Heart failure preserved EF

(HFpEF)

vs

High CO failure in renal failure

Under-diagnosis, Under-treatment

Heart failure with preserved ejection fraction
HFpEF

EF ≥ 50% with sign and symptoms of heart failure

About 5% in aged *≥ 60 years*

more than half of all heart failure (HF) hospital admissions.

The 5-year *survival rate* for all patients with heart failure, regardless of EF, *is less than 50%.*

Survival has improved over time for patients with HFrEF, it has *not changed for patients with HFpEF.*

Risk factors and comorbidities

-Advanced age

-Female sex

-Obesity

-Systemic arterial hypertension

-Diabetes mellitus

-Renal dysfunction

-Anaemia and Iron deficiency

-Sleep disorders

-Chronic obstructive pulmonary disease

- Heart failure with preserved ejection fraction ‘***masqueraders’*** such as heart valve disease, arrhythmias, and pericardial constriction need to ***be excluded***.

Patient with a normal LVEF and ***HF-like symptoms*** caused by significant coronary artery disease (CAD) is also not considered to have HFpEF

Pathophysiological processes

Increased systemic vascular resistance

Increased conduit arterial stiffness

Abnormal ventricular arterial coupling

Reduced LV long-axis systolic function

Slowed early diastolic relaxation

Reduced LV compliance *with* ***increased end diastolic stiffness***

Reduced LA reservoir and contractile function

Impaired right ventricular (RV) function and chronotropic incompetence.

Pathophysiological processes

Reduced reserve of stroke volume :

heart rate (*chronotropic incompetence*)

cardiac output (CO)

High LV filling pressures*(at* rest and or on exercise)

Fluid retention and an expanded plasma volume.

Sign and symptoms

DOE** (FC II or III) ***highly sensitive and moderately specific (about 50%)

Orthopnoea** is quite ***specific but relatively insensitive.

*Reduced exercise capacity and ***fatigue***, *out of proportion to cardiac abnormalities at rest.*

***Edema**

***Congestion**

ECG

- ***LVH***
- ***LA enlargement***
- ***AF rhythm***

Natriuretic peptides

NT-proBNP <125 pg/mL or BNP <35 pg/mL

high negative predictive values (NPV= 95–99%) for *excluding any heart failure*.

-The main trigger for release of NPs is high LV end-diastolic wall stress, which is inversely proportional to wall thickness.

.

-the excellent NPV of NPs is true particularly for HFrEF with a dilated LV, but not necessarily for HFpEF where LVH tends to normalize wall stress.

-up to 20% of patients with invasively proven HFpEF have NPs below these diagnostic thresholds

BNP is *higher* in PFpEF compared to normal people

BNP is *lower* in HFpEF compared to HFrEF(due to less wall stress)

BNP is *lower* in obecity

BNP is *higher* in women,older age,CKD and pulmonary diseases.

HFpEF- like syndromes

Ischemia

Toxic(Alchohol,Cocaine)

Radiation,Inflamations

Infections

Hormonal(thyroid)

Loading conditions

Valvular

Pericardial

High output state(Anemia,AV fistula,Sepsis,Pregnancy,Hyperthyroidism)

Volume overload(Renal failure and fluid load)

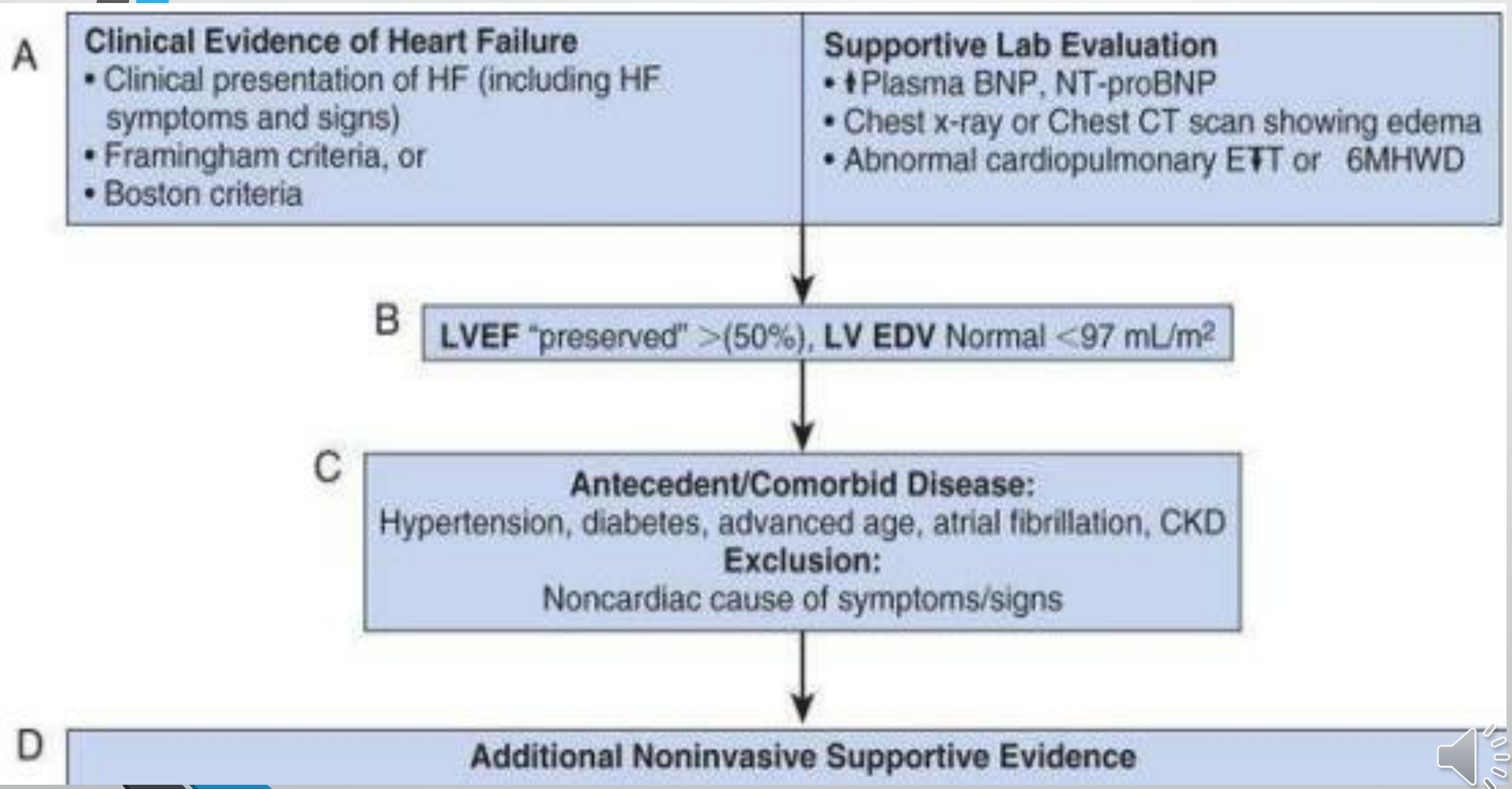
ESC European Society of Cardiology

European Heart Journal (2019) **00**, 1–21
doi:10.1093/eurheartj/ehz641

FASTTRACK CLINICAL RESEARCH
Heart failure/cardiomyopathy

How to diagnose heart failure with preserved ejection fraction: the HFA–PEFF diagnostic algorithm: a consensus recommendation from the Heart Failure Association (HFA) of the European Society of Cardiology (ESC)

Burkert Pieske[1,2,3,4]*, Carsten Tschöpe[1,2,5], Rudolf A. de Boer [6], Alan G. Fraser[7], Stefan D. Anker[1,2,5,8], Erwan Donal[9], Frank Edelmann[1,2], Michael Fu[10], Marco Guazzi[11,12], Carolyn S.P. Lam[13,14], Patrizio Lancellotti[15], Vojtech Melenovsky[16], Daniel A. Morris[1], Eike Nagel [17,18], Elisabeth Pieske-Kraigher[1], Piotr Ponikowski[19], Scott D. Solomon[20], Ramachandran S. Vasan[21], Frans H. Rutten [22], Adriaan A. Voors[6], Frank Ruschitzka[23], Walter J. Paulus[24], Petar Seferovic[25] and Gerasimos Filippatos[26,27]


A
Clinical Evidence of Heart Failure
• Clinical presentation of HF (including HF symptoms and signs)
• Framingham criteria, or
• Boston criteria
Supportive Lab Evaluation
• ↑Plasma BNP, NT-proBNP
• Chest x-ray or Chest CT scan showing edema
• Abnormal cardiopulmonary E↓T or 6MHWD
B
LVEF "preserved" >(50%), LV EDV Normal <97 mL/m²
C
Antecedent/Comorbid Disease:
Hypertension, diabetes, advanced age, atrial fibrillation, CKD
Exclusion:
Noncardiac cause of symptoms/signs
D
Additional Noninvasive Supportive Evidence

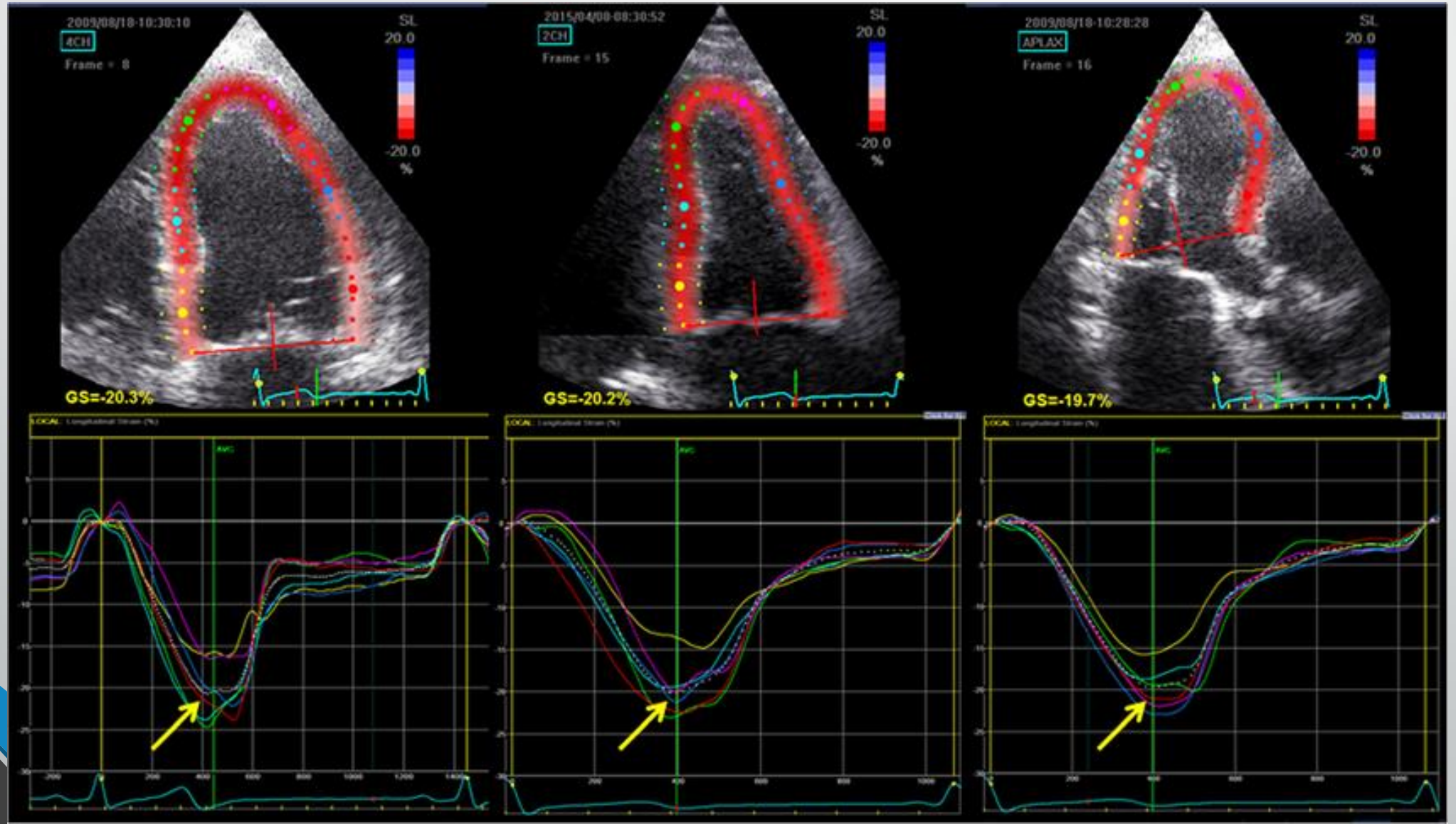
Despite a preserved LVEF, patients with HFpEF have ***impaired LV long-axis systolic function***

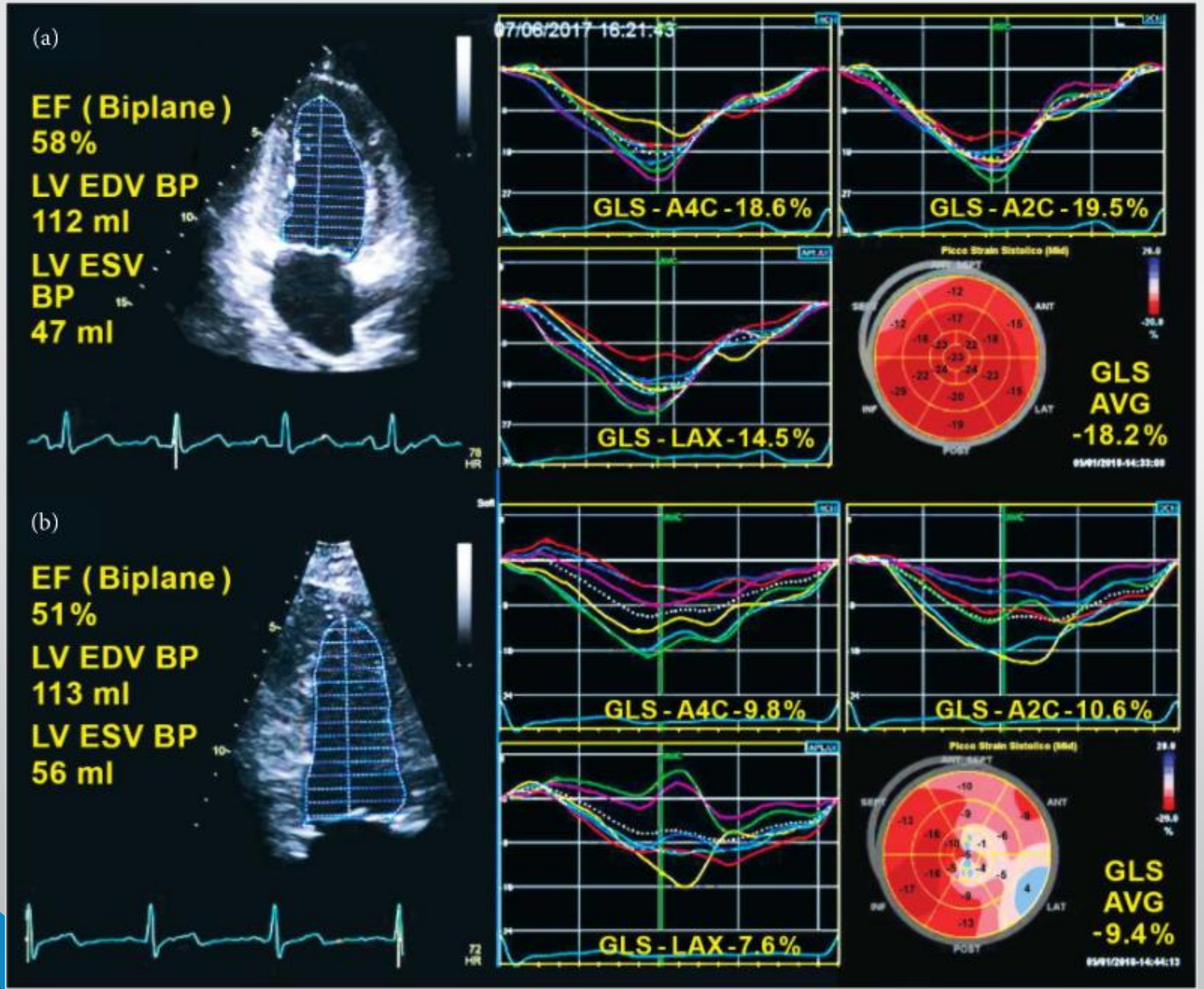
measured using Tissue echo from mitral annular velocity, ***e'*** *or LV global longitudinal strain (****GLS****).*

E/e': less age dependent relative to e'

Less dependent to volume relative to E

Global longitudinal strain
(GLS)



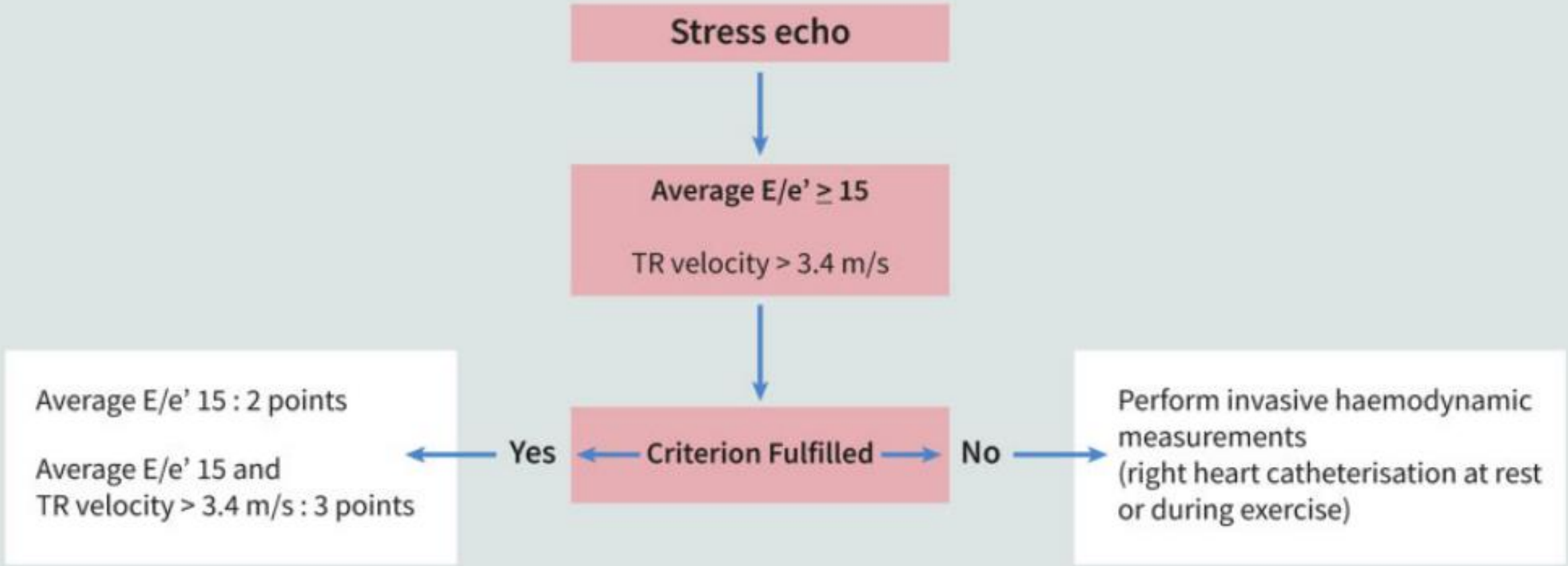

(a)
EF (Biplane)
58%
LV EDV BP
112 ml
LV ESV
BP
47 ml
07/06/2017 16:21:43
GLS - A4C -18.6%
GLS - A2C -19.5%
GLS - LAX -14.5%
GLS
AVG
-18.2%
(b)
EF (Biplane)
51%
LV EDV BP
113 ml
LV ESV BP
56 ml
GLS - A4C -9.8%
GLS - A2C -10.6%
GLS - LAX -7.6%
GLS
AVG
-9.4%

	Functional	Morphological	Biomarker (SR)	Biomarker (AF)
Major	septal e' < 7 cm/s or lateral e' < 10 cm/s or Average E/e' ≥ 15 or TR velocity > 2.8 m/s (PASP > 35 mmHg)	LAVI > 34 ml/m² or LVMI ≥ 149/122 g/m² (m/w) and RWT > 0,42 #	NT-proBNP > 220 pg/ml or BNP > 80 pg/ml	NT-proBNP > 660 pg/ml or BNP > 240 pg/ml
Minor	Average E/e' 9 -14 or GLS < 16 %	LAVI 29-34 ml/m² or LVMI > 115/95 g/m² (m/w) or RWT > 0,42 or LV wall thickness ≥ 12 mm	NT-proBNP 125-220 pg/ml or BNP 35-80 pg/ml	NT-proBNP 365-660 pg/ml or BNP 105-240 pg/ml

Major Criteria: 2 points	≥ 5 points: HFpEF
Minor Criteria: 1 point	2-4 points: Diastolic Stress Test or Invasive Haemodynamic Measurements

A

Advanced HFpEF workup: Echo stress test



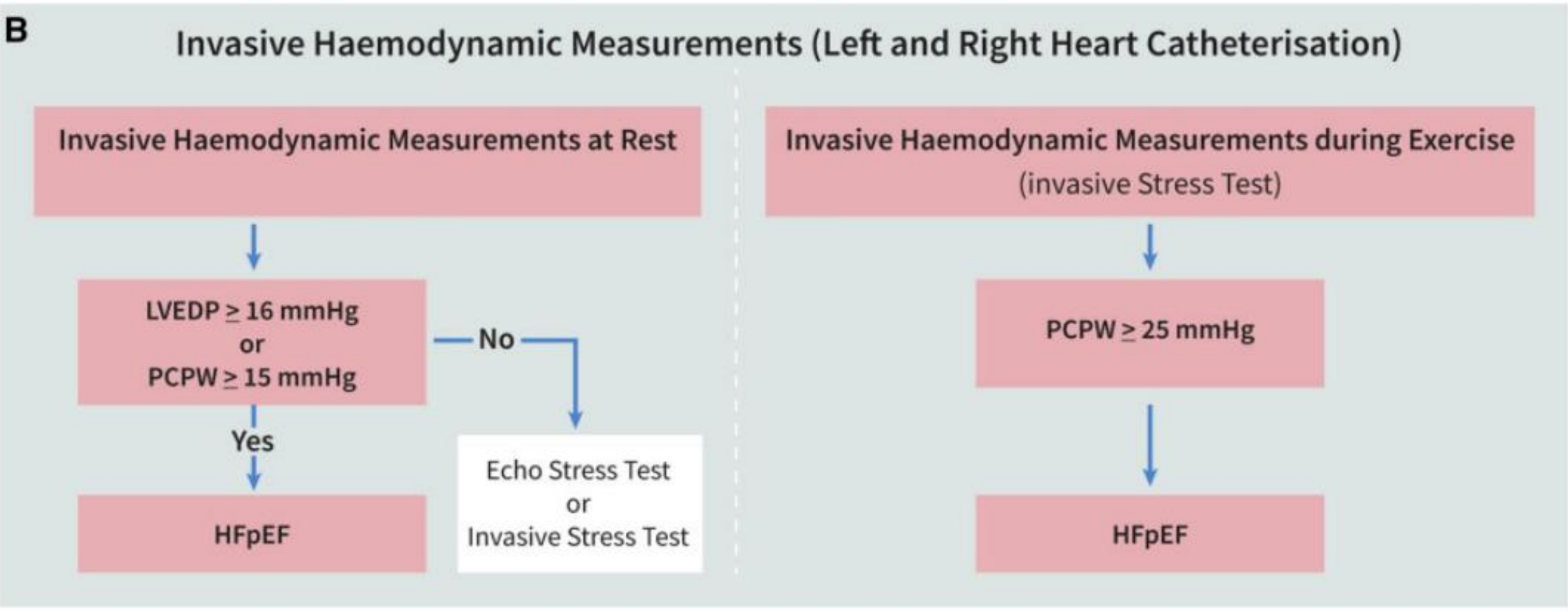
invasive haemodynamic stress test

The score remains <5 points

Exercise echocardiography cannot be performed

Any case of doubt

A therapeutic decision depends on the results


B
Invasive Haemodynamic Measurements (Left and Right Heart Catheterisation)
Invasive Haemodynamic Measurements at Rest
LVEDP ≥ 16 mmHg
or
PCPW ≥ 15 mmHg
No
Yes
HFpEF
Echo Stress Test
or
Invasive Stress Test
Invasive Haemodynamic Measurements during Exercise
(invasive Stress Test)
PCPW ≥ 25 mmHg
HFpEF

All causes of the clinical syndrome of heart failure with a normal ejection fraction are not under the term ‘HFpEF’

Non-myocardial aetiologies that may mimic HFpEF, such as:

constrictive pericarditis, primary VHD ***or high output failure***

should not be considered part of the HFpEF syndrome.

High CO failure

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2016 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER

VOL. 68, NO. 5, 2016
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2016.05.043

High-Output Heart Failure

A 15-Year Experience

Yogesh N.V. Reddy, MD, Vojtech Melenovsky, MD, PhD, Margaret M. Redfield, MD, Rick A. Nishimura, MD, Barry A. Borlaug, MD

High output HF is an important cause of clinical HF

Most frequently caused by :

-Obesity (31%)

-Arteriovenous shunts (23%). Mostly upper arm (Brachiocephalic > radial cephalic AV fistula) and in patient with volume flow > 2L/min and Q/CO >0.3

-liver disease (23%)

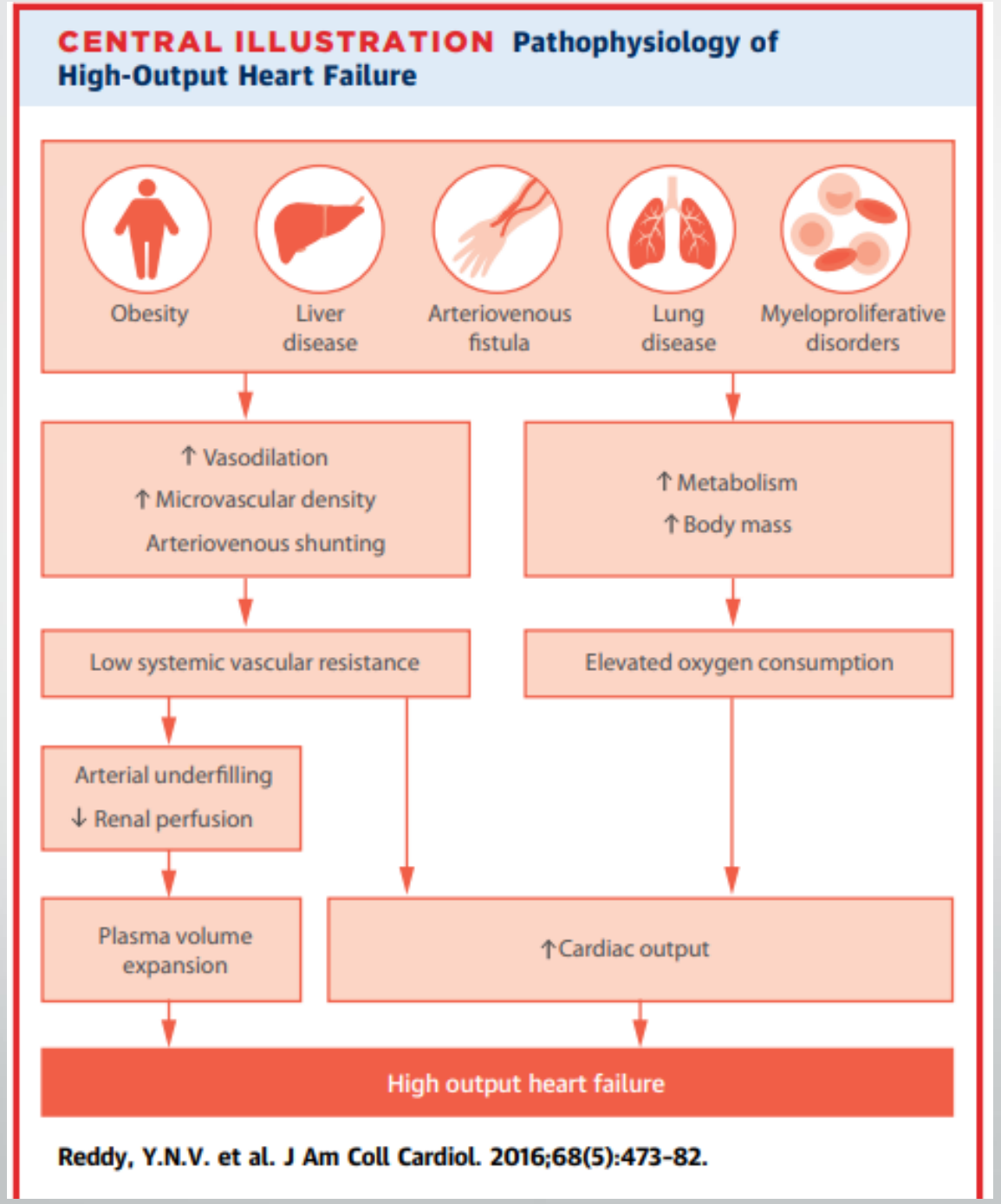
-Lung disease (%) and Myeloproliferative dis

(Severe anemia,thyrotoxicosis and reversible causes was excluded)

- *Patients with high-output HF displayed **increased 3-year mortality** compared with controls*

(38% vs. 0%; hazard ratio [HR]: 3.4; 95% confidence interval [CI]: 1.6 to 7.6; p =0.002)

Excessive vasodilation was associated with the poorest prognosis


CENTRAL ILLUSTRATION Pathophysiology of High-Output Heart Failure
Obesity
Liver disease
Arteriovenous fistula
Lung disease
Myeloproliferative disorders
↑ Vasodilation
↑ Microvascular density
Arteriovenous shunting
↑ Metabolism
↑ Body mass
Low systemic vascular resistance
Elevated oxygen consumption
Arterial underfilling
↓ Renal perfusion
Plasma volume expansion
↑Cardiac output
High output heart failure
Reddy, Y.N.V. et al. J Am Coll Cardiol. 2016;68(5):473-82.

Physical exam

- Bounding (water hammer) pulses
- Wide pulse pressure
- Pistol-shot sounds on femoral artery
- Edema and congestion

NONINVASIVE IDENTIFICATION OF HIGH-OUTPUT HF

Cardiac index : (by echocardiography) : 3.54 l/min/m2 or greater (CO >8L)

(62% sensitivity and 96% specificity)

RVSP (PH) : *42 mm Hg*

92% sensitivity; 100% specificity

Increased filling pressure (E/e'): 16± 6 (PCWP)

Rised NT-pro BNP

Reduced PVR (Mean BP- mean RA pr/ CO) x 80 : 400-800 dyne/s.cm5

- *Because of* ***elevated E/e' ratio and normal EF****, many of these patients might have been* ***erroneously*** *diagnosed as having* **HF with preserved EF (HFpEF)** *if there had been no direct assessment of cardiac output.*

- *This observation emphasizes the importance of considering high output HF in the differential diagnosis.*

- *the presence of an increased echocardiographic **Doppler-derived cardiac index >3.5 l/min/m2 (CO > 8 L)** should prompt clinicians to consider further evaluation to clarify the diagnosis.*

پایان