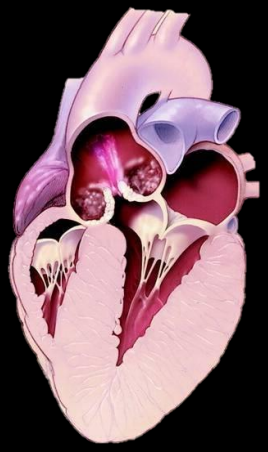


Aortic Stenosis with Depressed Systolic Function and Mitral Regurgitation: Severe or Not?

Philippe Pibarot, DVM, PhD, FACC, FAHA, FESC, FASE
Canada Research Chair in Valvular Heart Diseases

Institut Universitaire de Cardiologie et de Pneumologie de Québec / Québec Heart & Lung Institute

Université LAVAL

Disclosure Statement

Grant funding:

- Canadian Institutes of Health Research

- Heart and Stroke Foundation of Canada

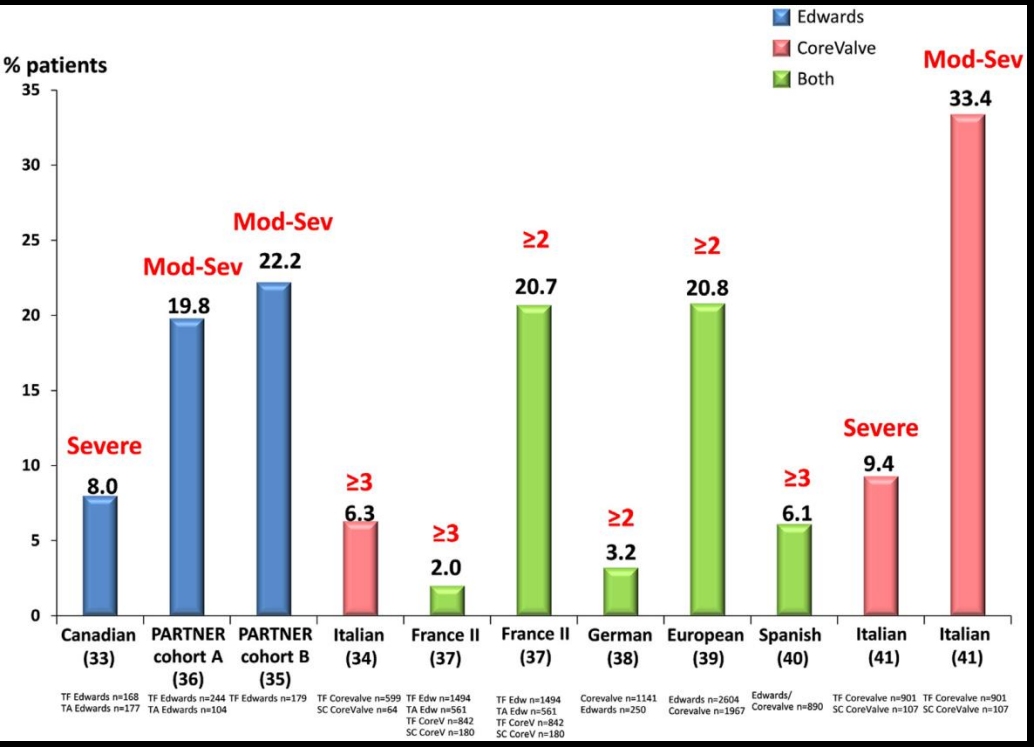
Industry:

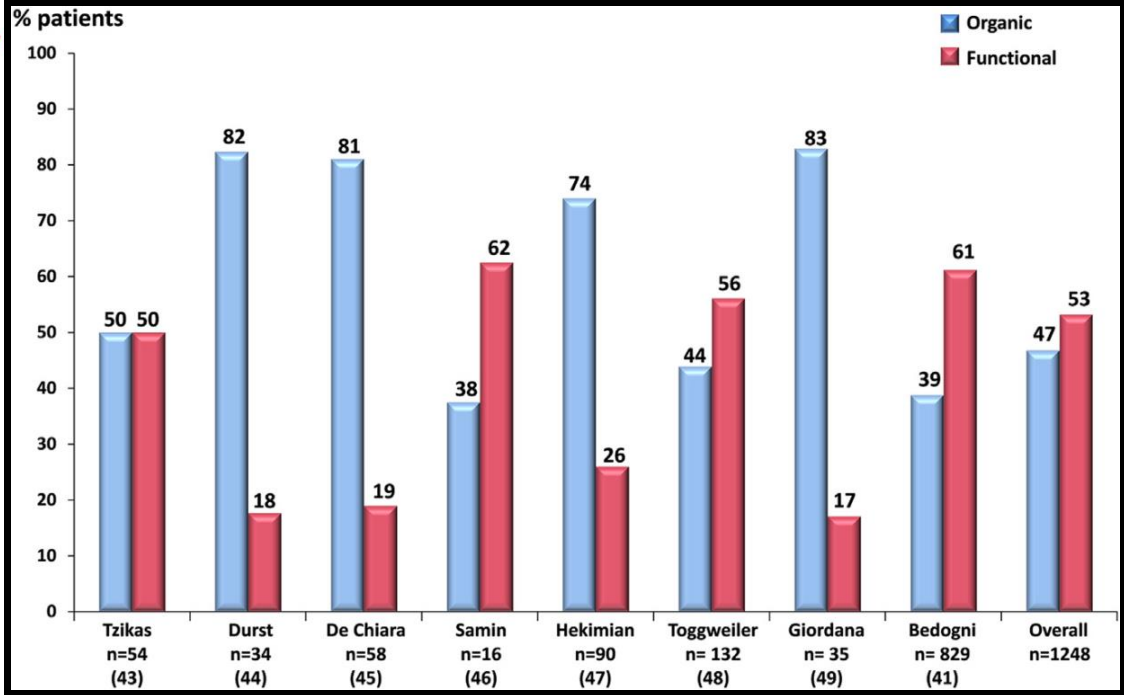
- Edwards Life Science: Research grant
Echo Core Lab – TAVI

- V-Wave Ltd. Research grant
Echo Core Lab Heart failure

Significant Mitral Regurgitation Left Untreated at the Time of Aortic Valve Replacement

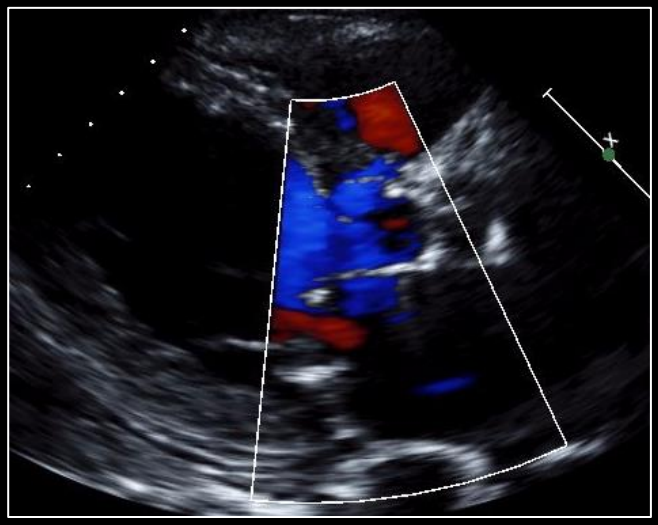
A Comprehensive Review of a Frequent Entity in the Transcatheter Aortic Valve Replacement Era

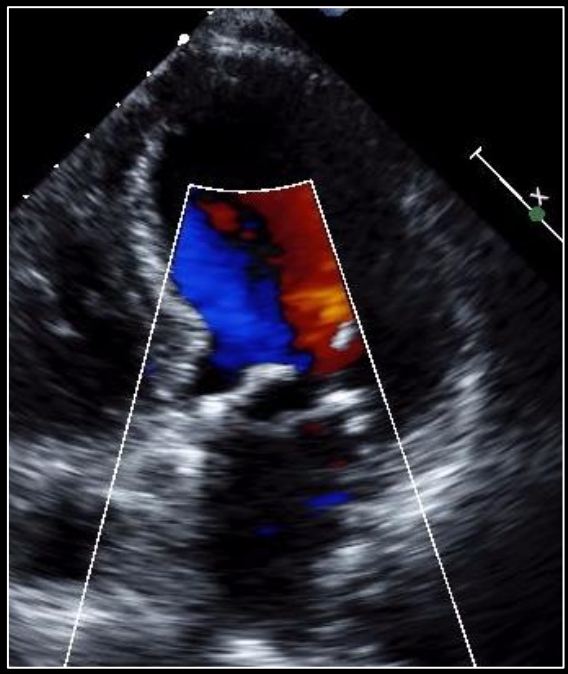




Nombela-Franco, JACC 2014

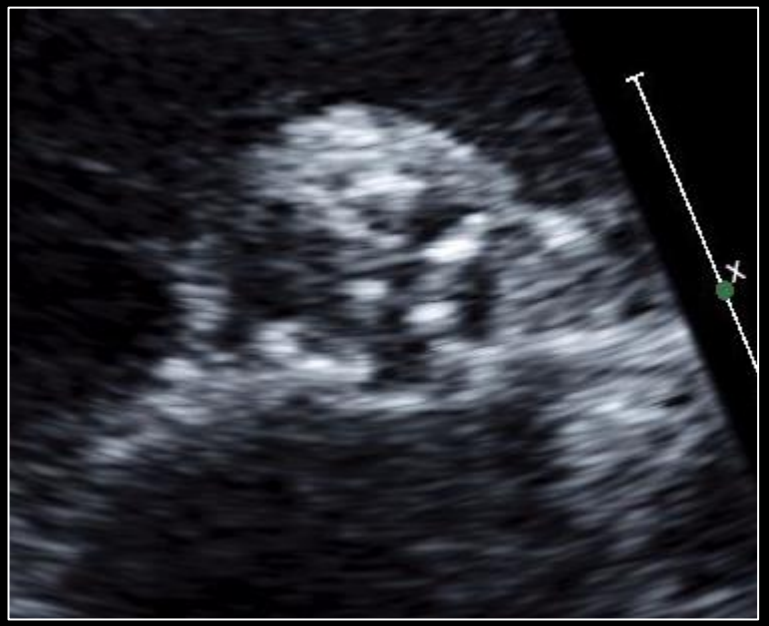
Case #1

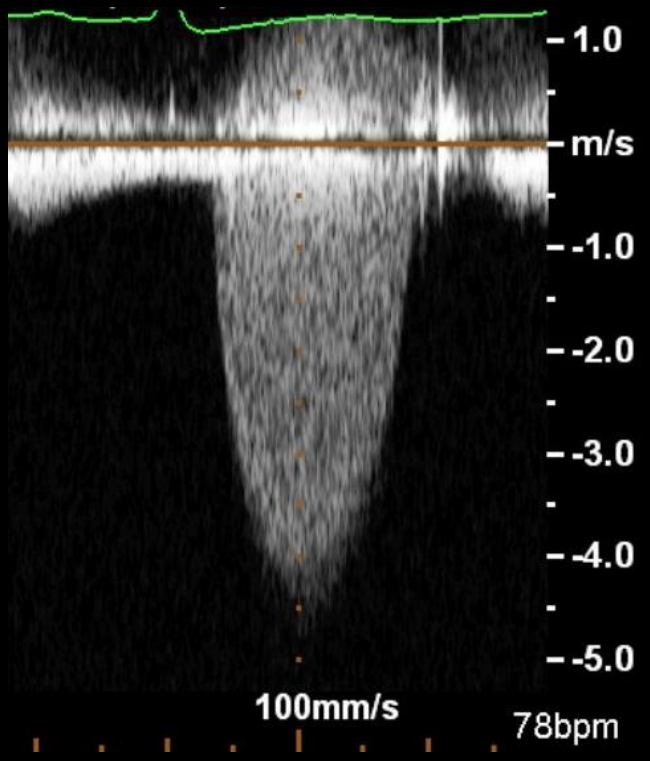




LVEF:40-45%
MR: 4/4

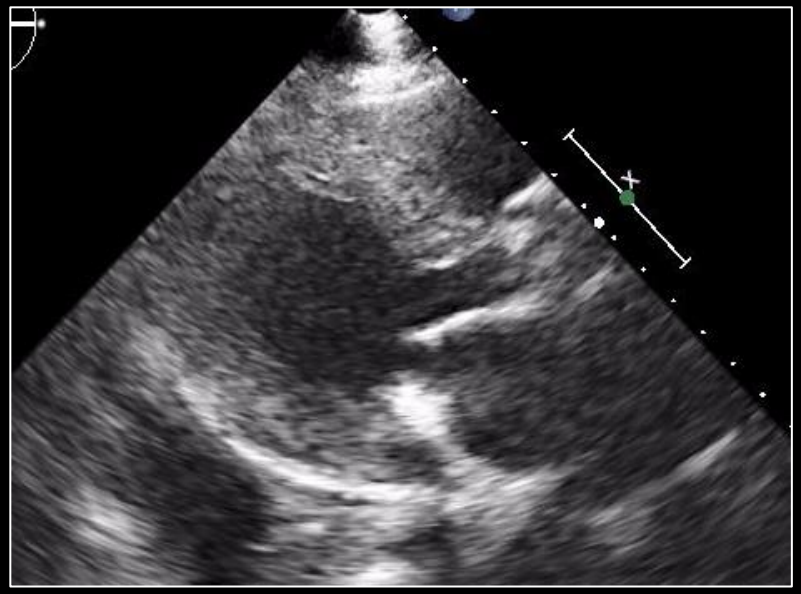
Case #1

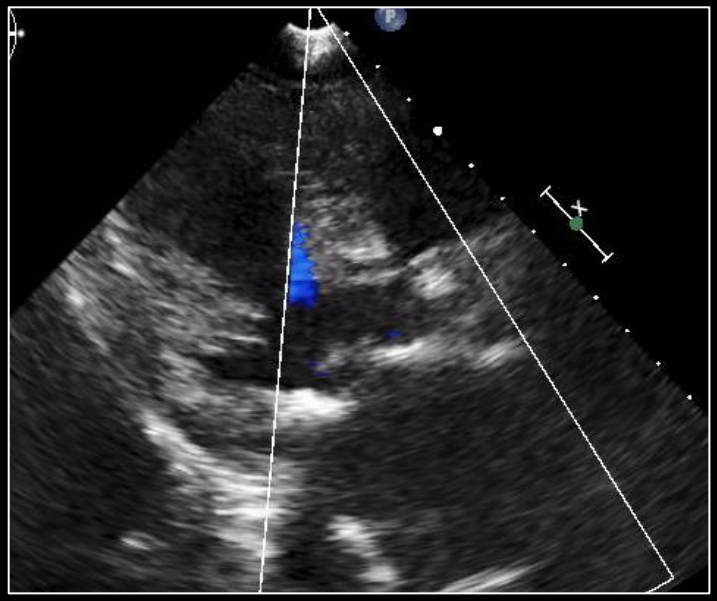


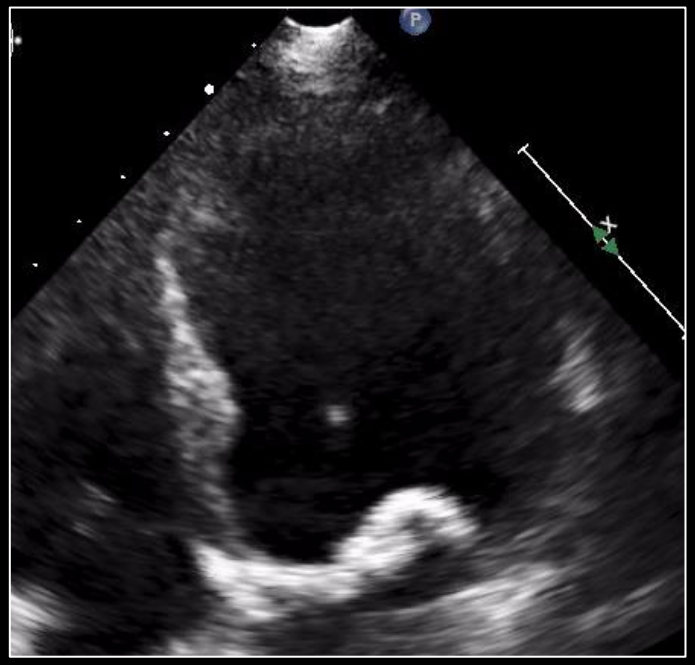


AVA: 0.45
Gradients: 84 / 50
SV: 50 ml

Case #2

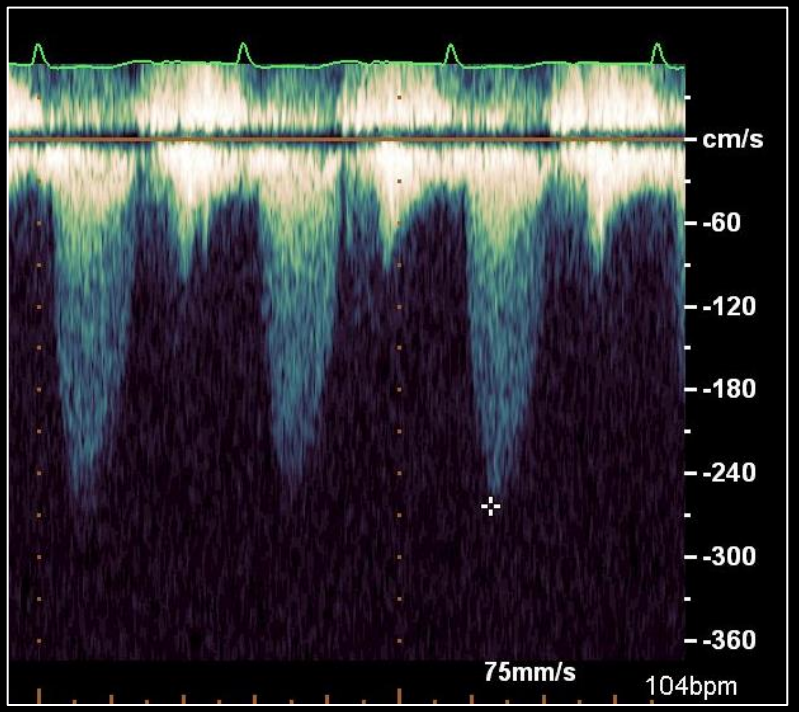




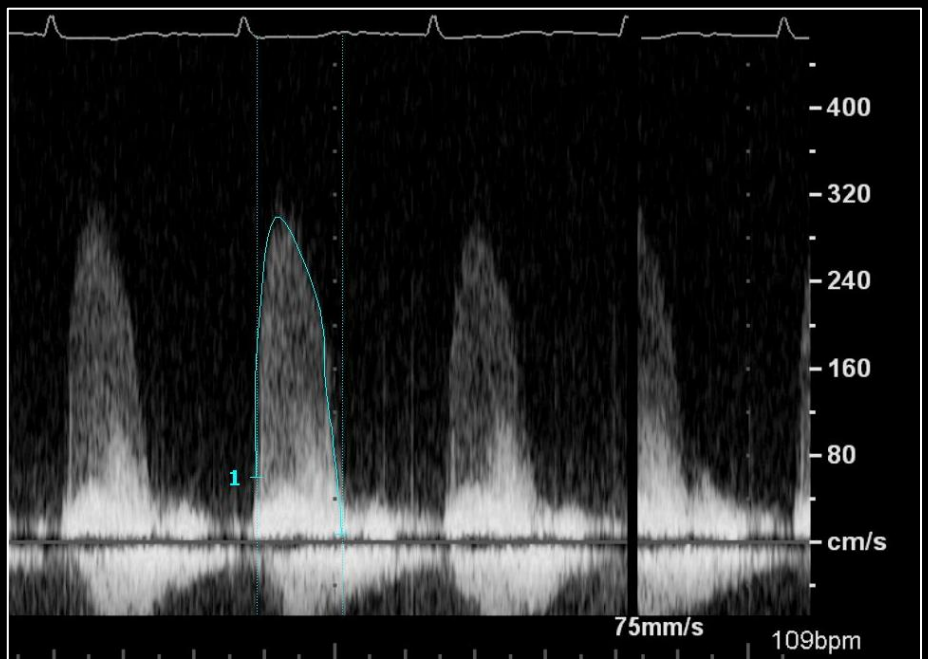


LVEF:45-50%
MR: 3/4

Case #2



AVA: 0.53
Gradients: 36 / 22
SV: 37 ml



Organic
Functional

↑ LV pressure
↑ LV-LA pressure gradient

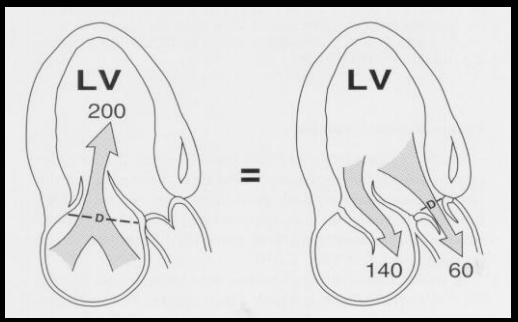
Aortic Stenosis

Mitral Regurgitation

LV remodeling
MV Tethering

Afterload mismatch
↓ LVEF

↓ Forward stroke volume



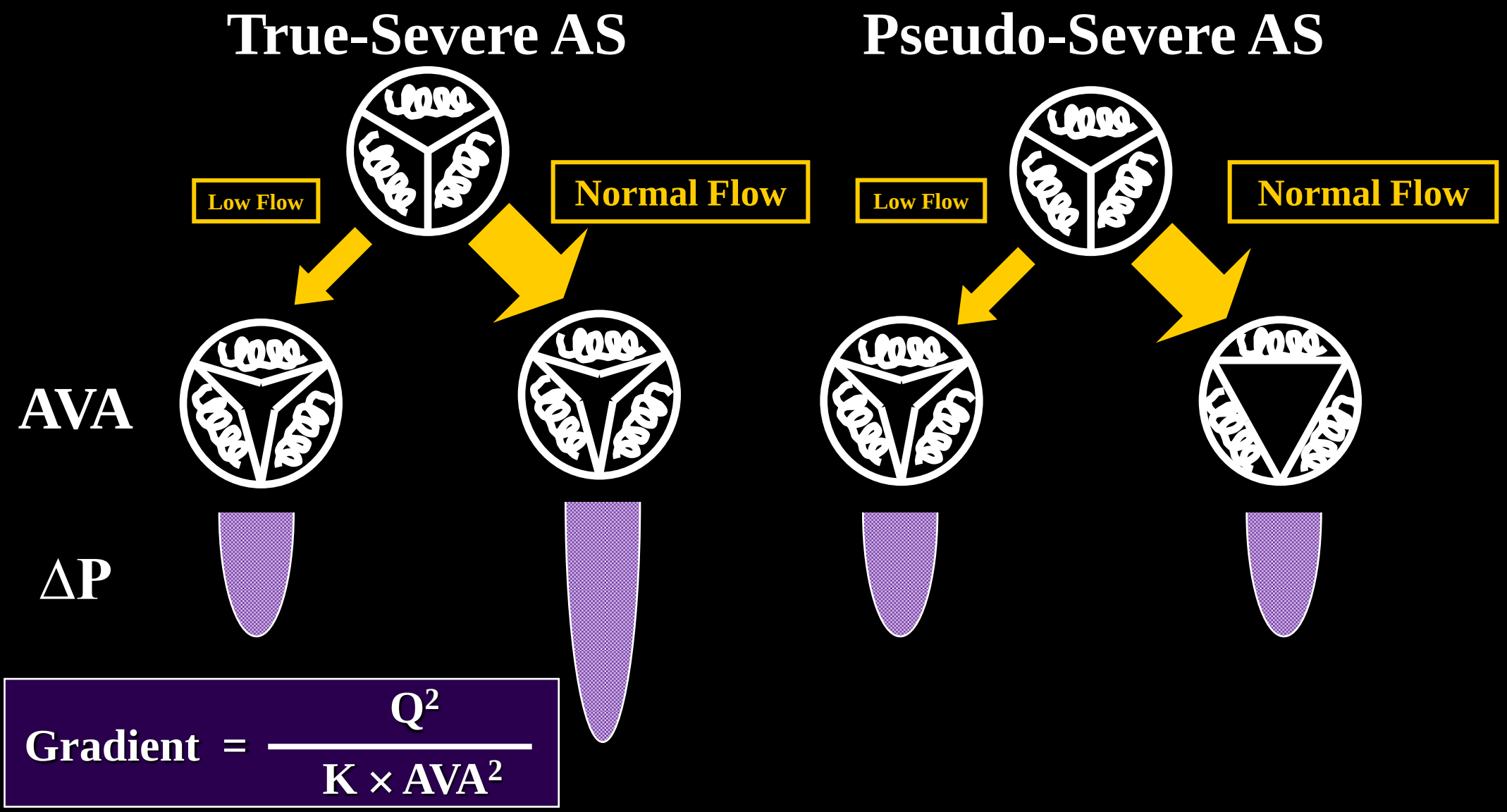
Low flow, low gradient AS

Diagnostic challenge
Severity of AS?

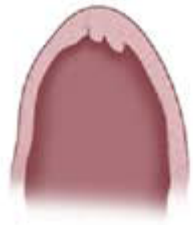
Worse Prognosis
Higher procedural risk

Unger P, Lancellotti P, et al. Heart 2010

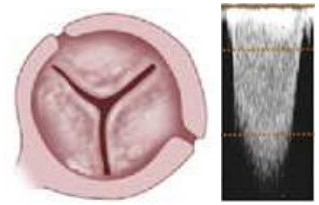
Low-Flow, Low-Gradient Severe(?) AS



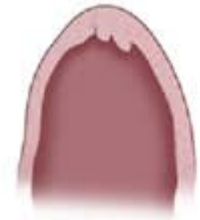
$$\text{Gradient} = \frac{Q^2}{K \times AVA^2}$$



LVEF≤50%
AVA≤1.0
ΔP<40



Dobutamine-Stress Echo / Cath.

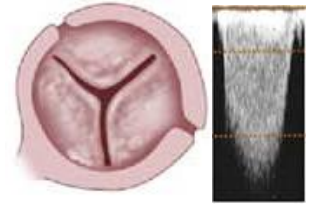


↑ SV ≥ 20 %

↑ SV < 20 %

Contractile (Flow) Reserve

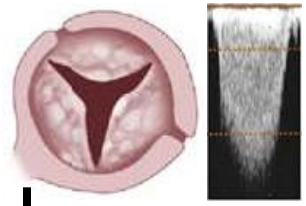
No Contractile (Flow) Reserve



AS Severity: Indeterminate

ΔP≥40
AVA≤1.0

ΔP<40
AVA>1.0



MSCT: AoV Ca Score
>1200♀ >2000♂

No

Yes

True-Severe AS

Pseudo-Severe AS

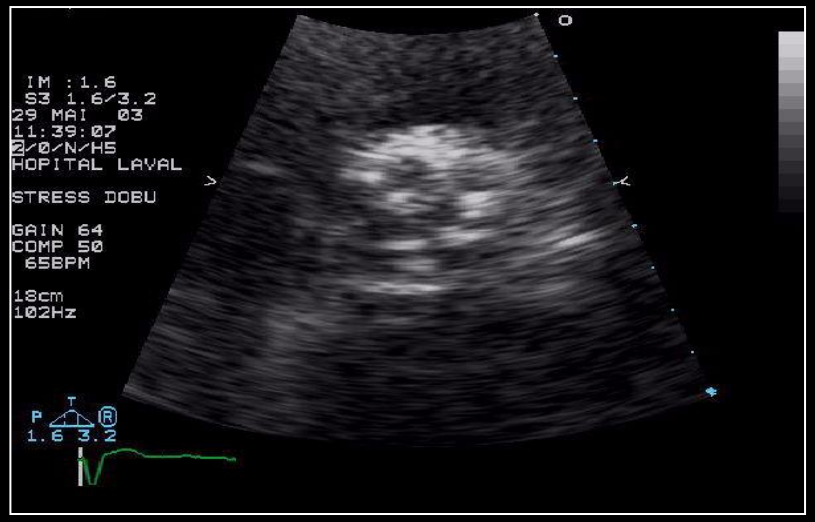
True-Severe AS

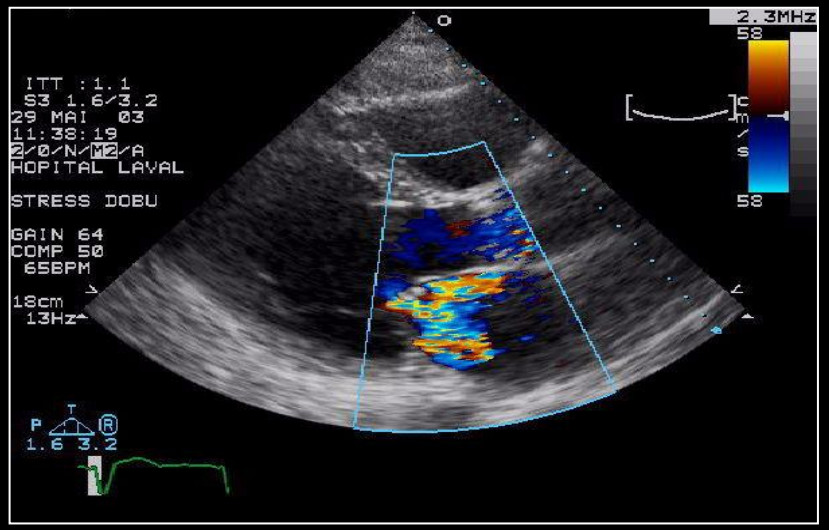
SAVR ± CABG
TAVR ± PCI

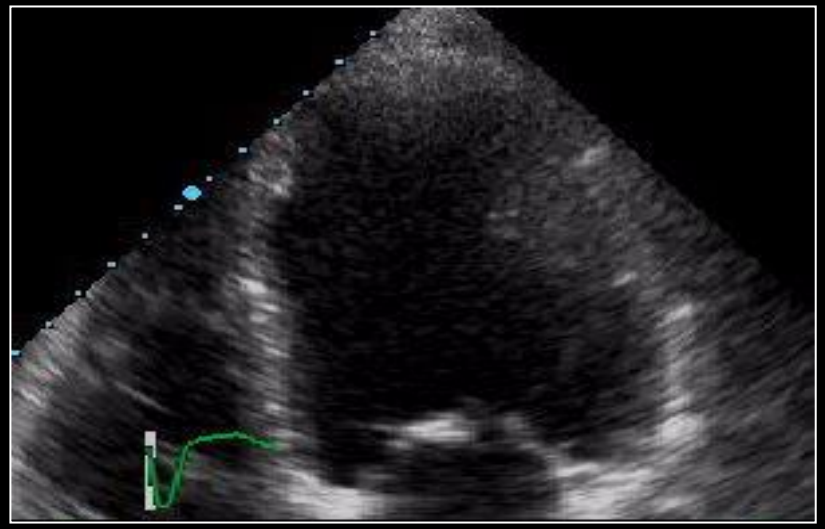
HF Therapy

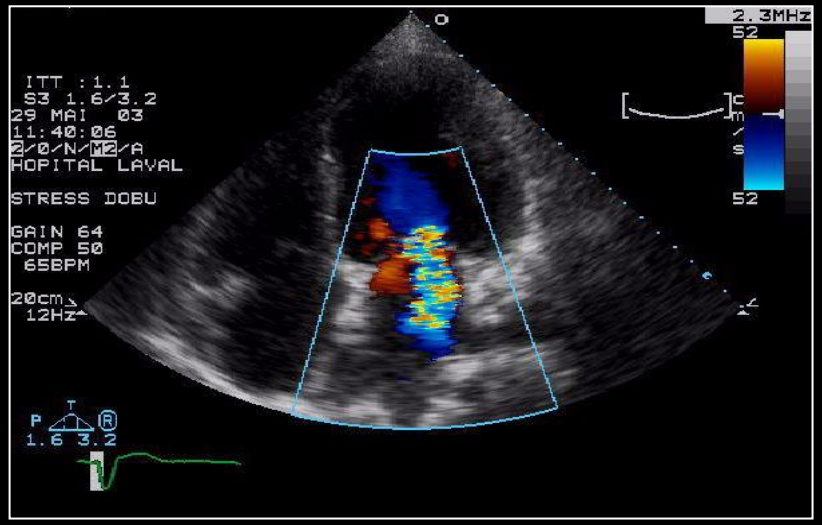
SAVR (High Op. Risk)
TAVR? BAV+TAVR?

Case #3


IM :1.6
S3 1.6/3.2
29 MAI 03
11:39:07
2/0/N/H5
HOPITAL LAVAL
STRESS DOBU
GAIN 64
COMP 50
65BPM
18cm
102Hz
P
1.6 3.2


2.3MHz
58
ITT :1.1
S3 1.6/3.2
29 MAI 03
11:38:19
2/0/N/M2/A
HOPITAL LAVAL
STRESS DOBU
GAIN 64
COMP 50
65BPM
18cm
13Hz
58
P
1.6 3.2

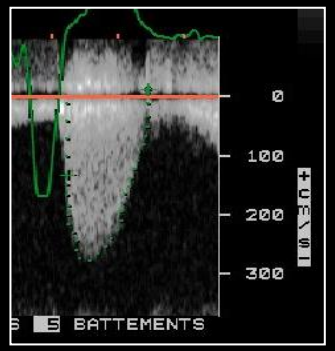



2.3MHz
52
ITT :1.1
S3 1.6/3.2
29 MAI 03
11:40:06
2/0/N/M2/A
HOPITAL LAVAL
STRESS DOBU
GAIN 64
COMP 50
65BPM
20cm
12Hz
52
P
1.6 3.2

Case #3

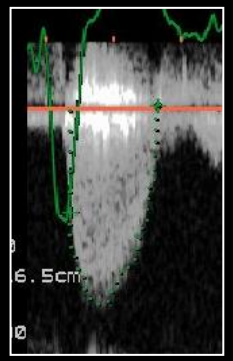
Resting Echo

LVEF=25% **MR 3/4**
SV= 60 ml **SVi=33 ml/m^2**
AVA= 1.0 cm^2 **AVAi= 0.55 cm^2/m^2**
ΔP= 33 / 20 mmHg



DSE

LVEF=30% **MR 2/4**
SV= 80 ml **SVi=44 ml/m^2**
AVA= 1.1 cm^2 **AVAi= 0.6 cm^2/m^2**
ΔP= 53 / 35 mmHg



Case #4 : Low-Flow, Low-Gradient AS + MR

	Rest	Dobutamine
Stroke Volume (ml)	**40**	**53**
Stroke Volume Index (ml/m^2)	**23**	**31**
Ejection Fraction	**25**	**33**
Mean Gradient (mm Hg)	**21**	**32**
AVA (cm^2)	**0.70**	**0.85**
AVA (cm^2/m^2)	**0.41**	**0.5**
MR	**2/4**	**3/4**

Valvular Heart Disease

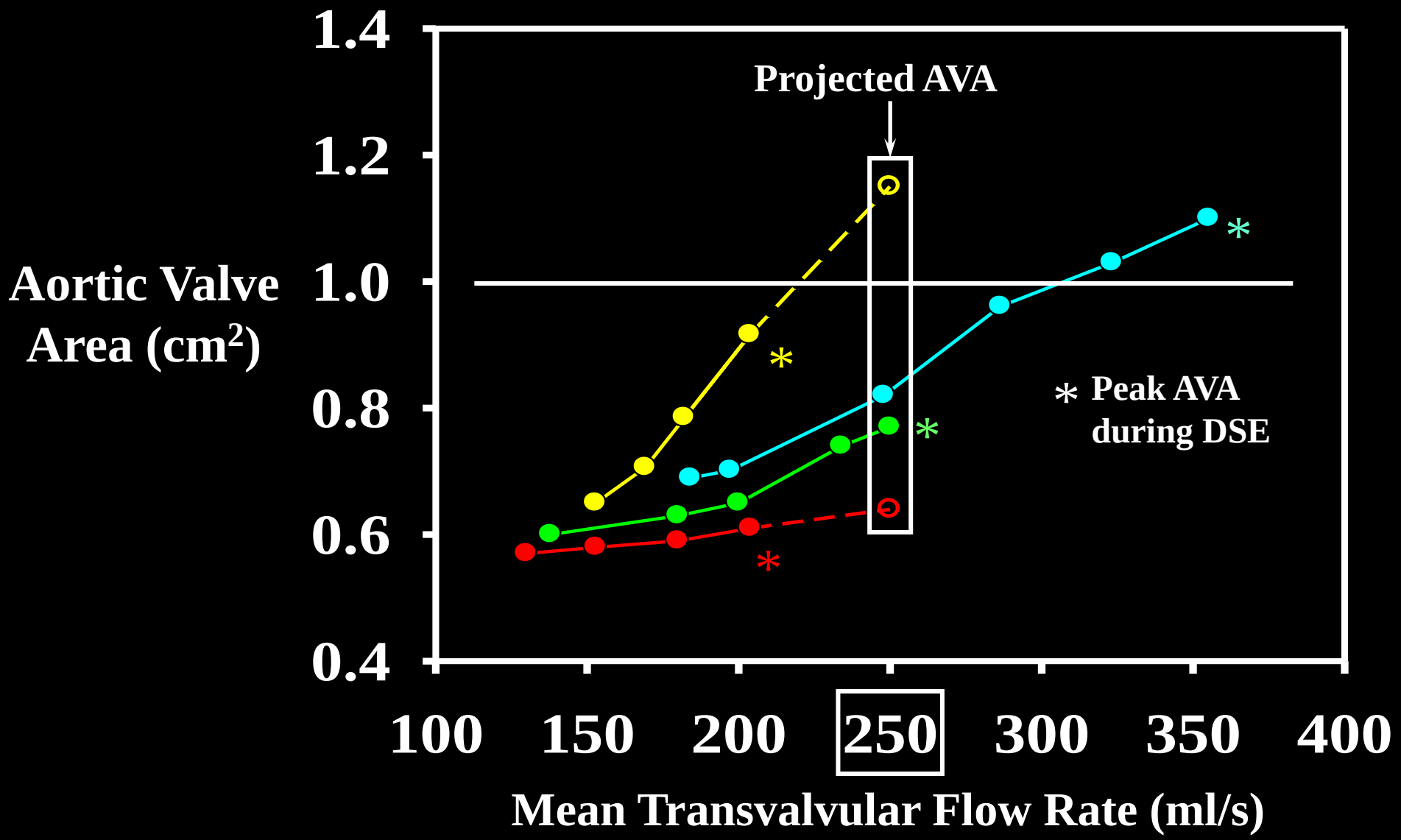
Projected Valve Area at Normal Flow Rate Improves the Assessment of Stenosis Severity in Patients With Low-Flow, Low-Gradient Aortic Stenosis

The Multicenter TOPAS (Truly or Pseudo-Severe Aortic Stenosis) Study

Claudia Blais, MSc; Ian G. Burwash, MD; Gerald Mundigler, MD; Jean G. Dumesnil, MD; Nicole Loho, MD; Florian Rader, MD; Helmut Baumgartner, MD; Rob S. Beanlands, MD; Boris Chayer, Eng; Lyes Kadem, Eng, PhD; Damien Garcia, Eng, PhD; Louis-Gilles Durand, Eng, PhD; Philippe Pibarot, DVM, PhD

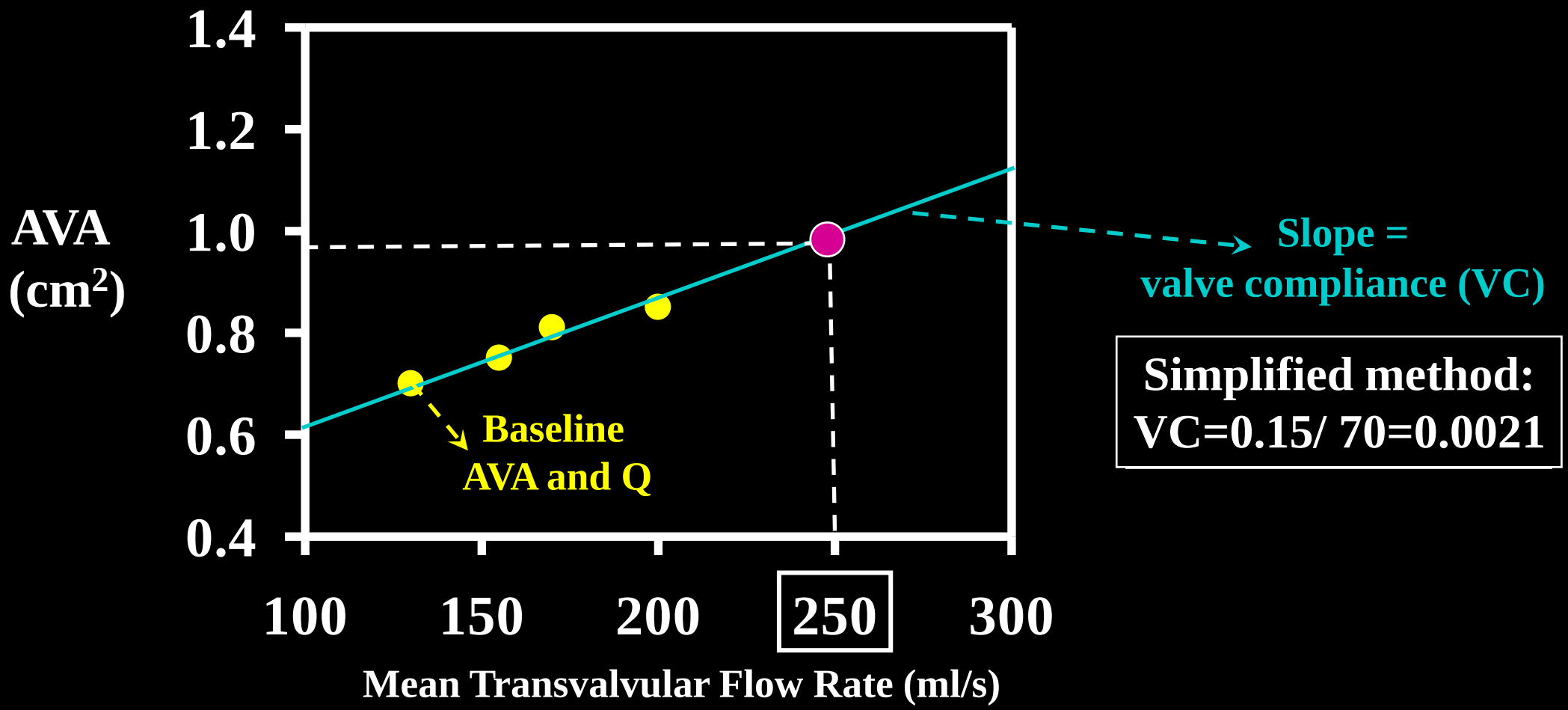
Blais et al, Circulation 2006;113:711-721

Concept of the Projected AVA (250 mL/s)



Blais et al, Circulation 2006;113:711-721

Calculation of the Projected AVA



Simplified method:
VC=0.15/ 70=0.0021

$$AVA_{projected} = 0.70 + 0.0021 \times (250 - 130) = 0.96\ cm^2$$

Blais et al, Circulation 2006;113:711-721 Clavel et al. JASE; 23:380-6, 2010

Case #4 : Low-Flow, Low-Gradient AS + MR

	Rest	Dobutamine
Stroke Volume (ml)	40	53
Stroke Volume Index (ml/m^2)	23	31
Ejection Fraction	25	33
Mean Gradient (mm Hg)	21	32
AVA (cm^2)	0.70	0.85
AVA (cm^2/m^2)	0.41	0.5
MR	2/4	3/4
Projected AVA (cm^2)	0.96	
Projected AVAi (cm^2/m^2)	0.56	

Usefulness of AoV Ca Scoring by MDCT to Differentiate True vs. Pseudo- Severe Stenosis in Low-Flow, Low-Gradient AS

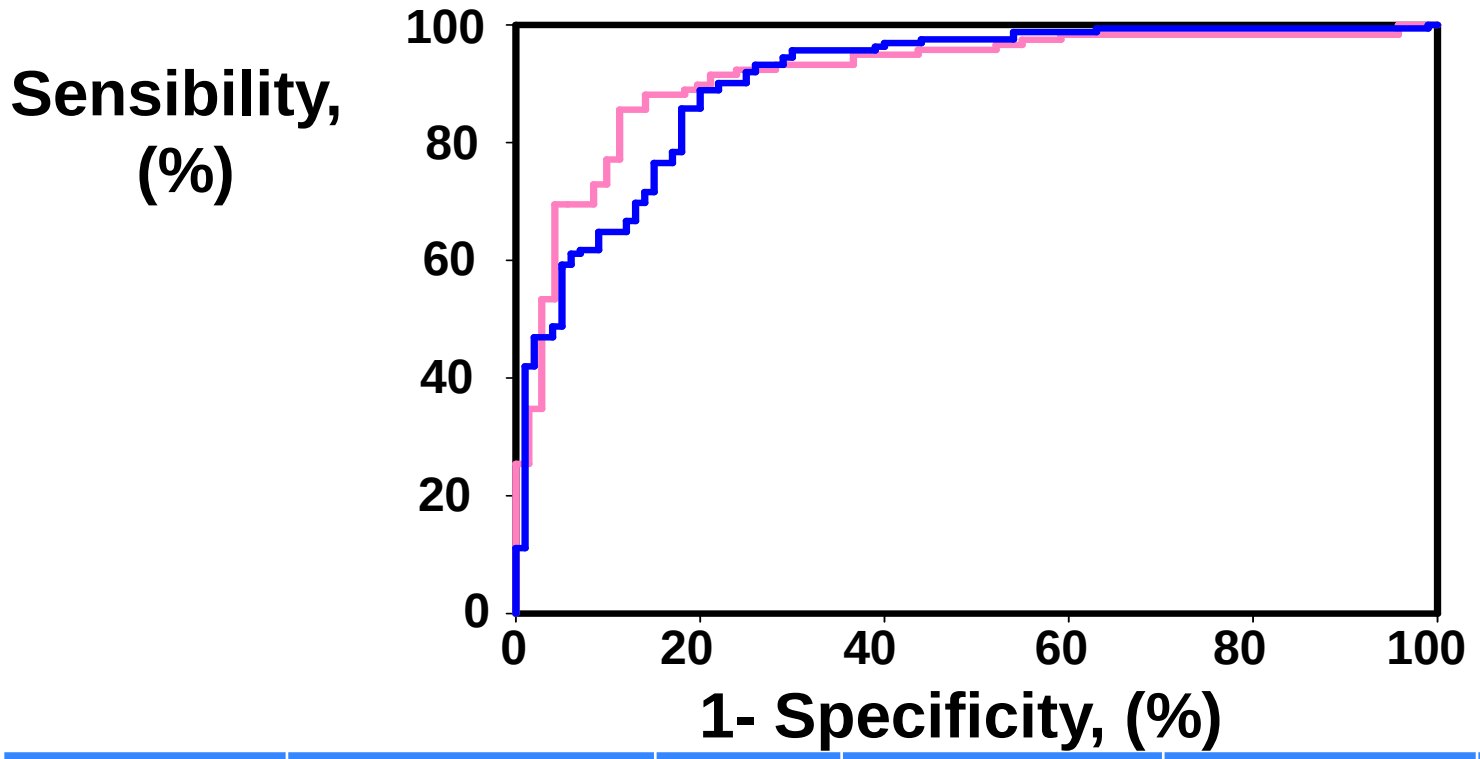
Pseudo-Severe

AVC: 1034 AU

True-Severe

AVC: 4682 AU

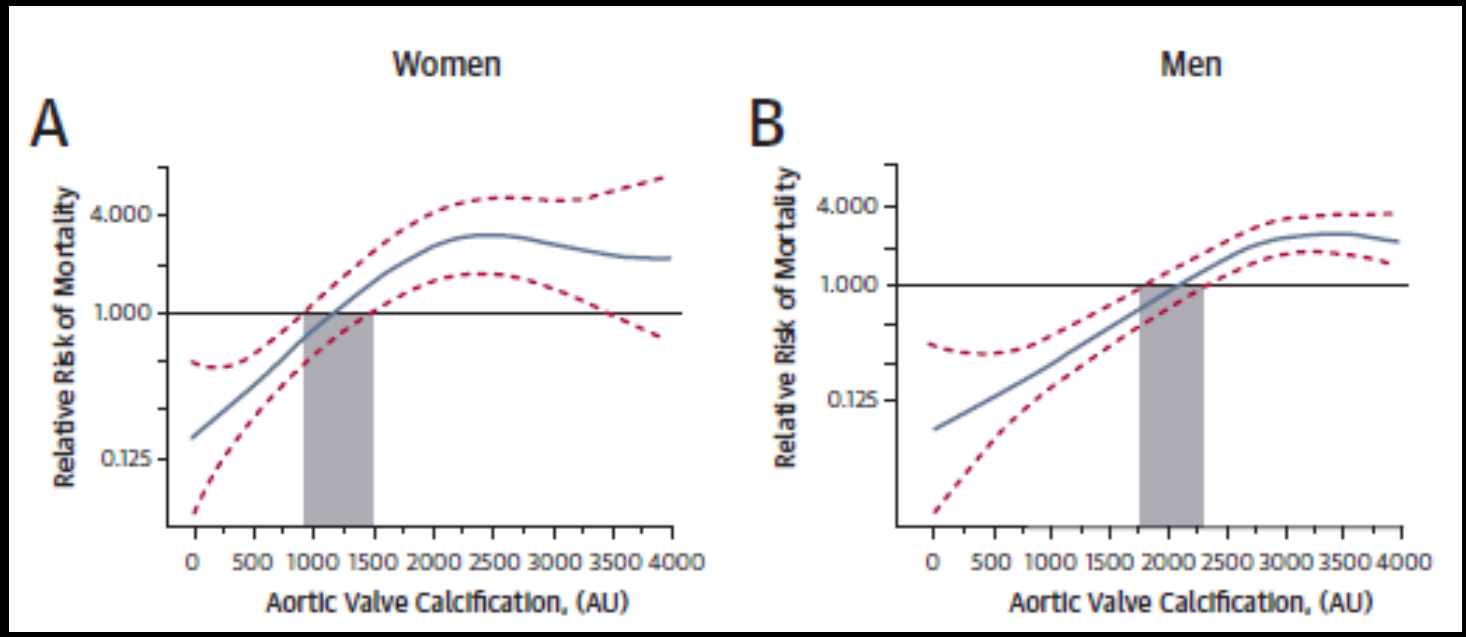
Mayo-Québec-Bichat Collaboration:
Accuracy of AVC to identify severe AS



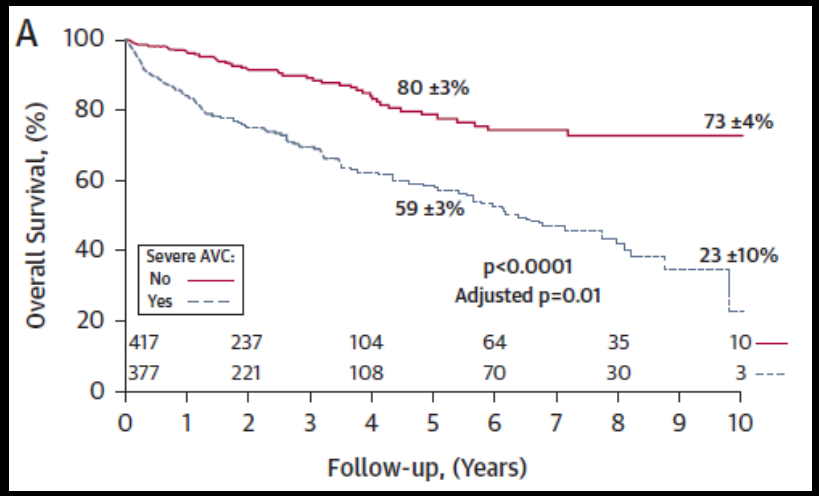
Gender	Threshold	AUC	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Women	1274 AU	0.91	89	86	93	79
Men	2065 AU	0.90	89	80	88	82

Clavel et al. JACC 2013

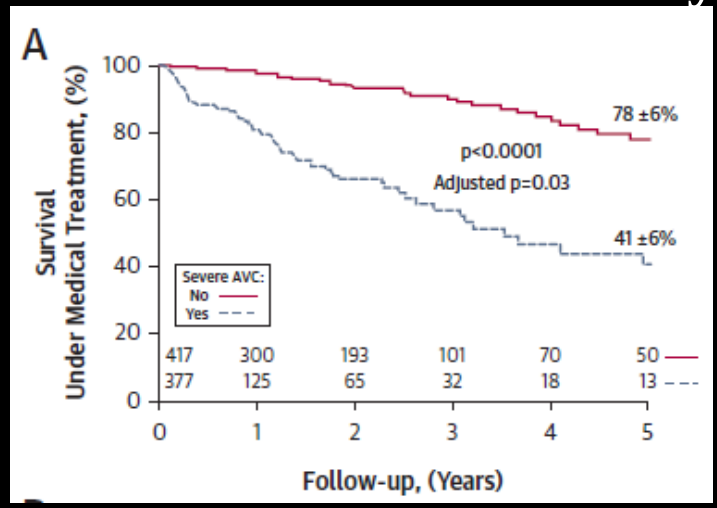
Mayo-Québec-Bichat Collaboration:
Impact of AVC on Survival In patients with AS



Whole Cohort



Patients treated Medically

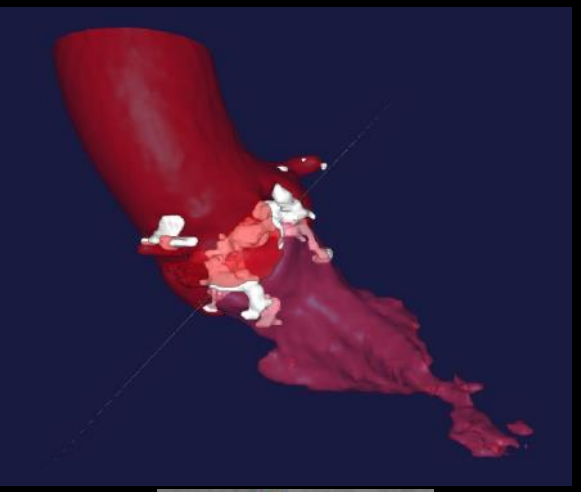


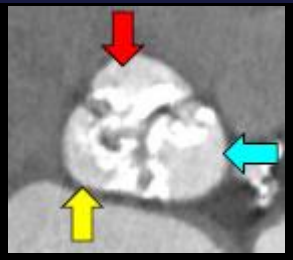
Clavel et al.
JACC
2014

Case #2

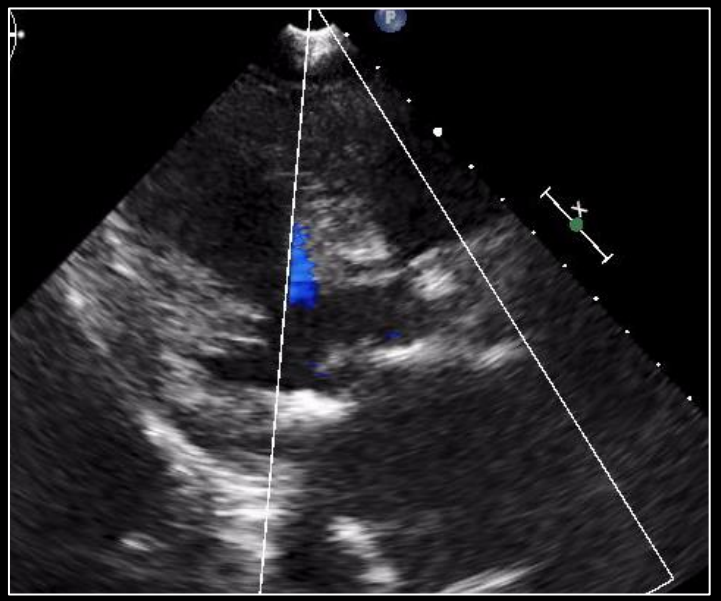
Pre TAVR

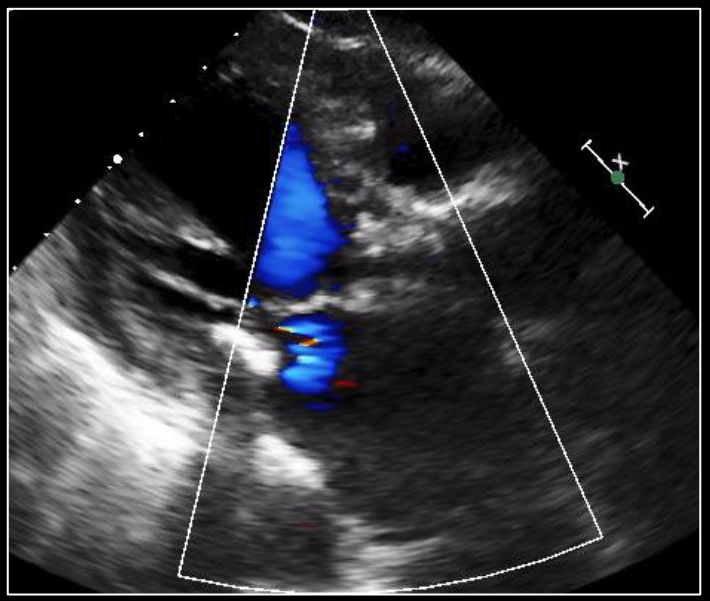
Post TAVR

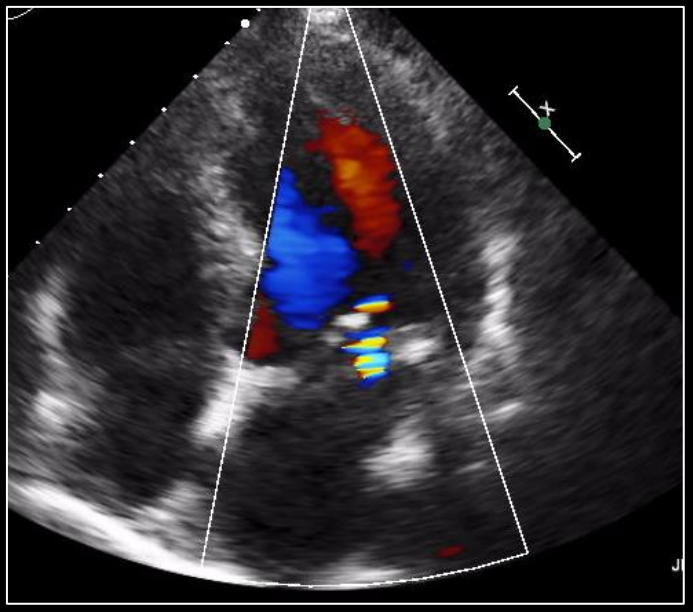




AVC Score:
4800 AU







Conclusions

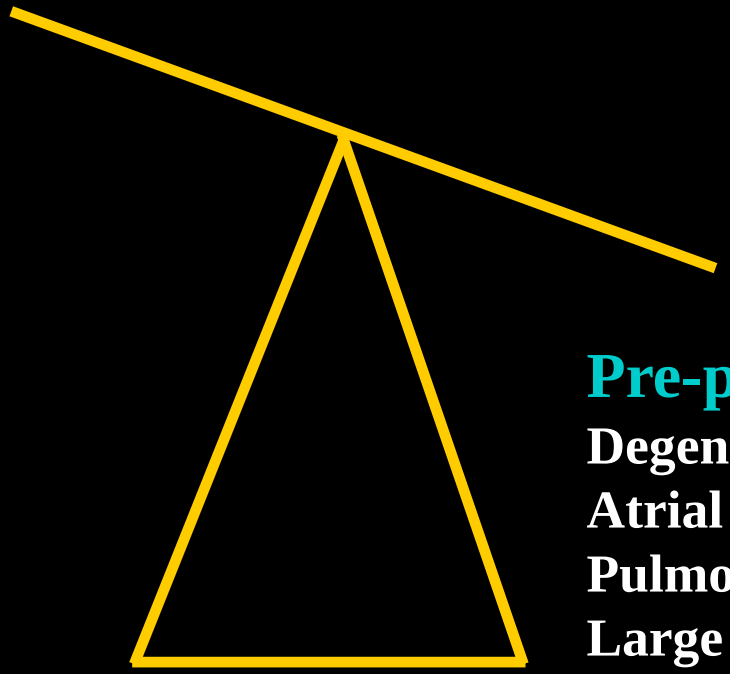
- **Concomitant MR in AS is often associated with reduced forward stroke volume and thus low-flow, low-gradient**
- **Stenosis severity and LV systolic dysfunction may be underestimated in presence of MR**
- **Low dose DSE may be used to diffentiate true vs. pseudo severe stenosis in patients with AS+MR but results are often inconclusive**
- **Aortic valve calcium scoring by MDCT is useful to corroborate stenosis severity in this context**

Regression of Untreated MR Following SAVR or TAVR

More

Pre-procedural factors:

High transaortic gradient
Low LVEF
Larger LV size



Less

Pre-procedural factors:

Degenerative vs. functional MR
Atrial fibrillation
Pulmonary hypertension
Large LA size

Procedural factors:

Prosthesis-Patient Mismatch
Residual AR

MR Improvement

Nombela-Franco, JACC 20134