

STS/EACTS Latin America Cardiovascular Surgery Conference

November 15-17, 2018

Hilton Cartagena | Cartagena, Colombia



The Society
of Thoracic
Surgeons



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European Association for Cardio-Thoracic Surgery

Valve-sparing repair with intraoperative balloon dilation in tetralogy of Fallot: Mid-term results



Valve-sparing repair with intraoperative balloon dilation in tetralogy of Fallot: Mid-term results

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No Disclosures

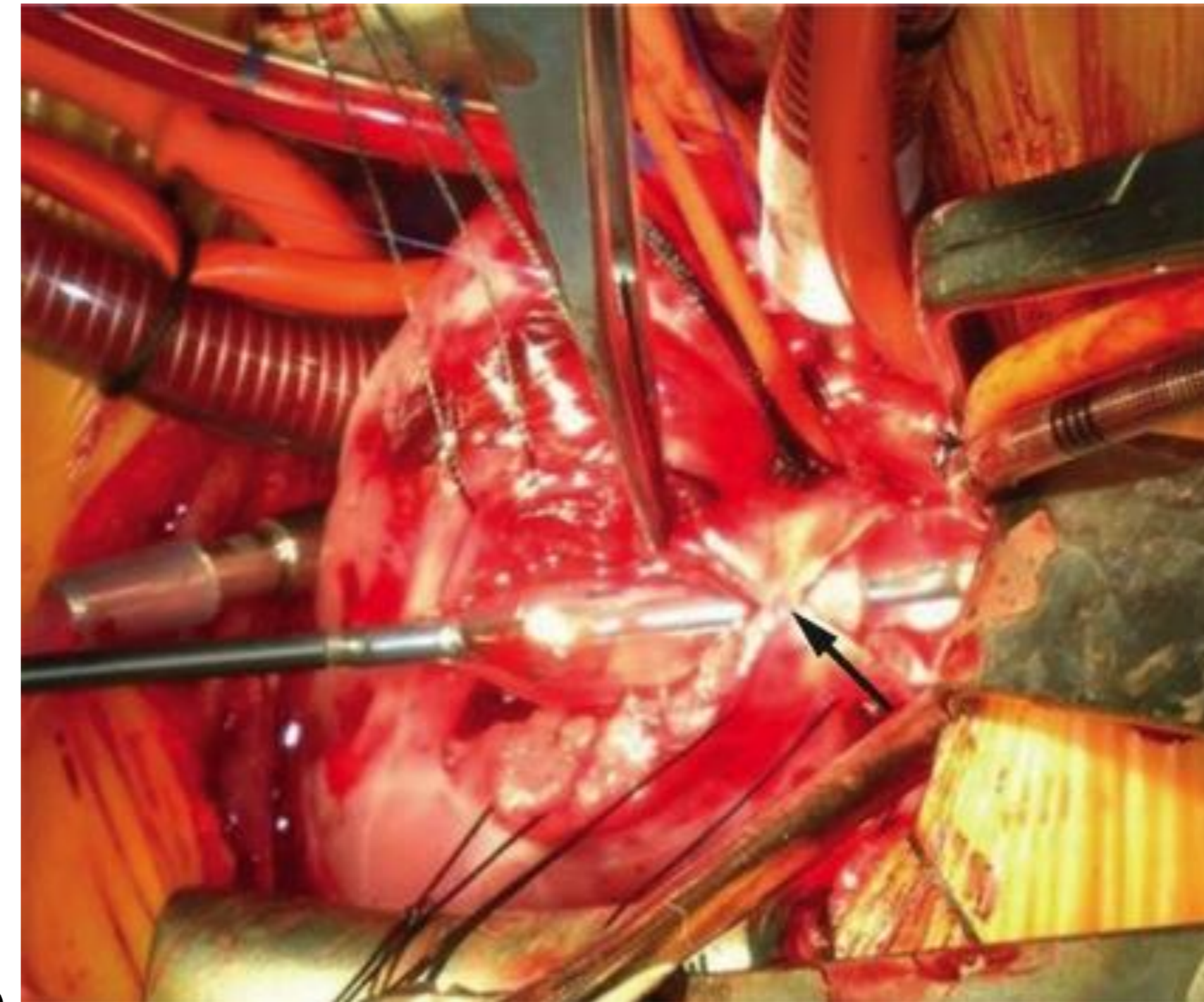


Valve-sparing repair with intraoperative balloon dilation

- **Implemented at our BCH since 2007**

- **Technique**

- Infundibulotomy
 - VSD closure, muscle bundle resection
 - Infundibular (non-transannular) patch
- MPA patch augmentation
- Pulmonary valve commissurotomy
- Pulmonary valve annulus dilation
 - Balloon inflation to 120 - 140% of measured annulus diameter
 - 1 unit increase in annulus z-score



Methods

- **Retrospective review of all ToF-PS pts who underwent valve-sparing repair with IBD under 1 year of age (2007 - 2015)**
 - Excluded pts: ToF/PA, ToF/MAPCAs, ToF/CAVC

Study Endpoints:

Early

- **Residual Lesion Score - pulmonary stenosis (discharge echocardiogram)**
 - RVOT peak gradient: Class 1: 0 - 20mmHg, Class 2: 20 - 40mmHg, Class 3: >40mmHg
- **Pulmonary valve reintervention for residual stenosis**
 - Multi-variable regression analysis - risk factors for valve reintervention

Late

- **Mid-term pulmonary valve competency**
- **RV remodeling - chamber size**

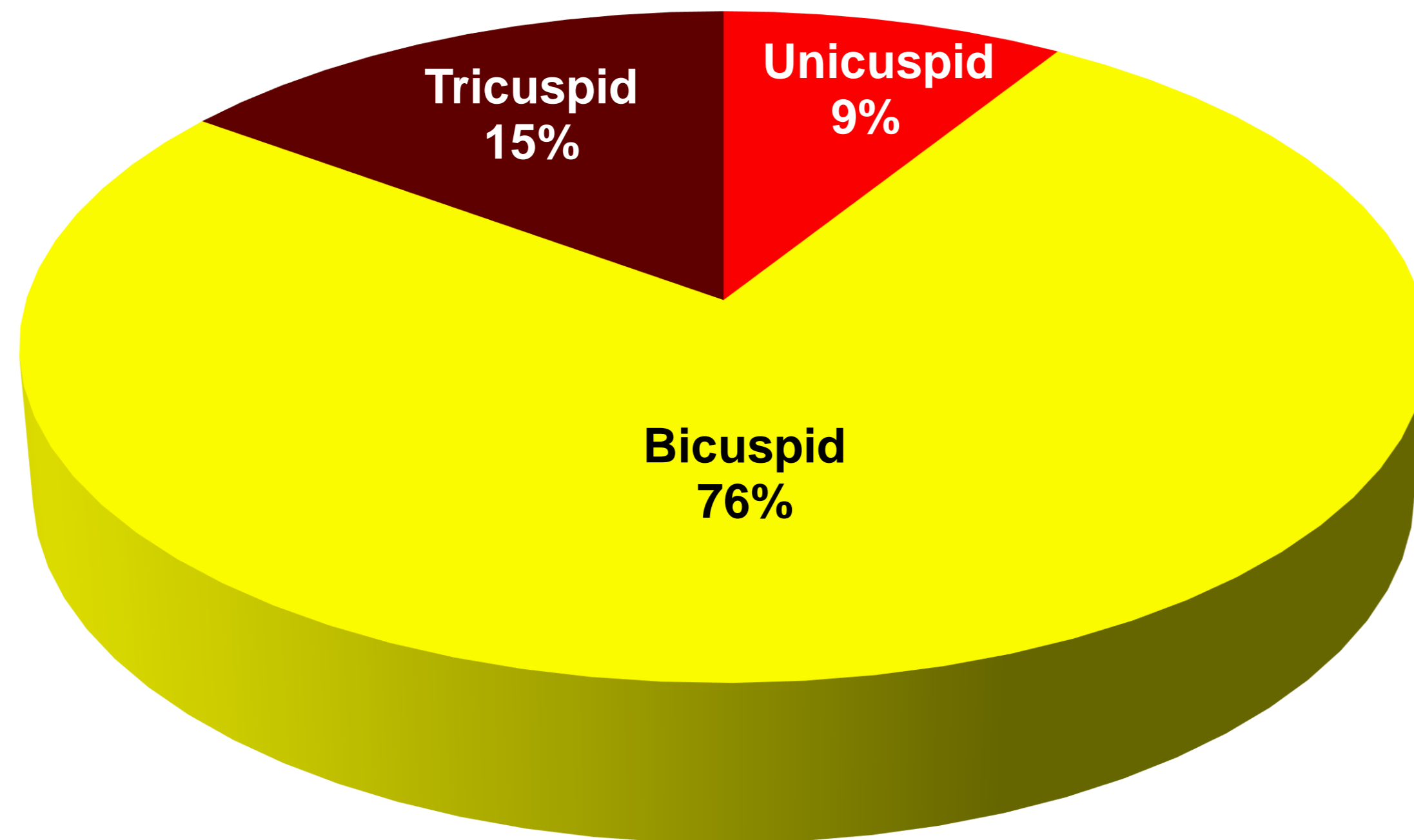
Baseline patient characteristics

Variable	Number (%) or Median (Interquartile range)
Patient Number	162
Age at primary repair, days	98 (73, 98 days)
Weight, kg	5.4 (4.6, 6.1 kg)
Pulmonary valve annulus z-score	-2.2 (-2.4, -1.8)
Chromosomal anomaly / genetic syndrome	19 (12%)
Prior pulmonary valve intervention	9 (6%)

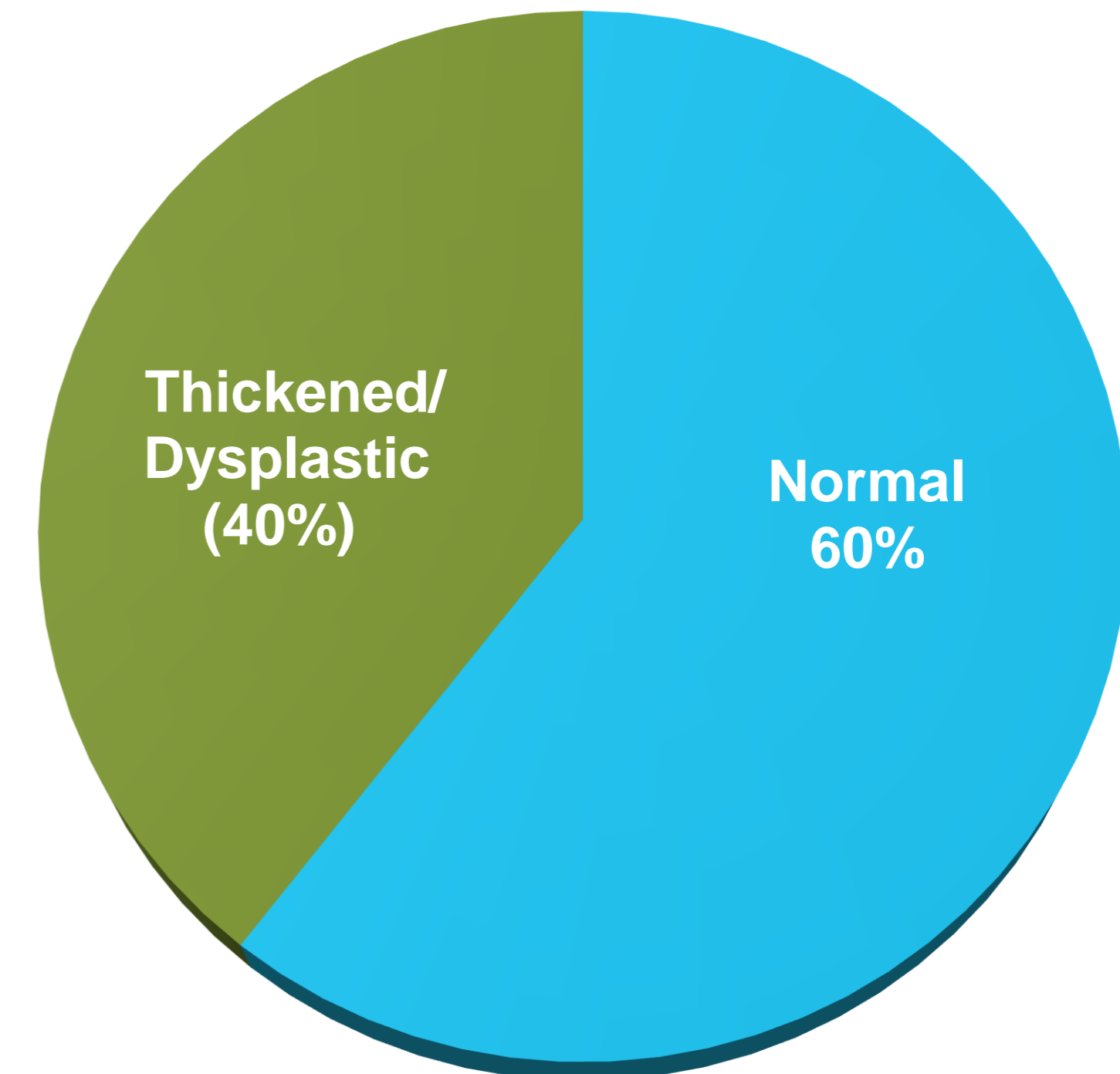
Pulmonary valve characteristics

Study cohort: N = 162

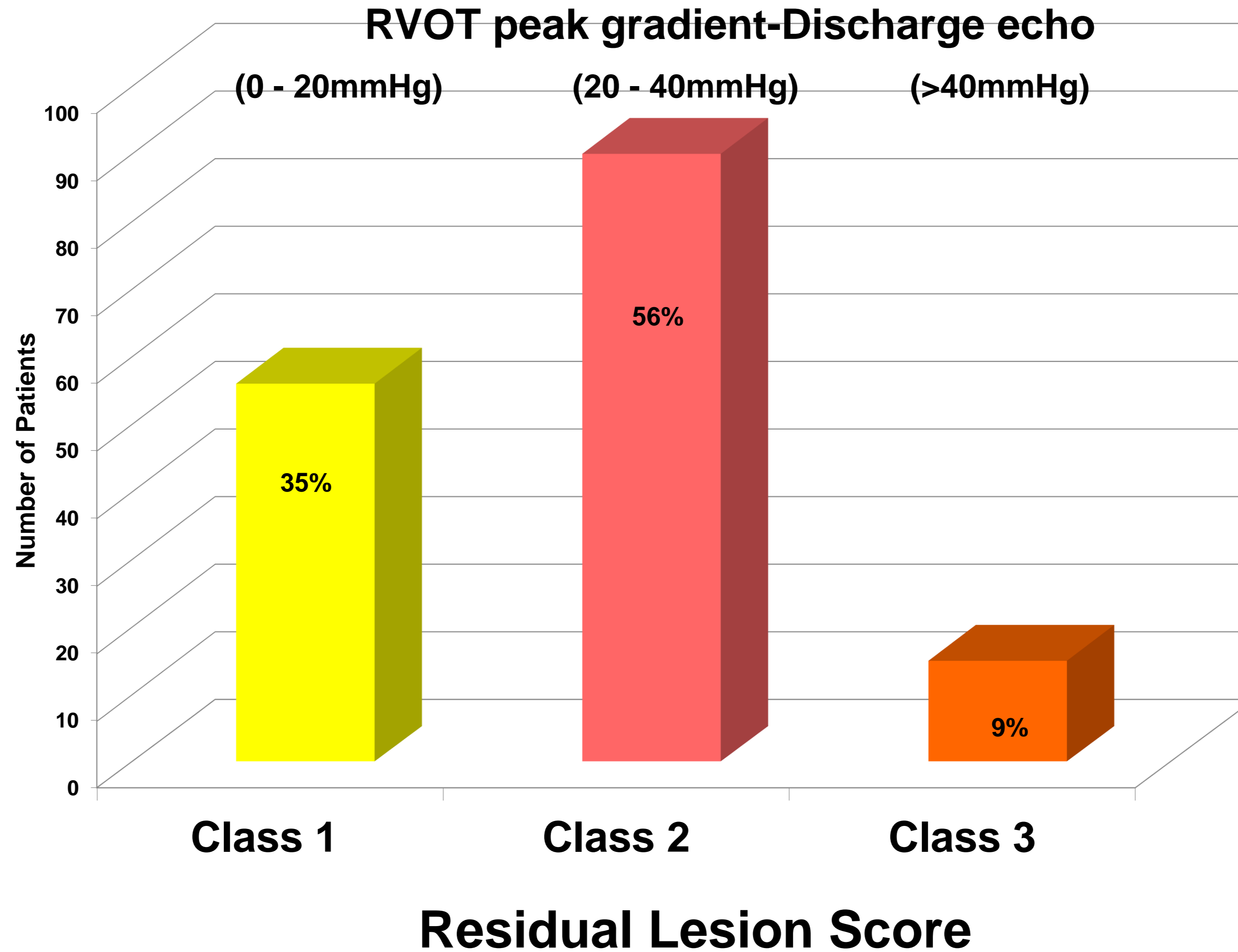
Valve morphology



Valve leaflet appearance

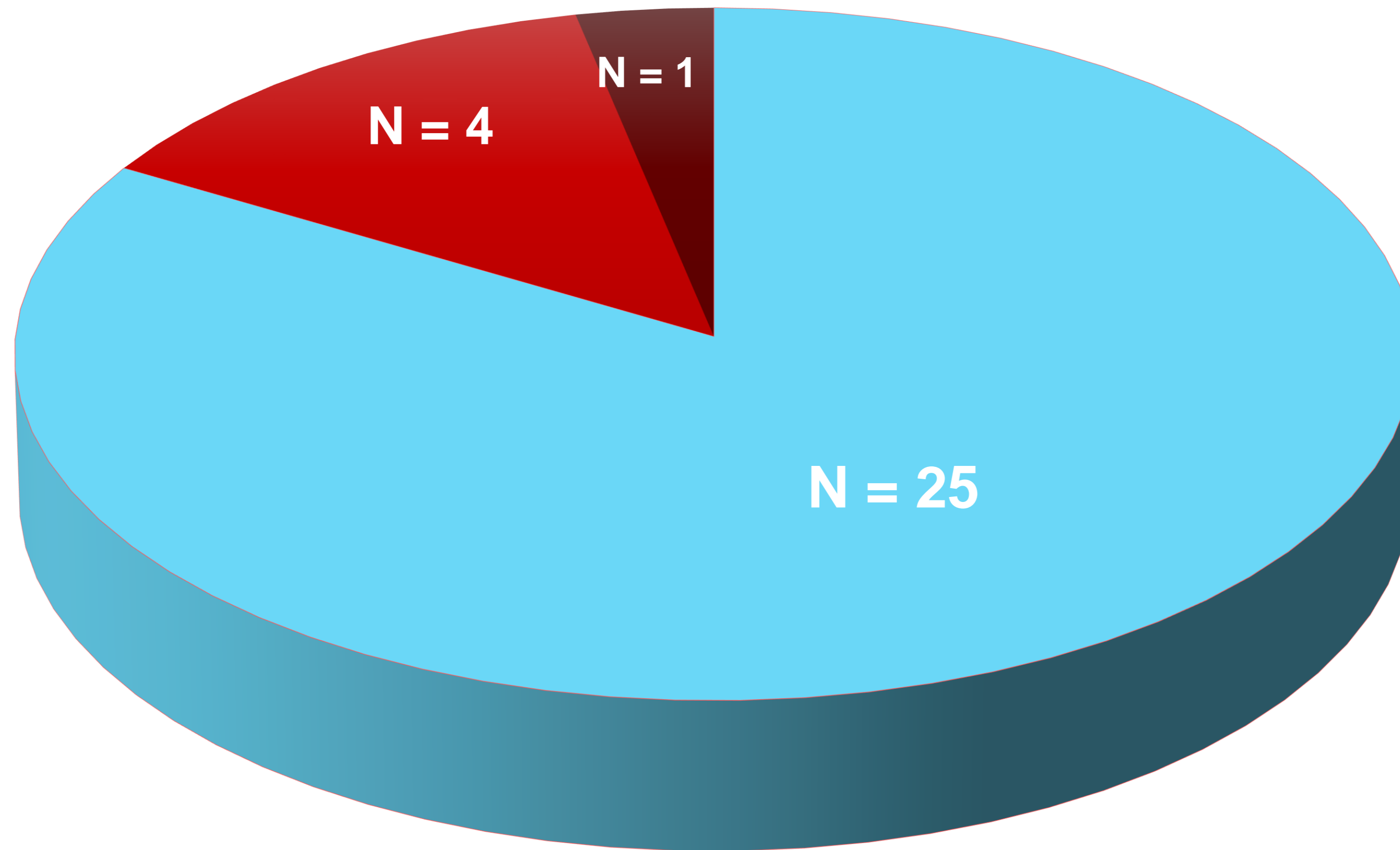


Early outcome 1: Residual Lesion Score - pulmonary stenosis



Reinterventions for residual RVOT stenosis

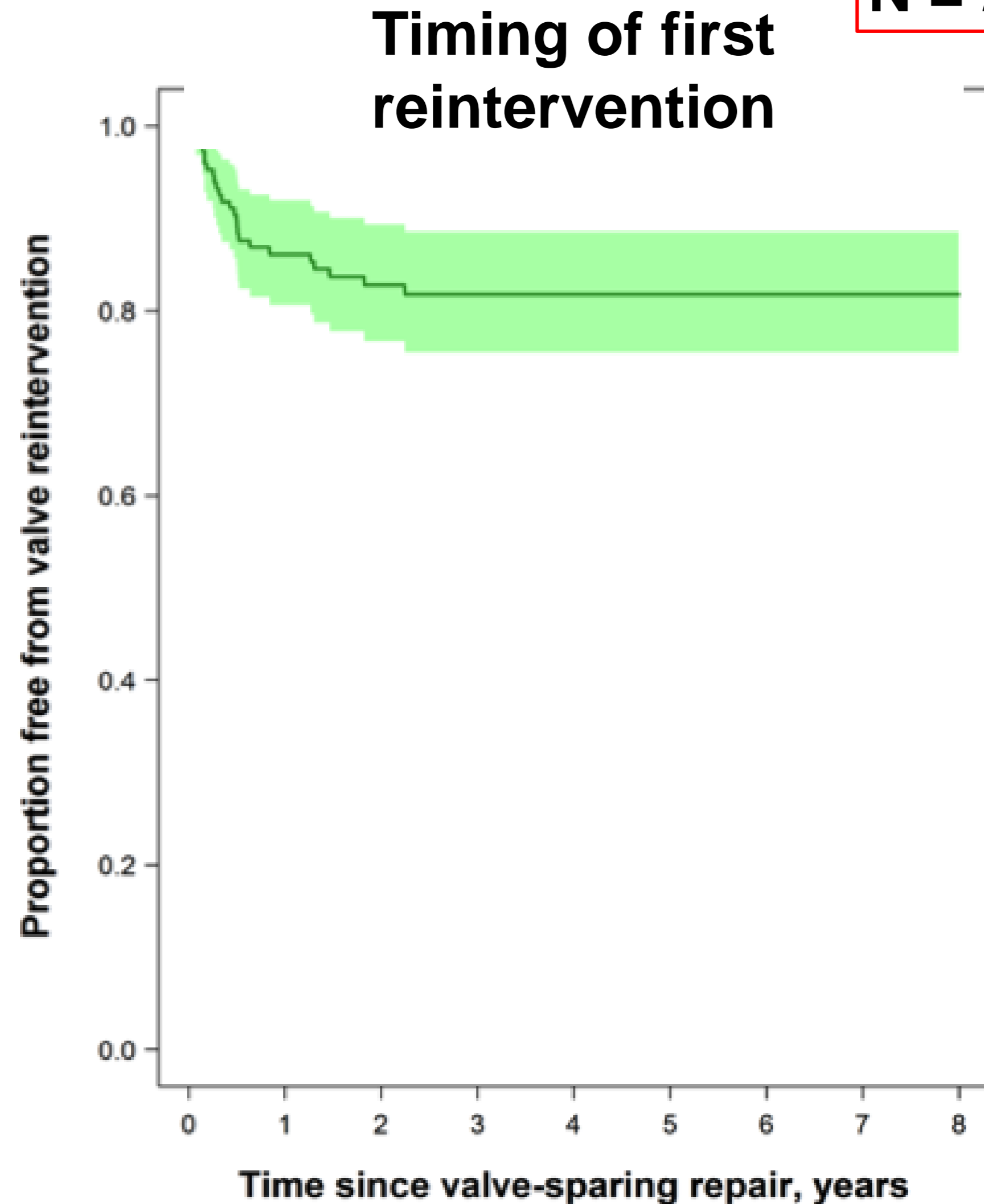
N = 30/162 (19%)



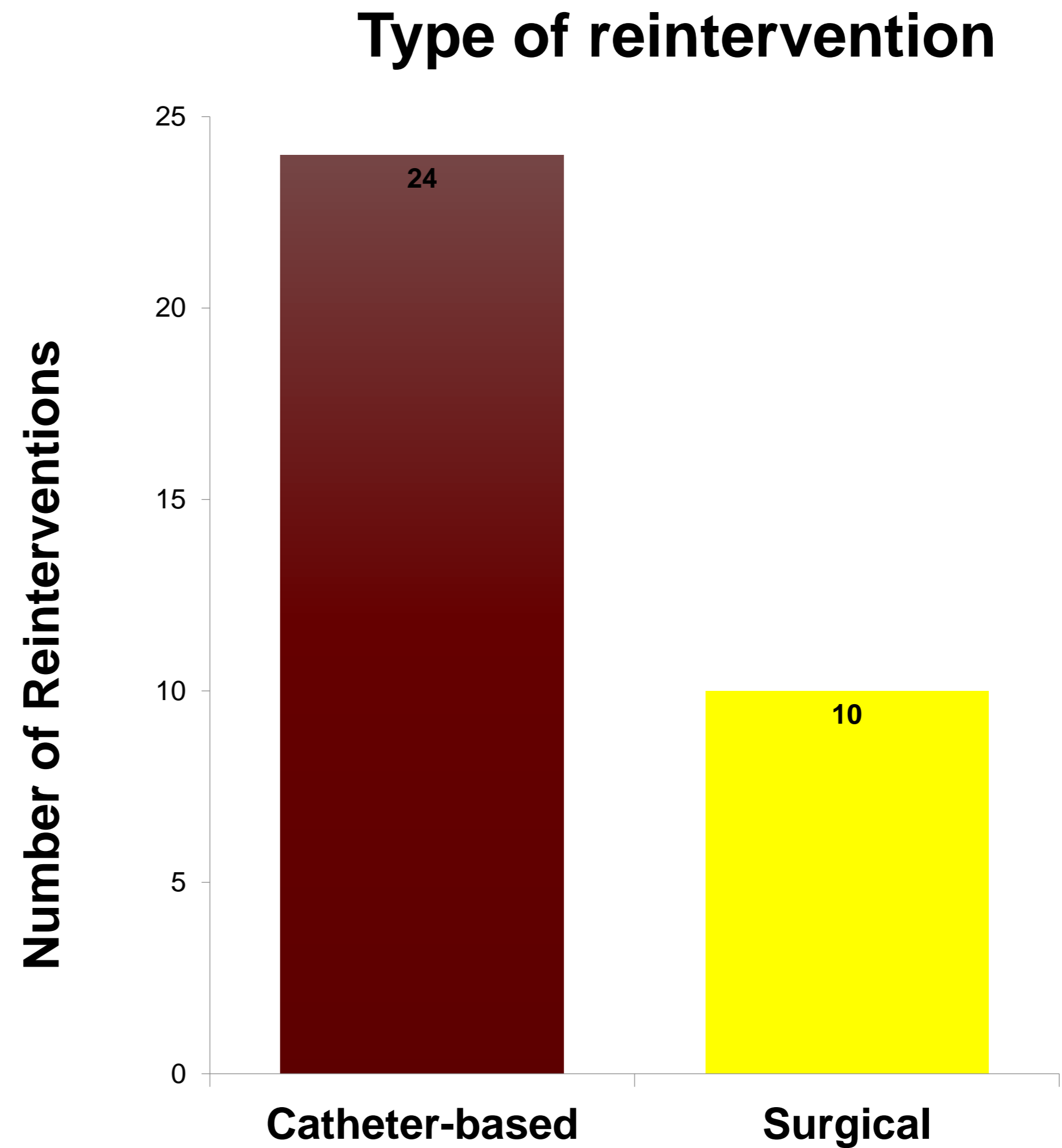
■ Pulmonary valve ■ Branch PA ■ Subvalvar

Early outcome 2: Pulmonary valve reintervention for residual stenosis

N = 25 (15%)



No. at risk 162 111 86 70 57 39 27 20 6



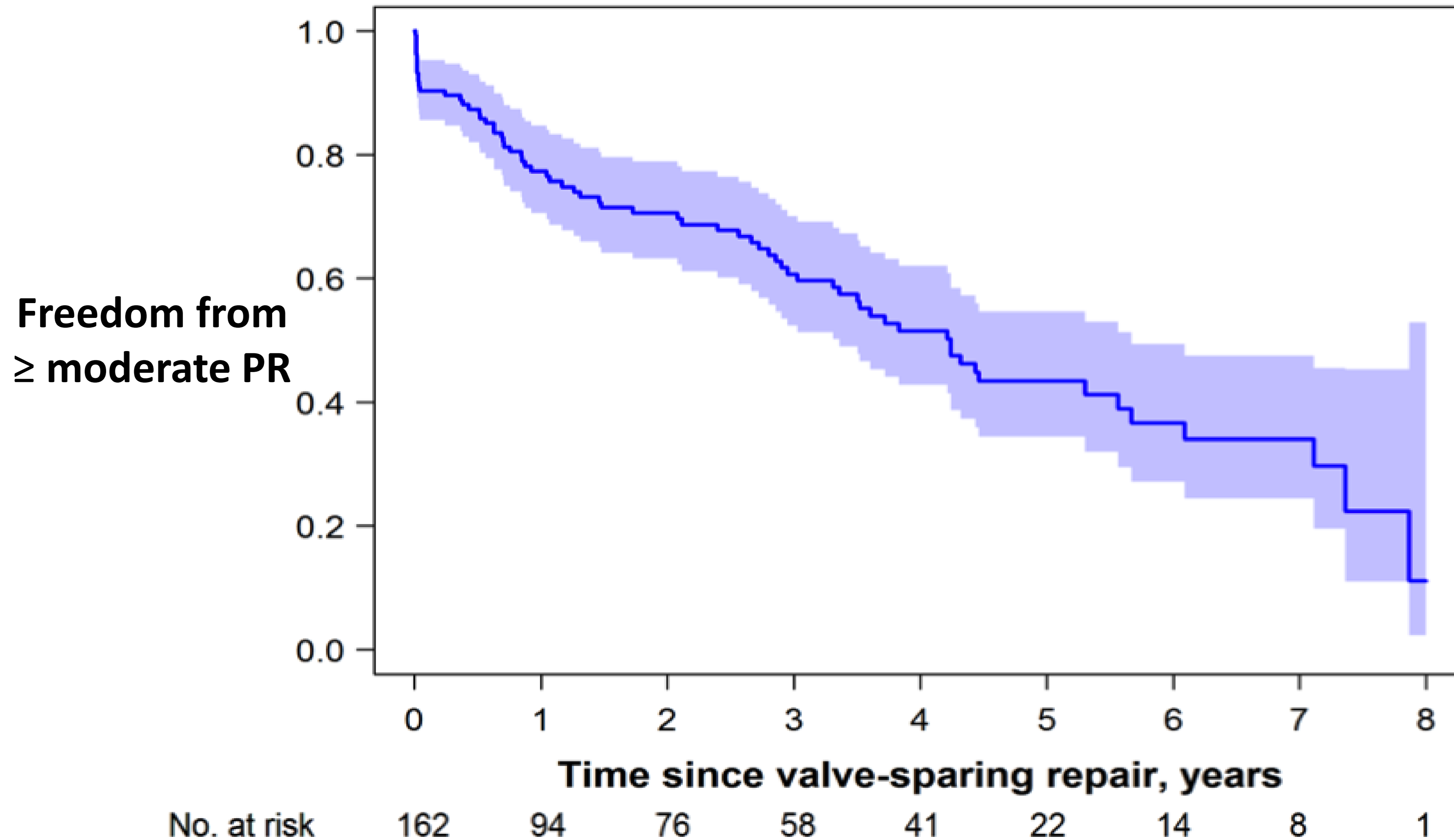
Risk factors for early pulmonary valve reintervention

Multivariable regression analysis (N = 162, N events = 25, R² = 0.21)

Risk Factor	Hazard Ratio	95% CI	<i>p</i> value
Pulmonary valve annulus z-score ≤ -2.45	4.47	1.24, 16.09	0.036
Younger age at primary repair (per 30 day decrease)	1.72	1.28, 2.33	0.001
Residual Lesion Score - pulmonary stenosis			0.001
Class 1 (0 - 20 mmHg)	Ref		
Class 2 (20 - 40 mmHg)	2.69	0.76, 9.49	
Class 3 (>40 mmHg)	10.59	2.64, 42.4	

Late outcome 1: pulmonary valve competence

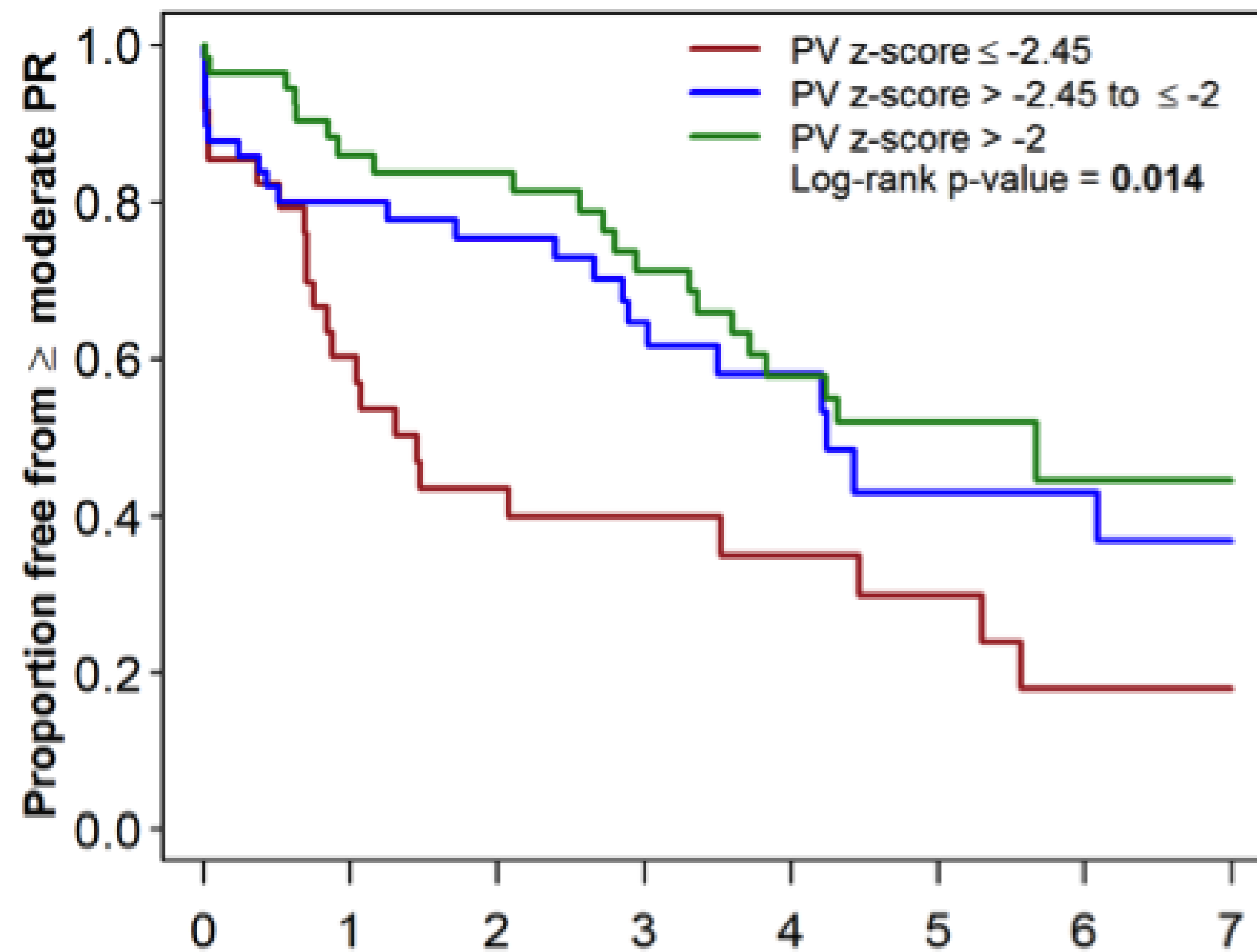
Median follow-up = 2.5 yrs (range: 0.6 - 8.5)



Risk factors for pulmonary regurgitation

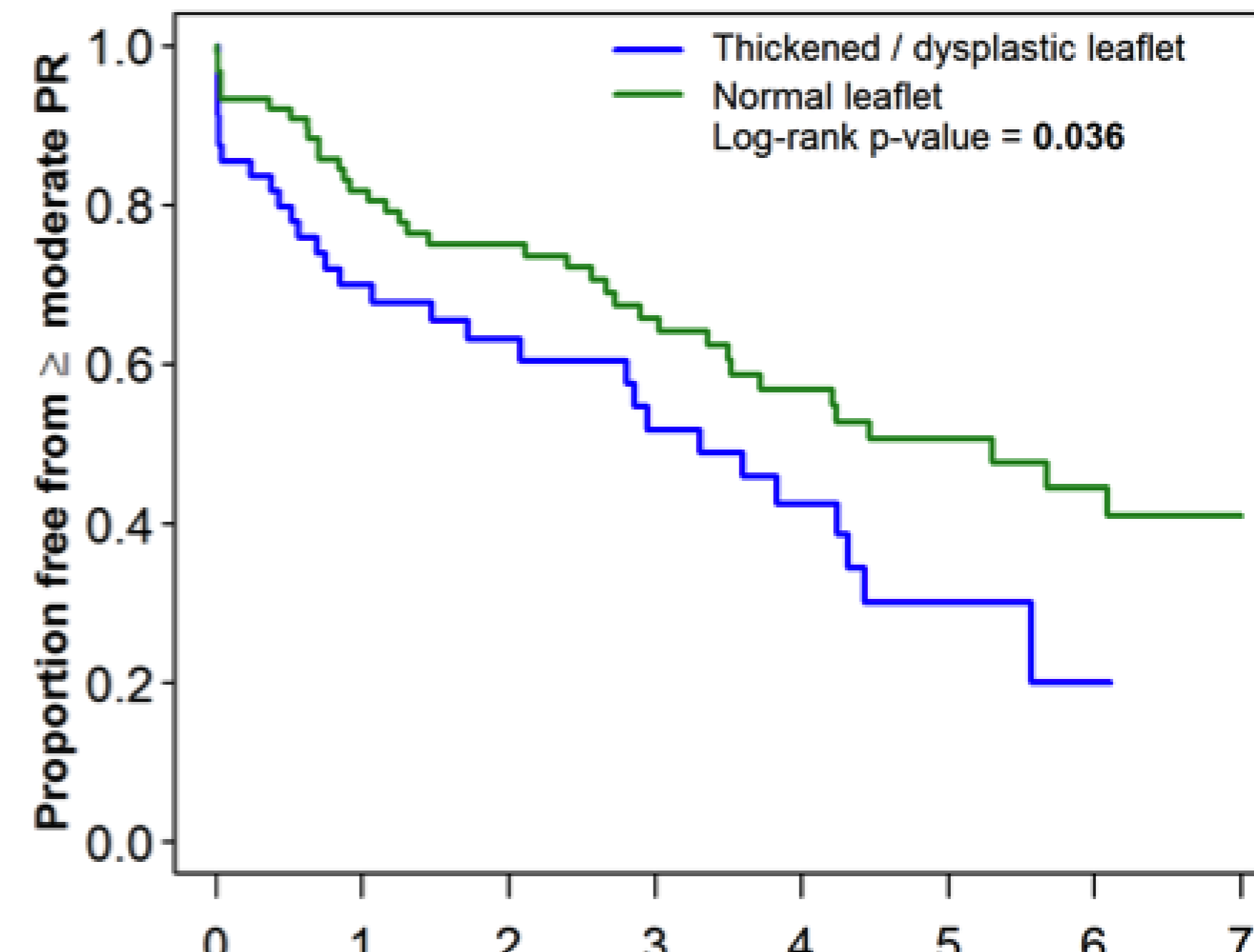
Multivariable regression analysis (N = 162, N events = 71)

Pulmonary valve annulus z-score
Hazard ratio = 2.31



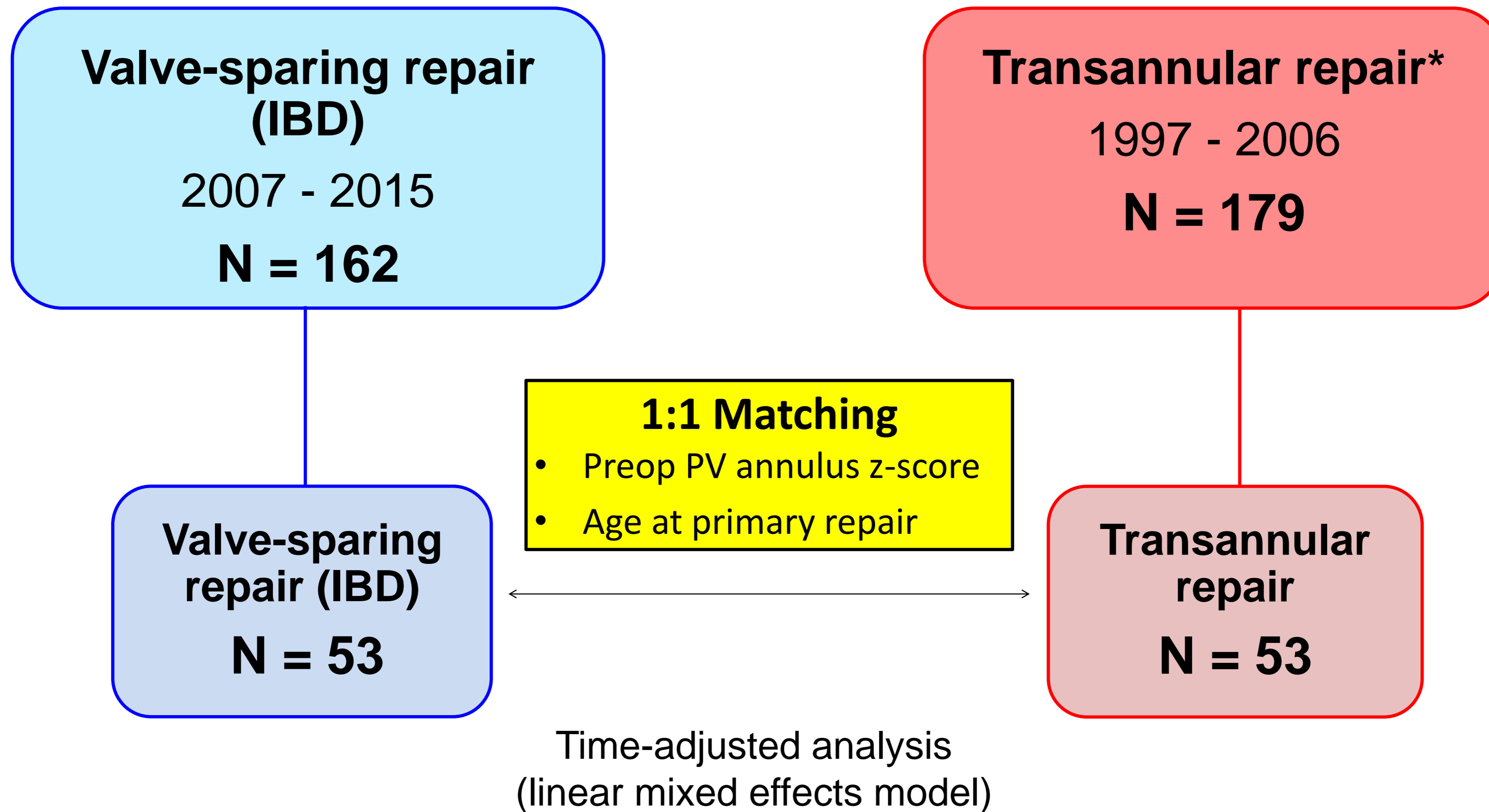
No. at risk	Time since surgery, years			
	0	1	2	3
≤ -2.45: 41	12	7	1	
≤ -2: 61	30	13	7	
> -2: 60	34	21	6	

Thickened/dysplastic valve leaflet
Hazard ratio = 1.67



No. at risk	Time since surgery, years			
	0	1	2	3
Abnormal leaflet: 64	23	12	1	
Normal leaflet: 97	52	29	13	

Late outcome 2: RV chamber size - Matched cohort analysis

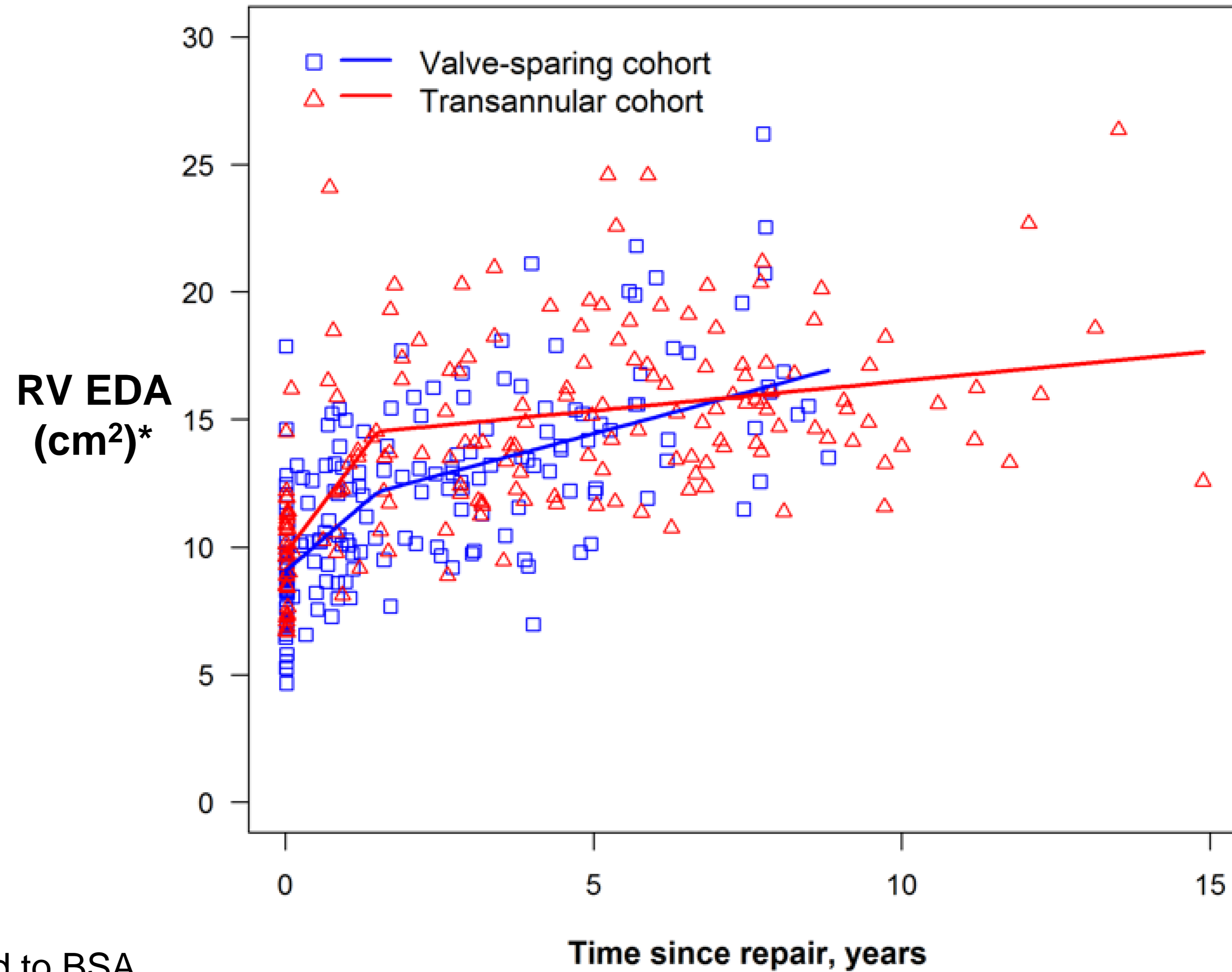


IBD = intraoperative balloon dilation

*Same inclusion criteria

Late outcome 2: RV chamber size

N = 53 per



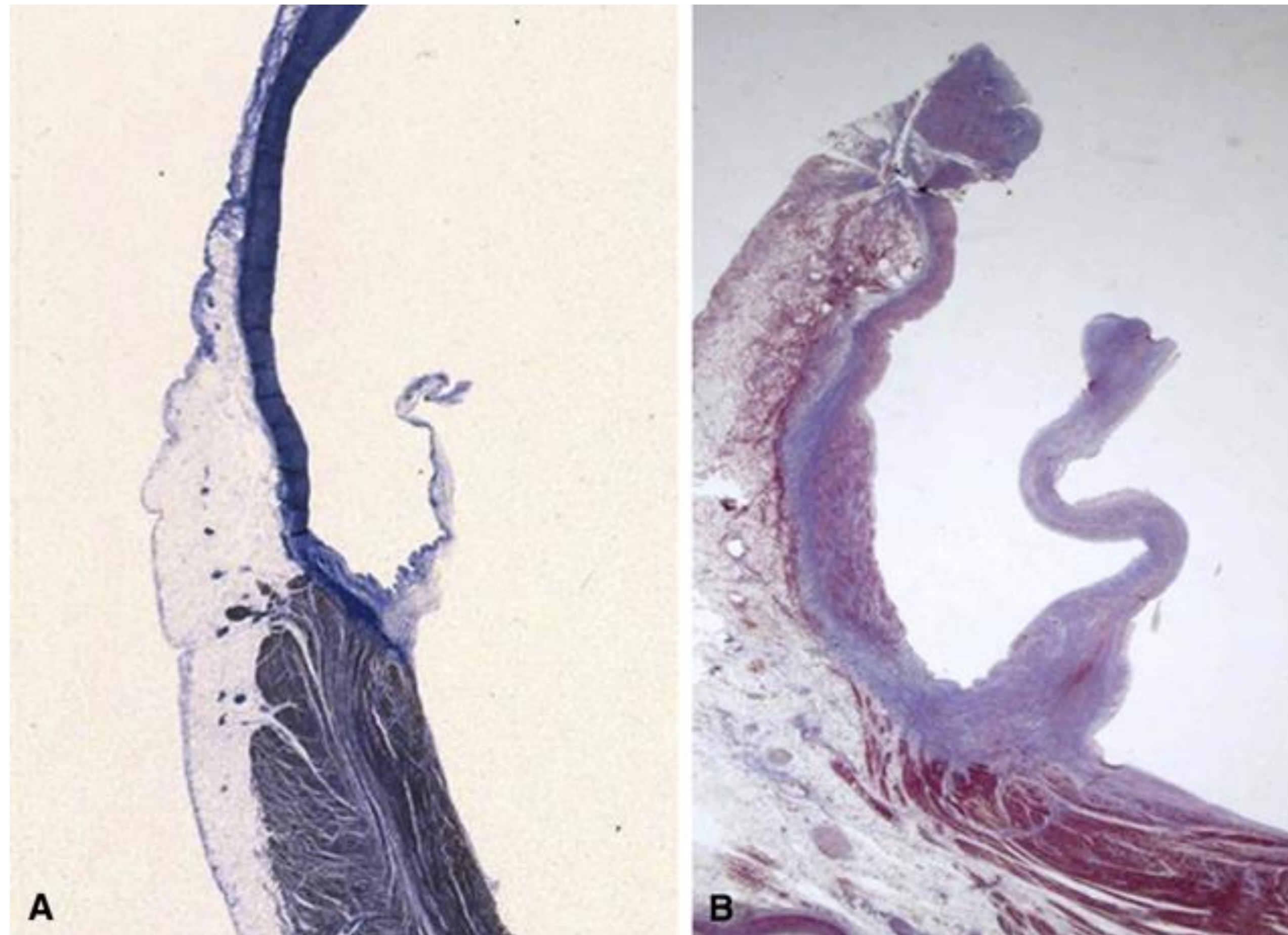
*Indexed to BSA

Conclusions

- **Patients with annular z score less than -2.45 and those under 3 months of age experience higher rates of early reintervention for residual pulmonary valve stenosis**
- **Valve-sparing repair with IBD is associated with development of progressive pulmonary regurgitation**
 - Significant annular hypoplasia, thickened/dysplastic leaflets are risk factors for early onset pulmonary regurgitation
- **Extent of RV dilation was not significantly different compared to transannular patch technique**
 - Further prospective studies required (cardiac MRI)

Pulmonary valve characteristics in ToF

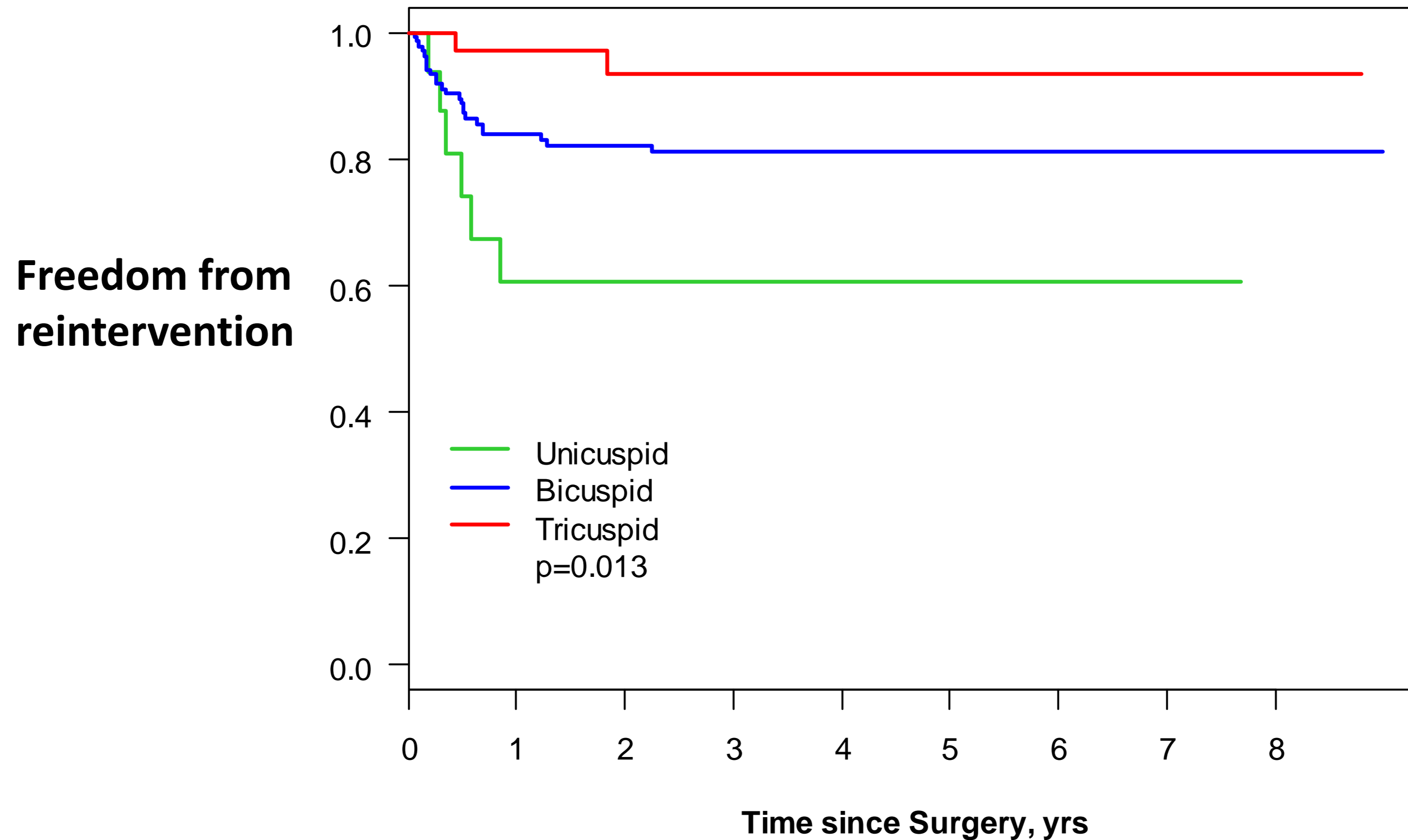
ToF: Valve leaflet histology



Histologic examination of (A) a normal PV, and (B) a dysplastic PV in ToF: At histology, the dysplastic PV in ToF shows enlargement of spongiosa, fragmentation of fibrosa, and fibrotic thickening of the free edge (magnification 31, elastic fiber Van Gieson staining).

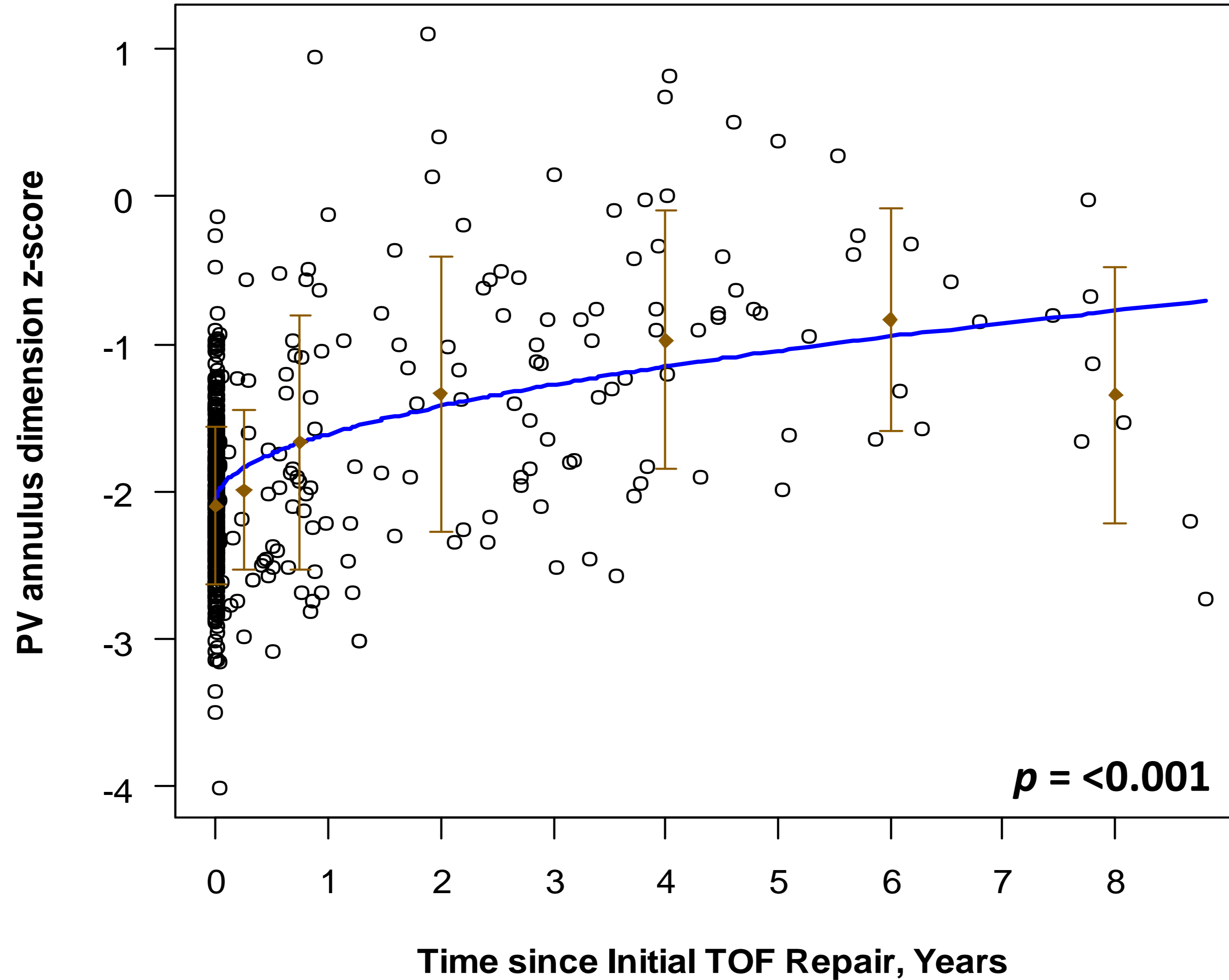
Pulmonary valve morphology and reintervention for residual stenosis

All valve-sparing repair cases at BCH - 2007-2015 (N = 207):
Pulmonary valve reintervention, N = 32



Unicuspid	18	9	4	4	2	2	1	1	0
Bicuspid	151	99	75	61	46	34	26	20	6
Tricuspid	38	28	24	20	17	14	9	4	1

Pulmonary valve annulus remodeling post valve-sparing repair



Valve annulus growth vs. healthy children

