


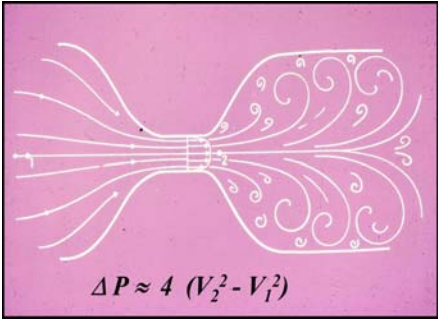
Dobutamine Stress testing In Low Flow, Low EF, Low Gradient Aortic Stenosis *Case Studies*

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Flow dependence of Velocity, Gradients, & Valve Motion/Orifice

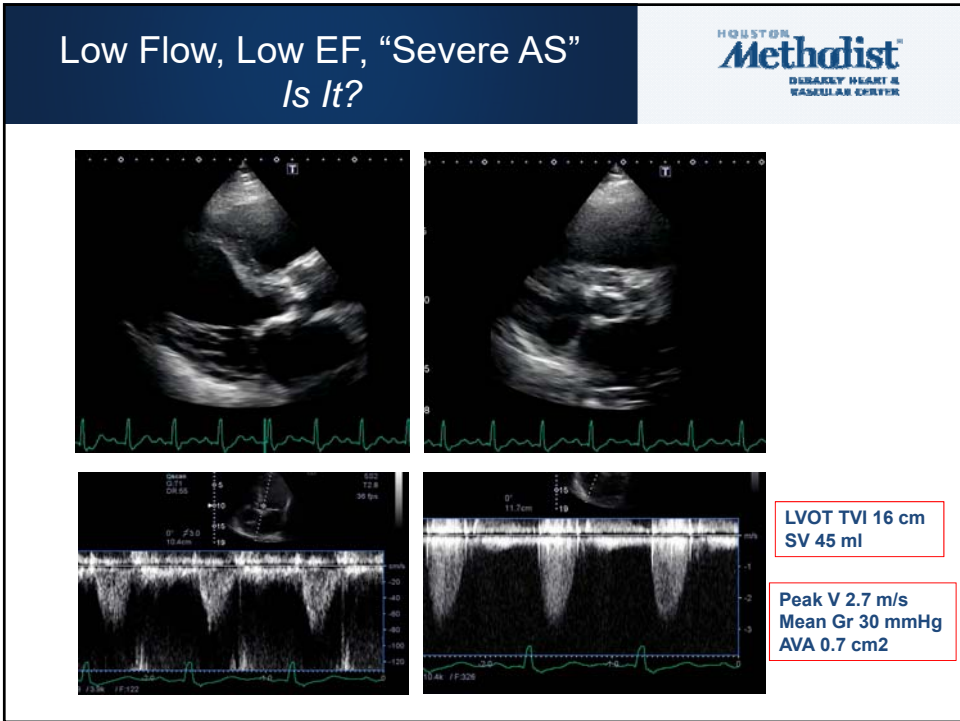


$\Delta P \approx 4 (V_2^2 - V_1^2)$

<h2 style="margin: 0;">Aortic Stenosis</h2> <h3 style="margin: 0;">AHA & ACC Guidelines</h3>			
Indicator	Mild	Moderate	Severe
Jet velocity	< 3.0 m/s	3.0 – 4.0	> 4.0 m/s
Mean gradient	< 25 mmHg	25 – 40	> 40 mmHg
Valve area	> 1.5 cm ²	1.0 – 1.5	< 1.0 cm ²

In Normal or High flow Conditions (SV > 35 mL/m²)

Nishimura R. et al. JACC 2014



Dobutamine Stress ECHO Protocol in Low Flow, Low EF, Severe AS



Starting dobutamine dose of 2.5 to 5 mcg/kg/min

↓

Increase dose 2.5 to 5 mcg/kg/min every 3-5 minutes

Maximum dobutamine dose of 20 mcg/kg/min

Infusion stopped when:

- 1) Maximum dobutamine dose reached (20 mcg/kg/min)
- 2) Positive result obtained
- 3) Heart rate rises 10-20 bpm over baseline or exceeds 100 bpm
- 4) Symptoms, blood pressure fall, or significant arrhythmias

Baumgartner H, et al. Recommendations on the Echocardiographic Assessment of Aortic Valve Stenosis: A Focused Update from the European Association of Cardiovascular Imaging and the American Society of Echocardiography. *J Am Soc Echocardiogr.* 2017 Apr;30(4):372-392.

Dobutamine Stress ECHO Protocol



3 types of responses

SV & LVEF	Gradient	AVA	Implication
↑	↑	-	Severe AS
↑	-	↑	AS not severe
-	-	-	Severe CM / ?Severe AS

Case 1



Clinical Presentation

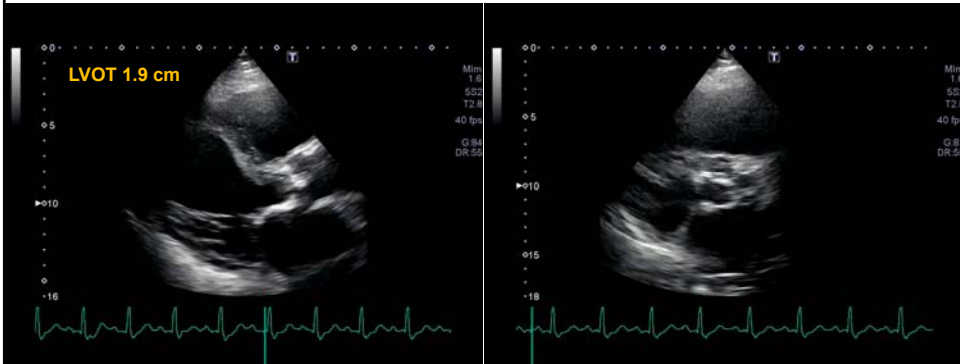
- 87 yo male with CAD s/p CABG, aortic stenosis, systolic HF EF 30-35%, HTN, DM, CKD III, TIA, paroxysmal AF presents with dyspnea and decompensated HF, NYHA III
- Exam: 124/59, HR 63, BMI 23 kg/m2
 - CV: RRR, +S3, II/VI SEM LSB

Echocardiogram



Parasternal

Short Axis – Aortic Valve



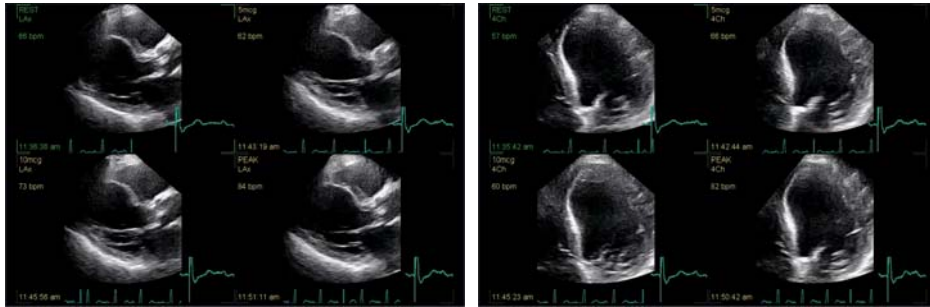
Vitals: BP 112/56 mmHg, HR 71 bpm

Dobutamine Stress ECHO



Parasternal

Apical 4 – Chamber

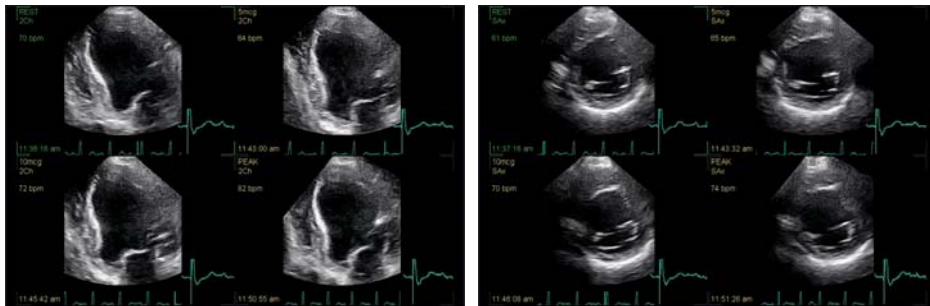


Dobutamine Stress ECHO

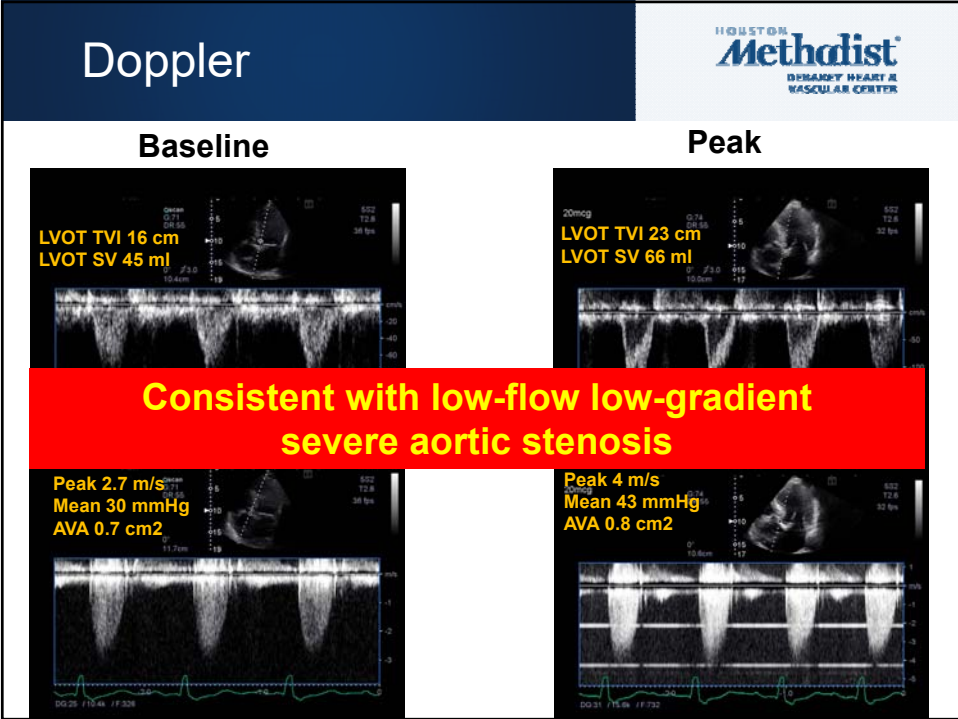


2 – Chamber

Short Axis



Baseline LVEF 30-34%
Peak LVEF 35-39%



Case 2

Clinical Presentation

86 yo M with CAD s/p CABG, aortic stenosis, systolic HF EF 25% s/p CRT-D, COPD presents with dyspnea, NYHA IV

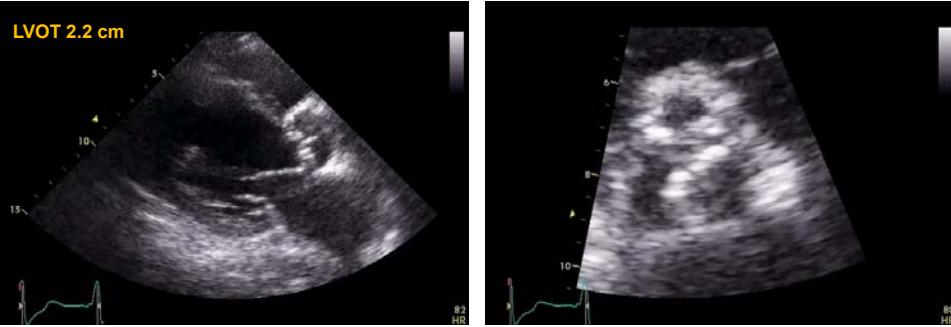
- Exam: 108/51, HR 79 , 3L O2 93%, BMI 21 kg/m²
 - CV: RRR, II/VI systolic murmur RUSB, +JVD (12 cm), decreased breath sounds, 1+ edema

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Echocardiogram

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Parasternal **Short Axis – Aortic Valve**



LVOT 2.2 cm

Vitals: BP 100/53 mmHg, HR 85 bpm

Dobutamine Stress ECHO

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Parasternal **Apical 4 – Chamber**

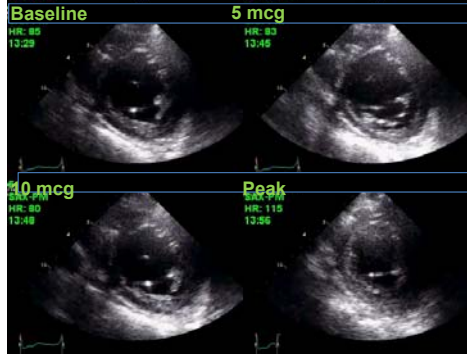
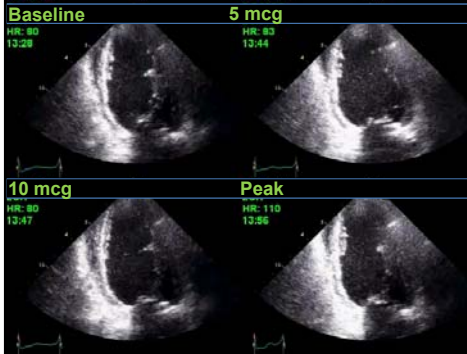
View	Baseline	5 mcg
Parasternal	HR: 80 13:29	HR: 84 13:44
Apical 4-Chamber	HR: 83 13:28	HR: 83 13:44
Parasternal	HR: 75 13:47	HR: 114 13:56
Apical 4-Chamber	HR: 80 13:47	HR: 112 13:56

Dobutamine Stress ECHO



2 – Chamber

Short Axis



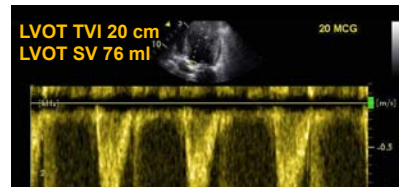
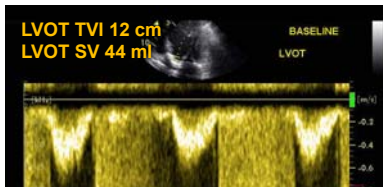
Baseline LVEF 25-29%
Peak LVEF 30-34%

Doppler

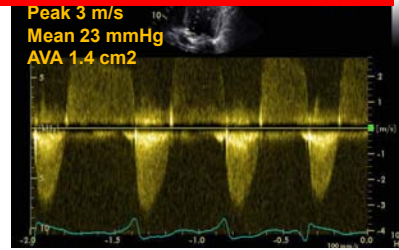
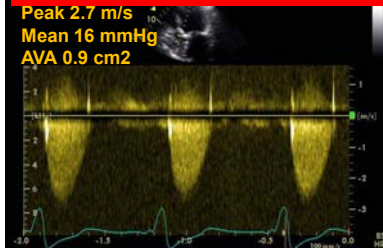


Baseline

Peak Dobutamine



**Consistent with pseudo-severe aortic stenosis
Mild aortic stenosis**



Case 3



Clinical Presentation

78 yo M with CAD, aortic stenosis, systolic HF EF 40%, COPD, CKD presents with dyspnea, NYHA III

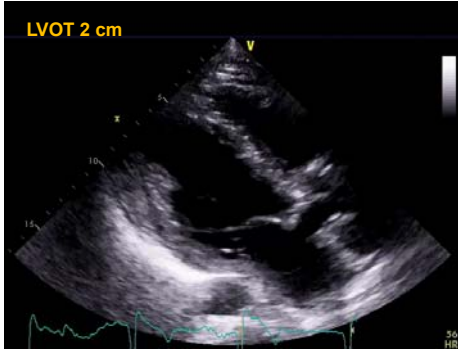
- Exam: 127/51, HR 70, BMI 21 kg/m2
 - CV: RRR, II/VI systolic murmur RUSB, +wheezing, 2+ edema, +JVD

Echocardiogram



Parasternal

Short Axis – Aortic Valve



Vitals: BP 166/71 mmHg, HR 59 bpm

Dobutamine Stress ECHO

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Parasternal **Apical 4 – Chamber**

Baseline HR: 57 8:36:32	5 mcg HR: 55 9:09:40	Baseline HR: 51 8:36:11	5 mcg HR: 61 9:09:18
10 mcg HR: 55 9:12:44	Peak HR: 52 9:15:19	10 mcg HR: 57 9:12:22	Peak HR: 58 9:14:53

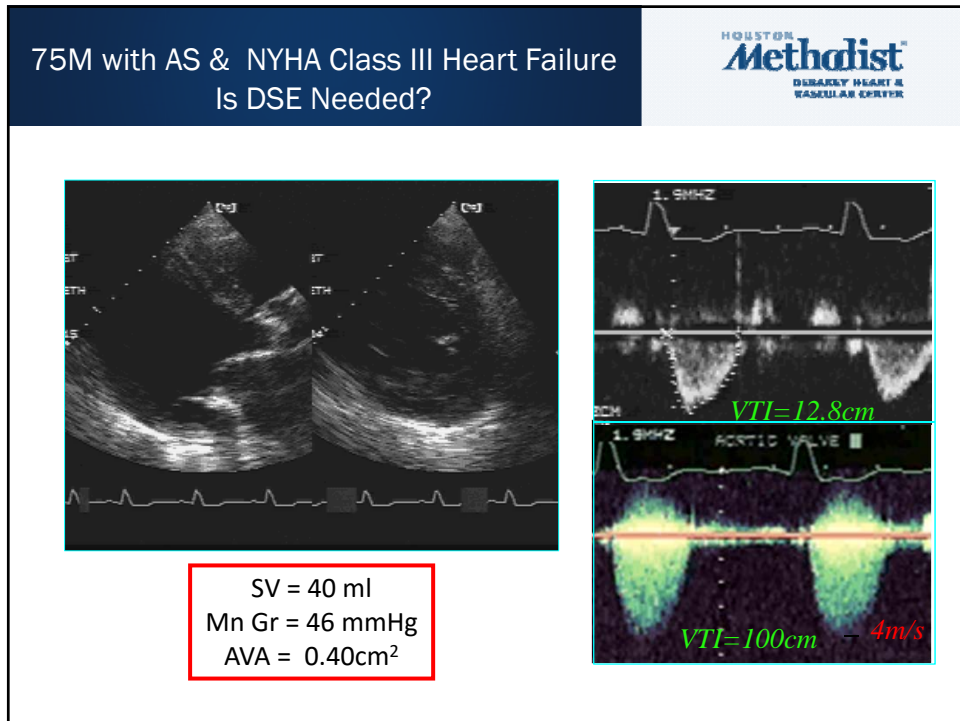
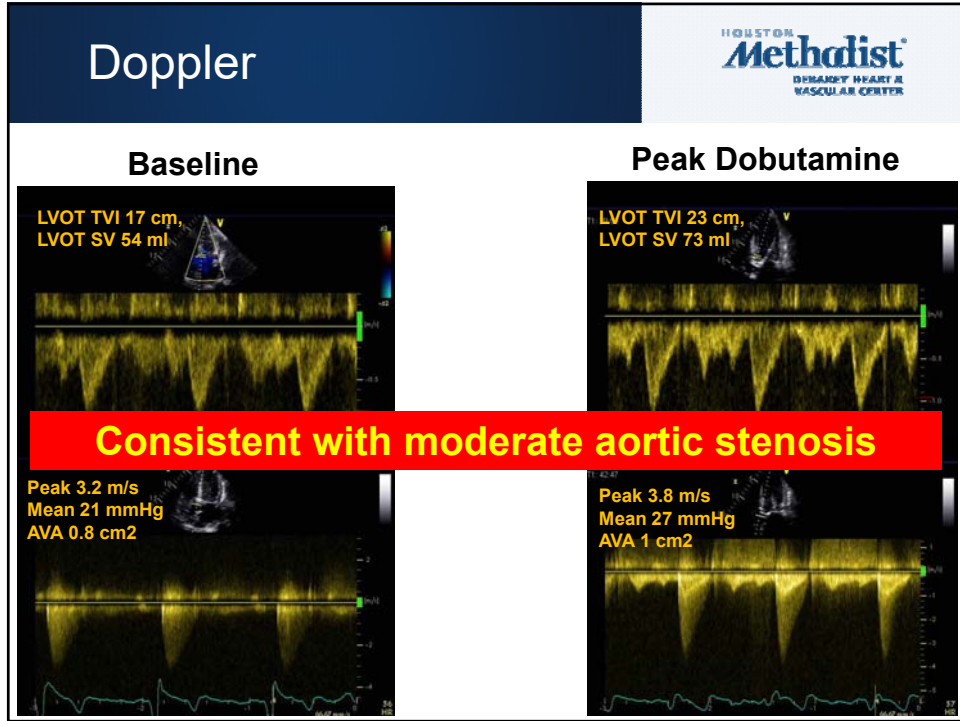
Dobutamine Stress ECHO

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2 – Chamber **Short Axis**

Baseline HR: 57 9:05:29	5 mcg HR: 56 9:09:29	Baseline HR: 58 9:05:51	5 mcg HR: 61 9:09:18
10 mcg HR: 59 9:12:39	Peak HR: 64 9:15:08	10 mcg HR: 52 9:12:58	Peak HR: 60 9:15:28

Baseline LVEF 40-44%
Peak LVEF 50-54%

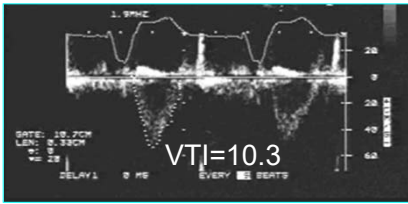
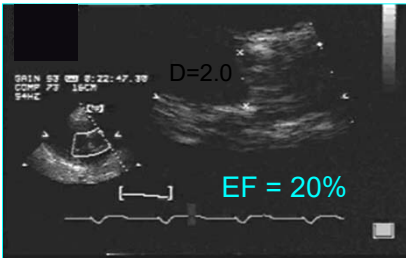


Case

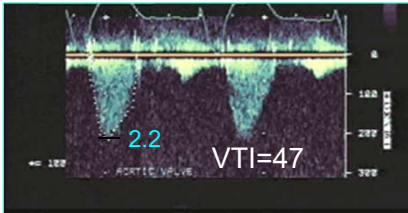


- 72 yr old man with NYHA class III heart failure
- Systolic ejection murmur
- The aortic valve was calcified
- LV dilated with an EF of 20%.

72M With Class III Heart Failure



Peak V = 2.2m/s
Mean Grad = 11mmHg
SV = 32 ml
AVA = 32/47 = 0.69cm²

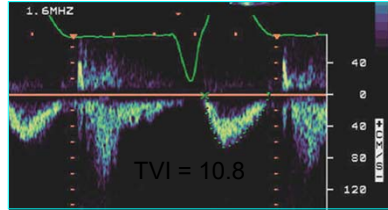


72M With Class III Heart Failure

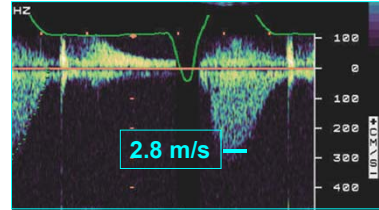


Dobutamine infusion at 20mcg/kg/min

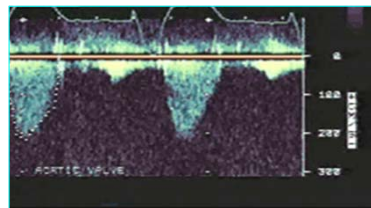
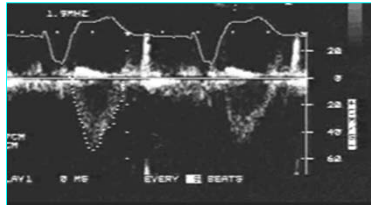
Pulsed Doppler- LVO



CW Aortic Valve

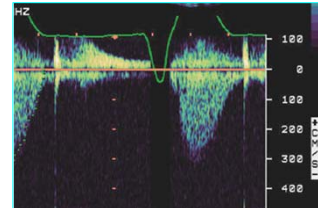
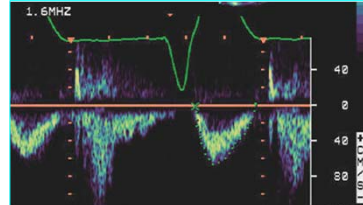


Baseline




Peak V = 2.2m/s
Mean Grad = 11mmHg
SV = 32 ml
AVA = 32/47 = 0.69cm²

Dobutamine



Peak V = 2.8 m/s
Mean Grad = 14 mmHg
SV = 35 ml
AVA = 35/52 = 0.69cm²


Dobutamine Echo in AS with Depressed LVEF & Low Gradient



3 types of responses

SV & LVEF	Gradient	AVA	Implication
↑	↑	-	Severe AS
↑	-	↑	AS not severe
-	-	-	Severe CM / ?Severe AS

Low Flow, Low EF, Low Gradient Severe AS



Low Flow Low Gradient Severe AS
 $MGr < 40 \text{ mmHg}$, $AVA < 1 \text{ cm}^2$, $LVEF < 50\%$, $SV < 35\text{ml/m}^2$

↓

Low Dose Dobutamine Stress Echo

$MGr \geq 40 \text{ mmHg}$

$MGr < 40 \text{ mmHg}$
& $AVA \leq 1 \text{ cm}^2$

$MGr < 40 \text{ mmHg}$
& $AVA > 1 \text{ cm}^2$

True Severe AS

Assess Δ in flow/Gr/AVA
 Is SV still reduced?
 How close to "cutoff" of Severe AS?
 Contour of AS Jet
 Ca Score of AV (1200 W, 2000 M)

Pseudo Severe AS