

2017 ASE Florida | Orlando, FL

October 9, 2017 | 10:40 – 11:00 PM | 20 min | Grand Harbor Ballroom South

Echo in Asymptomatic Mitral and Aortic Regurgitation

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Associate Professor of Medicine



Disclosures

Speakers Bureau (Philips, Medtronic)
Advisory Board (Siemens)

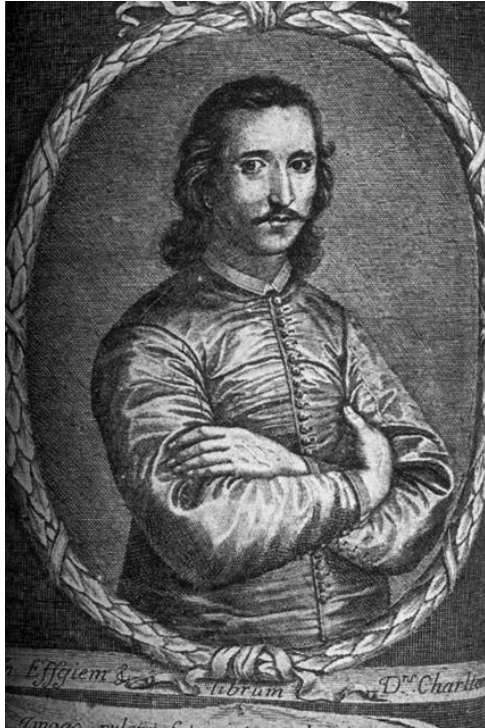
Regurgitation Axioms

- Typically, regurgitation is NOT symptomatic unless severe
- The opposite is not true: Severe regurgitation may be asymptomatic
- Chronic regurgitation leads to chamber dilatation on either side of the regurgitant valve

Regurgitation Discovery

- Regurgitation as a anatomic entity was recognized **in the 17th century**
- Regurgitation was first clinically diagnosed by auscultation **in the 19th century**, well before the advent of echocardiography

First Use of Regurgitation Term in English



Walter Charleton
(1619 – 1707)
English Physician

1683 W. Charleton *Three Anat. Lect.* i. 18

Those [valves] that are placed in the inlet and outlet of the left Ventricle, to obviate the **regurgitation** of the blood into the arteria venosa, and out of the aorta into the left Ventricle.

Heart Murmur

OXFORD ENGLISH DICTIONARY DEFINITION

- Any of various **auscultatory** sounds
- Adventitious sounds of cardiac or vascular origin [that is, separate from standard heart sounds: S₁, S₂, S₃, S₄]
- Sometimes of no significance
- But sometimes caused by valvular lesions of the heart or other diseases of the circulatory system



René Laënnec
(1781 – 1826)
French Physician
Inventor of stethoscope
in 1816



Στήθος : *Stēthos* = chest

Stethoscope
(‘Chest examiner’)
Hollow wooden cylinder

Laënnec Performing Auscultation



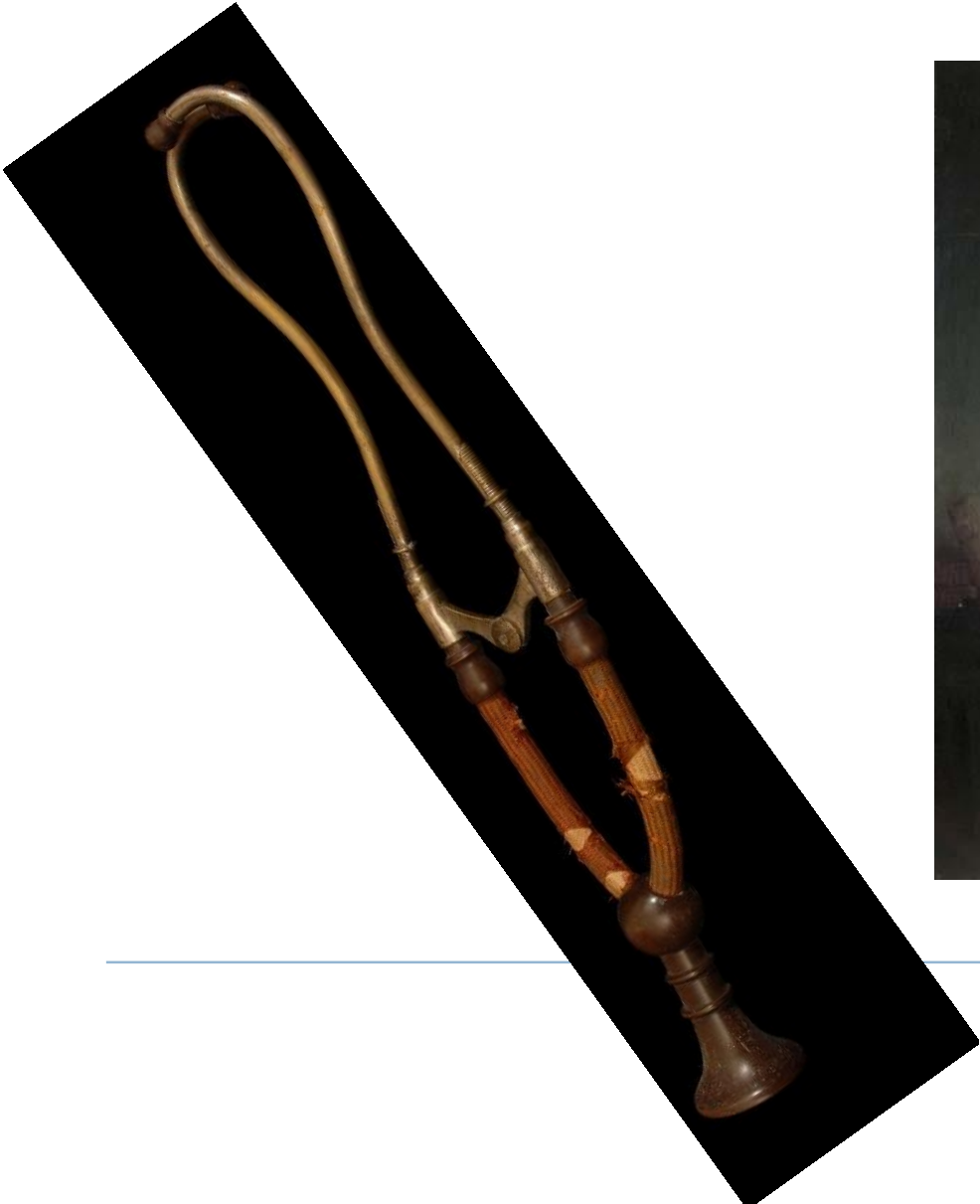
Painted by Robert Alan Thom (1915 – 1979), American illustrator
Commissioned by Parke, Davis & Co.



1816
René Laennec,
French physician
Invents **MONAURAL** stethoscope



1832
James Hope
British physician
separates MS from MR murmur



1852
George Cammann
New York City physician
Perfects **BINAURAL** stethoscope



1862
Austin Flint Sr.
New York City physician
Describes the eponymous murmur

PRACTICE GUIDELINE

2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease



A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Developed in Collaboration With the American Association for Thoracic Surgery, American Society of Echocardiography, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Anesthesiologists, and Society of Thoracic Surgeons

J Am Coll Cardiol. 2014 Jun 10;63(22):e57-185

ASE GUIDELINES AND STANDARDS

Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation



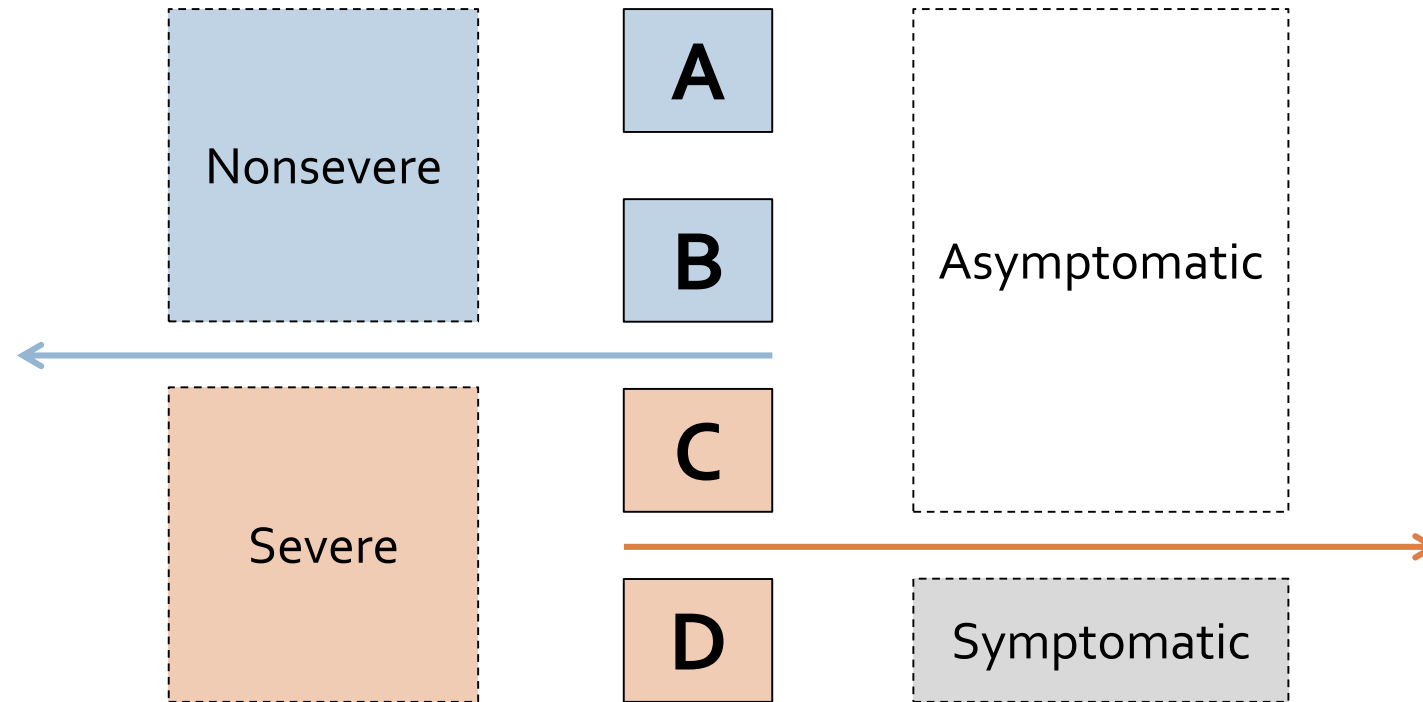
A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Magnetic Resonance

William A. Zoghbi, MD, FASE (Chair), David Adams, RCS, RDCS, FASE, Robert O. Bonow, MD, Maurice Enriquez-Sarano, MD, Elyse Foster, MD, FASE, Paul A. Grayburn, MD, FASE, Rebecca T. Hahn, MD, FASE, Yuchi Han, MD, MMSc,* Judy Hung, MD, FASE, Roberto M. Lang, MD, FASE, Stephen H. Little, MD, FASE, Dipan J. Shah, MD, MMSc,* Stanton Shernan, MD, FASE, Paaladinesh Thavendiranathan, MD, MSc, FASE,* James D. Thomas, MD, FASE, and Neil J. Weissman, MD, FASE, *Houston and Dallas, Texas; Durham, North Carolina; Chicago, Illinois; Rochester, Minnesota; San Francisco, California; New York, New York; Philadelphia, Pennsylvania; Boston, Massachusetts; Toronto, Ontario, Canada; and Washington, DC*

J Am Soc Echocardiogr. 2017 Apr;30(4):303-371

Stages of Valvular Heart Disease

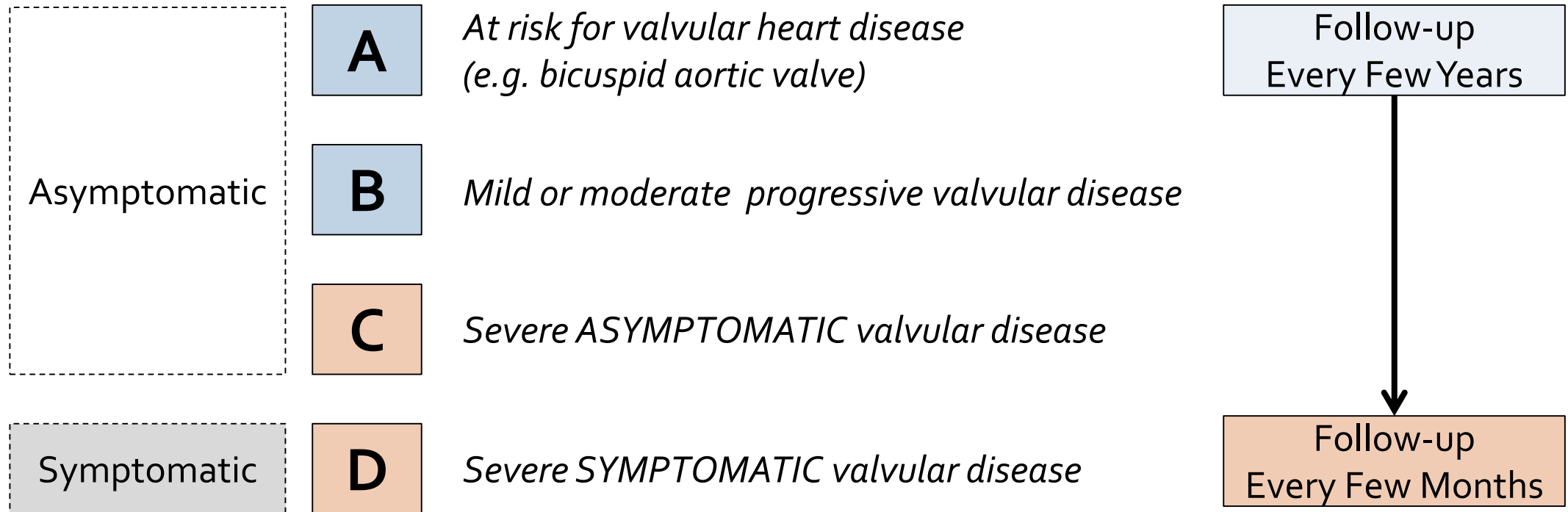
2014 ACC/AHA Valvular Guidelines



Valvular disease is typically NOT symptomatic unless SEVERE!

Stages of Valvular Heart Disease

2014 ACC/AHA Valvular Guidelines



Frequency of Echocardiographic Follow-up

2014 ACC/AHA Valvular Guidelines

Stage	Valve Lesion			
Stage	Aortic Stenosis*	Aortic Regurgitation	Mitral Stenosis	Mitral Regurgitation
Progressive (stage B)	Every 3–5 y (mild severity V_{max} 2.0–2.9 m/s)	Every 3–5 y (mild severity) Every 1–2 y (moderate severity)	Every 3–5 y (MVA >1.5 cm ²)	Every 3–5 y (mild severity) Every 1–2 y (moderate severity)
	Every 1–2 y (moderate severity V_{max} 3.0–3.9 m/s)			
Severe (stage C)	Every 6–12 mo ($V_{max} \geq 4$ m/s)	Every 6–12 mo Dilating LV: more frequently	Every 1–2 y (MVA 1.0–1.5 cm ²) Once every year (MVA <1.0 cm ²)	Every 6–12 mo Dilating LV: more frequently

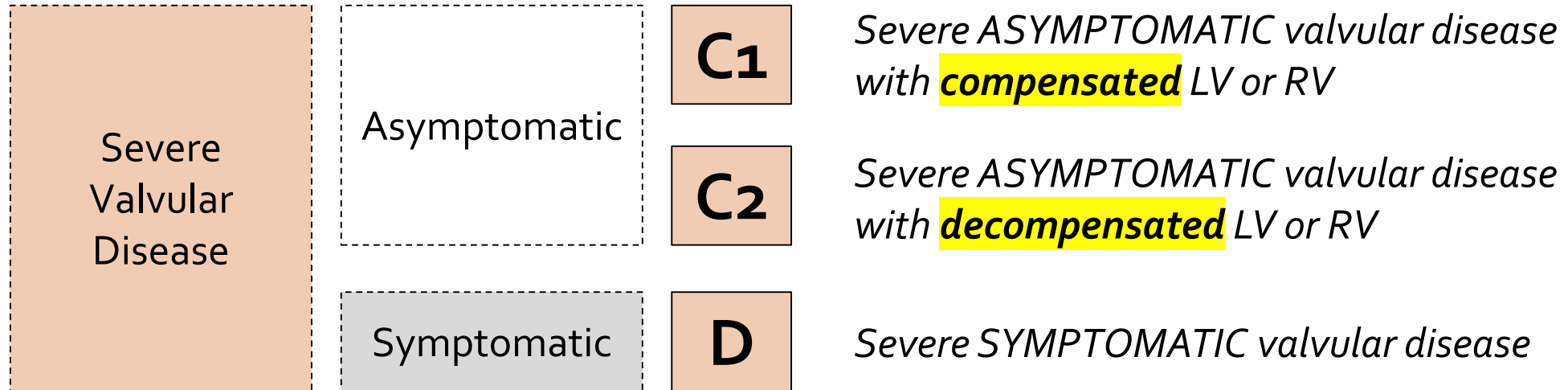
Patients with mixed valve disease may require serial evaluations at intervals earlier than recommended for single valve lesions.

*With normal stroke volume.

LV indicates left ventricle; MVA, mitral valve area; VHD, valvular heart disease; and V_{max} , maximum velocity.

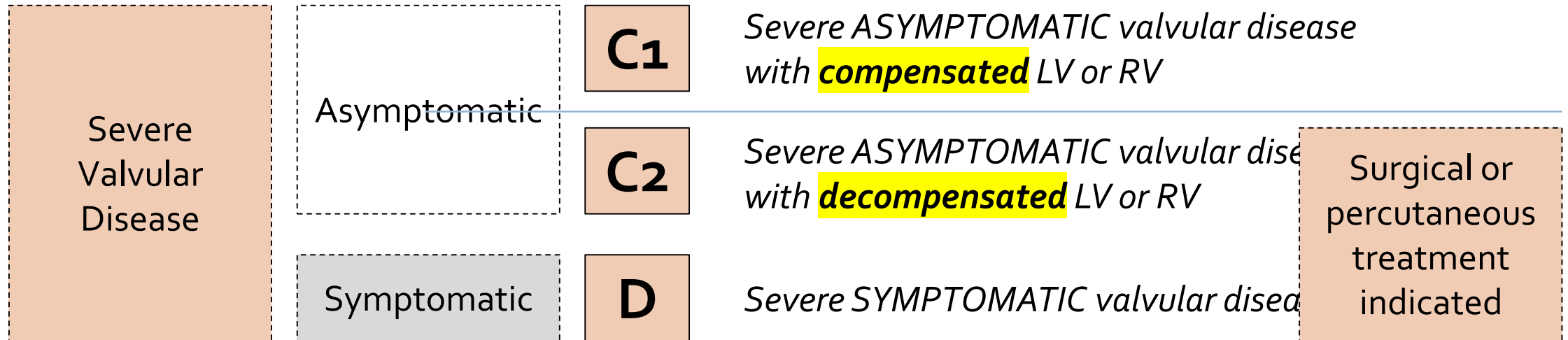
Stages of Valvular Heart Disease

2014 ACC/AHA Valvular Guidelines



Stages of Valvular Heart Disease

2014 ACC/AHA Valvular Guidelines



Valvular Disease Overview

	Acute (Sudden Onset)	Chronic (Worsening Over Many Years)
Valve Stenosis		<p>Chronic Stenosis Valve stenoses are almost always chronic.</p> <p>Compensated → Decompensated</p>
Valve Regurgitation	<p>Acute Regurgitation</p> <p><i>Severe ACUTE mitral & aortic regurgitations are life-threatening.</i></p>	<p>Chronic Regurgitation</p> <p><i>Guidelines deal primarily with CHRONIC valve disorders.</i></p>

Chronic Mitral Regurgitation

2014 ACC/AHA Valvular Heart Disease

<p>C Asymptomatic severe MR</p>	<ul style="list-style-type: none"> • Severe mitral valve prolapse with loss of coaptation or flail leaflet • Rheumatic valve changes with leaflet restriction and loss of central coaptation • Prior IE • Thickening of leaflets with radiation heart disease 	<ul style="list-style-type: none"> • Central jet MR >40% LA or holosystolic eccentric jet MR • Vena contracta ≥ 0.7 cm • Regurgitant volume ≥ 60 mL • Regurgitant fraction $\geq 50\%$ • ERO ≥ 0.40 cm² • Angiographic grade 3-4+ 	<ul style="list-style-type: none"> • Moderate or severe LA enlargement • LV enlargement • Pulmonary hypertension may be present at rest or with exercise • C1: LVEF >60% and LVESD <40 mm • C2: LVEF $\leq 60\%$ and LVESD ≥ 40 mm 	<ul style="list-style-type: none"> • None <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>60/40 RULE EF $\leq 60\%$ LVESD ≥ 40 mm</p> </div>
<p>D Symptomatic severe MR</p>	<ul style="list-style-type: none"> • Severe mitral valve prolapse with loss of coaptation or flail leaflet • Rheumatic valve changes with leaflet restriction and loss of central coaptation • Prior IE • Thickening of leaflets with radiation heart disease 	<ul style="list-style-type: none"> • Central jet MR >40% LA or holosystolic eccentric jet MR • Vena contracta ≥ 0.7 cm • Regurgitant volume ≥ 60 mL • Regurgitant fraction $\geq 50\%$ • ERO ≥ 0.40 cm² • Angiographic grade 3-4+ 	<ul style="list-style-type: none"> • Moderate or severe LA enlargement • LV enlargement • Pulmonary hypertension present 	<ul style="list-style-type: none"> • Decreased exercise tolerance • Exertional dyspnea

Chronic Aortic Regurgitation

2014 ACC/AHA Valvular Heart Disease

C	Asymptomatic severe AR	<ul style="list-style-type: none"> • Calcific aortic valve disease • Bicuspid valve (or other congenital abnormality) • Dilated aortic sinuses or ascending aorta • Rheumatic valve changes • IE with abnormal leaflet closure or perforation 	<ul style="list-style-type: none"> • Severe AR: <ul style="list-style-type: none"> ◦ Jet width $\geq 65\%$ of LVOT; ◦ Vena contracta > 0.6 cm; ◦ Holodiastolic flow reversal in the proximal abdominal aorta ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ Angiography grade 3+ to 4+; ◦ In addition, diagnosis of chronic severe AR requires evidence of LV dilation 	<p>C1: Normal LVEF ($\geq 50\%$) and mild-to-moderate LV dilation (LVESD ≤ 50 mm)</p> <p>C2: Abnormal LV systolic function with depressed LVEF ($< 50\%$) or severe LV dilatation (LVESD > 50 mm or indexed LVESD > 25 mm/m²)</p>	<p>50/50 RULE EF $< 50\%$ LVESD > 50 mm</p>
D	Symptomatic severe AR	<ul style="list-style-type: none"> • Calcific valve disease • Bicuspid valve (or other congenital abnormality) • Dilated aortic sinuses or ascending aorta • Rheumatic valve changes • Previous IE with abnormal leaflet closure or perforation 	<ul style="list-style-type: none"> • Severe AR: <ul style="list-style-type: none"> ◦ Doppler jet width $\geq 65\%$ of LVOT; ◦ Vena contracta > 0.6 cm, ◦ Holodiastolic flow reversal in the proximal abdominal aorta, ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ Angiography grade 3+ to 4+; ◦ In addition, diagnosis of chronic severe AR requires evidence of LV dilation 	<ul style="list-style-type: none"> • Symptomatic severe AR may occur with normal systolic function (LVEF $\geq 50\%$), mild-to-moderate LV dysfunction (LVEF 40%–50%), or severe LV dysfunction (LVEF $< 40\%$); • Moderate-to-severe LV dilation is present. 	<ul style="list-style-type: none"> • Exertional dyspnea or angina or more severe HF symptoms

Chronic Asymptomatic Mitral Regurgitation

Chronic Mitral Regurgitation

2014 ACC/AHA Valvular Heart Disease

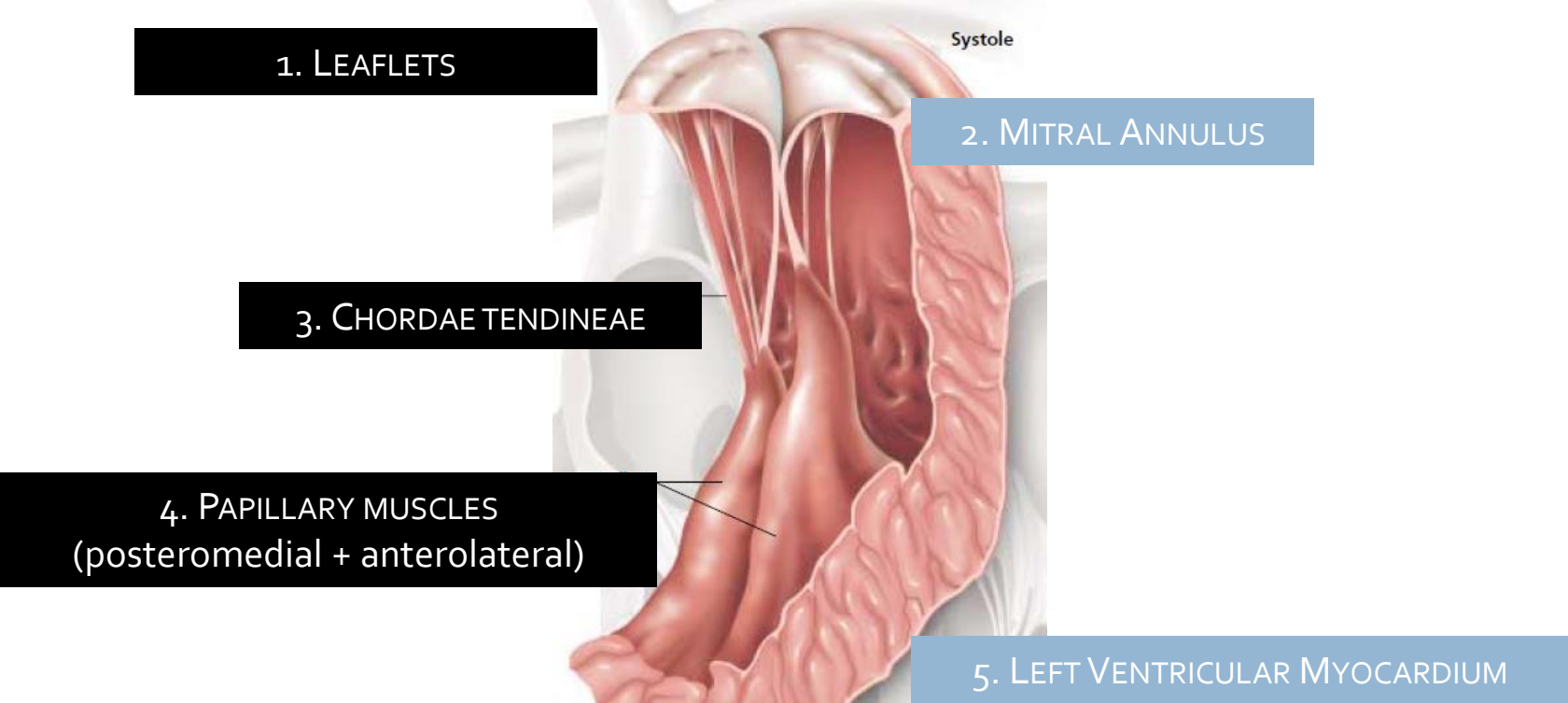
	MR Etiology	MR Severity	Chamber Dilatation	
C Asymptomatic severe MR	<ul style="list-style-type: none"> Severe mitral valve prolapse with loss of coaptation or flail leaflet Rheumatic valve changes with leaflet restriction and loss of central coaptation Prior IE Thickening of leaflets with radiation heart disease 	<ul style="list-style-type: none"> Central jet MR >40% LA or holosystolic eccentric jet MR Vena contracta ≥ 0.7 cm Regurgitant volume ≥ 60 mL Regurgitant fraction $\geq 50\%$ ERO ≥ 0.40 cm² Angiographic grade 3-4+ 	<ul style="list-style-type: none"> Moderate or severe LA enlargement LV enlargement Pulmonary hypertension may be present at rest or with exercise: C1: LVEF >60% and LVESD <40 mm C2: LVEF $\leq 60\%$ and LVESD ≥ 40 mm 	<ul style="list-style-type: none"> None
D Symptomatic severe MR	<ul style="list-style-type: none"> Severe mitral valve prolapse with loss of coaptation or flail leaflet Rheumatic valve changes with leaflet restriction and loss of central coaptation Prior IE Thickening of leaflets with radiation heart disease 	<ul style="list-style-type: none"> Central jet MR >40% LA or holosystolic eccentric jet MR Vena contracta ≥ 0.7 cm Regurgitant volume ≥ 60 mL Regurgitant fraction $\geq 50\%$ ERO ≥ 0.40 cm² Angiographic grade 3-4+ 	<ul style="list-style-type: none"> Moderate or severe LA enlargement LV enlargement Pulmonary hypertension present 	<ul style="list-style-type: none"> Exertional dyspnea

60/40 RULE
 EF $\leq 60\%$
 LVESD ≥ 40 mm

Stress Testing

Mitral Valve Anatomy

Geriatrics & Aging 2003;6:42-45.



**Degenerative (Primary)
Mitral Regurgitation**
Sick valve >>> sick ventricle

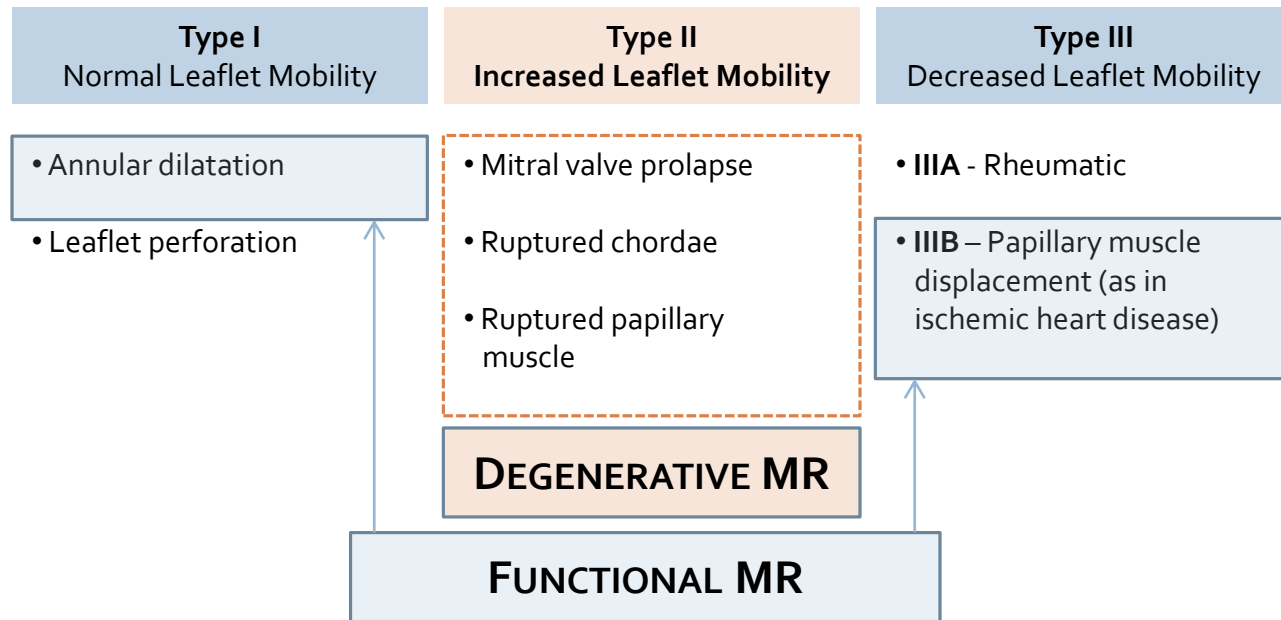
**Functional (Secondary)
Mitral Regurgitation**
Sick ventricle >> sick valve

Carpentier Classification of Native Mitral Regurgitation



Alain Frédéric Carpentier
(b. 1933 in Toulouse)
French surgeon

Based on mitral leaflet mobility



Carpentier A. Cardiac valve surgery—the “French correction.” *J Thorac Cardiovasc Surg* 1983;86:323–37.

The French Correction is a word play on The French Connection, a 1971 movie about smuggling heroin from Marseille to New York.

Functional Mitral Regurgitation

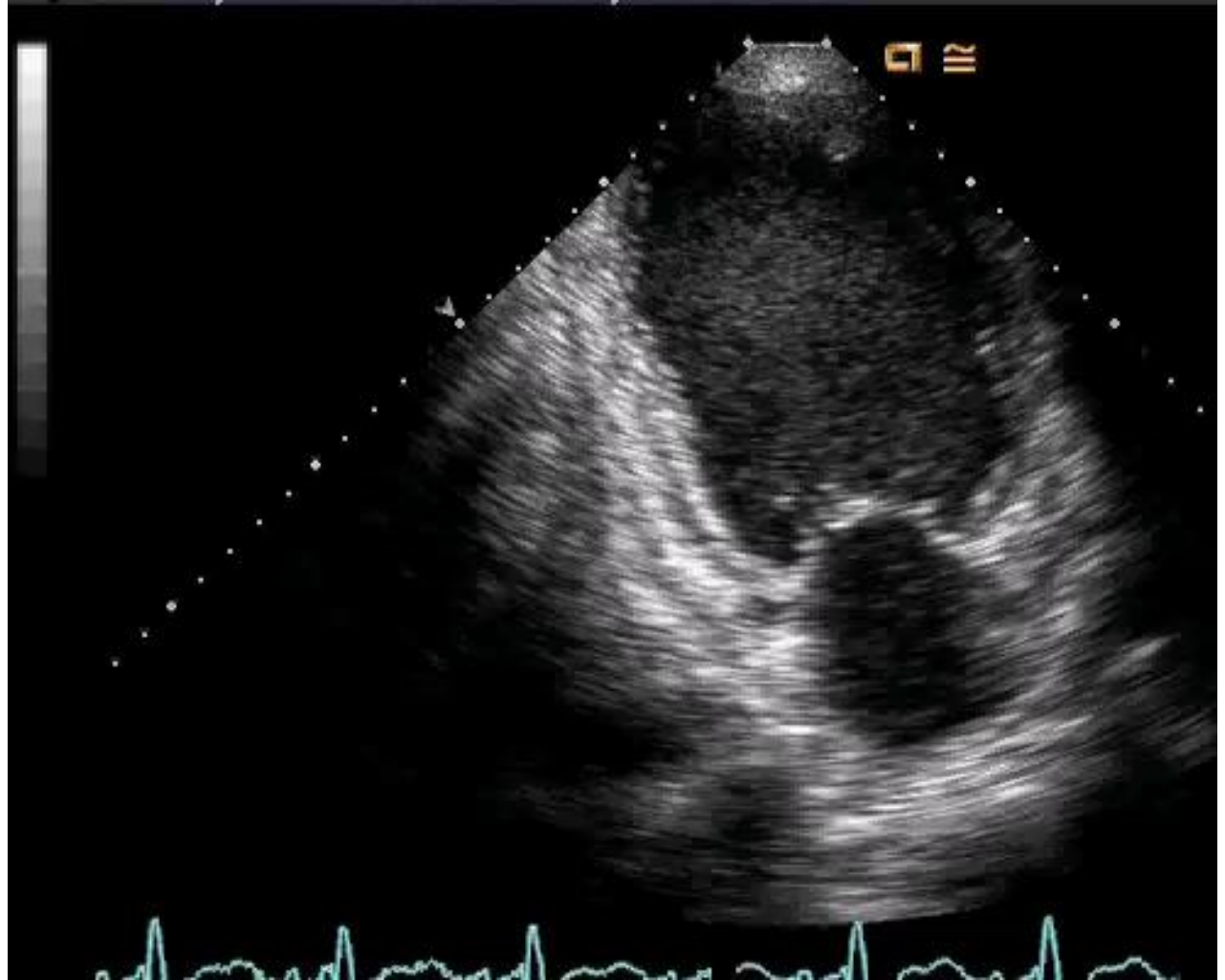
Functional MR – Annular Dilatation

47-y/o man with
**nonischemic
dilated cardiomyopathy**
&
acutely decompensated heart failure



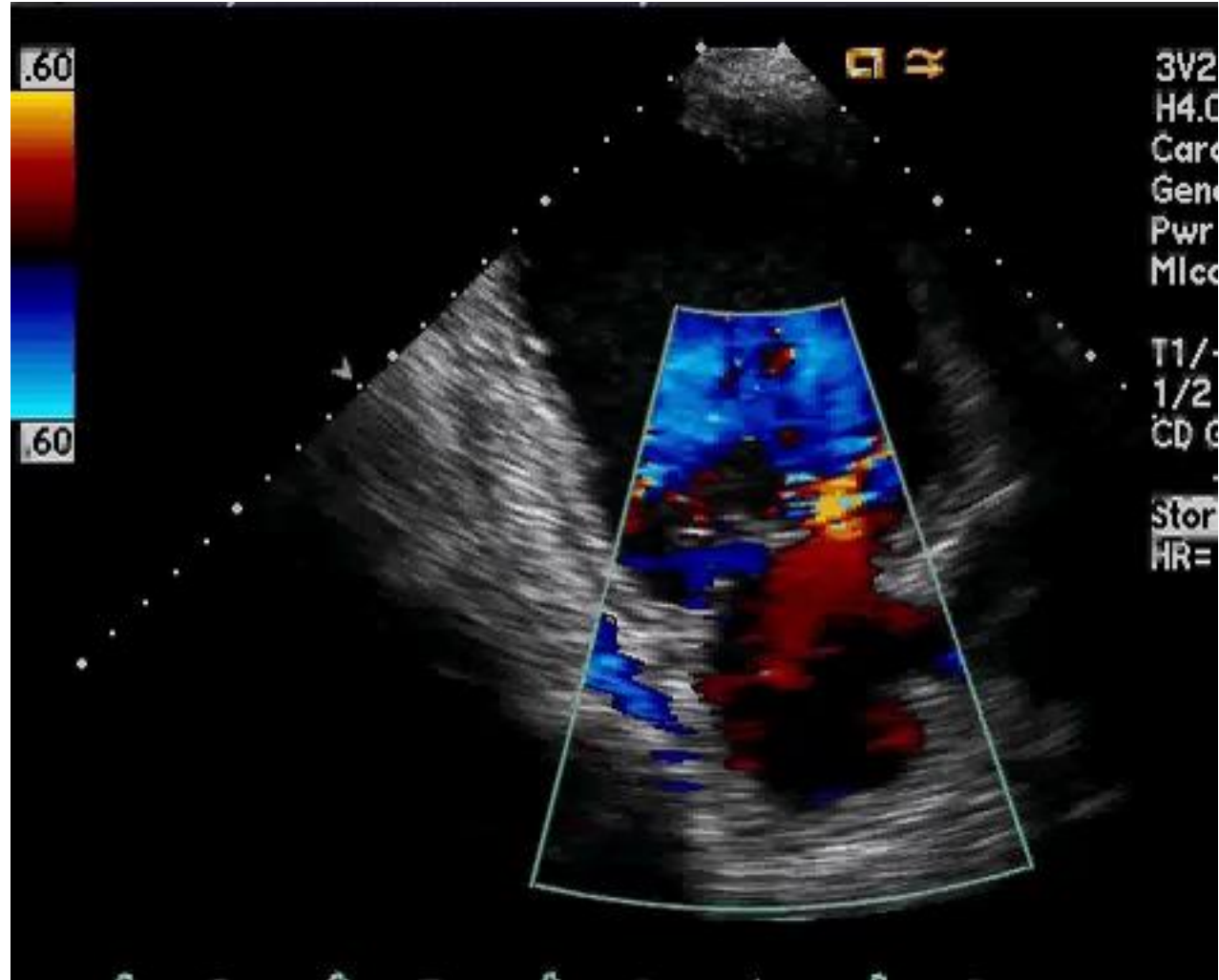
Functional MR – Annular Dilatation

47-y/o man with
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dilated cardiomyopathy**
&
acutely decompensated heart failure

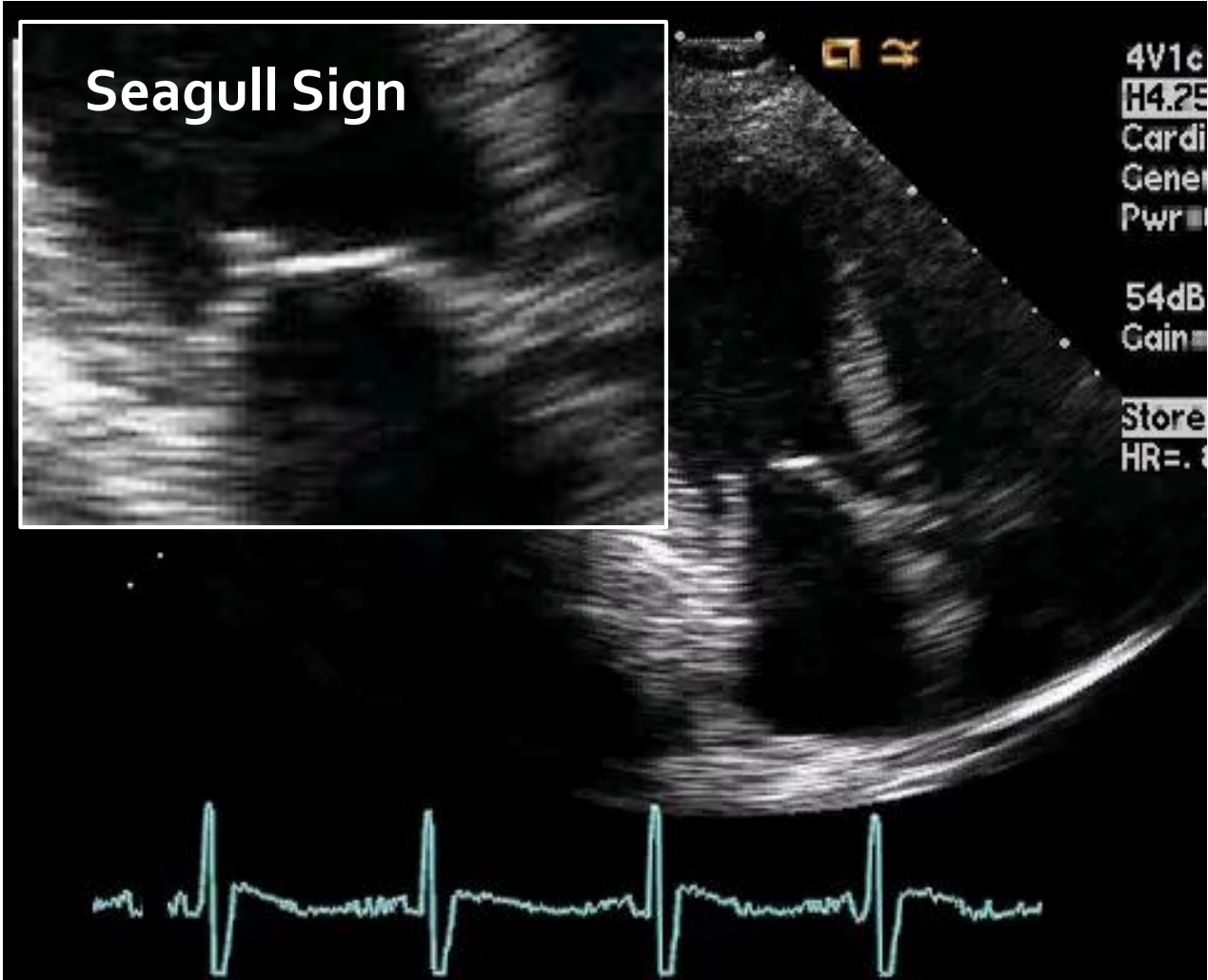


Functional MR – Annular Dilatation

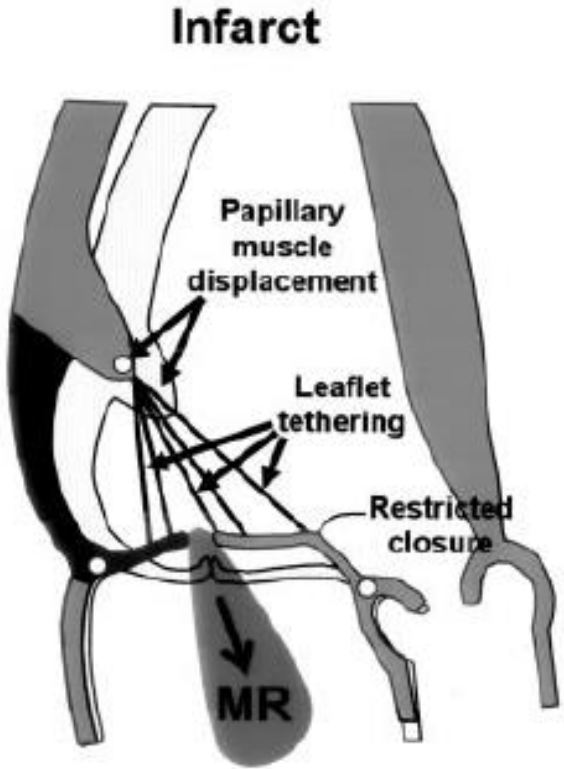
47-y/o man with
**nonischemic
dilated cardiomyopathy**
&
acutely decompensated heart failure



Functional MR – Chronic Ischemic

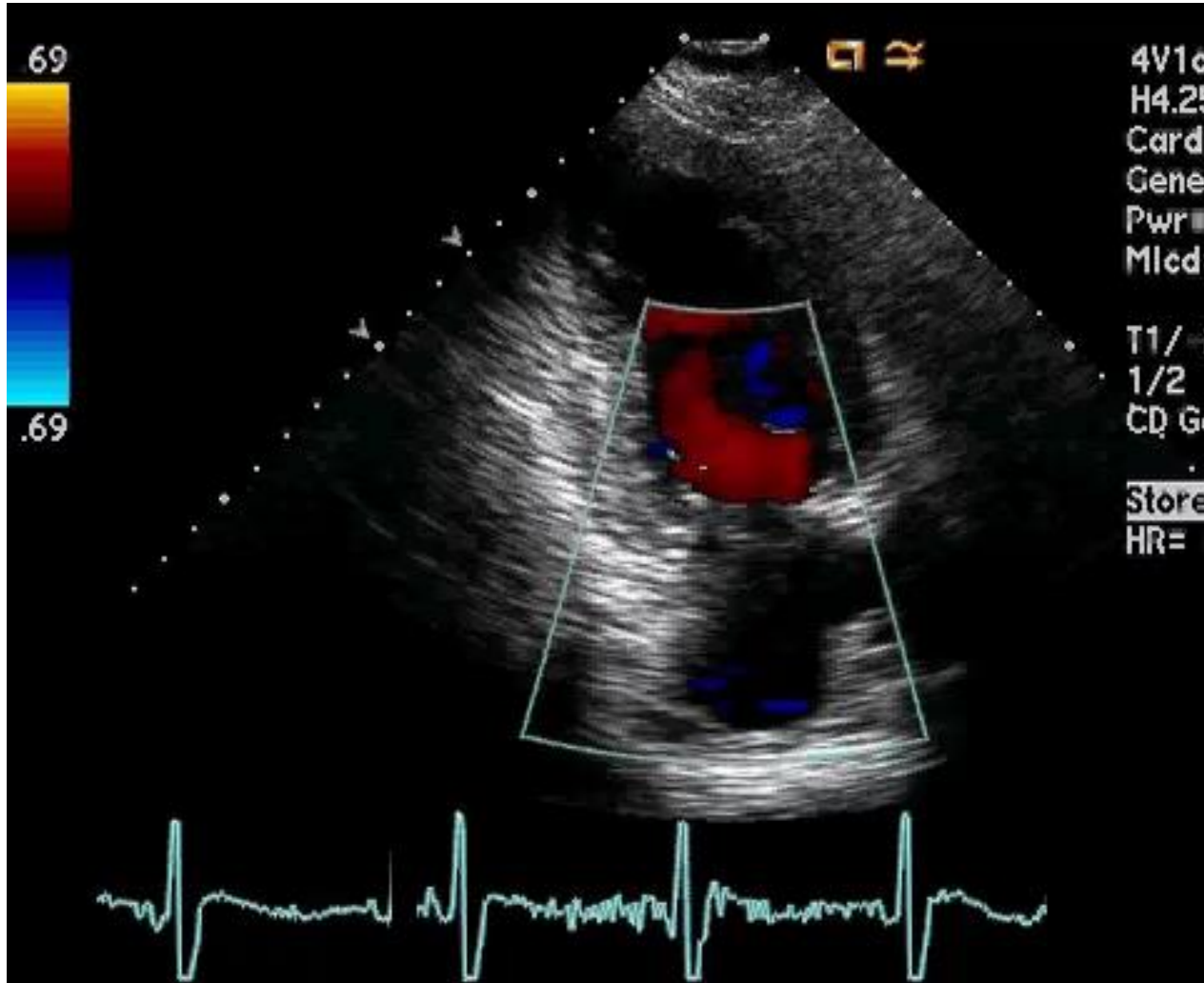


50-y/o woman with murmur
a year after an RCA infarct

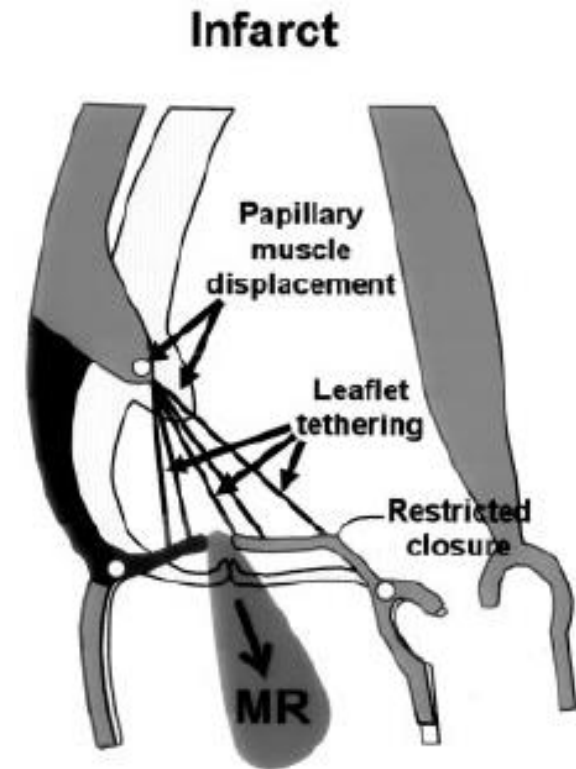


Circulation. 2005;112:745-758

Functional MR – Chronic Ischemic

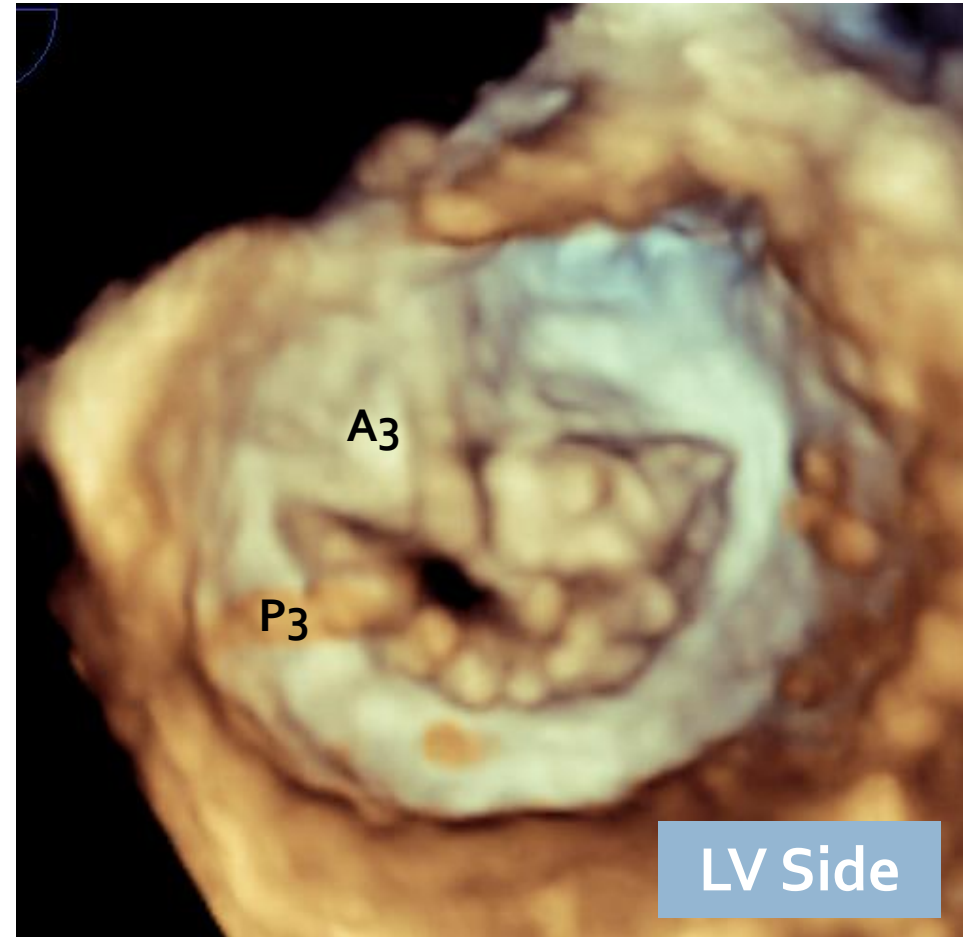


50-y/o woman with murmur
a year after an **RCA** infarct

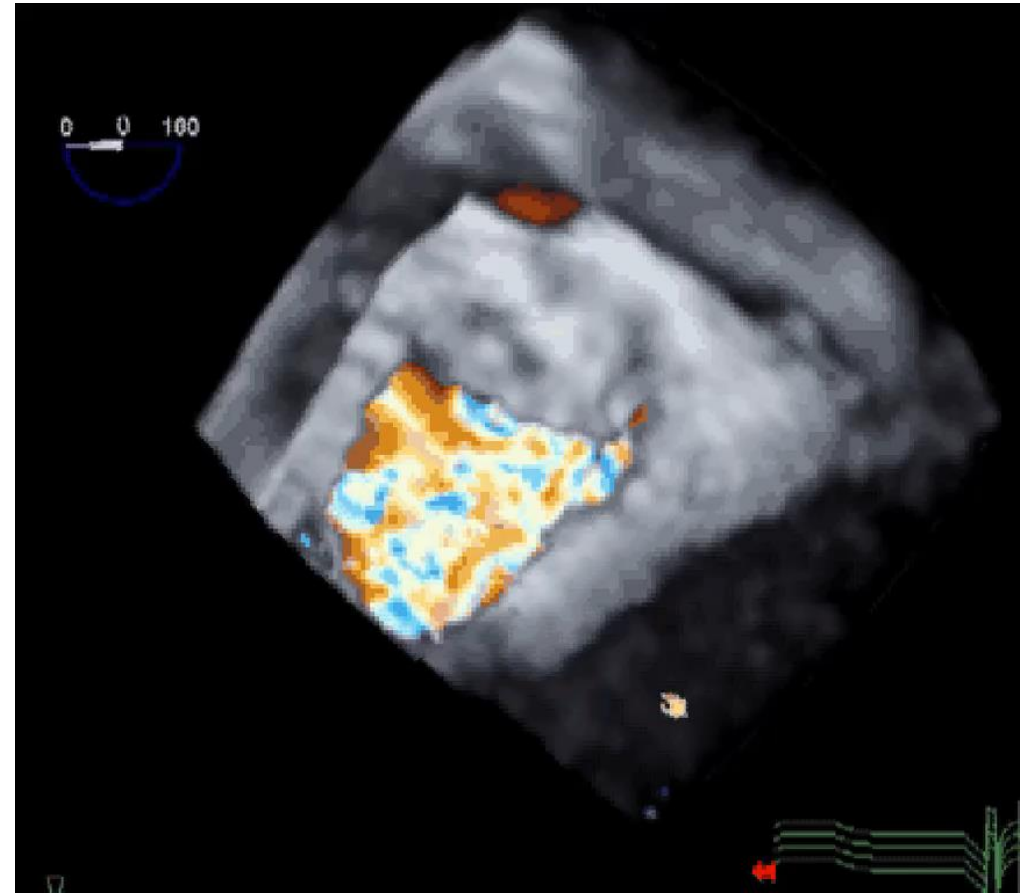


Circulation. 2005;112:745-758

Functional Ischemic MR: Crooked Smile



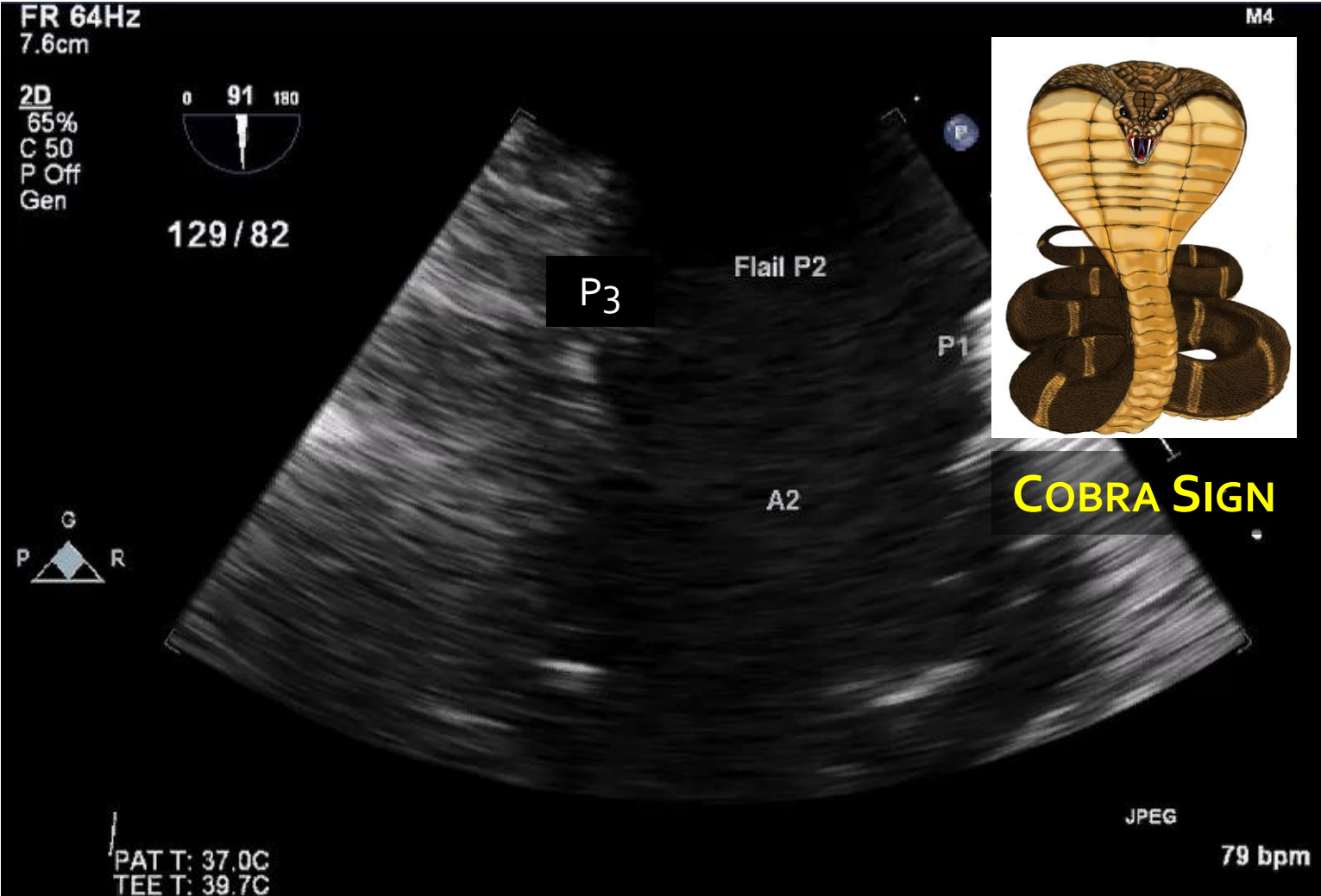
Functional Ischemic MR: Crooked Smile



Degenerative Mitral Regurgitation

Degenerative MR – Prolapsed / Flail Segment

74-year-old man
Recent onset
of exertional dyspnea

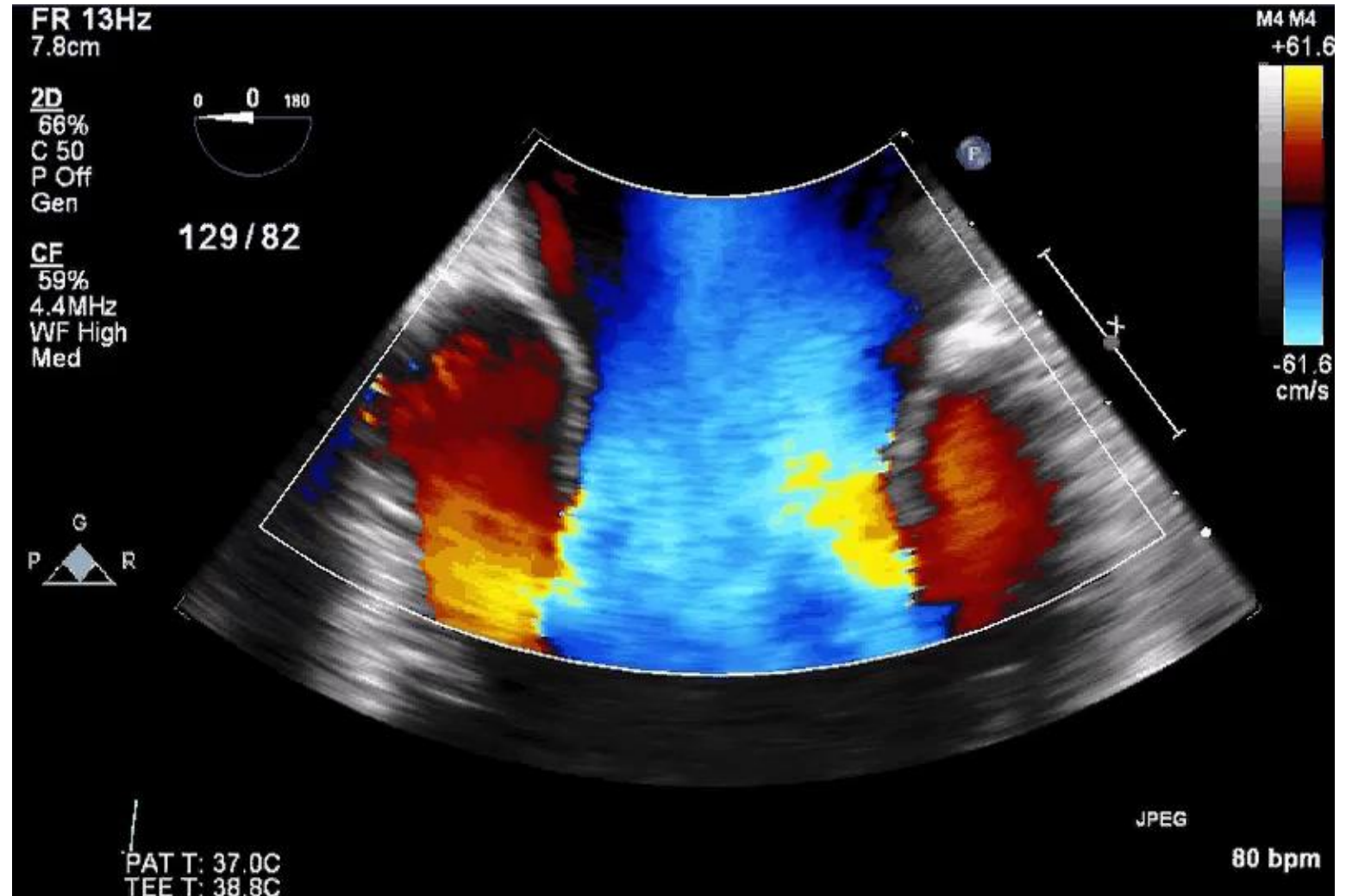


Degenerative MR – Myxomatous Degeneration

74-year-old man
Recent onset
of exertional dyspnea

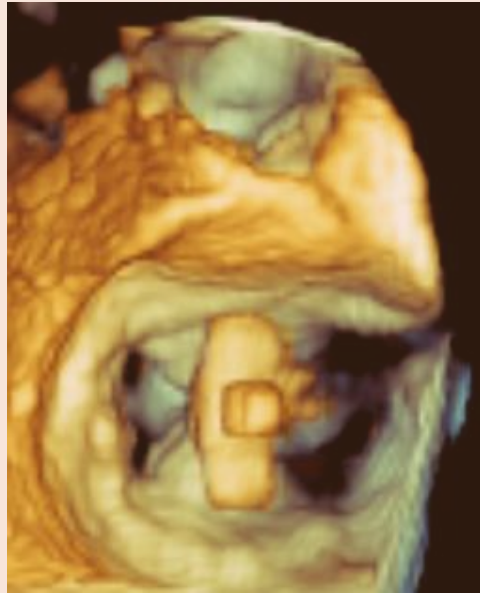


Henri Coanda (1886-1972)
Romanian
aeronautics engineer

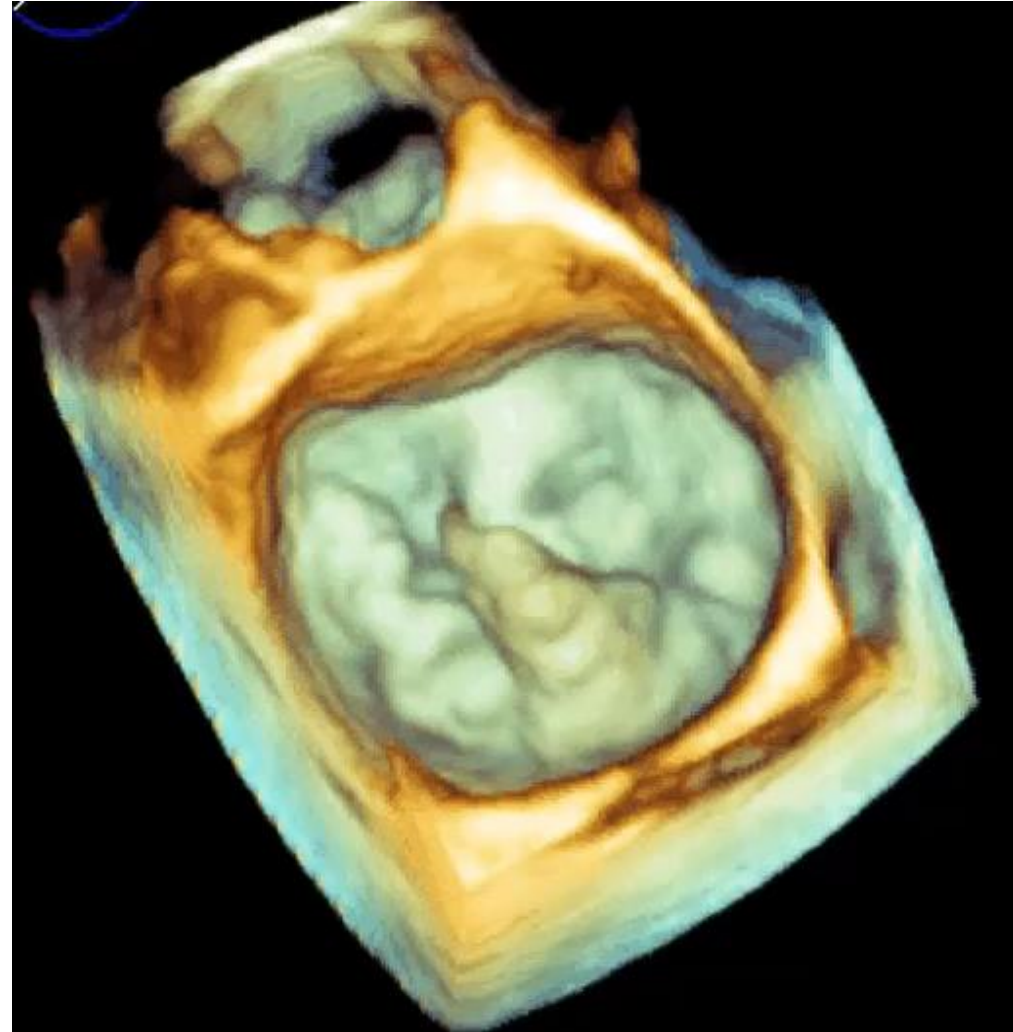


Degenerative MR – Myxomatous Degeneration

74-year-old man
Recent onset
of exertional dyspnea



Clip across **A2-P2**
is ideal clip location.



Severity of Mitral Regurgitation

Table 8 Grading the severity of chronic MR by echocardiography

	MR severity*			
	Mild	Moderate	Severe	
Structural				
MV morphology	None or mild leaflet abnormality (e.g., mild thickening, calcifications or prolapse, mild tenting)	Moderate leaflet abnormality or moderate tenting	Severe valve lesions (primary: flail leaflet, ruptured papillary muscle, severe retraction, large perforation; secondary: severe tenting, poor leaflet coaptation)	
LV and LA size [†]	Usually normal	Normal or mild dilated	Dilated [‡]	
Qualitative Doppler				
Color flow jet area [§]	Small, central, narrow, often brief	Variable	Large central jet (>50% of LA) or eccentric wall-impinging jet of variable size	
Flow convergence	Not visible, transient or small	Intermediate in size and duration	Large throughout systole	
CWD jet	Faint/partial/parabolic	Dense but partial or parabolic	Holosystolic/dense/ triangular	
Semiquantitative				
VCW (cm)	<0.3	Intermediate	≥0.7 (>0.8 for biplane) [¶]	
Pulmonary vein flow [#]	Systolic dominance (may be blunted in LV dysfunction or AF)	Normal or systolic blunting [#]	Minimal to no systolic flow/ systolic flow reversal	
Mitral inflow ^{**}	A-wave dominant	Variable	E-wave dominant (>1.2 m/sec)	
Quantitative^{††,‡‡}				
EROA, 2D PISA (cm ²)	<0.20	0.20-0.29	0.30-0.39	≥0.40 (may be lower in secondary MR with elliptical ROA)
RVol (mL)	<30	30-44	45-59 ^{††}	≥ 60 (may be lower in low flow conditions)
RF (%)	< 30	30-39	40-49	≥ 50

Chronic Mitral Regurgitation: Chamber Dilatation

2014 ACC/AHA Valvular Heart Disease

<p>C Asymptomatic severe MR</p>	<ul style="list-style-type: none"> • Severe mitral valve prolapse with loss of coaptation or flail leaflet • Rheumatic valve changes with leaflet restriction and loss of central coaptation • Prior IE • Thickening of leaflets with radiation heart disease 	<ul style="list-style-type: none"> • Central jet MR >40% LA or holosystolic eccentric jet MR • Vena contracta ≥ 0.7 cm • Regurgitant volume ≥ 60 mL • Regurgitant fraction $\geq 50\%$ • ERO ≥ 0.40 cm² • Angiographic grade 3-4+ 	<ul style="list-style-type: none"> • Moderate or severe LA enlargement • LV enlargement • Pulmonary hypertension may be present at rest or with exercise 	<ul style="list-style-type: none"> • None 	
<p>D Symptomatic severe MR</p>		<ul style="list-style-type: none"> • Severe mitral valve prolapse with loss of coaptation or flail leaflet • Rheumatic valve changes with leaflet restriction and loss of central coaptation • Prior IE • Thickening of leaflets with radiation heart disease 	<ul style="list-style-type: none"> • Central jet MR >40% LA or holosystolic eccentric jet MR • Vena contracta ≥ 0.7 cm • Regurgitant volume ≥ 60 mL • Regurgitant fraction $\geq 50\%$ • ERO ≥ 0.40 cm² • Angiographic grade 3-4+ 	<ul style="list-style-type: none"> • C1: LVEF >60% and LVESD <40 mm • C2: LVEF $\leq 60\%$ and LVESD ≥ 40 mm 	<p>60/40 RULE EF $\leq 60\%$ LVESD ≥ 40 mm</p>
<p style="text-align: center;">Stage C2 Refer for Surgical or Percutaneous Correction</p>					

Chronic Asymptomatic Aortic Regurgitation

Mechanisms of Aortic Regurgitation

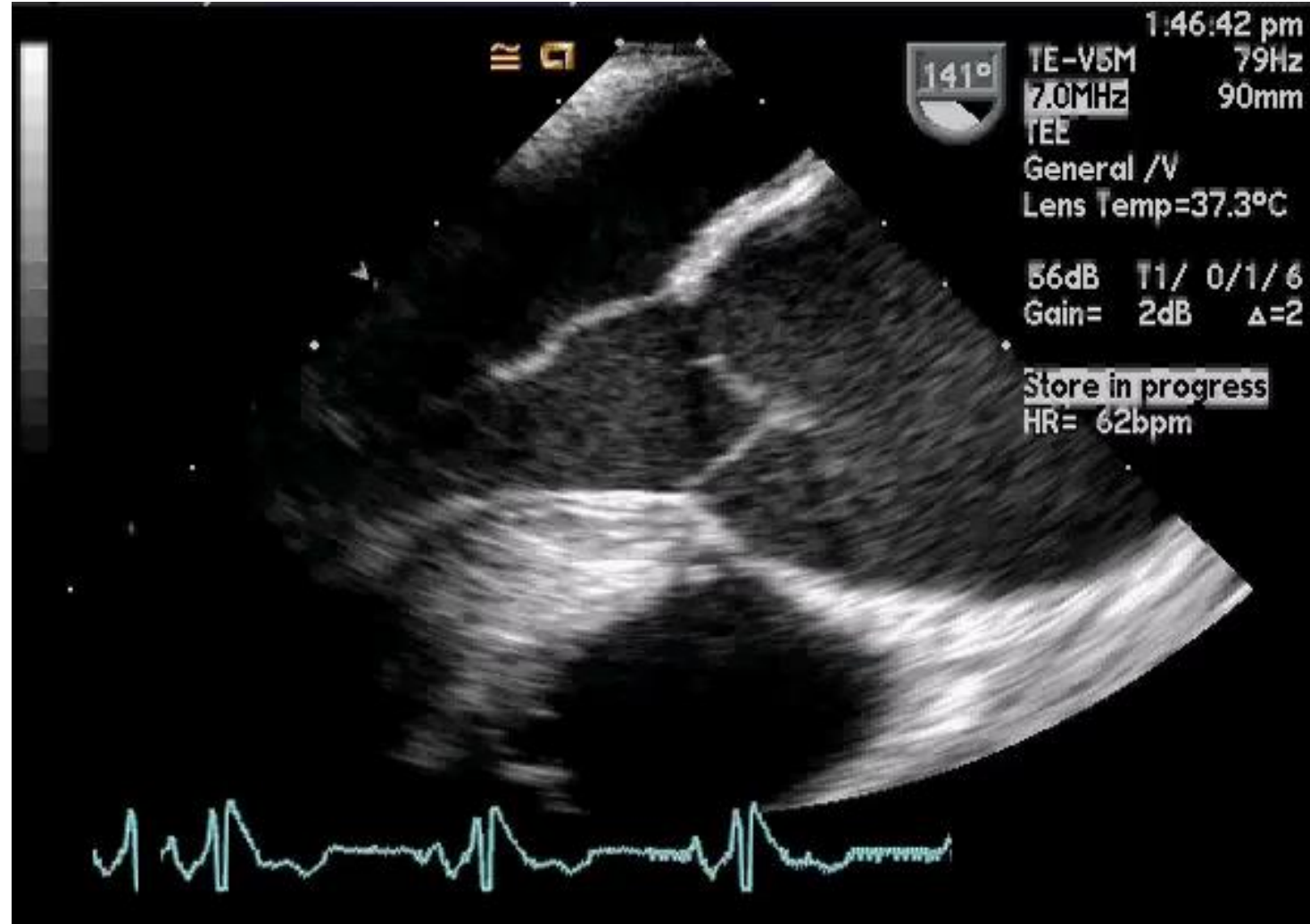
AI Class	Type I Normal cusp motion with FAA dilatation or cusp perforation				Type II Cusp Prolapse	Type III Cusp Restriction
	Ia	Ib	Ic	Id		
Mechanism						
Repair Techniques (Primary)	STJ remodeling <i>Ascending aortic graft</i>	Aortic Valve sparing: <i>Reimplantation or Remodeling with SCA</i>	SCA	Patch Repair <i>Autologous or bovine pericardium</i>	Prolapse Repair <i>Plication Triangular resection Free margin Resuspension Patch</i>	Leaflet Repair <i>Shaving Decalcification Patch</i>
(Secondary)	SCA		STJ Annuloplasty	SCA	SCA	SCA

J Thorac Cardiovasc Surg 2009;137:286-94

Aortic Regurgitation: Marfan Syndrome



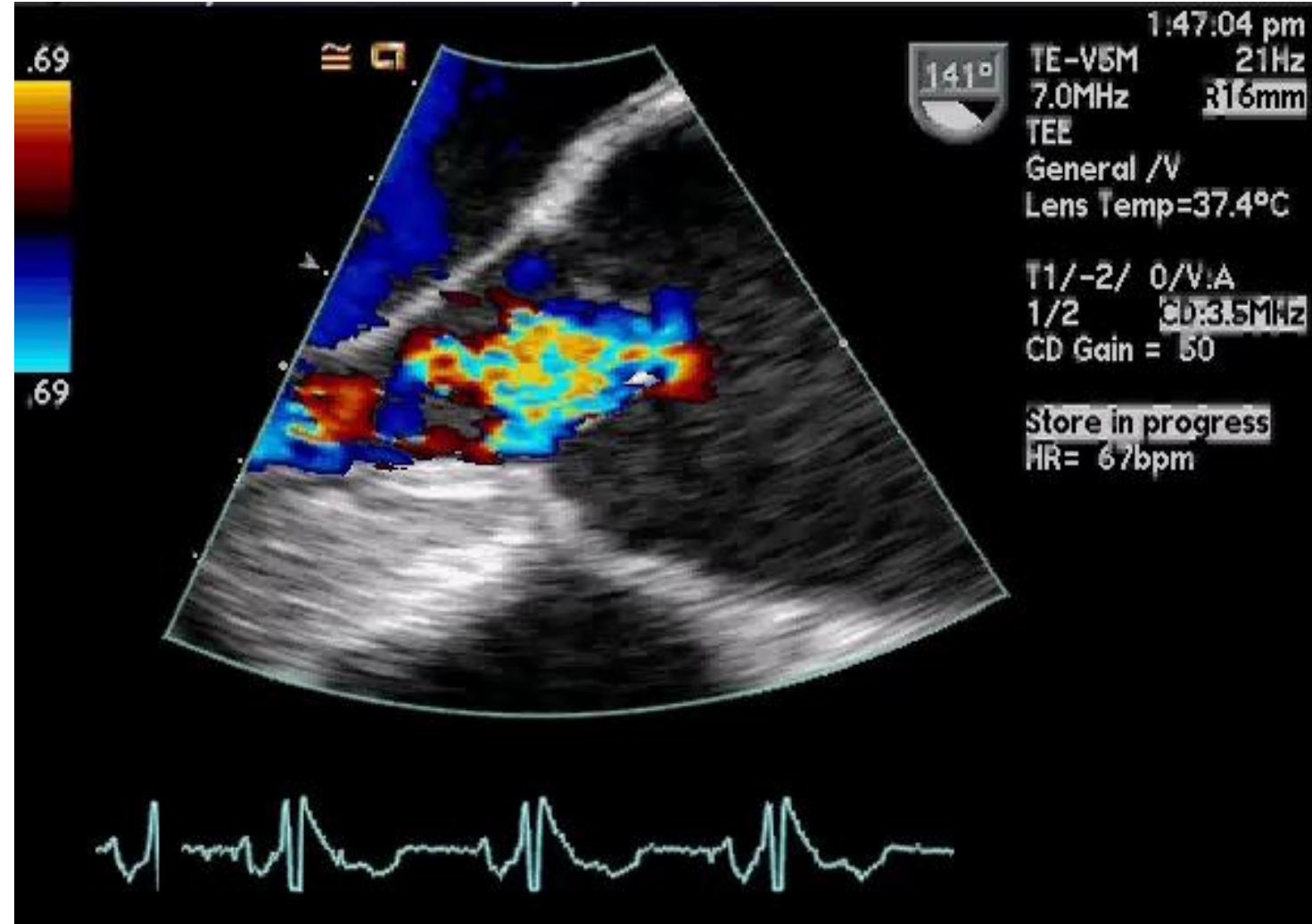
Antoine Marfan
(1858 – 1942)
French pediatrician



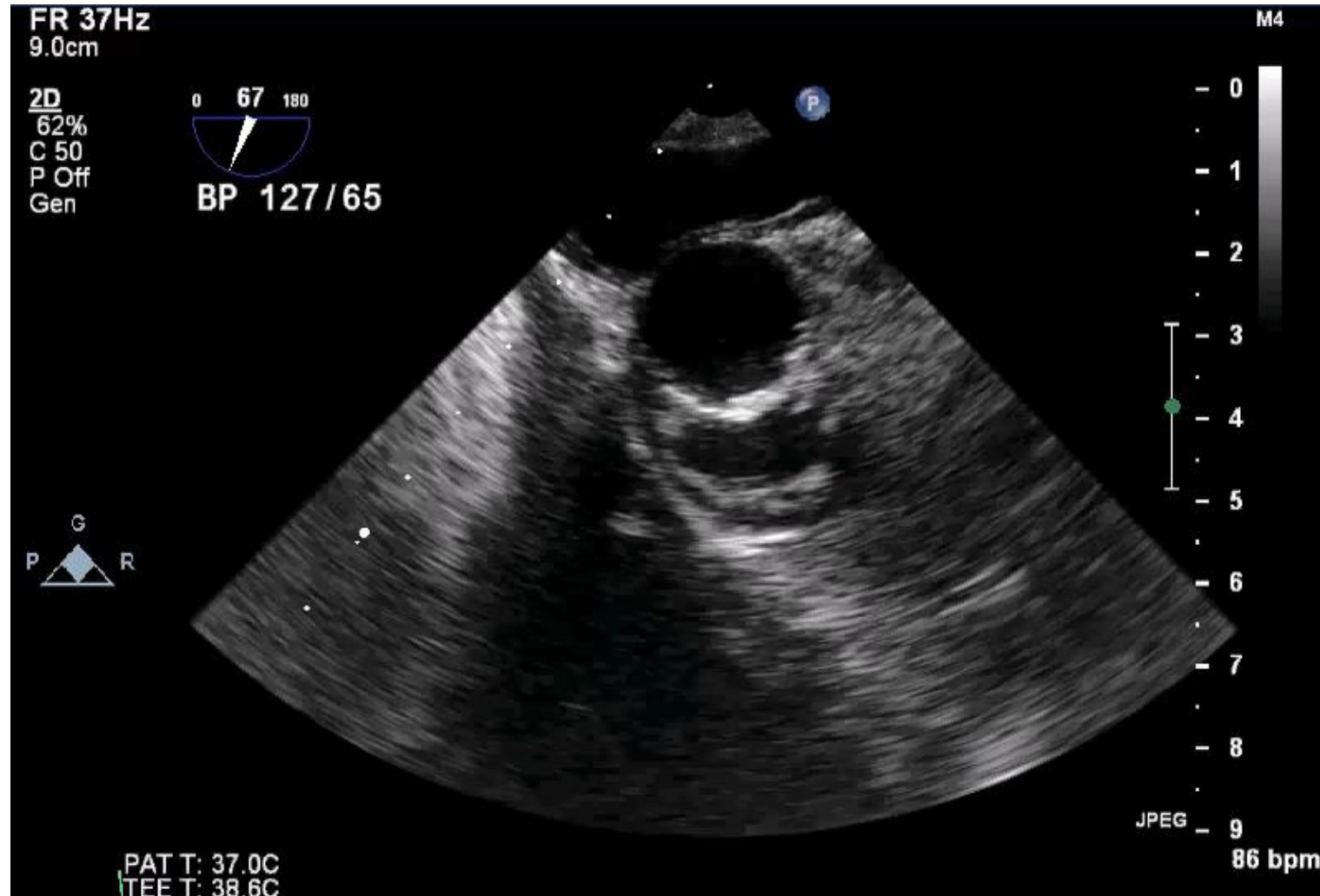
Aortic Regurgitation: Marfan Syndrome



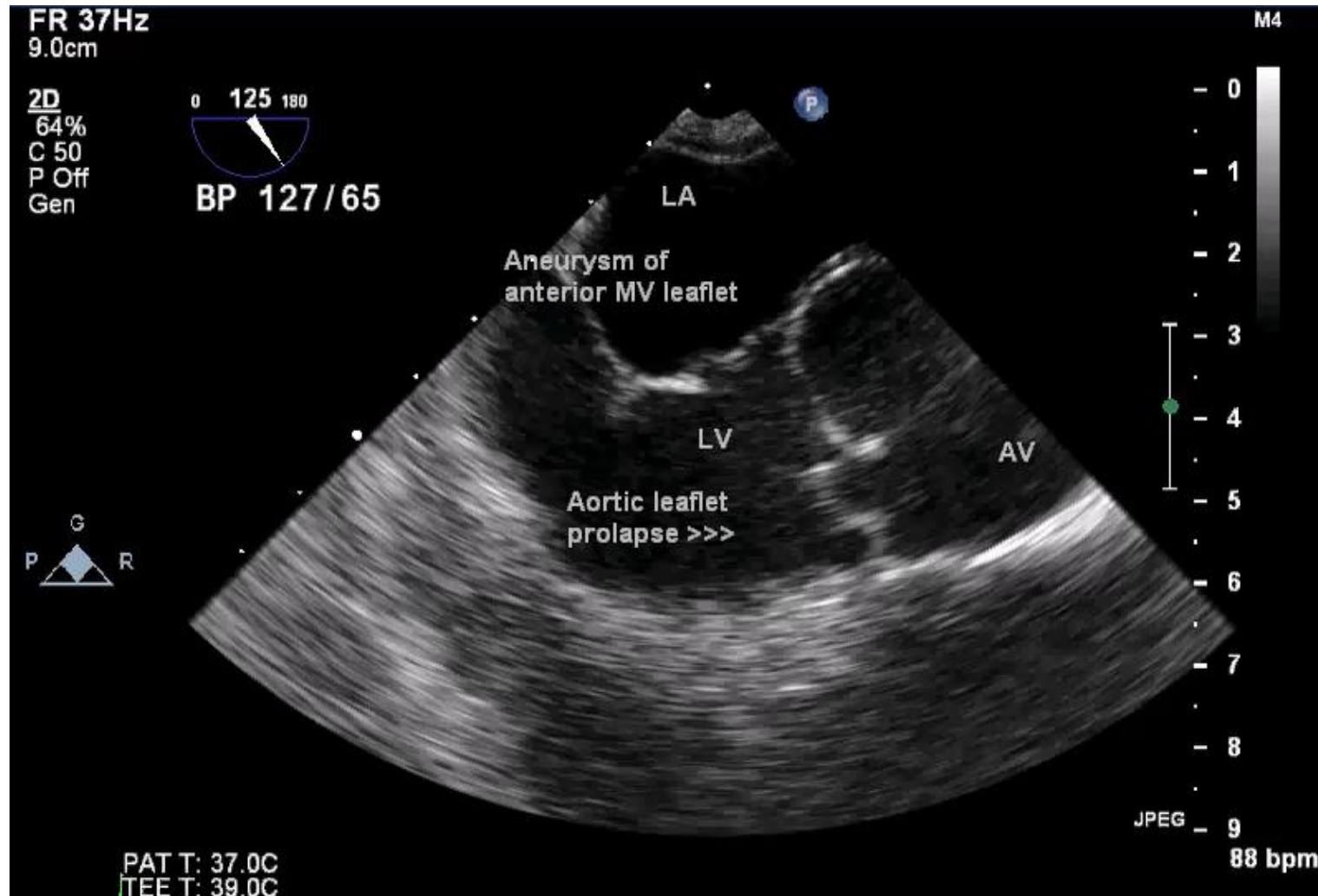
Antoine Marfan
(1858 – 1942)
French pediatrician



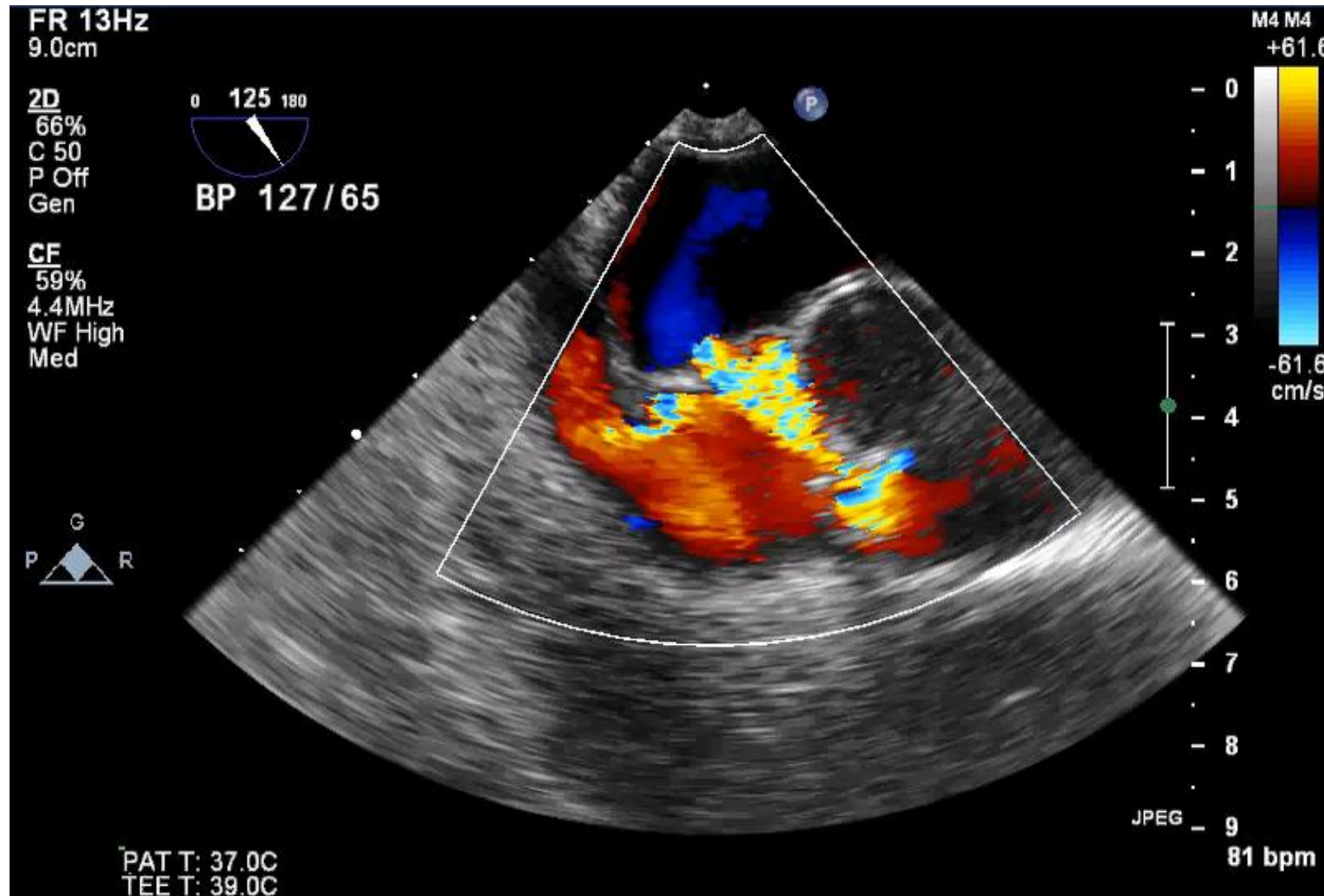
Aortic Regurgitation: Bicuspid Aortic Valve



Aortic Regurgitation: Bicuspid Aortic Valve



Aortic Regurgitation: Bicuspid Aortic Valve



Chronic Aortic Regurgitation

<p>C Asymptomatic severe AR</p>	<ul style="list-style-type: none"> • Calcific aortic valve disease • Bicuspid valve (or other congenital abnormality) • Dilated aortic sinuses or ascending aorta • Rheumatic valve changes • IE with abnormal leaflet closure or perforation 	<ul style="list-style-type: none"> • Severe AR: <ul style="list-style-type: none"> ◦ Jet width $\geq 65\%$ of LVOT; ◦ Vena contracta > 0.6 cm; ◦ Holodiastolic flow reversal in the proximal abdominal aorta ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ Angiography grade 3+ to 4+; ◦ In addition, diagnosis of chronic severe AR requires evidence of LV dilation 	<ul style="list-style-type: none"> • C1: Normal LVEF ($\geq 50\%$) and mild-to-moderate LV dilation (LVESD ≤ 50 mm) • C2: Abnormal LV systolic function with depressed LVEF ($< 50\%$) or severe LV dilatation (LVESD > 50 mm or indexed LVESD > 25 mm/m²) 	<p>50/50 RULE EF $< 50\%$ LVESD > 50 mm</p>
<p>D Symptomatic severe AR</p>	<ul style="list-style-type: none"> • Calcific valve disease • Bicuspid valve (or other congenital abnormality) • Dilated aortic sinuses or ascending aorta • Rheumatic valve changes • Previous IE with abnormal leaflet closure or perforation 	<ul style="list-style-type: none"> • Severe AR: <ul style="list-style-type: none"> ◦ Doppler jet width $\geq 65\%$ of LVOT; ◦ Vena contracta > 0.6 cm, ◦ Holodiastolic flow reversal in the proximal abdominal aorta, ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ Angiography grade 3+ to 4+; ◦ In addition, diagnosis of chronic severe AR requires 	<ul style="list-style-type: none"> • Symptomatic severe AR may occur with normal systolic function (LVEF $\geq 50\%$), mild-to-moderate LV dysfunction (LVEF 40%–50%), or severe LV dysfunction (LVEF $< 40\%$); • Moderate-to-severe LV dilation is present. 	<p>Stress Testing</p> <ul style="list-style-type: none"> • angina or more severe HF symptoms
<p>AR Etiology</p>		<p>AR Severity</p>		<p>Chamber Dilatation</p>

Severity of Aortic Regurgitation

Table 11 Grading the severity of chronic AR with echocardiography

	AR severity		
	Mild	Moderate	Severe
Structural parameters			
Aortic leaflets	Normal or abnormal	Normal or abnormal	Abnormal/flail, or wide coaptation defect
LV size	Normal*	Normal or dilated	Usually dilated [†]
Qualitative Doppler			
Jet width in LVOT, color flow	Small in central jets	Intermediate	Large in central jets; variable in eccentric jets
Flow convergence, color flow	None or very small	Intermediate	Large
Jet density, CW	Incomplete or faint	Dense	Dense
Jet deceleration rate, CW (PHT, msec) [‡]	Incomplete or faint Slow, >500	Medium, 500-200	Steep, <200
Diastolic flow reversal in descending aorta, PW	Brief, early diastolic reversal	Intermediate	Prominent holodiastolic reversal
Semiquantitative parameters[§]			
VCW (cm)	<0.3	0.3-0.6	
Jet width/LVOT width, central jets (%)	<25	25-45	46-64
Jet CSA/LVOT CSA, central jets (%)	<5	5-20	21-59
Quantitative parameters[§]			
RVol (mL/beat)	<30	30-44	45-59
RF (%)	<30	30-39	40-49
EROA (cm ²)	<0.10	0.10-0.19	0.20-0.29
			≥0.30

Mitral vs. Aortic Regurgitation Severity

	Severe Mitral Regurgitation	Severe Aortic Regurgitation	
ERO	$\geq 0.4 \text{ cm}^2$	$\geq 0.3 \text{ cm}^2$	DIFFERENT VALUES Smaller ERO and VC for aortic regurgitation (by 0.1)
Vena Contracta	$\geq 0.7 \text{ cm}$	$\geq 0.6 \text{ cm}$	
Regurgitant Fraction	$\geq 50\%$	$\geq 50\%$	SAME VALUES Regurgitant Volume Regurgitant Fraction
Regurgitant Volume	$\geq 60 \text{ mL}$	$\geq 60 \text{ mL}$	

Chronic Aortic Regurgitation

2014 ACC/AHA Valvular Heart Disease

<p>C</p>	<p>Asymptomatic severe AR</p>	<ul style="list-style-type: none"> • Calcific aortic valve disease • Bicuspid valve (or other congenital abnormality) • Dilated aortic sinuses or ascending aorta • Rheumatic valve changes • IE with abnormal leaflet closure or perforation 	<ul style="list-style-type: none"> • Severe AR: <ul style="list-style-type: none"> ◦ Jet width $\geq 65\%$ of LVOT; ◦ Vena contracta > 0.6 cm; ◦ Holodiastolic flow reversal in the proximal abdominal aorta ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ Angiography grade 3+ to 4+; ◦ In addition, diagnosis of chronic severe AR requires evidence of LV dilation 	<p>C1: Normal LVEF ($\geq 50\%$) and mild-to-moderate LV dilation (LVESD ≤ 50 mm)</p> <p>C2: Abnormal LV systolic function with depressed LVEF ($< 50\%$) or severe LV dilatation (LVESD > 50 mm or indexed LVESD > 25 mm/m²)</p>	<p>50/50 RULE EF $< 50\%$ LVESD > 50 mm</p>
<p>Stage C2 Refer for Surgical or Percutaneous Correction</p>					
<p>D</p>	<p>Symptomatic severe AR</p>	<ul style="list-style-type: none"> • Calcific valve disease • Bicuspid valve (or other congenital abnormality) • Dilated aortic sinuses or ascending aorta • Rheumatic valve changes • Previous IE with abnormal leaflet closure or perforation 	<ul style="list-style-type: none"> • Severe AR: <ul style="list-style-type: none"> ◦ Doppler jet width $\geq 65\%$ of LVOT; ◦ Vena contracta > 0.6 cm, ◦ Holodiastolic flow reversal in the proximal abdominal aorta, ◦ RVol ≥ 60 mL/beat; ◦ RF $\geq 50\%$; ◦ ERO ≥ 0.3 cm²; ◦ Angiography grade 3+ to 4+; ◦ In addition, diagnosis of chronic severe AR requires evidence of LV dilation 	<p>occur with normal systolic function (LVEF $\geq 50\%$), mild-to-moderate LV dysfunction (LVEF 40%–50%), or severe LV dysfunction (LVEF $< 40\%$);</p> <ul style="list-style-type: none"> • Moderate-to-severe LV dilation is present. 	<p>angina or more severe HF symptoms</p>

Thank You!



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