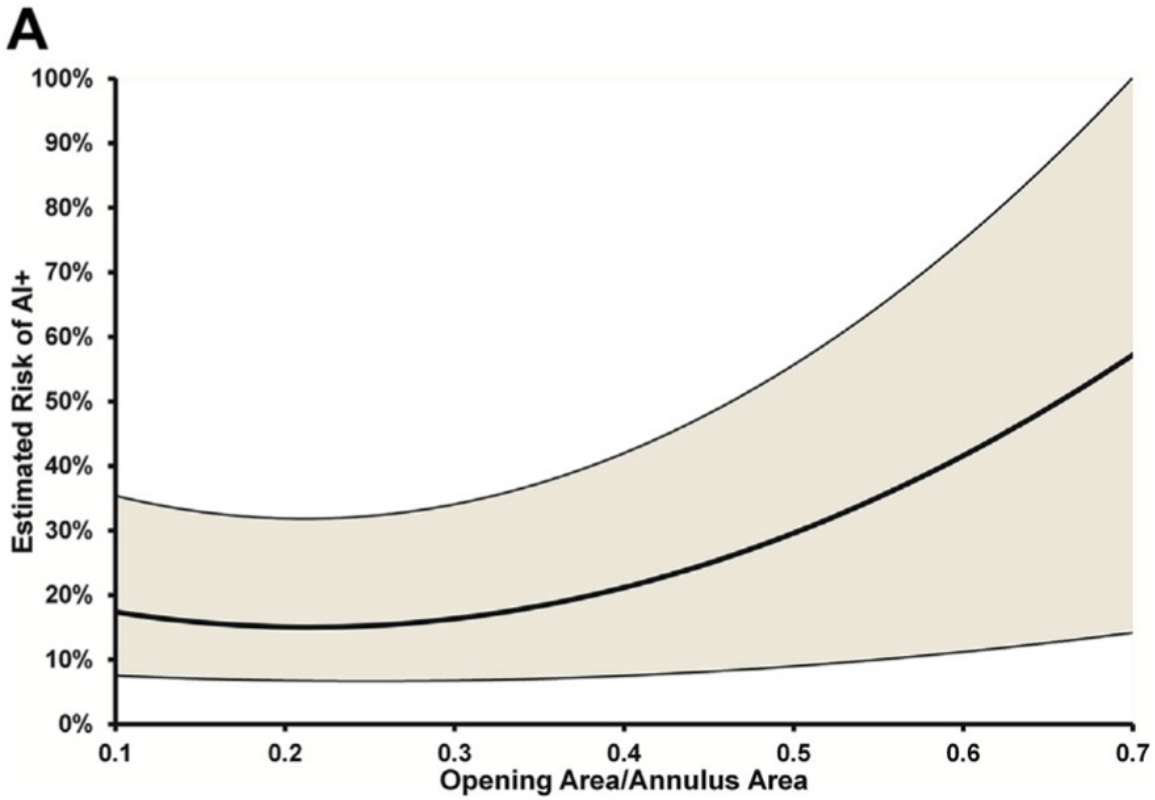
CONGENITAL CATHETERIZATION RESEARCH COLLABORATIVE

Tear into Leaflet or Along Commissure?



Petit, AJC 2016

Risk of AI Post-Balloon



What do I worry about?

- Severe aortic insufficiency
- Leaving residual AS
- Ventricular arrhythmias
- Mitral valve damage
- Vascular injury
- Stroke

What do I worry about?

- Severe aortic insufficiency **
- Leaving residual AS ***
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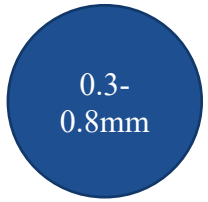
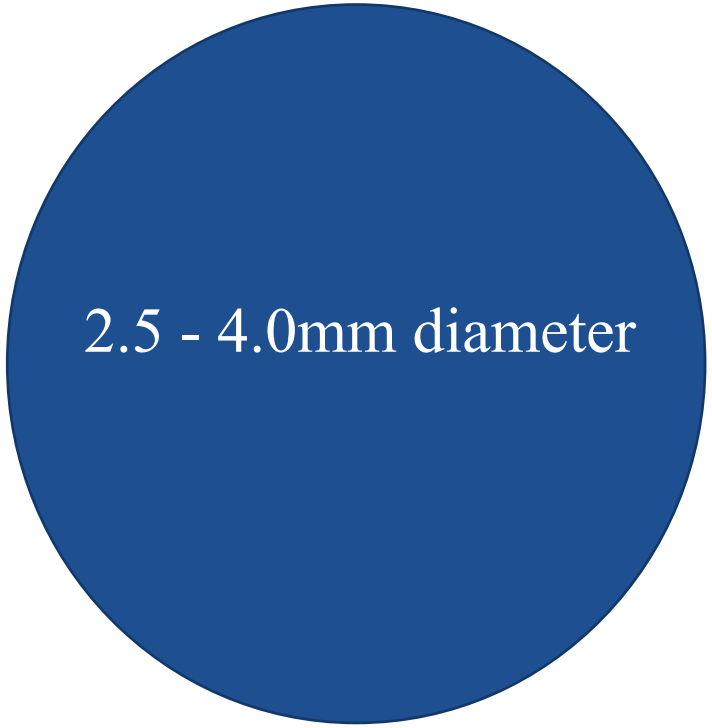
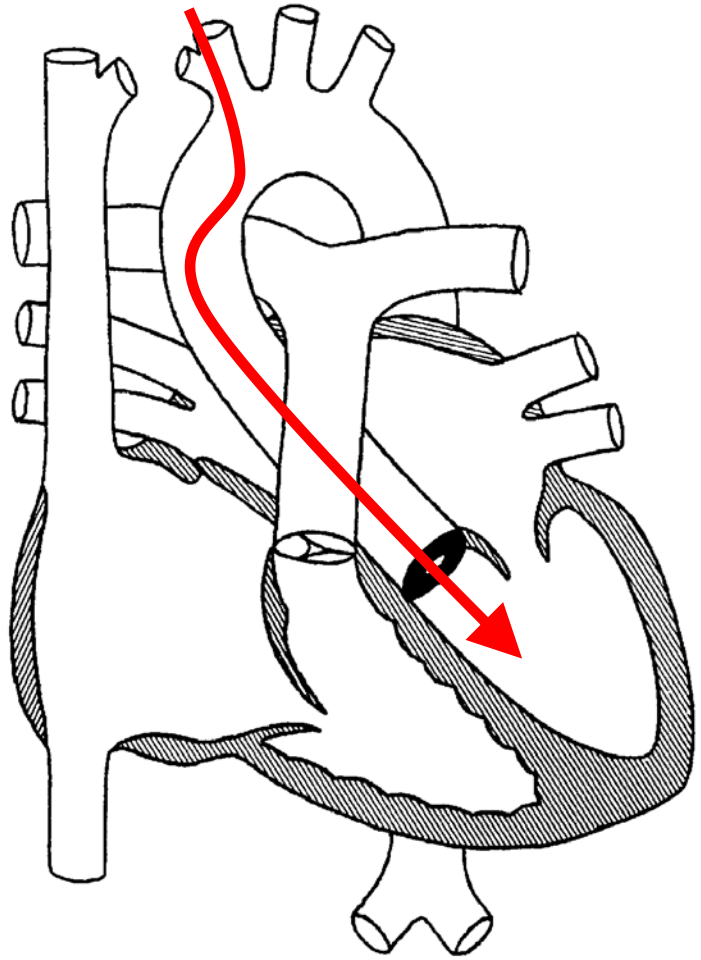
Carotid Access



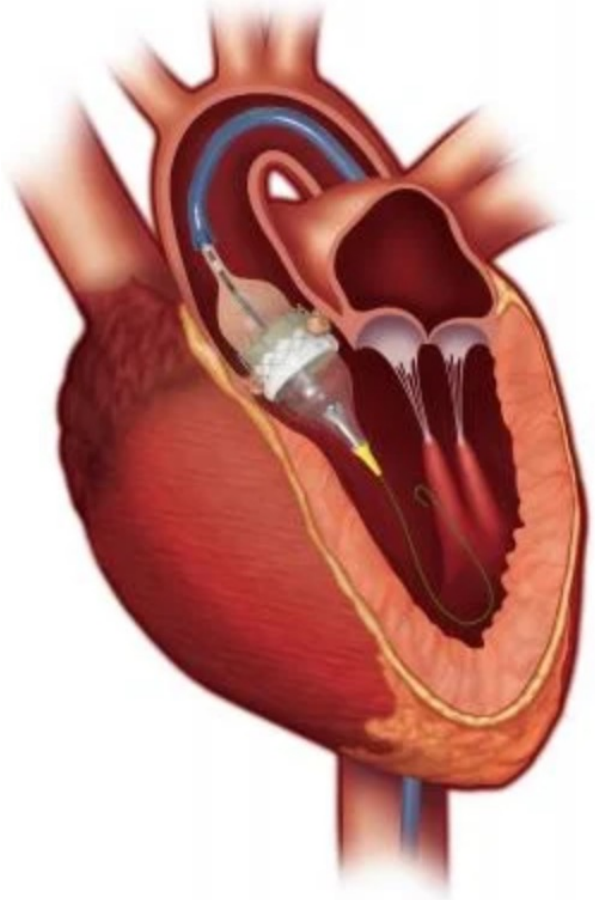
Femoral artery



Carotid artery



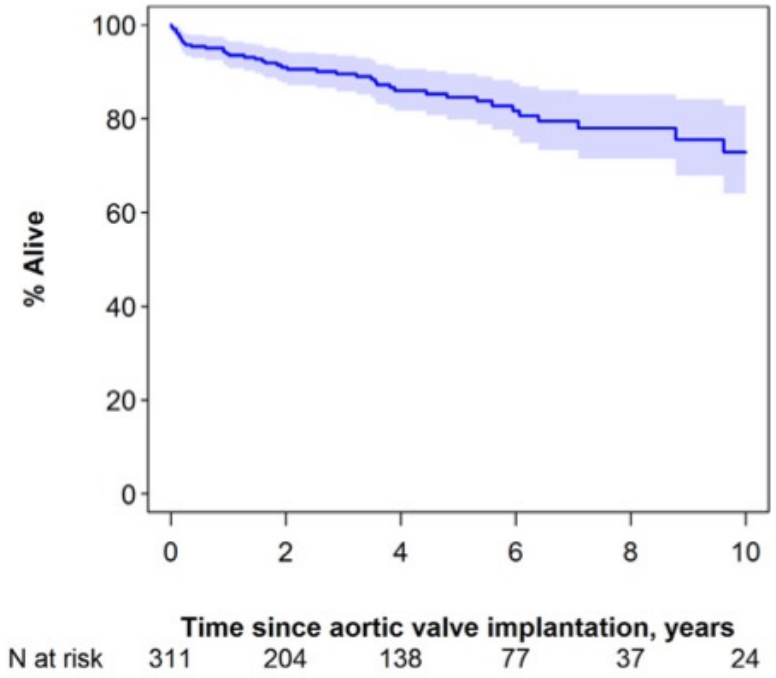
Transcatheter Aortic Valve Replacement - TAVI



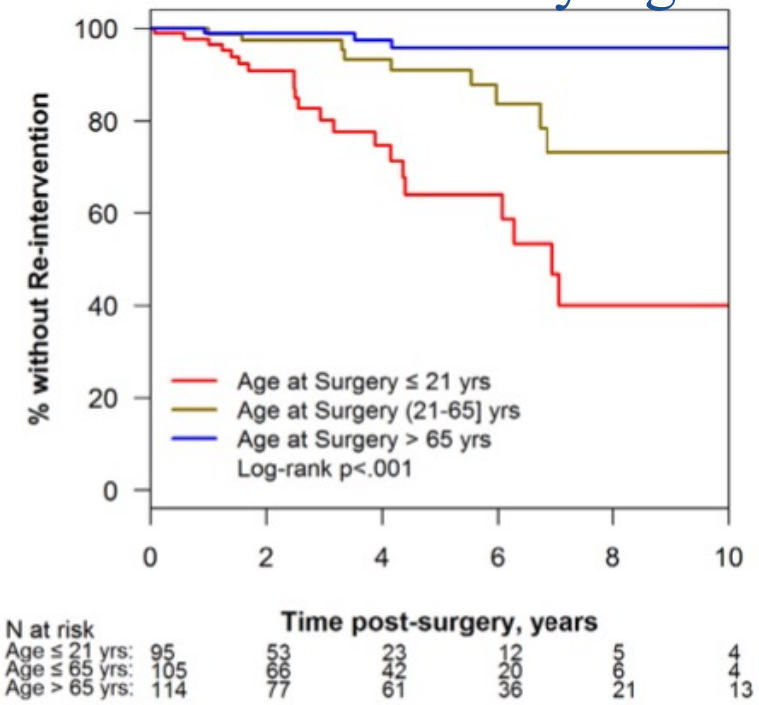
Mortality and Reoperation Risk After Bioprosthetic Aortic Valve Replacement in Young Adults With Congenital Heart Disease

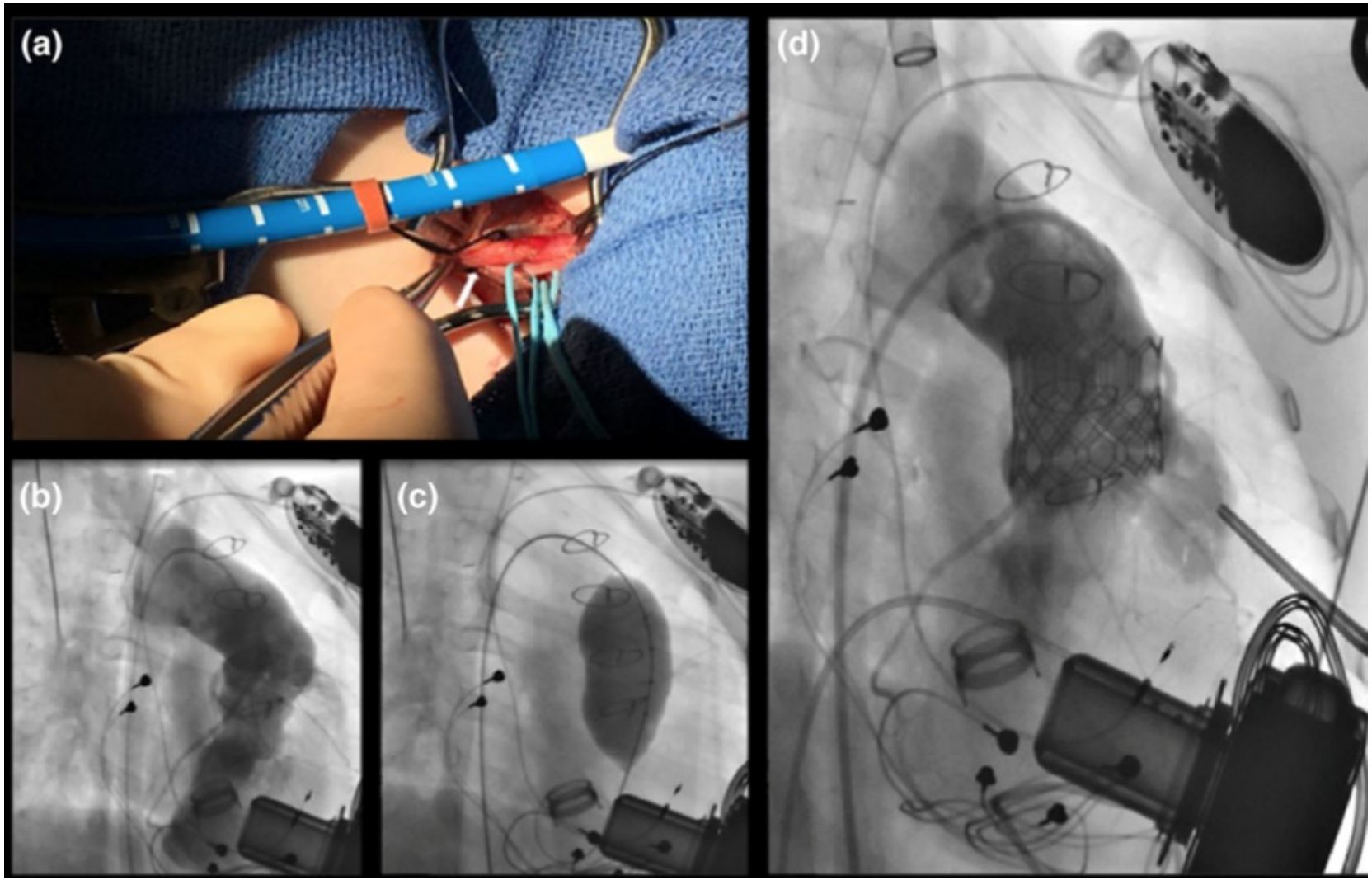
Stephanie M. Fuller, MD, MS,[*] Michele J. Borisuk, MSN, CPNP,[†] Lynn A. Sleeper, ScD,[†,‡] Emile Bacha, MD,[§] Luke Burchill, MD,[¶] Kristine Guleserian, MD,[**] Michel Ilbawi, MD,[††] Anees Razzouk, MD,[‡‡] Takeshi Shinkawa, MD,[§§] Minmin Lu, MS,[†] and Christopher W. Baird, MD[¶¶]

Survival post-Bioprosthetic AVR



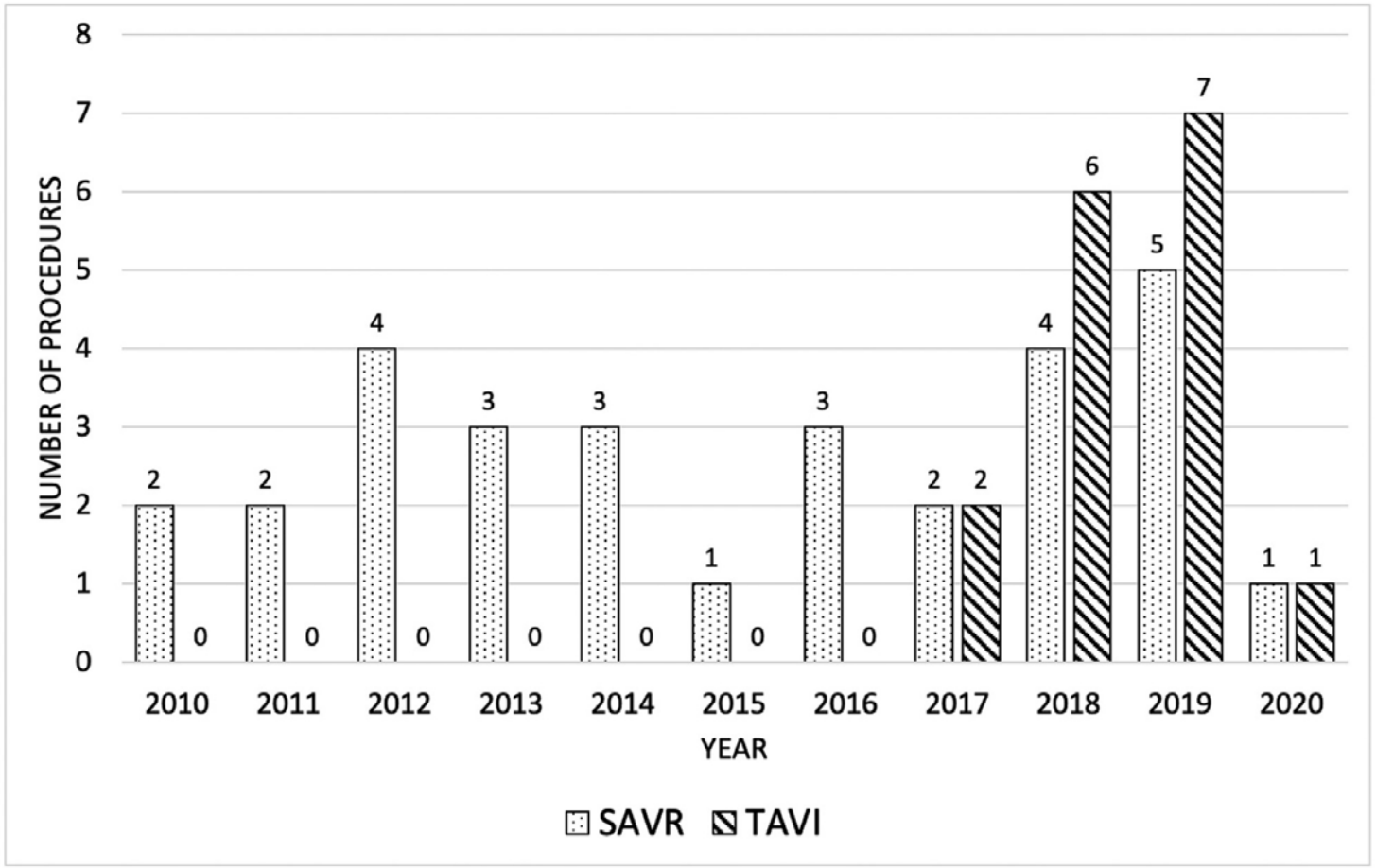
Reintervention by Age





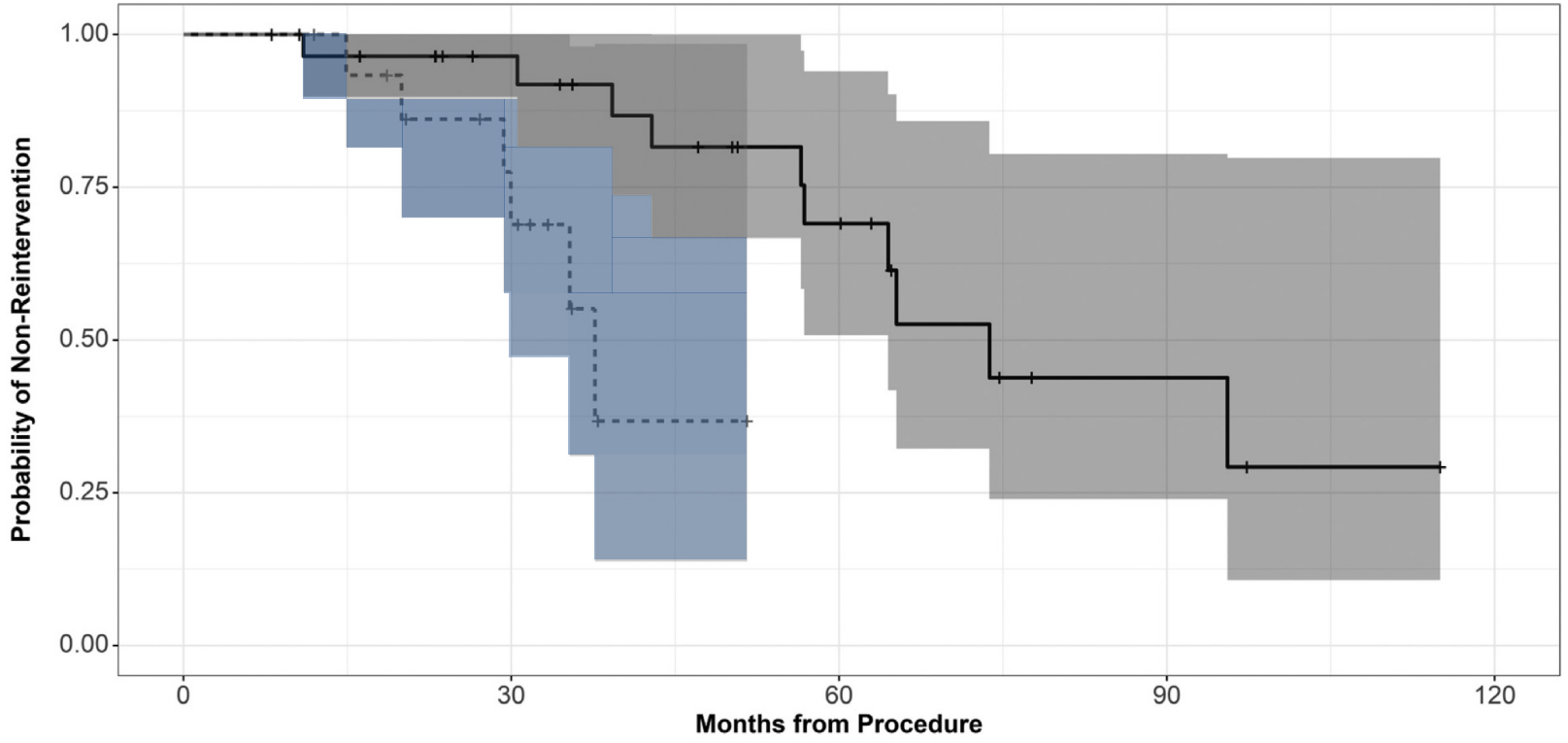
Sinha, Khan et al CCI 2019

TAVI in Children



Robertson et al, AJC 2022

Risk of Reintervention with TAVI

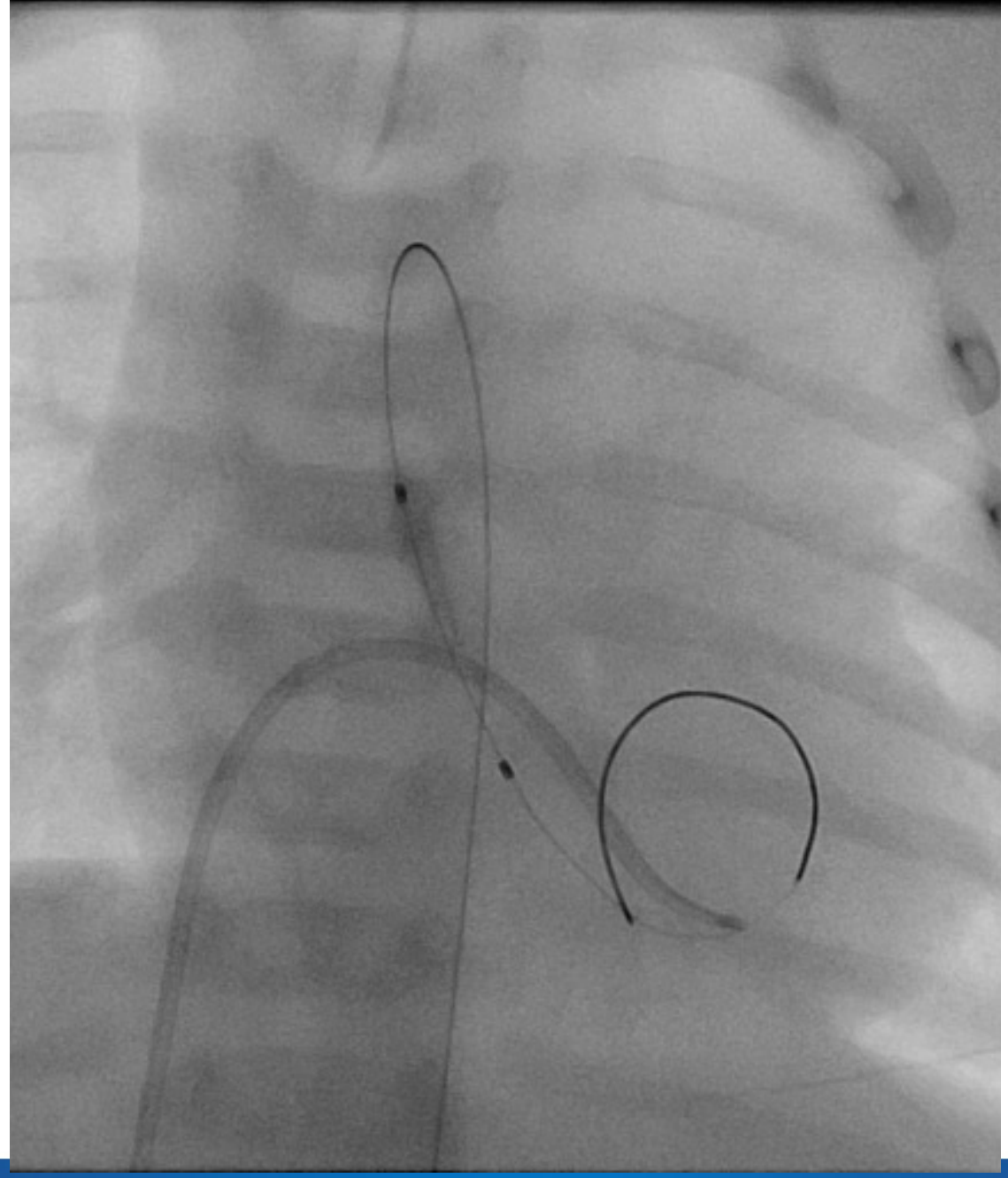


Robertson et al, AJC 2022

Conclusions

- BAV – effective palliation
- TAVI – solution for bailout situations
- Area of necessary partnership with CHD surgeons

Thank you



Mind the wire!