Clinical scenario:

Acute decompensated heart failure Pulmonary oedema.

A.Pasquet, MD,PhD

UCL -Cliniques Saint Luc
Brussels, Belgium

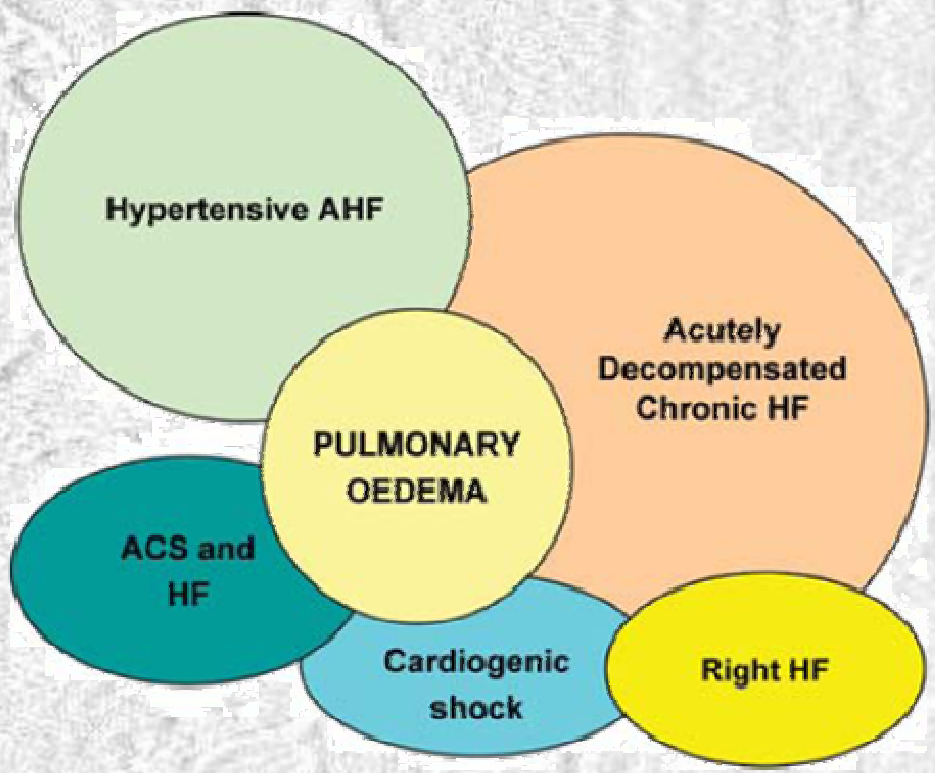
Acute heart failure
Definition

Defined as a rapid onset of change in the signs and symptoms of HF, resulting in the need for urgent therapy

Caracterized by

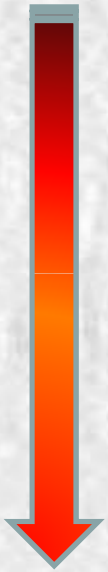
- Pulmonary congestion

- Reduced cardiac output
- Tissue hypoperfusion



Acute heart failure
Clinical aspect

- Dyspnea ------ → Pulmonary oedema
  → Signs of hypoperfusion
  → Signs of low cardiac output

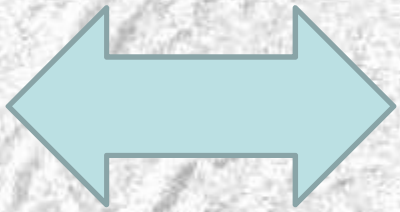


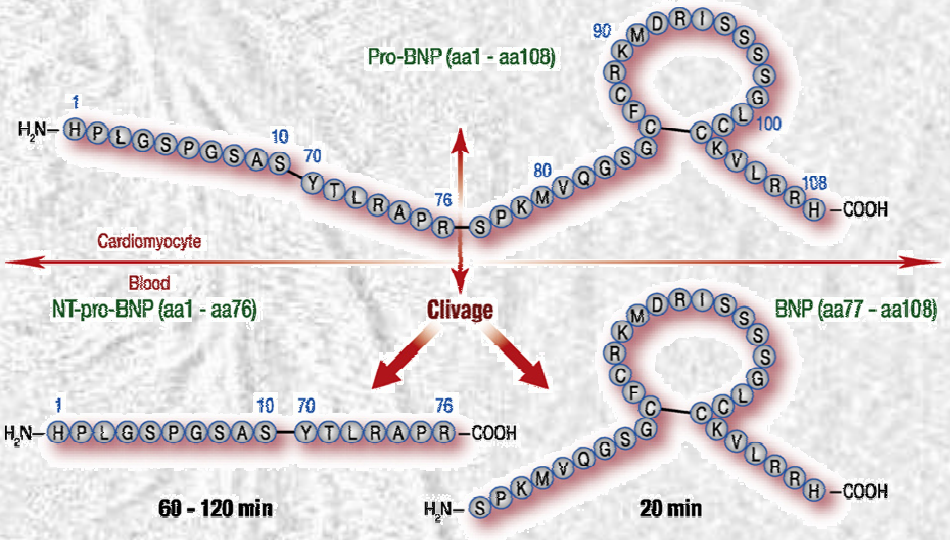
→ systolic and diastolic murmurs
→ third and fourth heart sounds (S3,S4)
→ bibasal rales
→ jugular venous filling

Cardiac or Non Cardiac ?

Acute heart failure

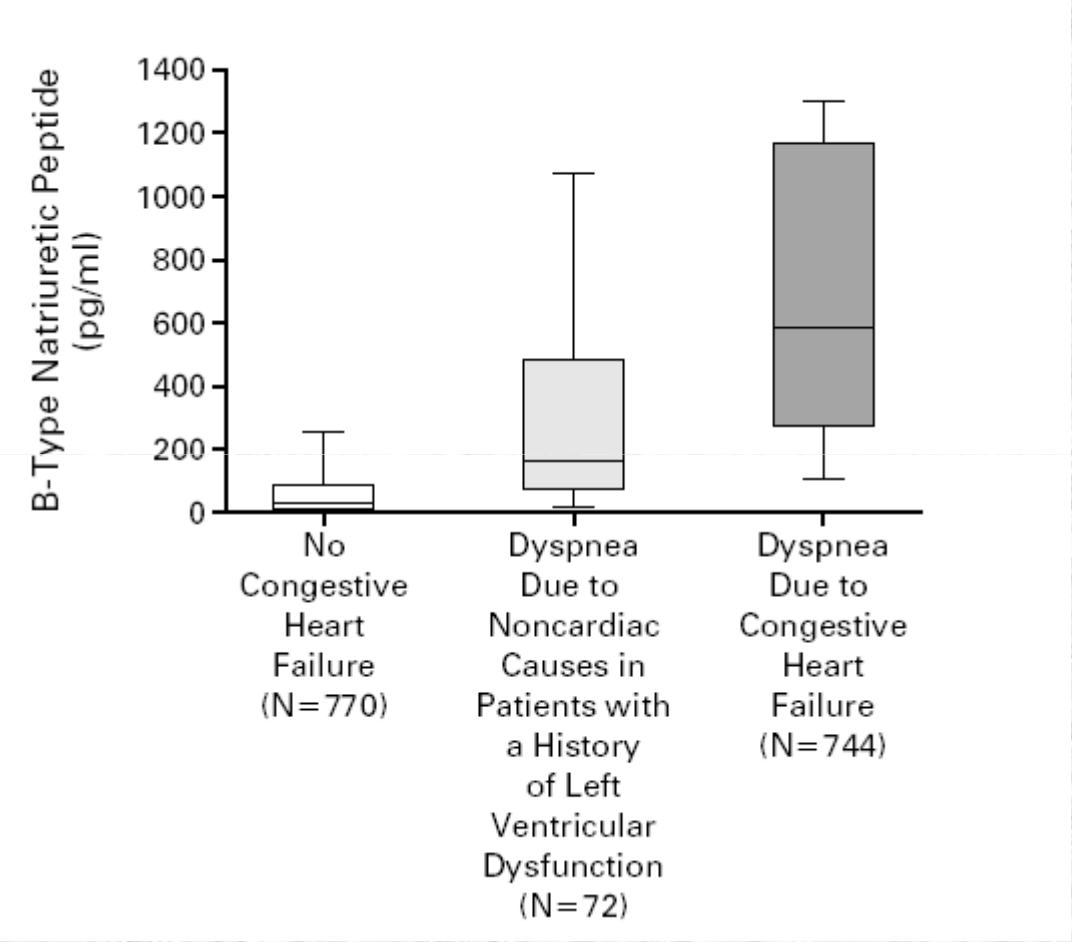
Cardiac of non cardiac ?





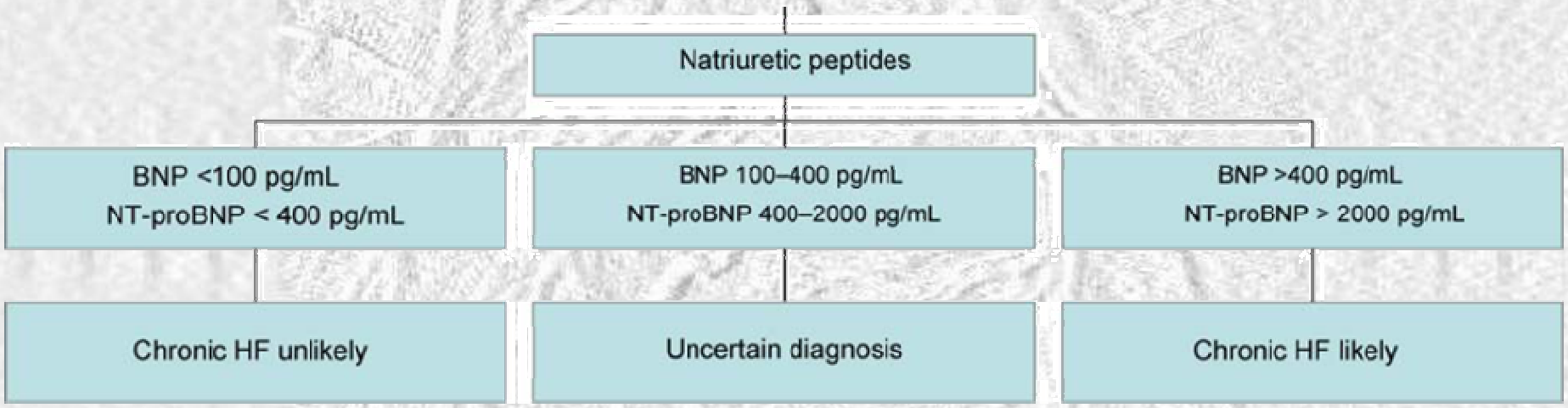
BNP

Acute heart failure
Cardiac or non cardiac



Maisel, NEJM: 2002

Acute heart failure
Cardiac or non cardiac ?



ESC guidelines acute and chronic HF 2008

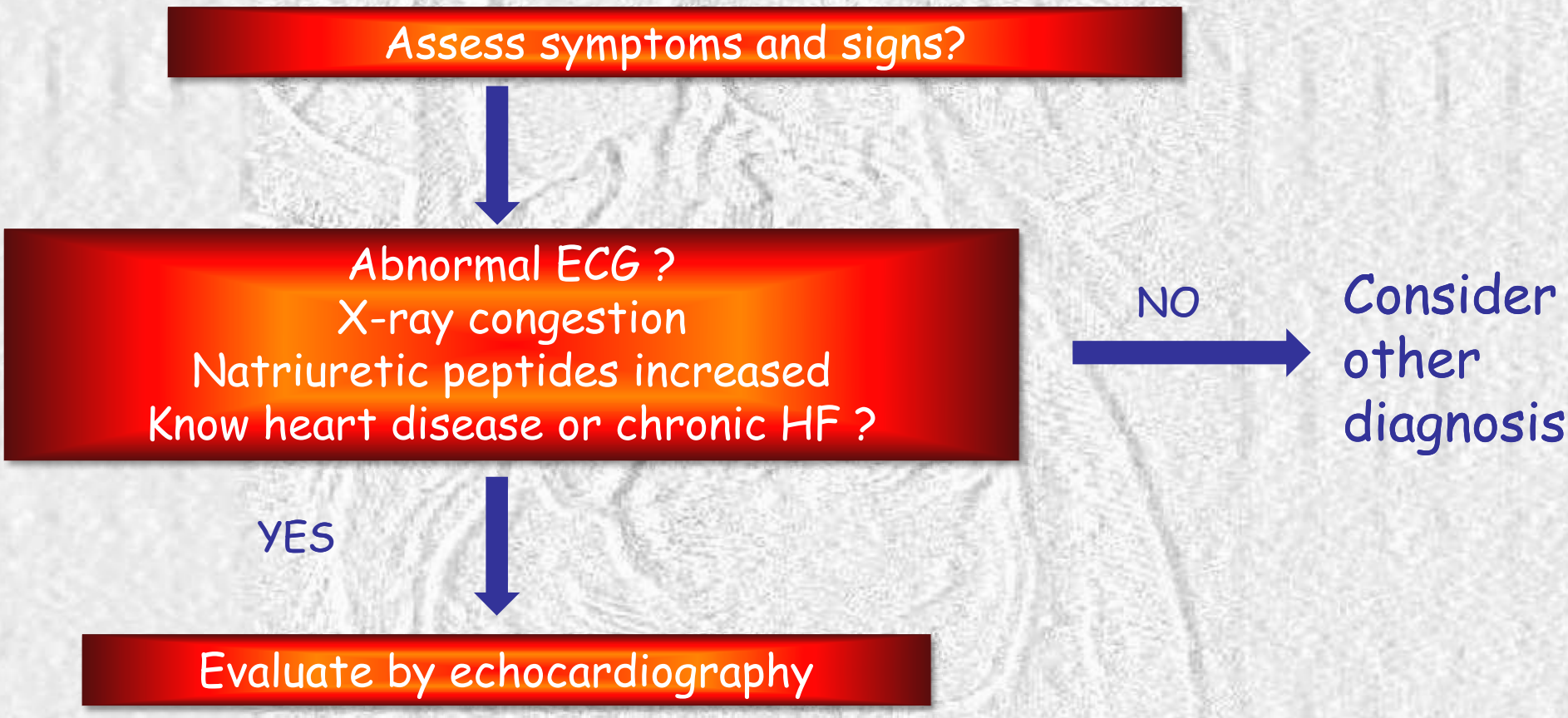
Acute heart failure
Echocardiography ?

Echocardiography

Echocardiography with Doppler is an essential tool for the evaluation of the functional and structural changes underlying or associated with AHF. All patients with AHF should be evaluated as soon as possible. The findings will frequently direct treatment strategy. Echo/Doppler imaging should be used to evaluate and monitor regional and global left and right ventricular systolic function, diastolic function, valvular structure and function, pericardial pathology, mechanical complications of acute MI, and evidence of dyssynchrony. Non-invasive, semi-quantitative assessment of right and left ventricular filling pressures, stroke volume, and pulmonary artery pressures may influence treatment strategy. An echo/Doppler study, repeated as required during the hospital stay, may often obviate the need for invasive evaluation/ monitoring.

Acute heart failure

Evaluation of patients with AHF



Acute heart failure

Cause and precipitating factors of acute heart failure

Ischaemic heart disease

- Acute coronary syndromes
- Mechanical complications of acute MI
- Right ventricular infarction

Valvular

- Valve stenosis
- Valvular regurgitation
- Endocarditis
- Aortic dissection

Myopathies

- Postpartum cardiomyopathy
- Acute myocarditis

Hypertension/arrhythmia

- Hypertension
- Acute arrhythmia

Circulatory failure

- Septicaemia
- Thyrotoxicosis
- Anaemia
- Shunts
- Tamponade
- Pulmonary embolism

Decompensation of pre-existing chronic HF

- Lack of adherence
- Volume overload
- Infections, especially pneumonia
- Cerebrovascular insult
- Surgery
- Renal dysfunction
- Asthma, COPD
- Drug abuse
- Alcohol abuse

ESC guidelines acute and chronic HF 2008

Acute heart failure
Echocardiography

- Global and regional LV function
- Diastolic function
- Valvular structure and fonction
- Pericardial pathology
- Complication of myocardial infarction

Assess type,
severity
and aetiology of AHF

Acute heart failure

Echo abnormalities in heart failure

Measurement	Abnormality	Clinical implications
LV ejection fraction	Reduced (<45–50%)	Systolic dysfunction
LV function, global and focal	Akinesis, hypokinesis, dyskinesis	Myocardial infarction/ischaemia Cardiomyopathy, myocarditis
End-diastolic diameter	Increased (>55–60 mm)	Volume overload HF likely
End-systolic diameter	Increased (>45 mm)	Volume overload HF likely
Fractional shortening	Reduced (<25%)	Systolic dysfunction
Left atrial size	Increased (>40 mm)	Increased filling pressures Mitral valve dysfunction Atrial fibrillation
Left ventricular thickness	Hypertrophy (>11–12 mm)	Hypertension, aortic stenosis, hypertrophic cardiomyopathy
Valvular structure and function	Valvular stenosis or regurgitation (especially aortic stenosis and mitral insufficiency)	May be primary cause of HF or complicating factor Assess gradients and regurgitant fraction Assess haemodynamic consequences Consider surgery
Mitral diastolic flow profile	Abnormalities of the early and late diastolic filling patterns	Indicates diastolic dysfunction and suggests mechanism
Tricuspid regurgitation peak velocity	Increased (>3 m/s)	Increased right ventricular systolic pressure Suspect pulmonary hypertension
Pericardium	Effusion, haemopericardium, thickening	Consider tamponade, uraemia, malignancy, systemic disease, acute or chronic pericarditis, constrictive pericarditis
Aortic outflow velocity time integral	Reduced (<15 cm)	Reduced low stroke volume
Inferior vena cava	Dilated Retrograde flow	Increased right atrial pressures Right ventricular dysfunction Hepatic congestion

ESC guidelines acute and chronic HF 2008

Acute heart failure

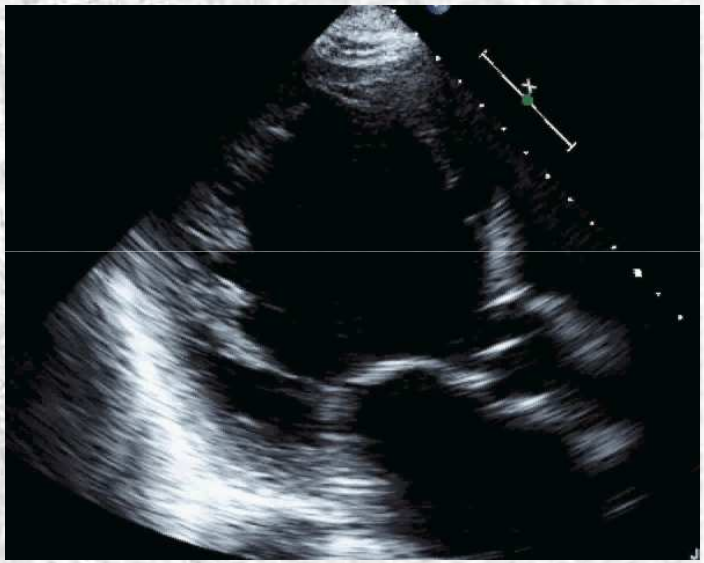
Doppler indices for assessment of LV filling

Doppler indices	Pattern	Consequence
E/A waves ratio	Restrictive (>2, short deceleration time <115 to 150 ms)	High filling pressures Volume overload
	Slowed relaxation (<1)	Normal filling pressures Poor compliance
	Normal (>1)	Inconclusive as may be pseudo-normal
E/Ea	Increased (>15)	High filling pressures
	Reduced (<8)	Low filling pressures
	Intermediate (8–15)	Inconclusive
(A mitral–A pulm) duration	>30 ms	Normal filling pressures
	<30 ms	High filling pressures
Pulmonary S wave	>D wave	Low filling pressures
Vp	<45 cm/s	Slow relaxation
E/Vp	>2.5	High filling pressures
	<2	Low filling pressures
Valsalva manoeuvre	Change of the pseudonormal to abnormal filling pattern	Unmasks high filling pressure in the setting of systolic and diastolic dysfunction

ESC guidelines acute and chronic HF 2008

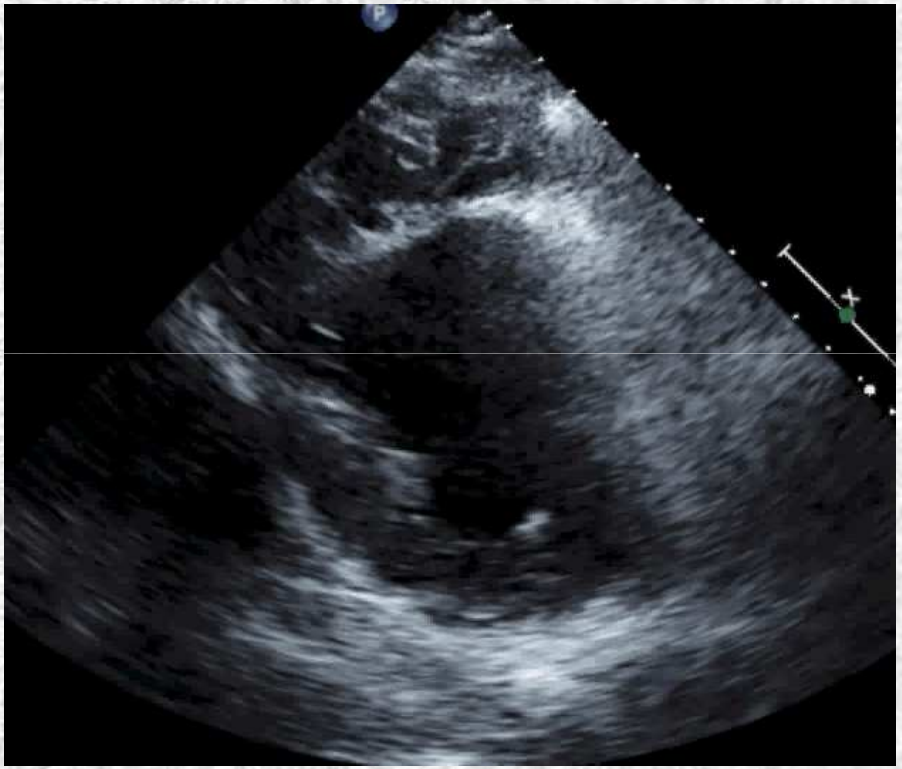
Acute heart failure
Alteration of LV function





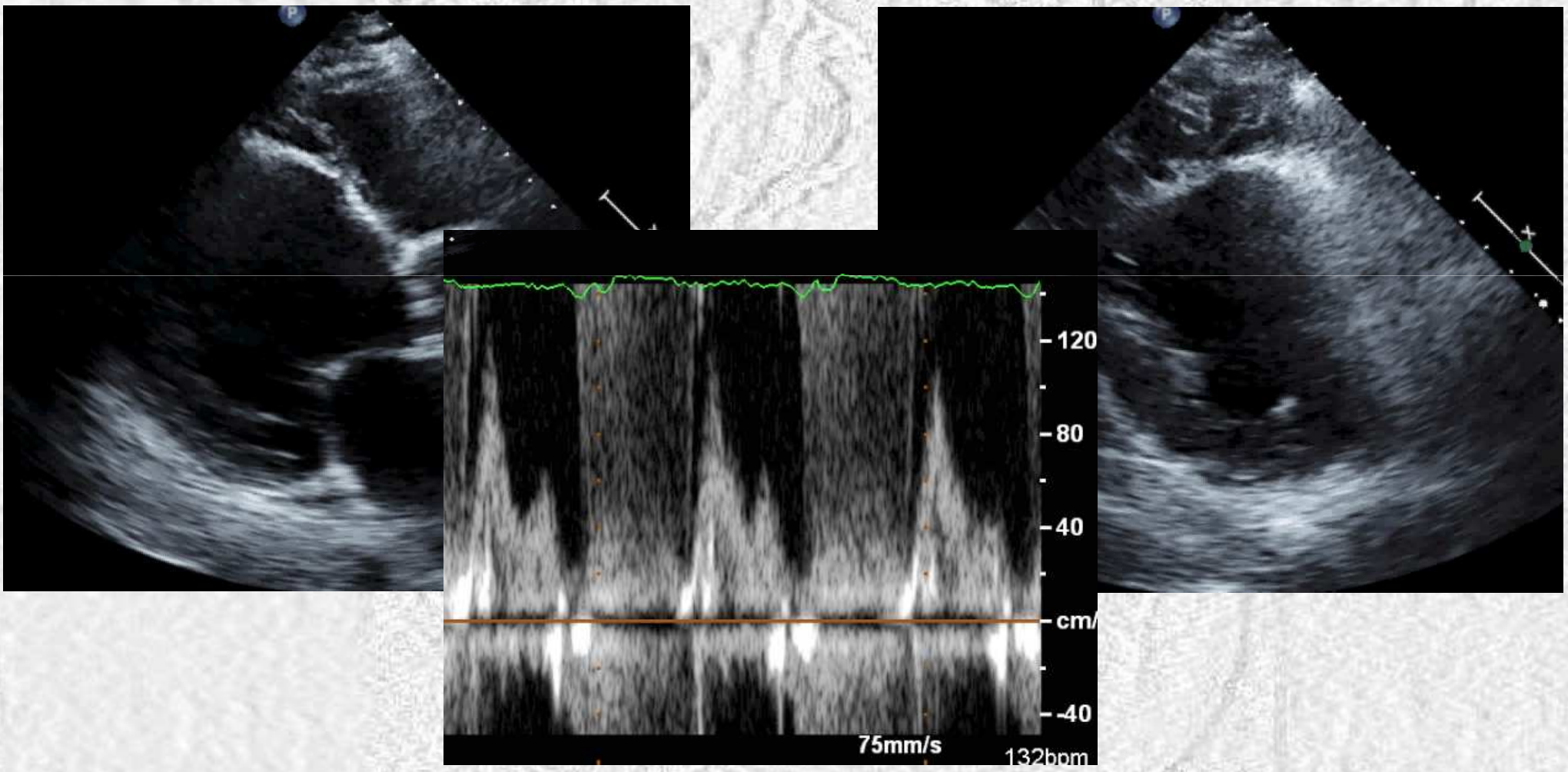
Acute heart failure

Alteration of LV function: after anterior MI

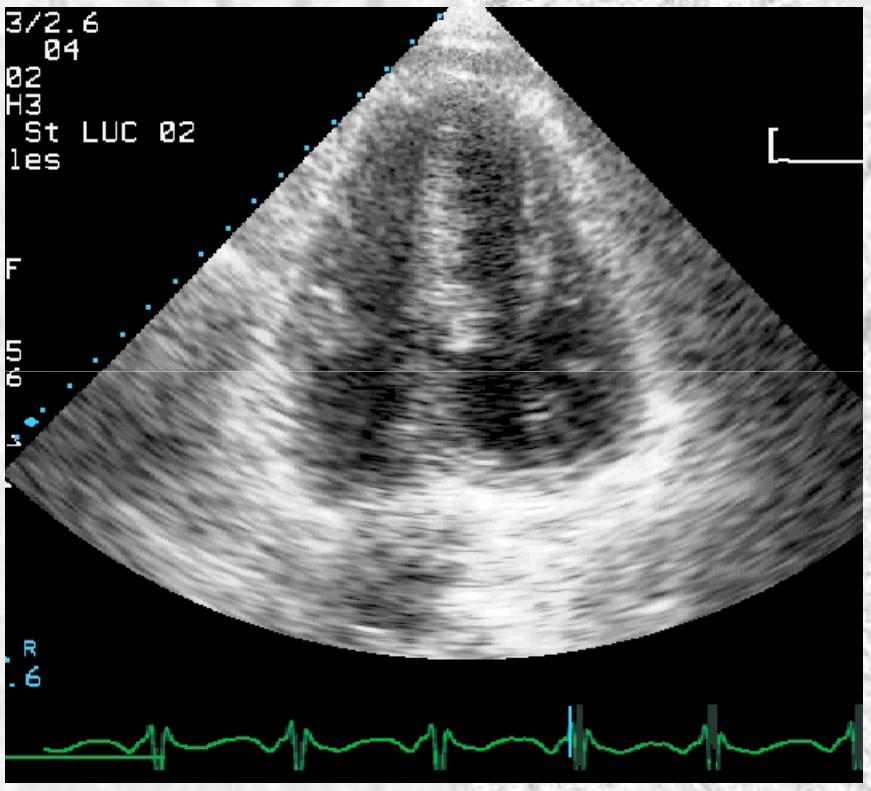


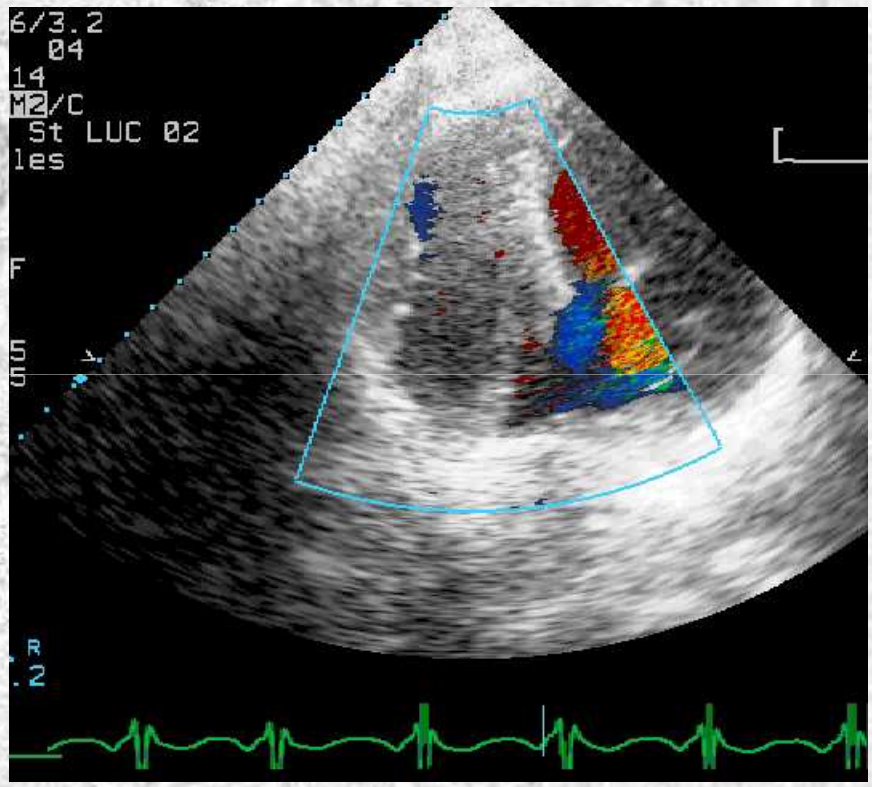
Acute heart failure

Alteration of LV function: after anterior MI



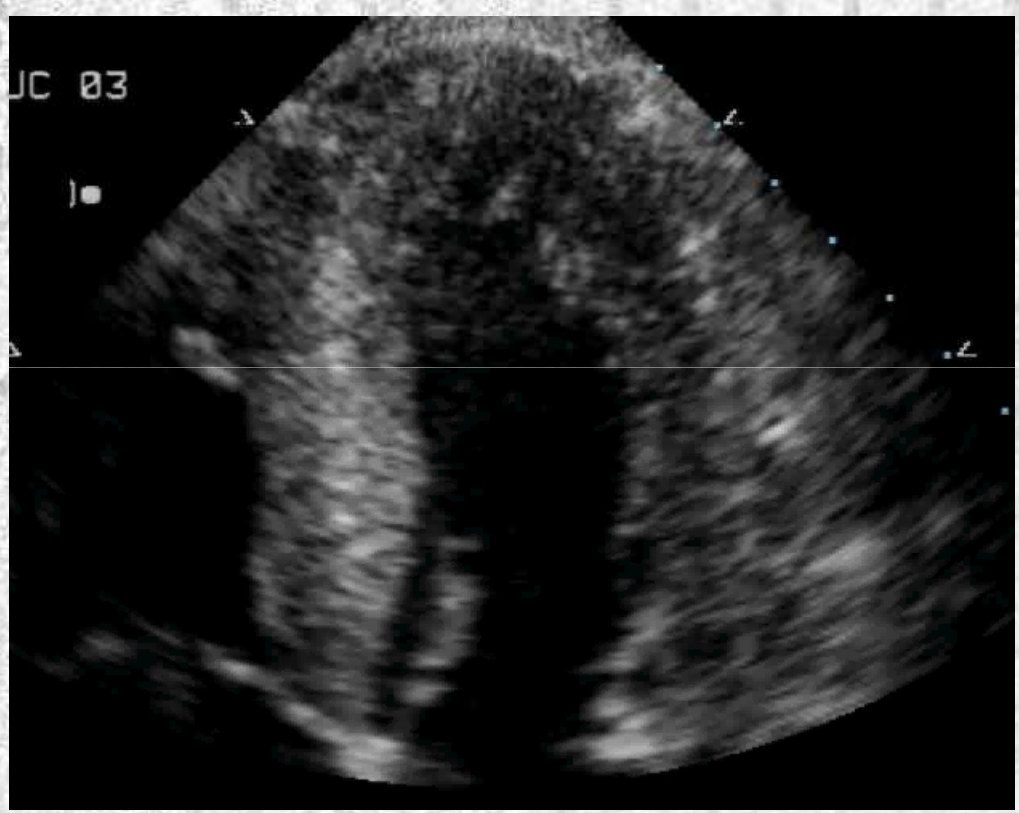
Acute heart failure
Complication post MI





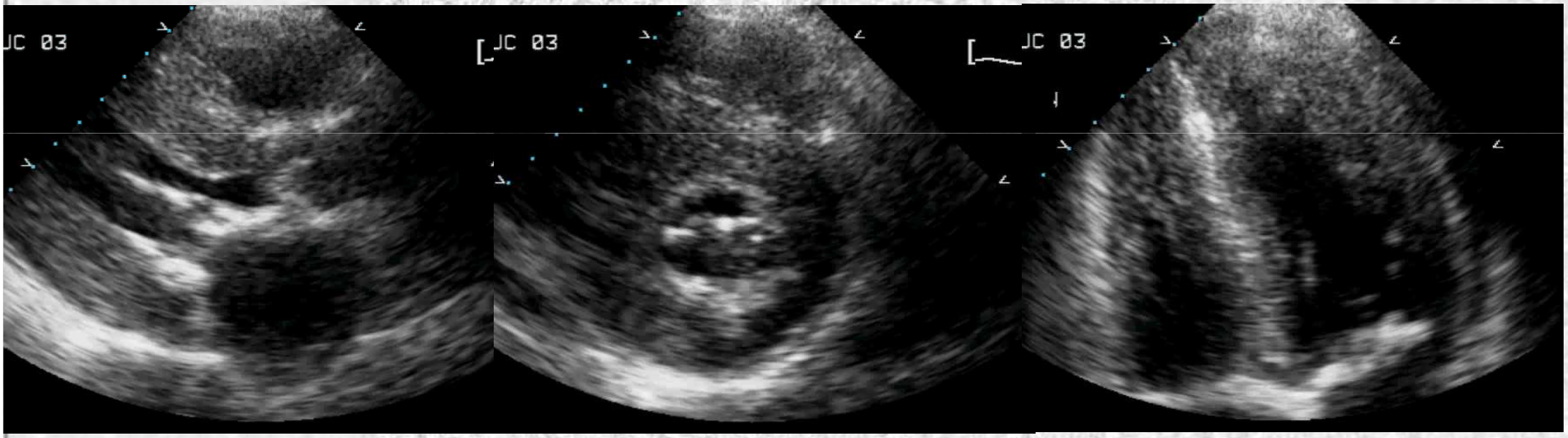
Acute heart failure

Hypertrophic cardiomyopathy

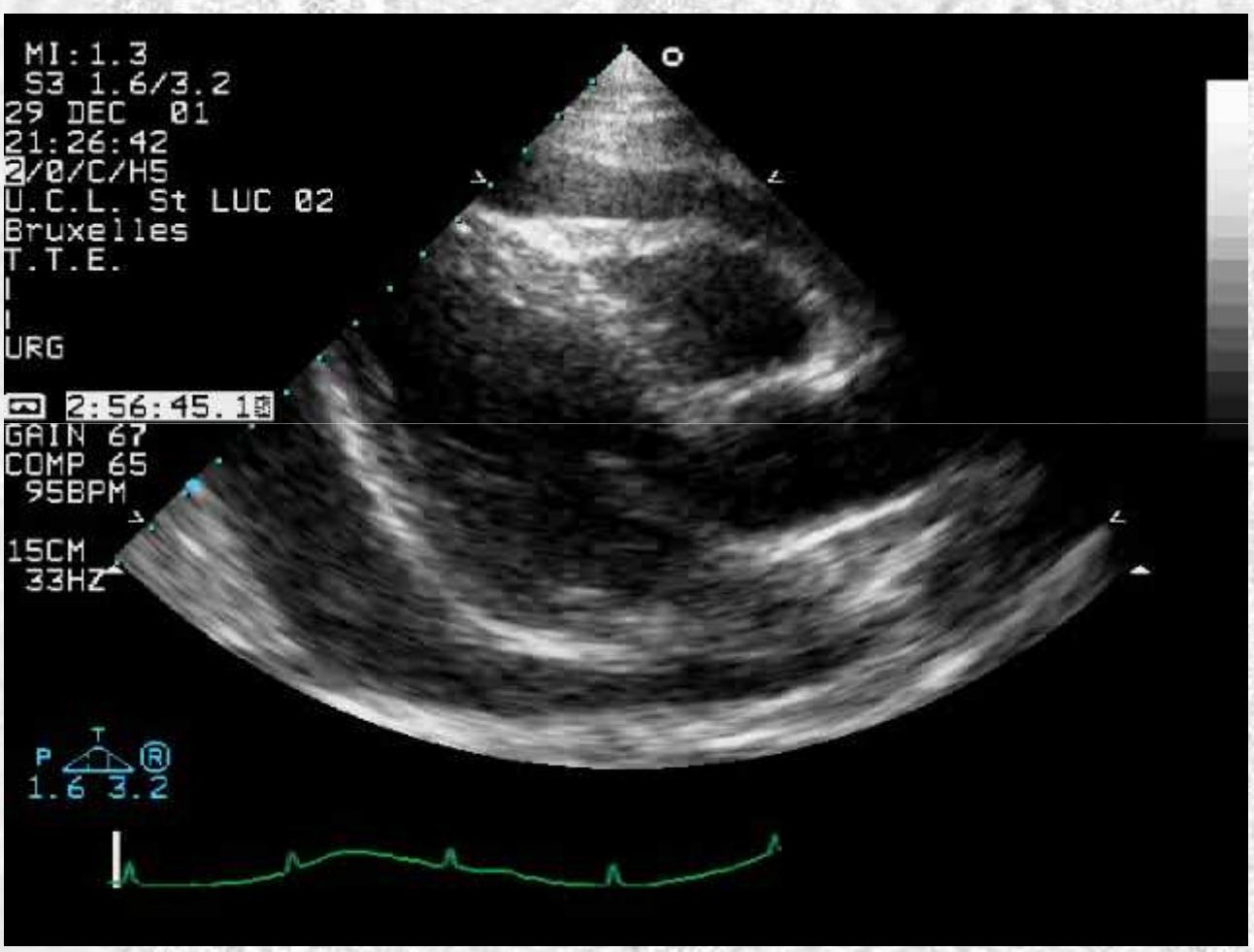


Acute heart failure

Hypertrophic cardiomyopathy: Fabry disease

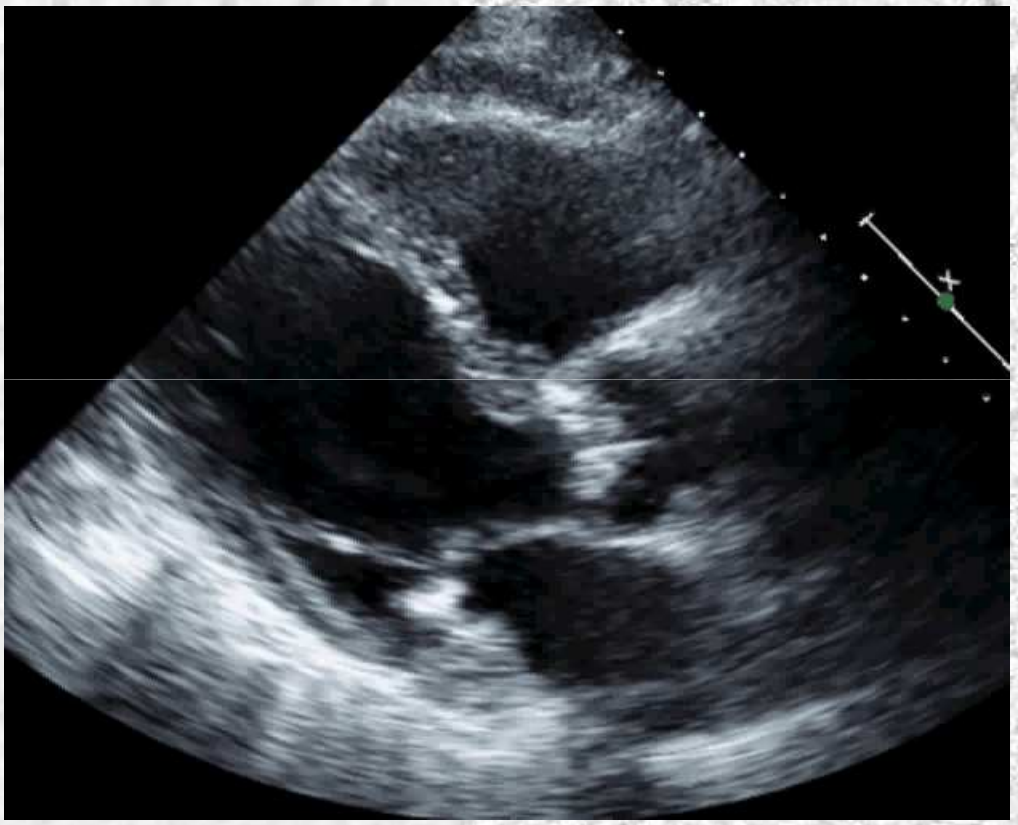


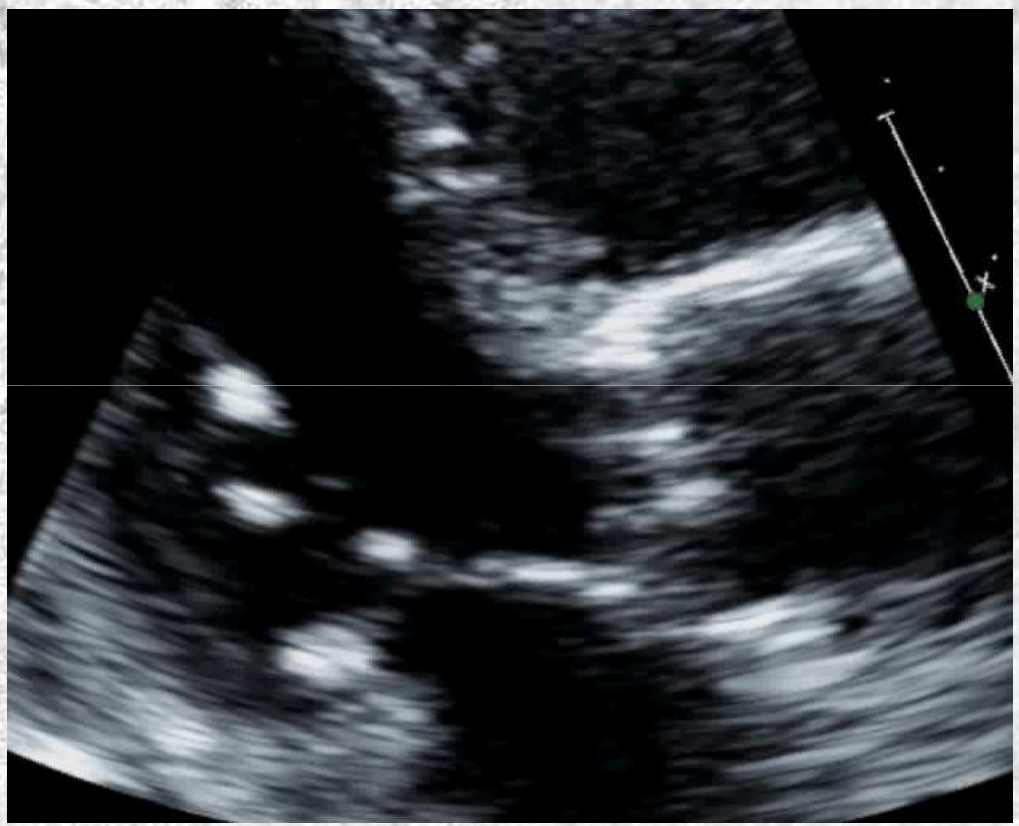
Acute heart failure
Pericardial effusion



Acute heart failure

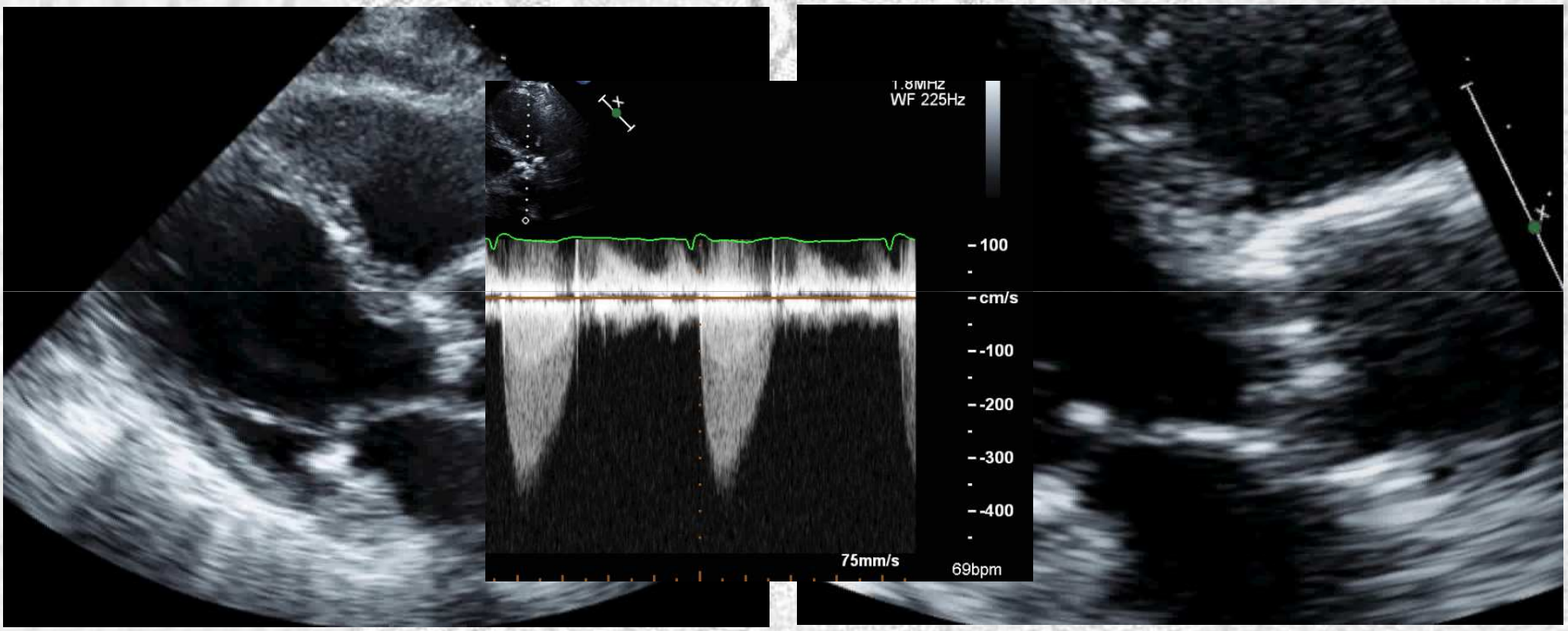
Aortic stenosis with nl function





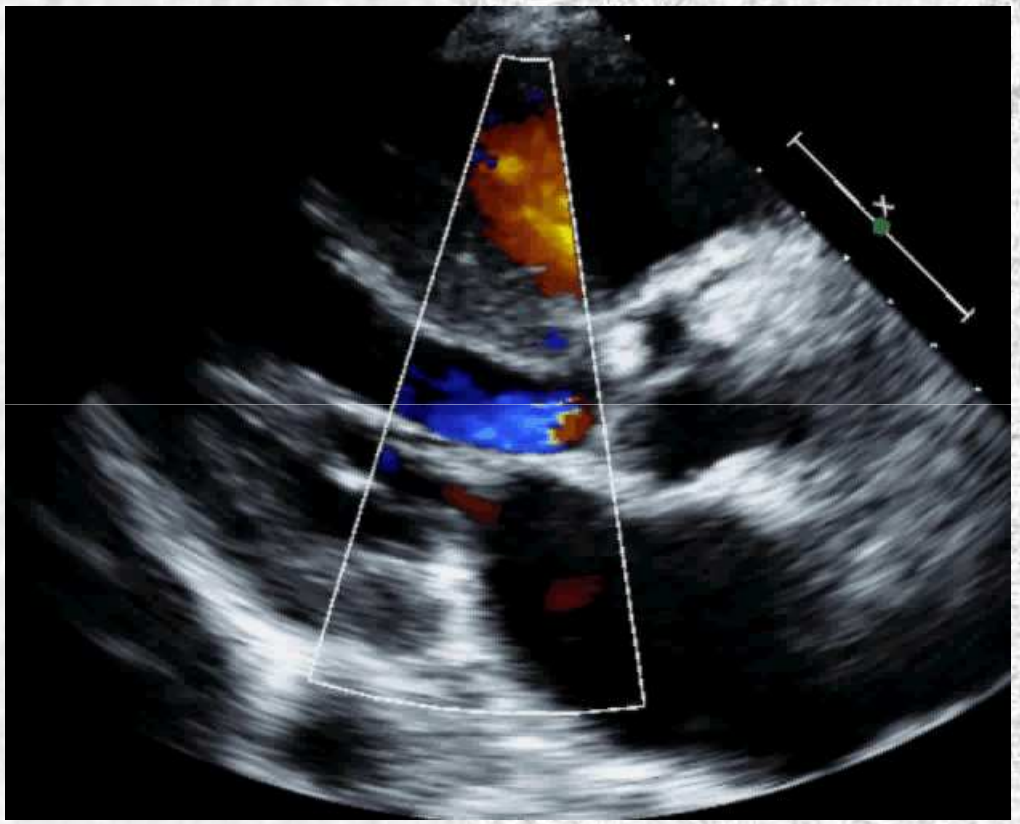
Acute heart failure

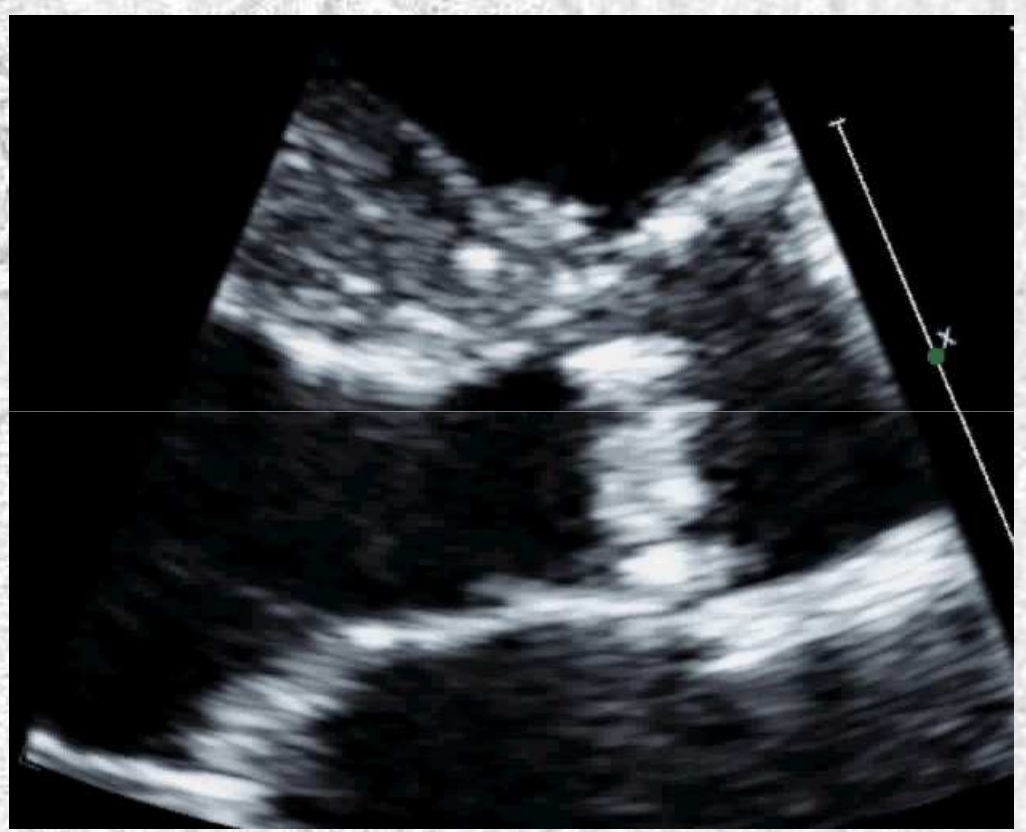
Aortic stenosis with nl function



Acute heart failure

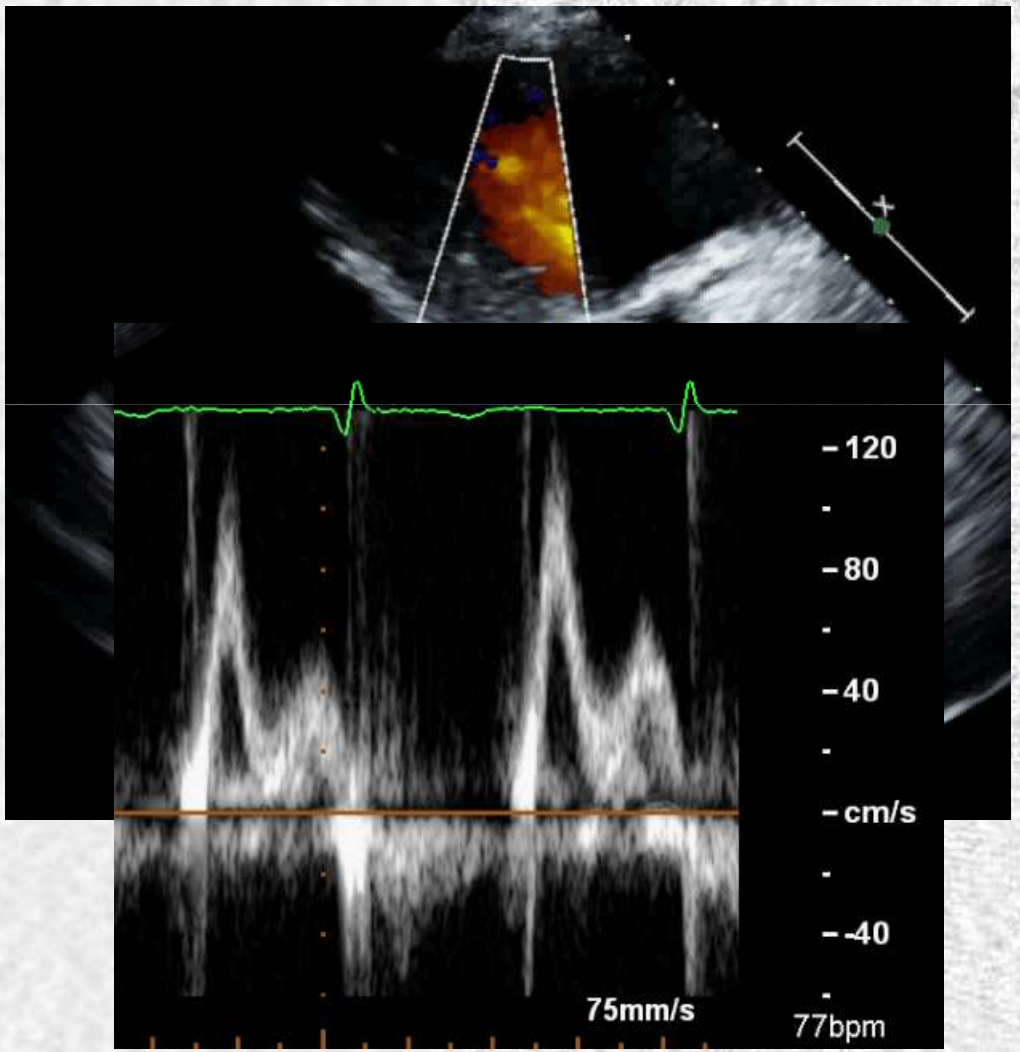
Aortic stenosis with low gradient

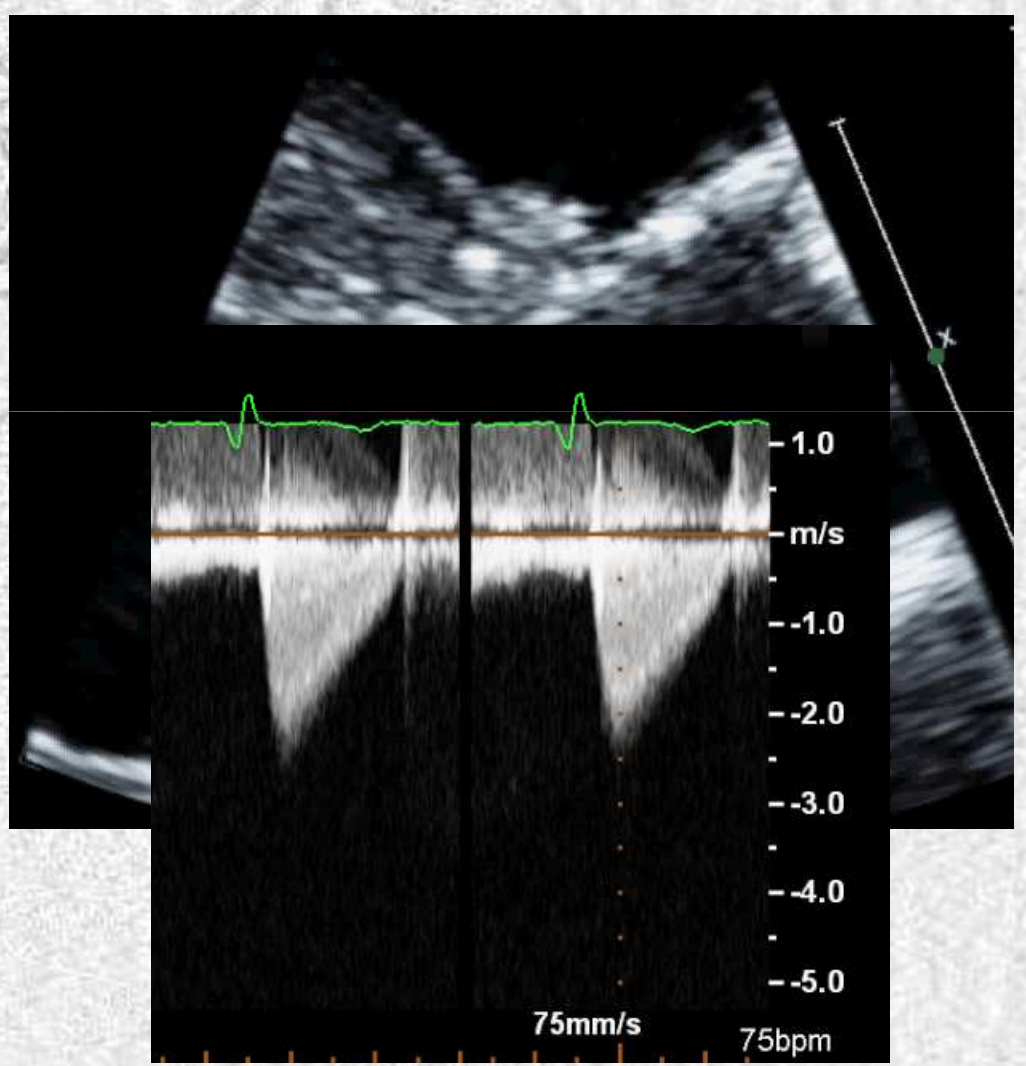




Acute heart failure

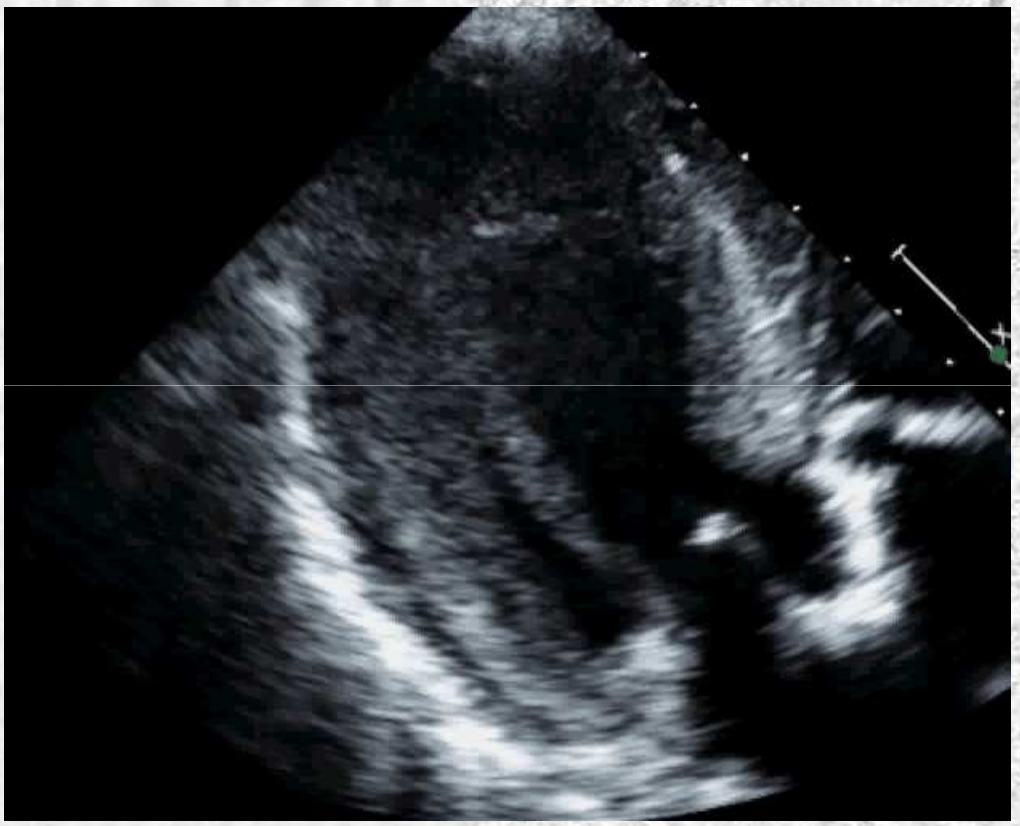
Aortic stenosis with low gradient

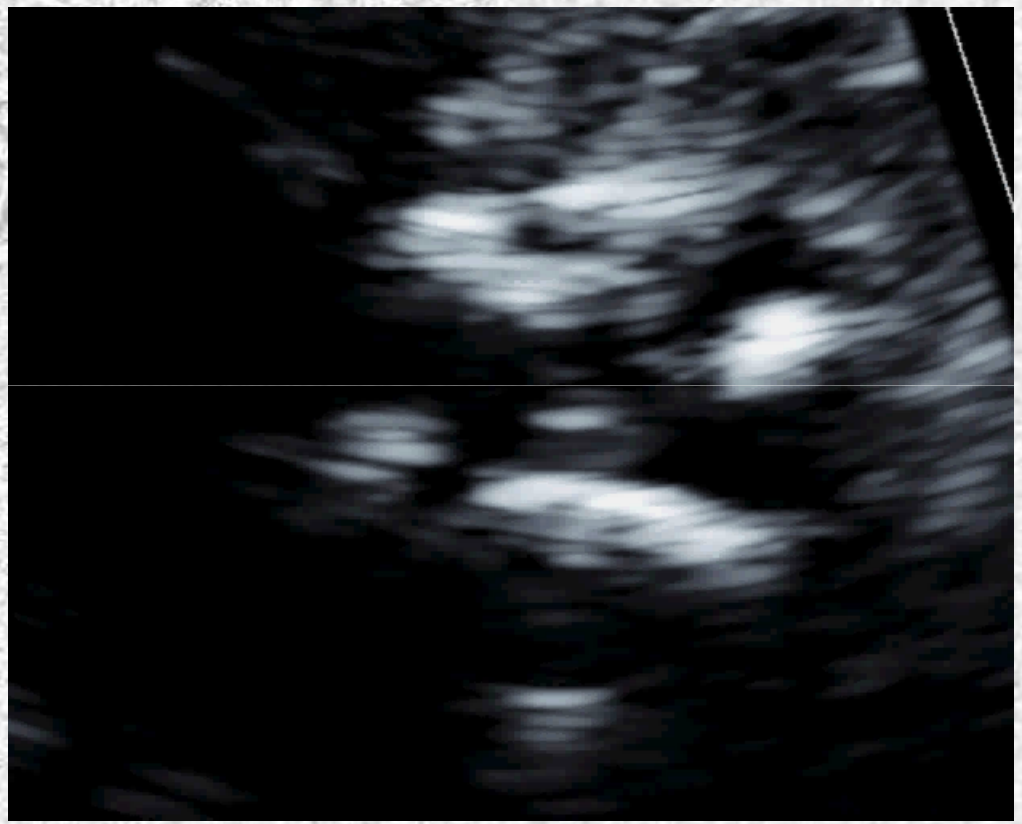




Acute heart failure

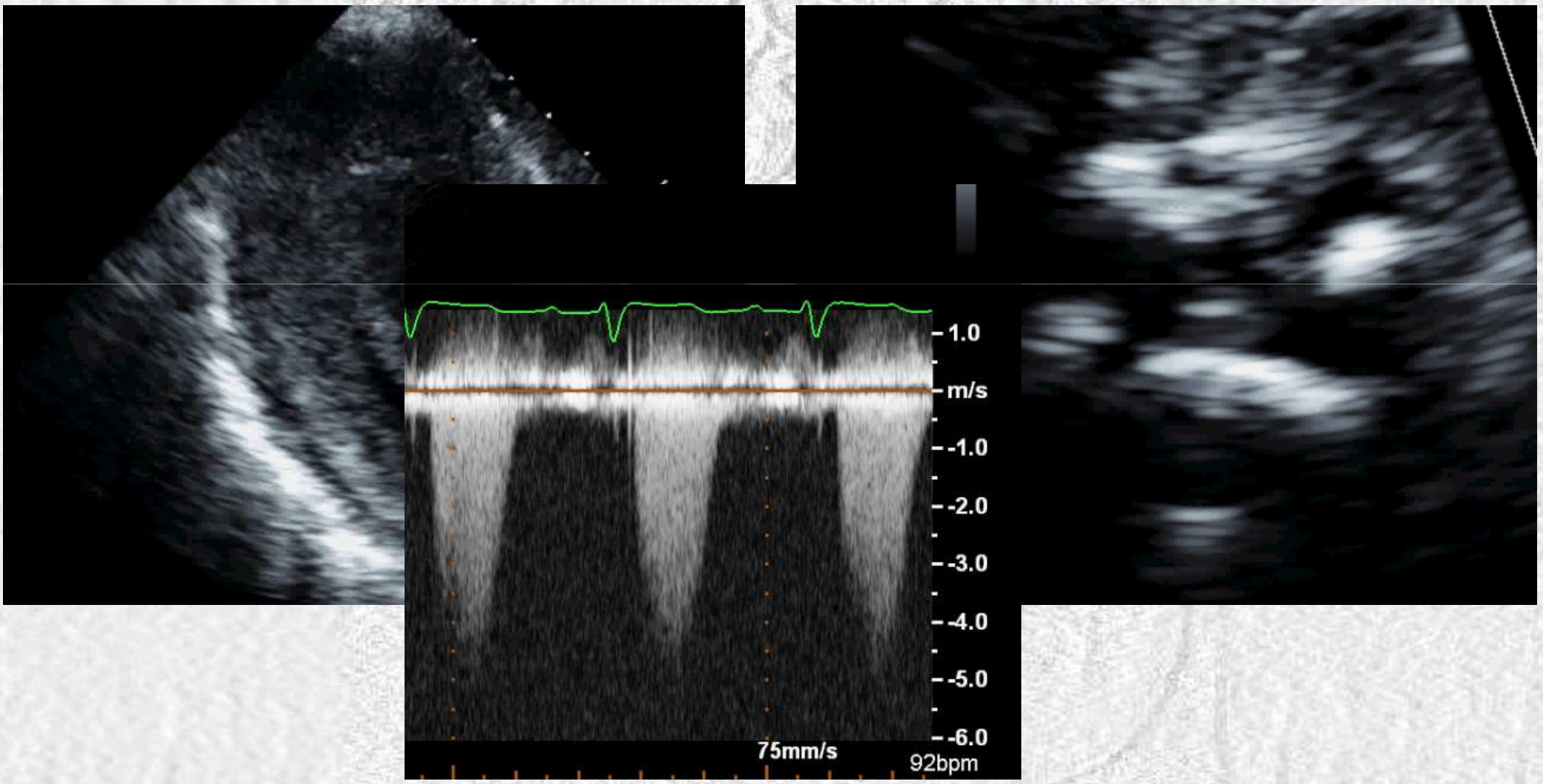
Aortic stenosis with severe hypertrophy





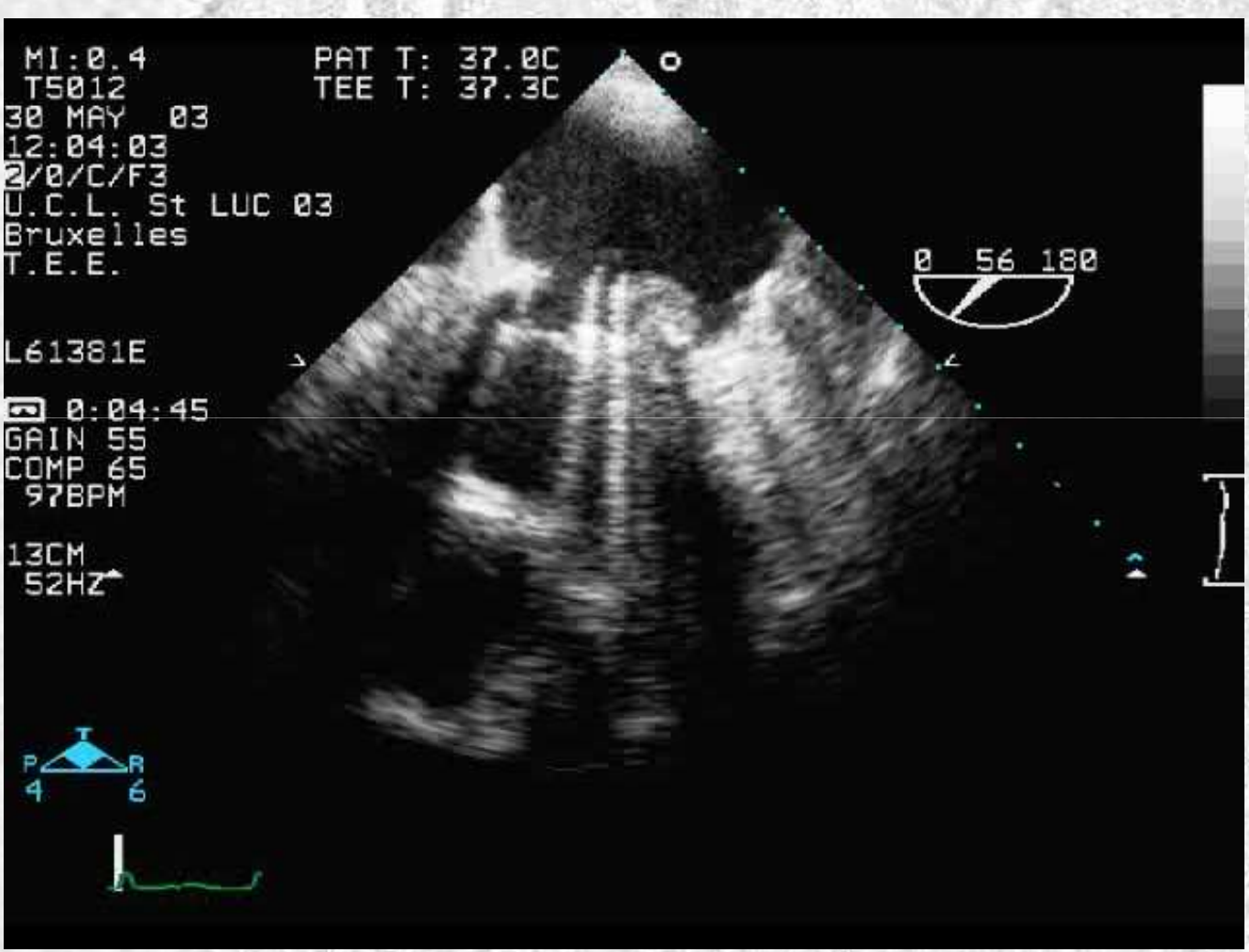
Acute heart failure

Aortic stenosis with severe hypertrophy



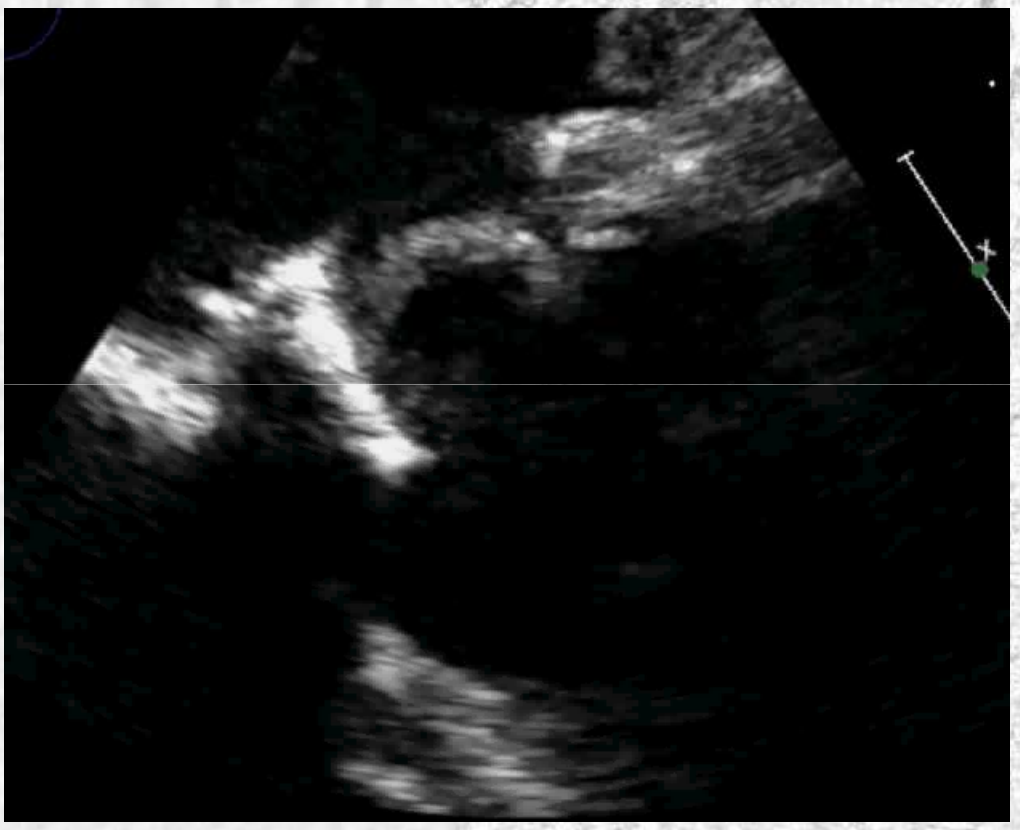
Acute heart failure

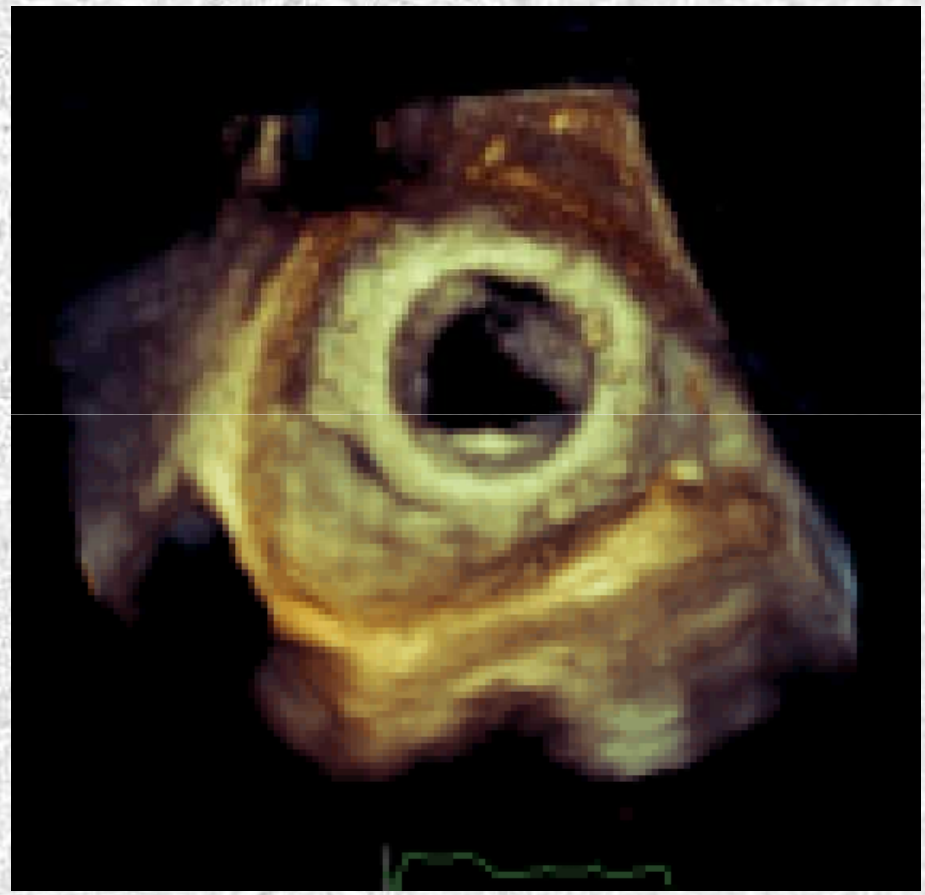
Dysfunction of mitral prosthesis



Acute heart failure

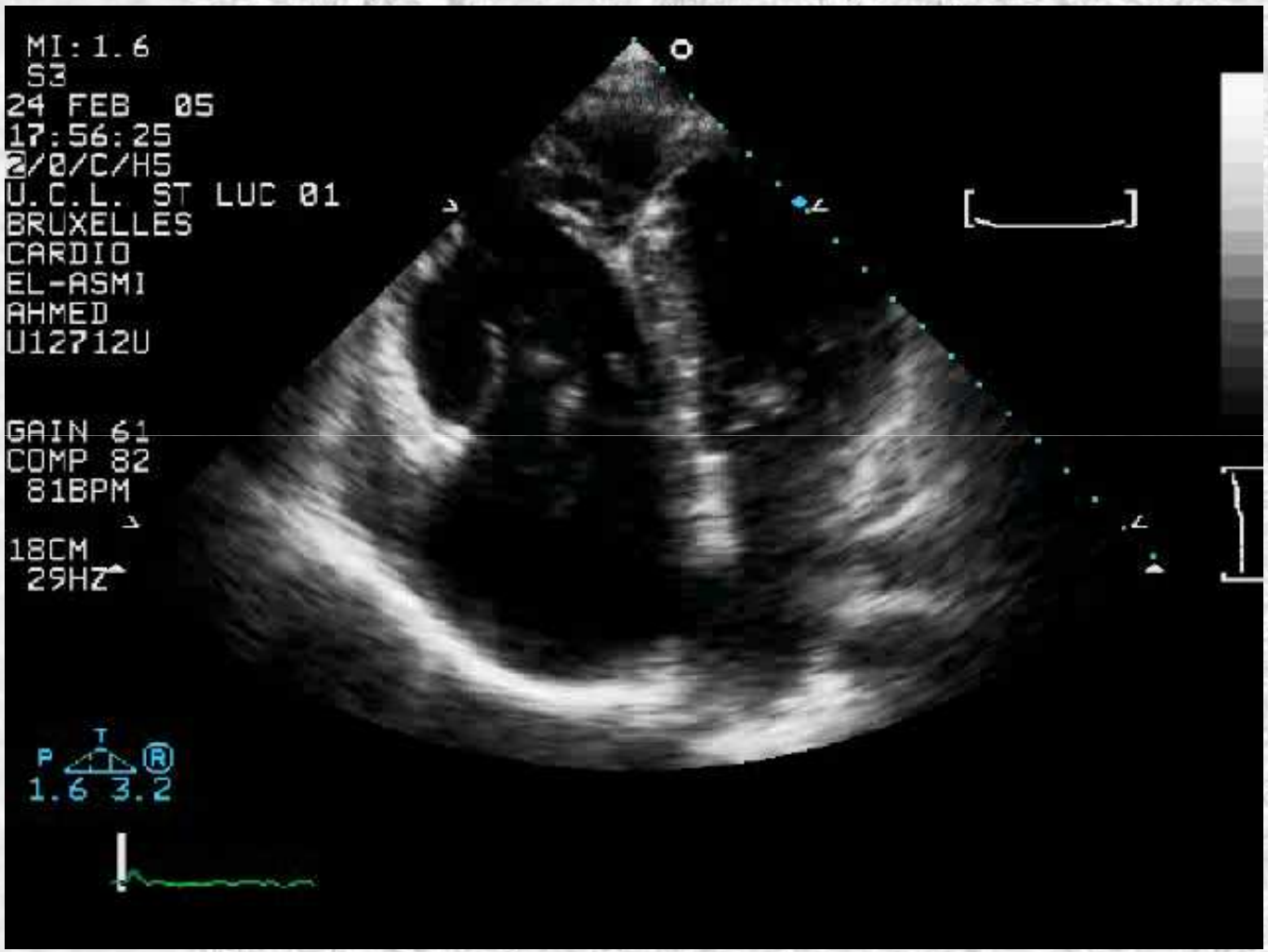
Thrombosis of mitral bioprosthesis





Acute heart failure

RV failure



Acute heart failure

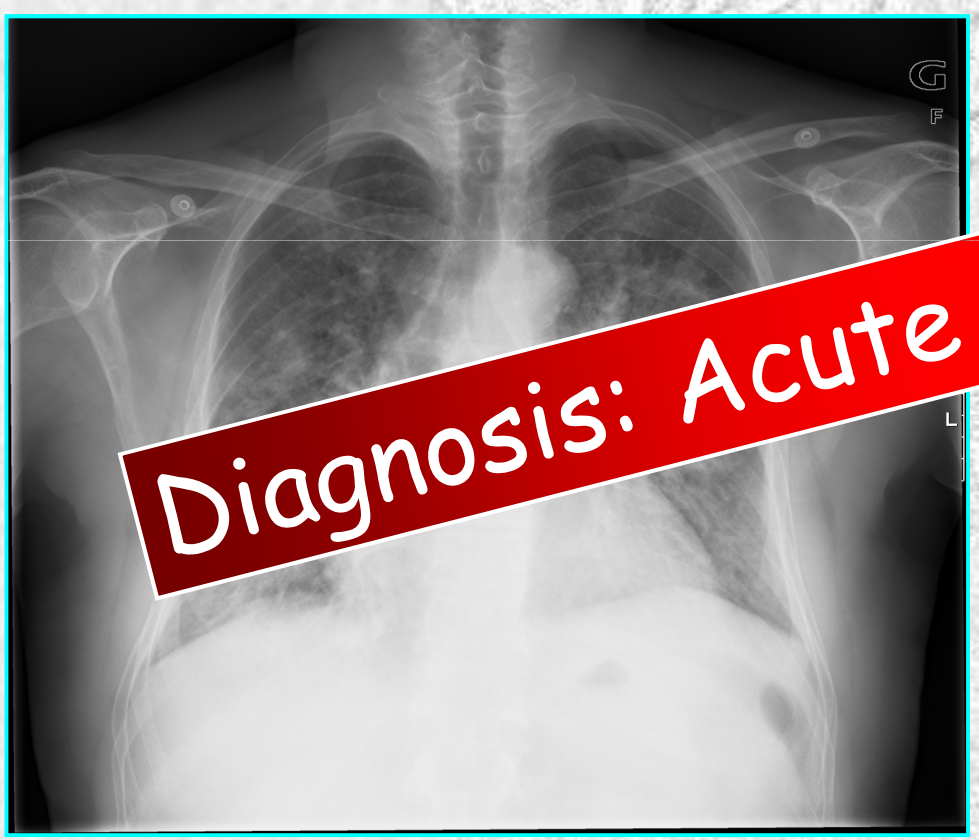
Cardiac tumor: myxoma

Acute heart failure
Atrial fibrillation

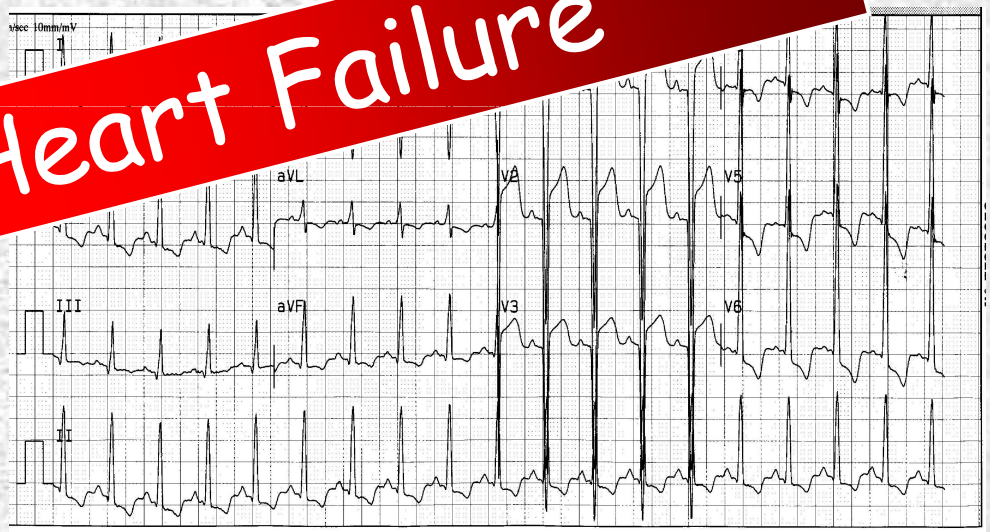
Acute heart failure

But in some patient.....

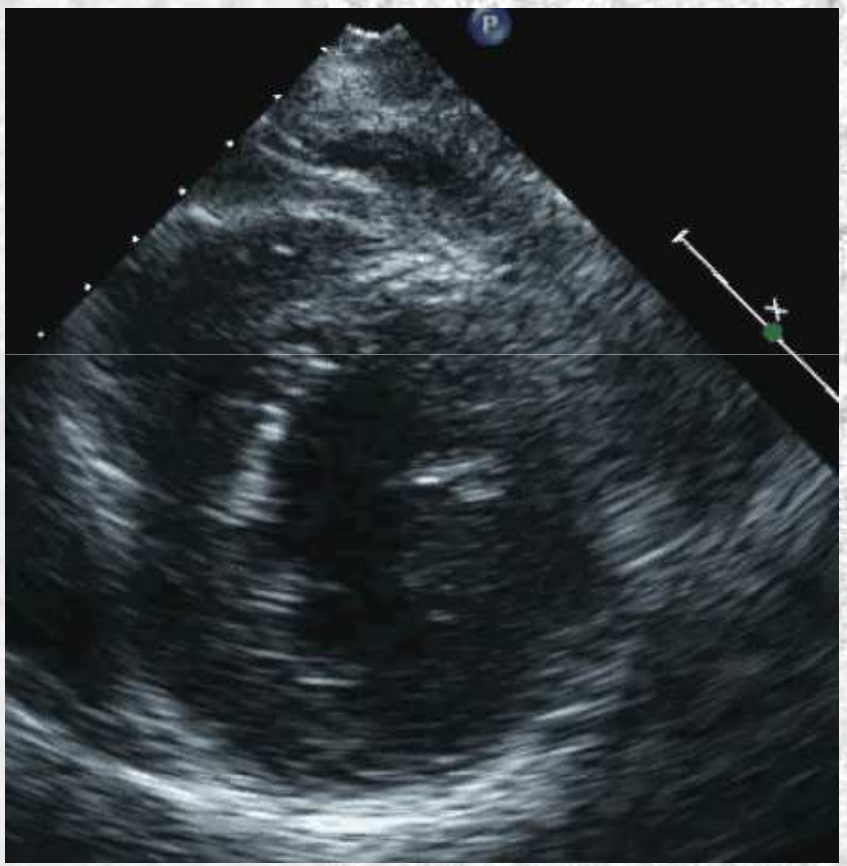
Abrupt worsening of dyspnea, basal rales, elevated jugular venous pressure.

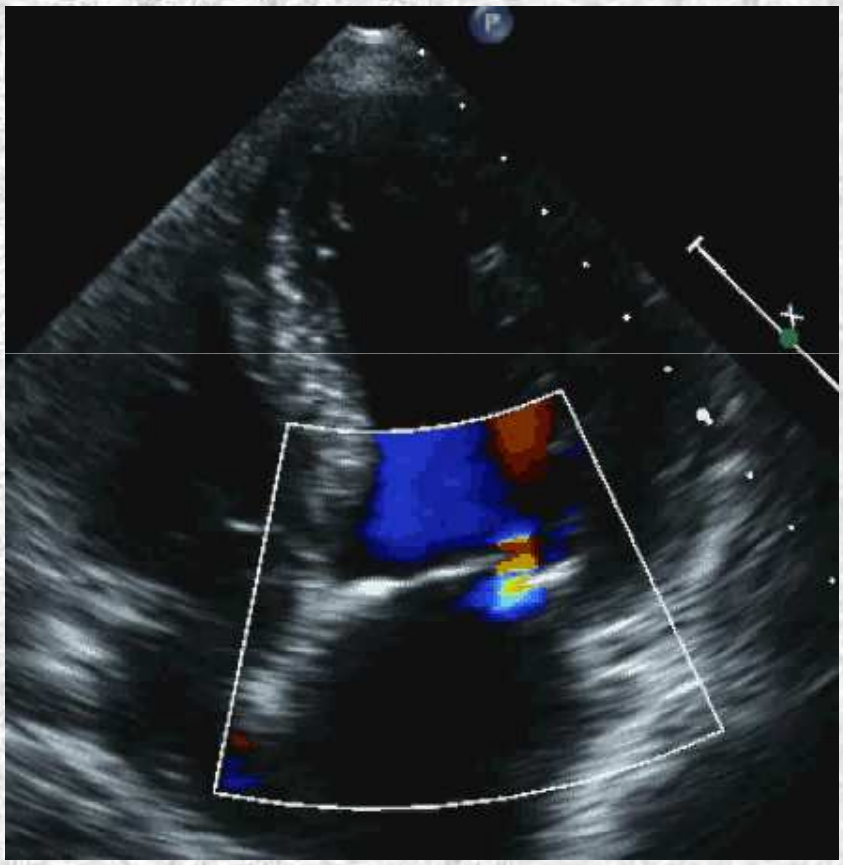


Diagnosis: Acute Heart Failure

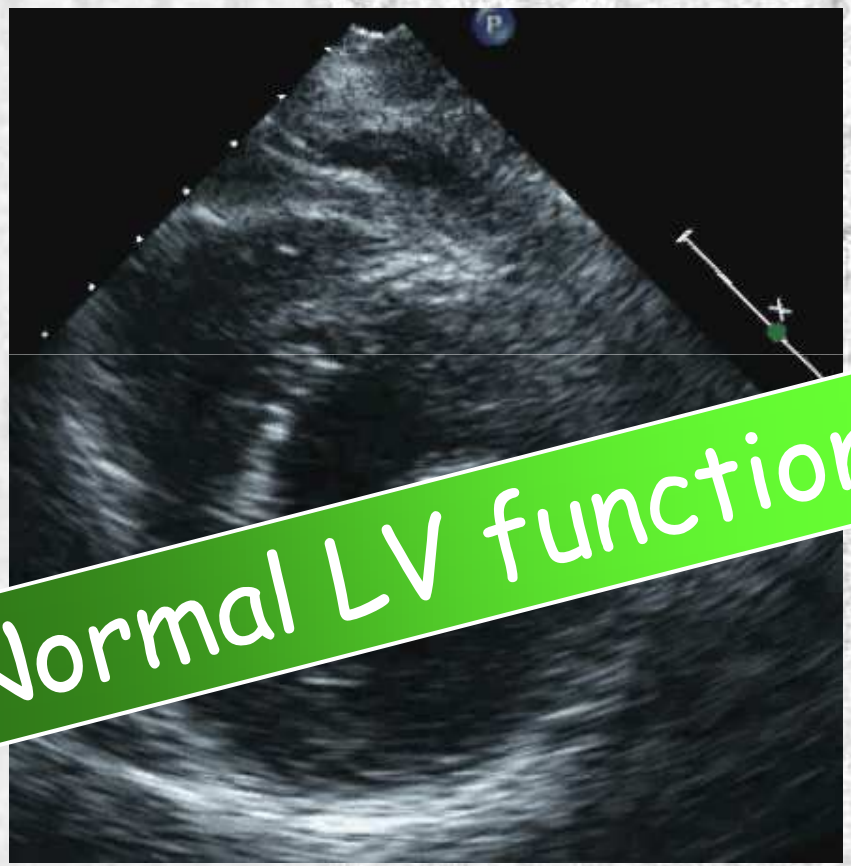


Acute heart failure
Echocardiography





Acute heart failure
Echocardiography



Normal LV function, no valve disease.....

Acute heart failure
Diagnosis...

HFNEF
Heart Failure with Normal Ejection Fraction

Diastolic Heart Failure

Acute heart failure
Signs and symptoms

Variable	Reduced Ejection Fraction (<40%) (N=1570)	Preserved Ejection Fraction (>50%) (N=880)	P Value
	no. (%)		
Symptoms			
Acute pulmonary edema	332 (21.1)	152 (17.3)	0.02
Dyspnea or shortness of breath	1511 (96.2)	835 (94.9)	0.11
Chest pain	399 (25.4)	212 (24.1)	0.47
Orthopnea	729 (46.4)	374 (42.5)	0.06
Syncope	27 (1.7)	10 (1.1)	0.26
Paroxysmal nocturnal dyspnea	473 (30.1)	220 (25.0)	0.007
Signs			
Bilateral ankle edema	888 (56.6)	581 (66.0)	<.001
Wheezing	302 (19.2)	173 (19.7)	0.80
Neck-vein distention	962 (61.3)	506 (57.5)	0.07
Crackles or rales on lung examination	1324 (84.3)	743 (84.4)	0.95
Hepatojugular reflux	119 (7.6)	69 (7.8)	0.82
Hepatomegaly	81 (5.2)	38 (4.3)	0.35
Presence of S3	196 (12.5)	74 (8.4)	0.002
Presence of S4	80 (5.1)	33 (3.8)	0.13
Chest radiographic signs			
Pulmonary edema	814 (51.8)	414 (47.0)	0.02
Pleural effusion	716 (45.6)	360 (40.9)	0.03

Bathia R ,NEJM; 2006;355:260-9

Acute heart failure
Systolic and diastolic HF

Table 2. Characteristics of Patients with Diastolic Heart Failure and Patients with Systolic Heart Failure.*

Characteristic	Diastolic Heart Failure	Systolic Heart Failure
Age	Frequently elderly	All ages, typically 50–70 yr
Sex	Frequently female	More often male
Left ventricular ejection fraction	Preserved or normal, approximately 40% or higher	Depressed, approximately 40% or lower
Left ventricular cavity size	Usually normal, often with concentric left ventricular hypertrophy	Usually dilated
Left ventricular hypertrophy on electrocardiography	Usually present	Sometimes present
Chest radiography	Congestion with or without cardiomegaly	Congestion and cardiomegaly
Gallop rhythm present	Fourth heart sound	Third heart sound
Coexisting conditions		
Hypertension	+++	++
Diabetes mellitus	+++	++
Previous myocardial infarction	+	+++
Obesity	+++	+
Chronic lung disease	++	0
Sleep apnea	++	++
Long-term dialysis	++	0
Atrial fibrillation	+ (usually paroxysmal)	+ (usually persistent)

Jessup M , NEJM 2003;348:2007-18.

Acute heart failure
Diagnosis "diastolic HF"

HF Symptoms or clinical signs

Abnormal ECG, X Ray, BNP abnormal ? → Diastolic HF unlikely

EF > 50% → EF < 45% « Syst » HF

Valves, congenital disease, pericard, lung: → No diast HF

Hypertension, diabetes, overweight → Kidney, lever disease

Increased Lv mass, OG dilated

Diastolic HF likely

Diastolic dysfunction by Echo → Diastolic HF

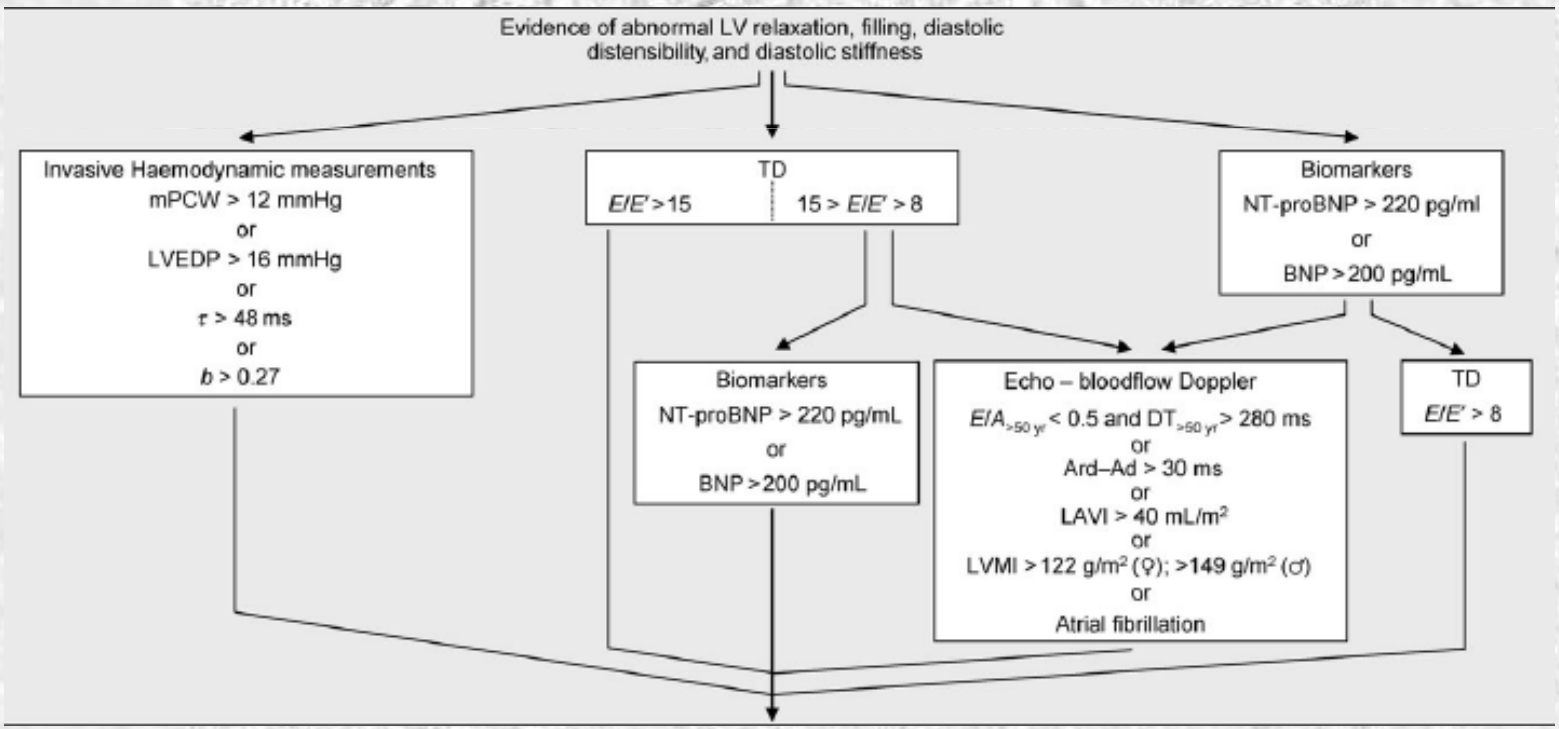
Acute heart failure
Diagnosis "diastolic HF"

HF Symptoms or clinical signs

↓

LVEF > 50%, LVEDVI > 97ml/m2

↓



↓

Diastolic HF

Paulus W , Eur H J (2007) 28, 2539–2550

Acute heart failure
Conclusion

- Echocardiography is a very useful tool in the diagnosis of heart failure not only to diagnose the cause but also the precipiting factor

- Beside classical form of HF, don't forget "diastolic HF"