



Centre hospitalier
universitaire vaudois

Lausanne
University Hospital

Prise en charge de la dyspnée en ambulatoire Point de vue du cardiologue Jeudi d'Unisanté

Barbara Pitta Gros

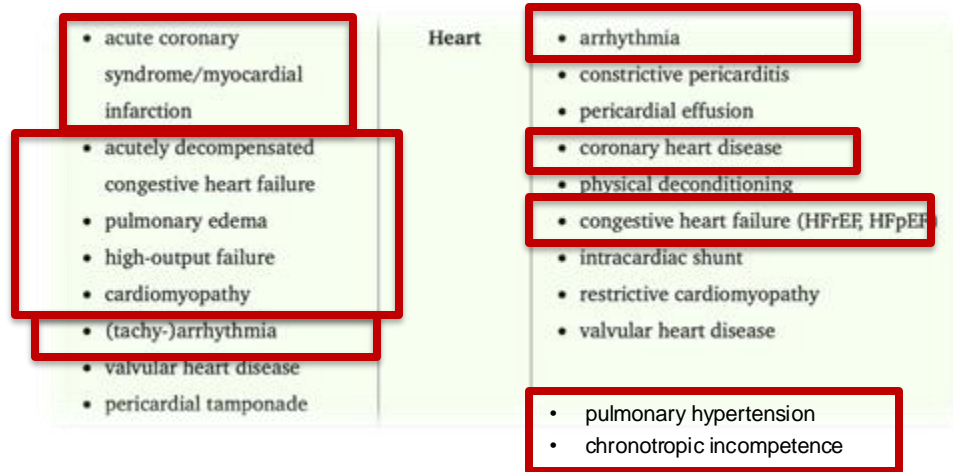
**Cheffe de Clinique Adjointe en Insuffisance et Greffe Cardiaque
Service de Cardiologie du CHUV**

Declaration of interests: No relevant material or financial interests that relate to the subject of this presentation

Dyspnea

Umbrella term for a number of distinguishable subjective experiences including effortful respiration, a feeling of choking or asphyxiation, and hunger for air.

- Affecting as many as **25%** of patients seen in the ambulatory setting
- Up to **50%** of patients admitted to acute, tertiary care hospital



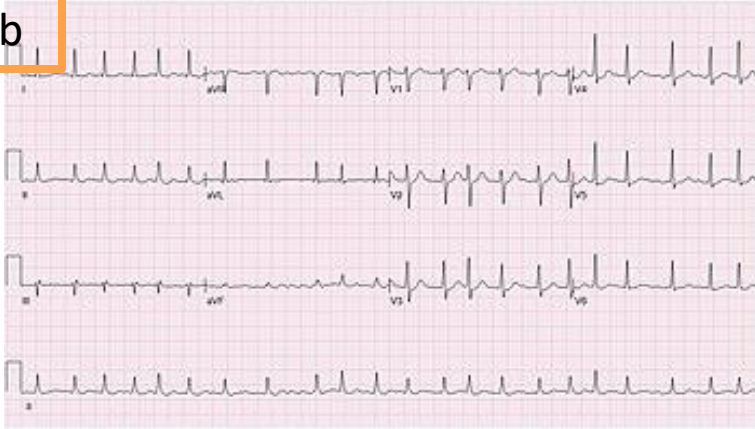
Workup

- Laboratory tests
 - Anemia? Thyroid function? D-dimers? **NT-proBNP?** **Troponins?**
- **ECG**
 - Signs of ischemia? Bradyarrhythmias? Tachyarrhythmias? **FA?** Ectopic beats? Signs of amyloidosis?
- Xray
 - Lung parenchyma? Cardiomegaly?
- **Echocardiography**

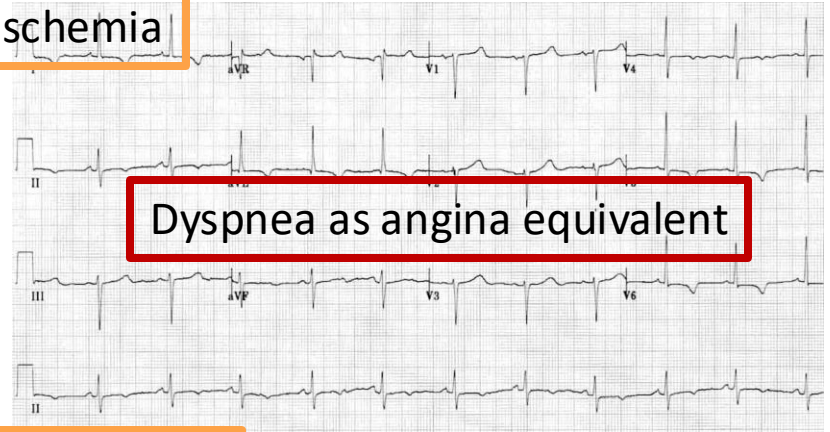
- **6-minute walking test**
- Cardiac MRI/PET-CT/coronary angiography
- **CPET**

ECG

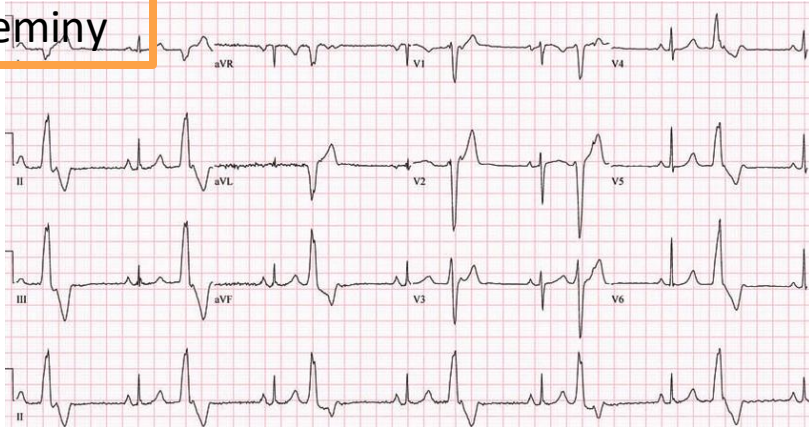
AFib



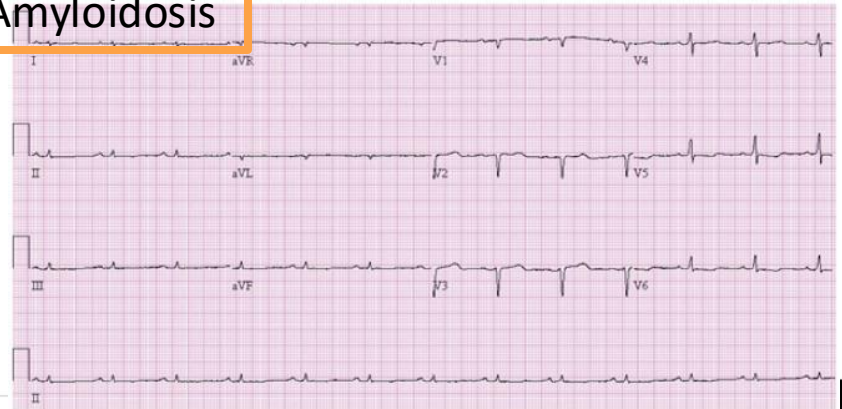
Ischemia



Bigeminy



Amyloidosis

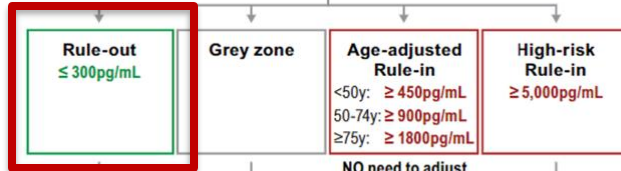


NT-proBNP

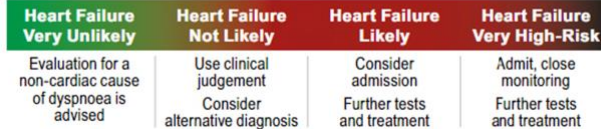
Suspicion of Heart Failure in the **Emergency Department**
(History, physical exam, CXR, ECG)



“wet” NT-proBNP



NO need to adjust for sex, BMI, kidney function, AF, LVEF



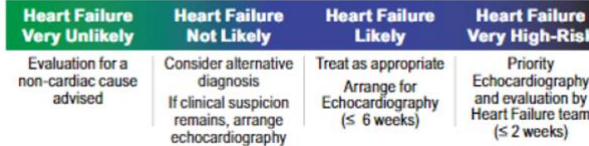
Suspected *de novo* Heart Failure as an **Outpatient**
(History, physical exam, ECG)



NT-proBNP



Consider obesity, race-based variations, and treatment (diuretics, RASi, MRA)



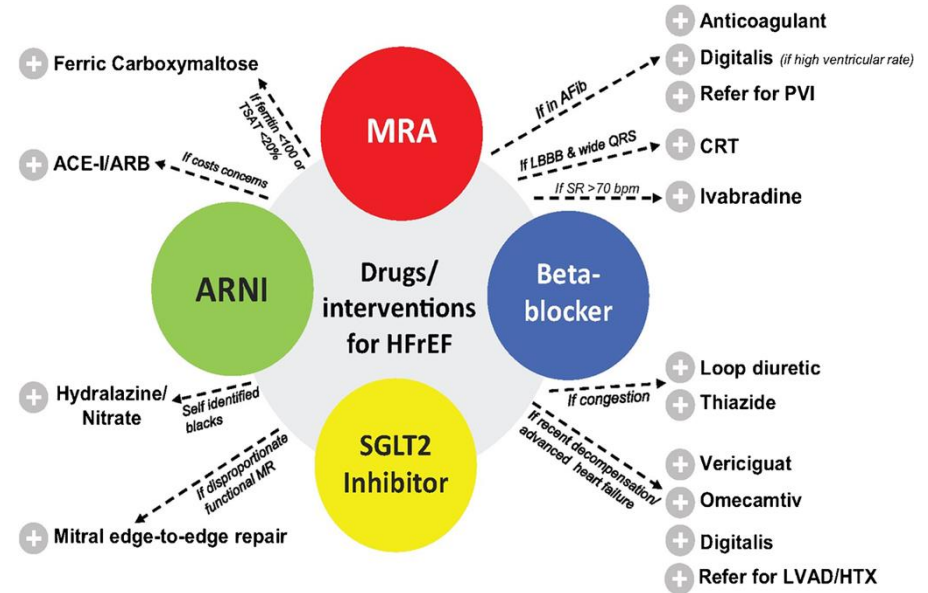
Sensible mais peu spécifique !!

Table 7 Causes of elevated concentrations of natriuretic peptides³⁶⁻⁸⁸

Cardiac	<ul style="list-style-type: none"> Heart failure ACS Pulmonary embolism Myocarditis Left ventricular hypertrophy Hypertrophic or restrictive cardiomyopathy Valvular heart disease Congenital heart disease Atrial and ventricular tachyarrhythmias Heart contusion Cardioversion, ICD shock Surgical procedures involving the heart Pulmonary hypertension
Non-cardiac	<ul style="list-style-type: none"> Advanced age Ischaemic stroke Subarachnoid haemorrhage Renal dysfunction Liver dysfunction (mainly liver cirrhosis with ascites) Paraneoplastic syndrome COPD Severe infections (including pneumonia and sepsis) Severe burns Anaemia Severe metabolic and hormone abnormalities (e.g. thyrotoxicosis, diabetic ketosis)

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Heart Failure

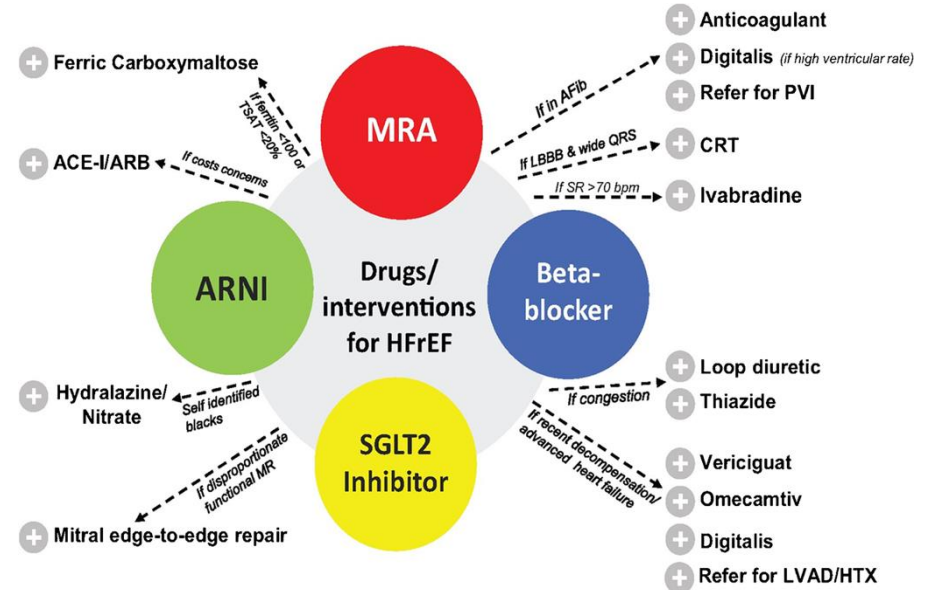


Heart Failure

Table 8 Evidence-based doses of disease-modifying drugs in key randomized trials in patients with heart failure with reduced ejection fraction

	Starting dose	Target dose
ACE-I		
Captopril ^a	6.25 mg t.i.d.	50 mg t.i.d.
Enalapril	2.5 mg b.i.d.	10–20 mg b.i.d.
Lisinopril ^b	2.5–5 mg o.d.	20–35 mg o.d.
Ramipril	2.5 mg b.i.d.	5 mg b.i.d.
Trandolapril ^a	0.5 mg o.d.	4 mg o.d.
ARNI		
Sacubitril/valsartan	49/51 mg b.i.d. ^c	97/103 mg b.i.d.
Beta-blockers		
Bisoprolol	1.25 mg o.d.	10 mg o.d.
Carvedilol	3.125 mg b.i.d.	25 mg b.i.d. ^e
Metoprolol succinate (CR/XL)	12.5–25 mg o.d.	200 mg o.d.
Nebivolol ^d	1.25 mg o.d.	10 mg o.d.
MRA		
Eplerenone	25 mg o.d.	50 mg o.d.
Spirolactone	25 mg o.d. ^f	50 mg o.d.
SGLT2 inhibitor		
Dapagliflozin	10 mg o.d.	10 mg o.d.
Empagliflozin	10 mg o.d.	10 mg o.d.
Other agents		
Candesartan	4 mg o.d.	32 mg o.d.
Losartan	50 mg o.d.	150 mg o.d.
Valsartan	40 mg b.i.d.	160 mg b.i.d.
Ivabradine	5 mg b.i.d.	7.5 mg b.i.d.
Vericiguat	2.5 mg o.d.	10 mg o.d.
Digoxin	62.5 µg o.d.	250 µg o.d.
Hydralazine/Isosorbide dinitrate	37.5 mg t.i.d./20 mg t.i.d.	75 mg t.i.d./40 mg t.i.d.

Washout 36h
IEC to Entresto

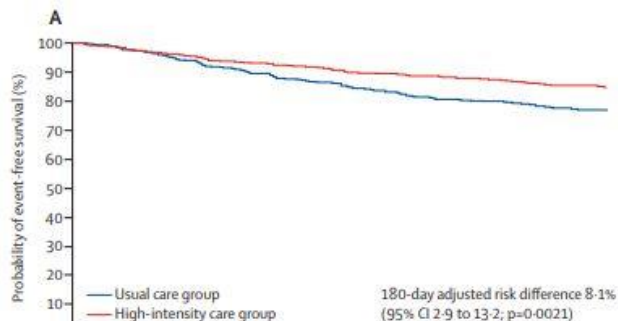


Heart Failure

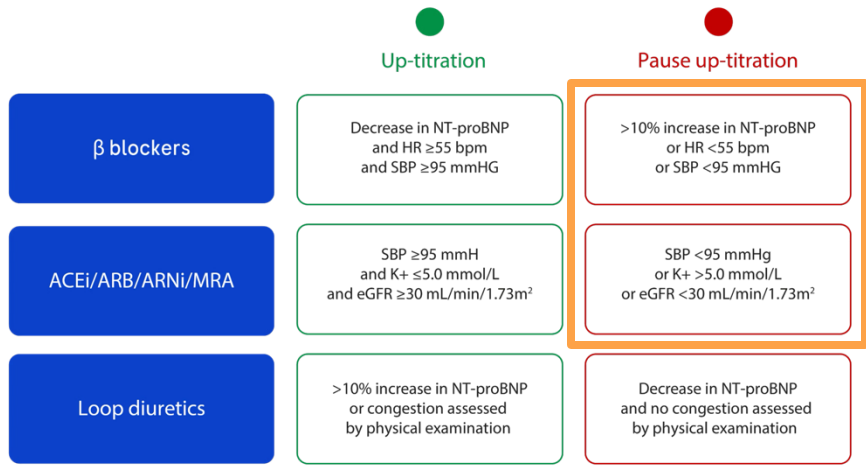


Safety, tolerability, and efficacy of up-titration of guideline-directed medical therapies for acute heart failure (STRONG-HF): a multinational, open-label, randomised, trial

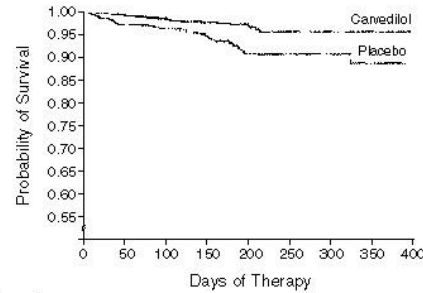
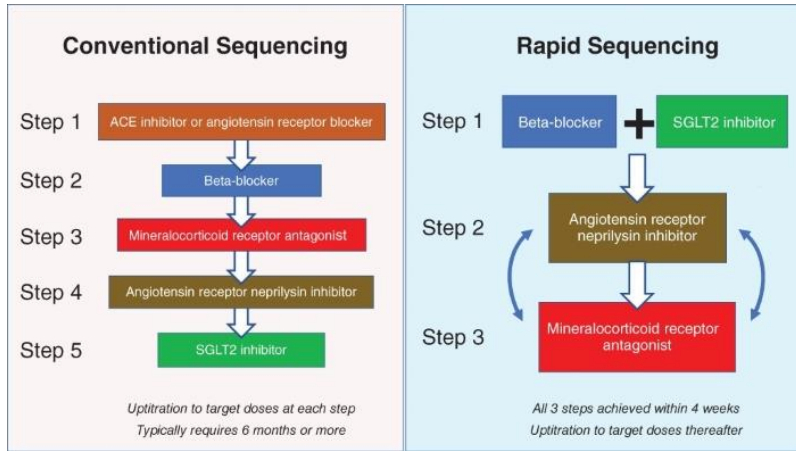
Alexandre Mebazaa, Beth Davison, Ovidiu Chioncel, Alain Cohen-Solal, Rafael Diaz, Gerasimos Filippatos, Marco Metra, Piotr Ponikowski, Karen Sliwa, Adriaan A Voors, Christopher Edwards, Maria Novosadova, Koji Takagi, Albertino Damasceno, Hadiza Saidu, Etienne Gayat, Peter S Pang, Jelena Celutkiene, Gad Cotter



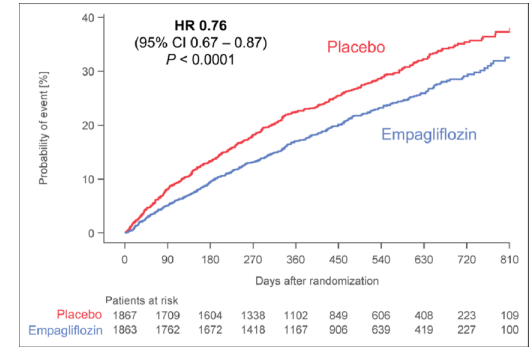
Number at risk		0	15	30	45	60	75	90	105	120	135	150	165	180
Usual care group	502	494	474	454	439	423	410	394	381	373	366	353	329	
High-intensity care group	506	497	484	466	449	440	430	419	415	408	397	384	345	



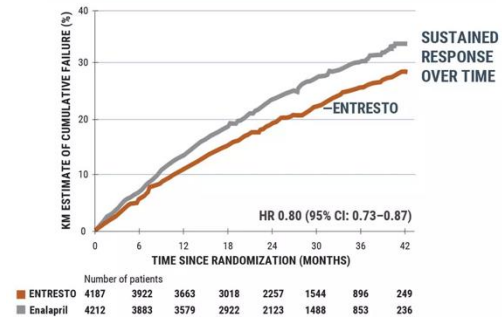
Heart Failure



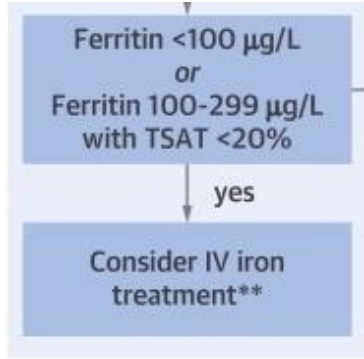
No. at Risk	0	50	100	150	200	250	300	350	400
Placebo	398	353	329	305	163	71	55	43	3
Carvedilol	696	637	581	546	314	131	106	83	11



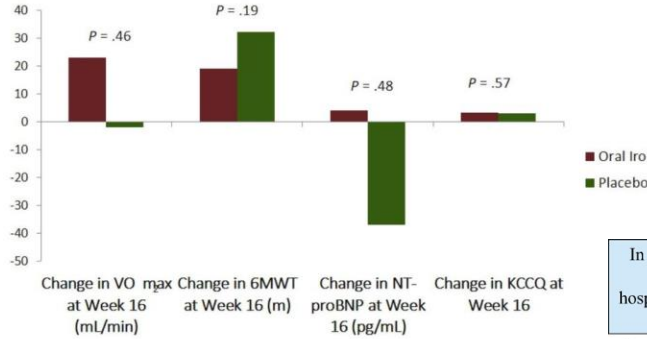
PARADIGM-HF: TIME TO FIRST OCCURRENCE OF CV DEATH OR HF HOSPITALIZATION*



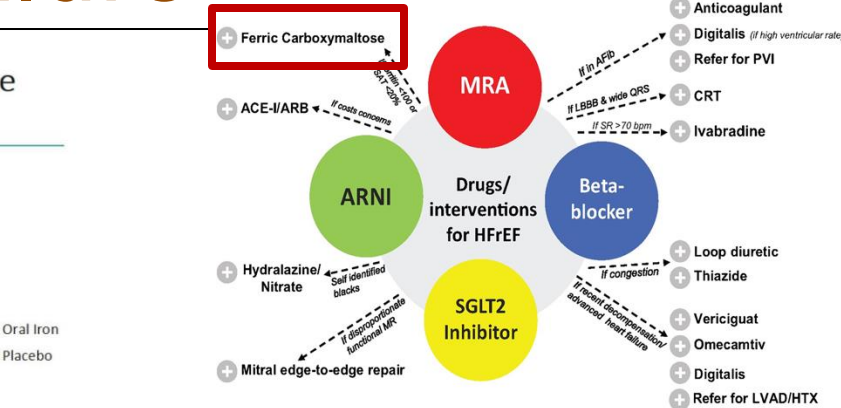
Heart Failure



High-Dose Oral Iron in HFrEF: Results of the IRONOUT HF Trial



Lewis GD, et al. JAMA. 2017;317:1958-1966.



In a meta-analysis of 7 trials, administration of IV iron to patients with heart failure and iron deficiency reduces the risk of the composite outcome of first heart failure hospitalisation or cardiovascular mortality, but this outcome is driven predominantly by an effect on heart failure hospitalisations.

Study or Subgroup	IV Iron Events	IV Iron Total	Control Events	Control Total	Weight	Odds Ratio M-H, Fixed, 95% CI	Year
Tobill 2007	0	20	5	20	2.7%	0.07 [0.00, 1.34]	2007
Okonko 2008	2	24	1	11	0.6%	0.01 [0.07, 11.23]	2008
Anker 2009	10	304	10	155	6.3%	0.43 [0.20, 1.21]	2009
Ponikowski 2014	18	150	22	151	13.9%	0.51 [0.27, 0.95]	2014
van Veldhuisen 2017	11	88	10	86	4.4%	1.00 [0.44, 2.71]	2017
Yee 2018	5	24	5	25	1.0%	1.05 [0.26, 4.22]	2018
Ponikowski 2020	181	558	209	550	70.2%	0.78 [0.61, 1.00]	2020
Total (95% CI)		1168		998	100.0%	0.73 [0.59, 0.90]	
Total events	227		272				
Heterogeneity: Chi ² = 5.80, df = 6 (P = 0.45); I ² = 0%							
Test for overall effect: Z = 2.95 (P = 0.003)							



Heart failure & iron deficiency
n = 2,166

Intravenous iron
n = 1,168

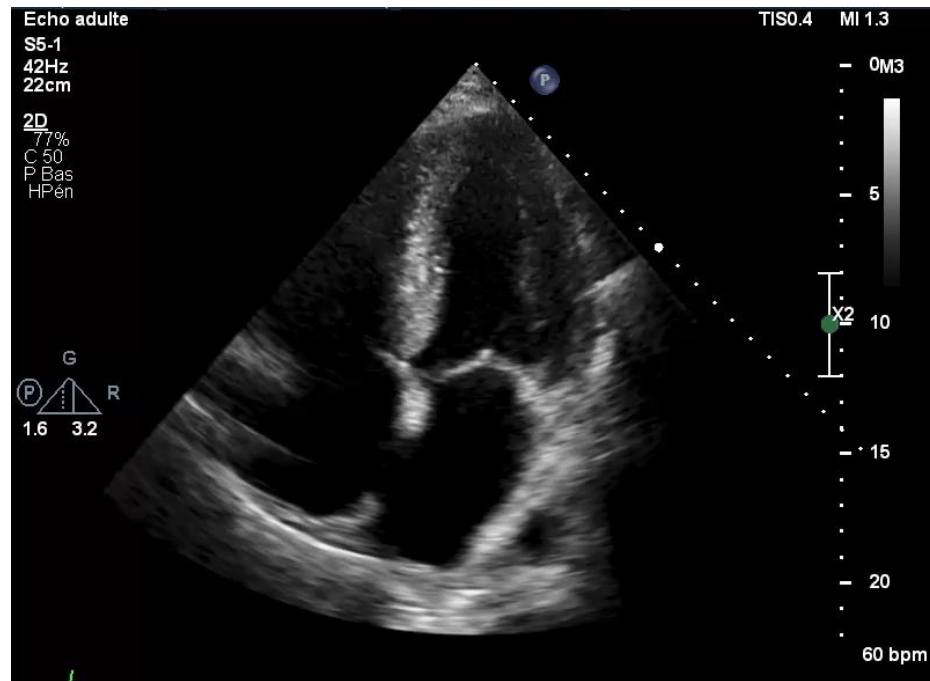
Reduction in risk of hospitalisation for heart failure in subsequent 6-12 months by ~30%

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Heart Failure

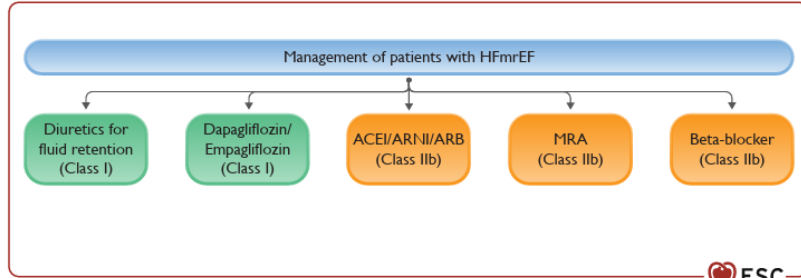
	Clinical Variable	Values	Points
H ₂	Heavy	Body mass index > 30 kg/m ²	2
	Hypertensive	2 or more antihypertensive medicines	1
F	Atrial Fibrillation	Paroxysmal or Persistent	3
P	Pulmonary Hypertension	Doppler Echocardiographic estimated Pulmonary Artery Systolic Pressure > 35 mmHg	1
E	Elder	Age > 60 years	1
F	Filling Pressure	Doppler Echocardiographic E/e' > 9	1
H₂FPEF score			Sum (0-9)
Total Points			0 1 2 3 4 5 6 7 8 9
Probability of HFpEF			0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 0.95



	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/m ² or LVMI ≥ 149/122 g/m ² (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/m ² or LVMI > 115/95 g/m ² (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		

Figure 3 Step 2 (E): Echocardiographic and natriuretic peptide heart failure with preserved ejection fraction workup and scoring system (diagnostic workup).

Heart Failure



SGLT2 inhibitor

Dapagliflozin	10 mg o.d.	10 mg o.d.
Empagliflozin	10 mg o.d.	10 mg o.d.

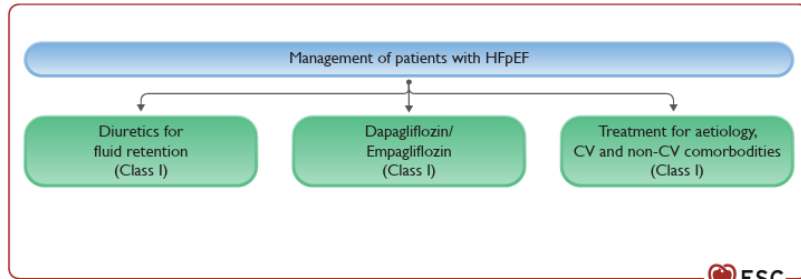


Figure 2 Management of patients with heart failure with preserved ejection fraction. CV, cardiovascular; HFpEF, heart failure with preserved ejection fraction.

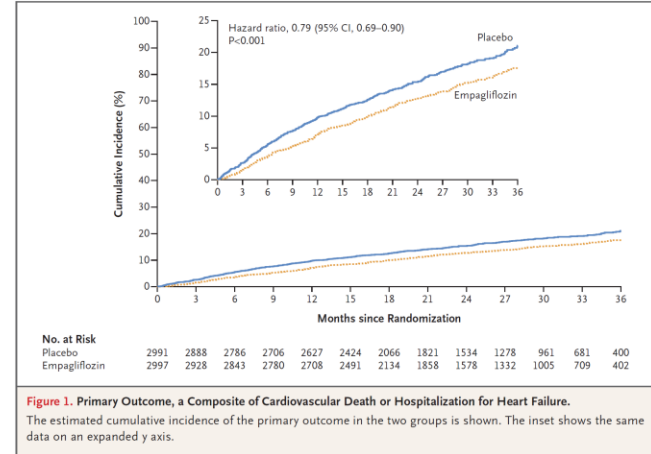
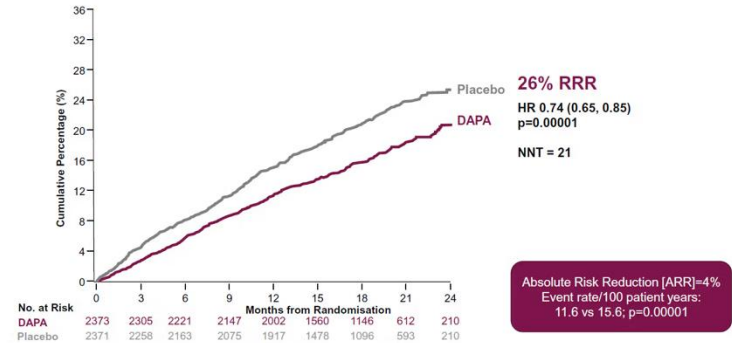


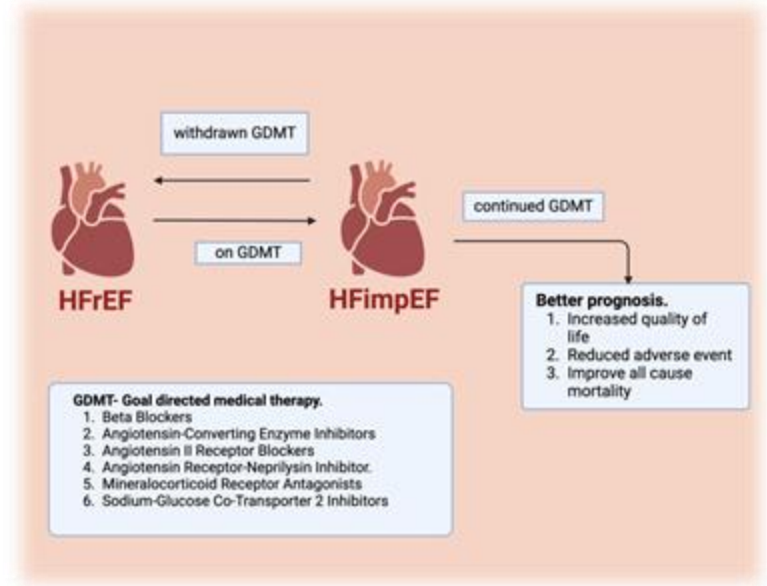
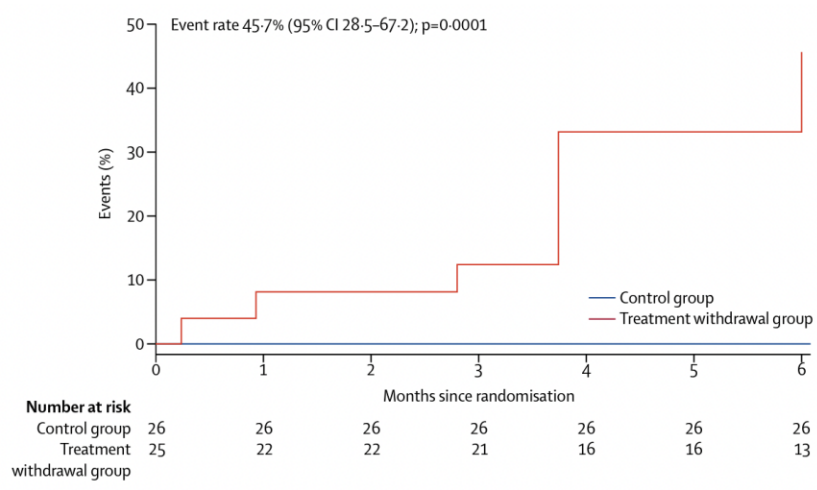
Figure 1. Primary Outcome, a Composite of Cardiovascular Death or Hospitalization for Heart Failure. The estimated cumulative incidence of the primary outcome in the two groups is shown. The inset shows the same data on an expanded y-axis.



DAPA = dapagliflozin; HF = heart failure; HF = hospitalisation for heart failure; HR = hazard ratio; NNT = number needed to treat.

Can we stop the treatment?

TRED-HF



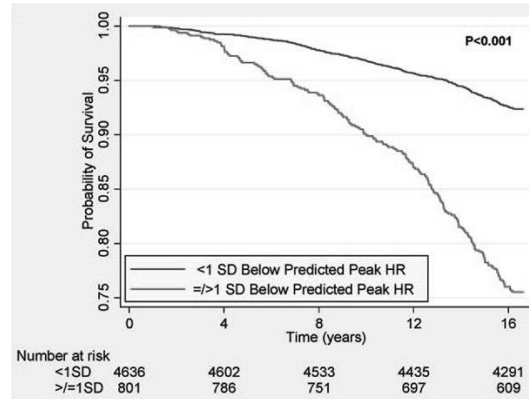
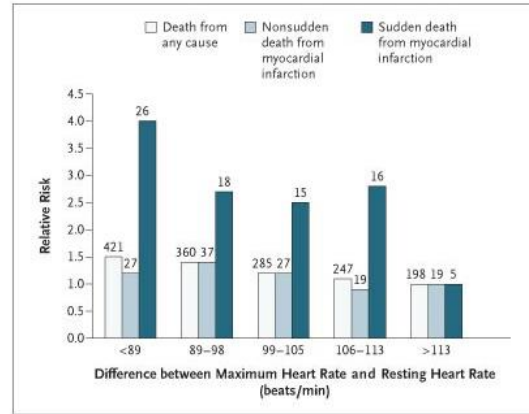
Chronotropic Incompetence

- Dyspnea felt as exercise intolerance
- Independent predictor of major adverse cardiovascular events and overall mortality
- Failure to obtain $\geq 80\%$ of the HR reserve, obtained during a graded exercise test, as the primary criteria for CI.

6-minute walking test for screening
Diagnosis with Cardiac Stress Test/CPET

How to approach it:

Exercise training (especially endurance)
+- Rate adaptative Pacing



Pulmonary Hypertension

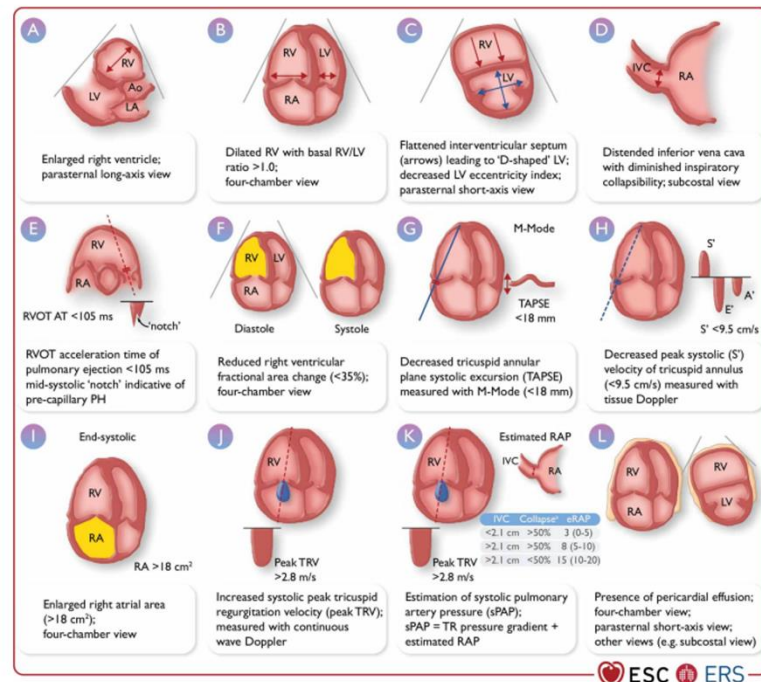
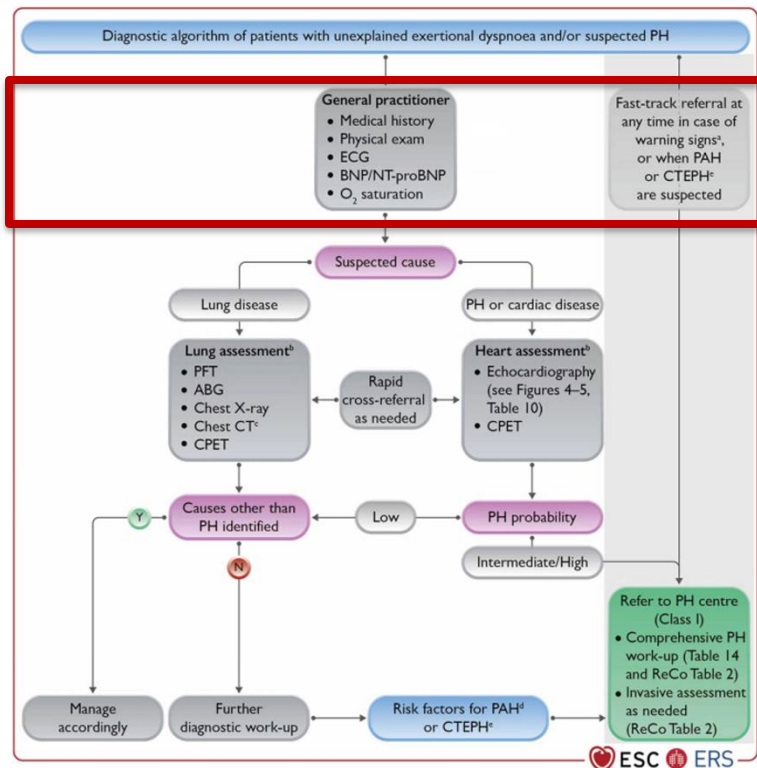


FIGURE 4 Transthoracic echocardiographic parameters in the assessment of pulmonary hypertension. Ao, aorta; IVC, inferior vena cava; LA, left atrium; LV, left ventricle; PH, pulmonary hypertension; RA, right atrium; RAP, right atrial pressure; RV, right ventricle; RVOT AT, right ventricular outflow tract acceleration time; sPAP, systolic pulmonary artery pressure; sPAP = TR pressure gradient + estimated RAP; TRV, tricuspid regurgitation velocity. ^aRefers to collapse on inspiration.

Pulmonary Hypertension



	FE estimée	% Global LStrain	%
> 52%			
> 54%			
norm.			
< -50			
80-120			
8-20			
>10			
>7			
< -14			
< -30			
L normales			
M			
F			
< -0.9			
< -42			
< -36			
< -28			
< -24			
< -15			
< -11			

WALL MOTION SCORE INDEX

Antéro-septal Antérieur

Inféro-septal Latéral

Inférieur Inféro-lat

Normalo/Hyper: 0 Hypokinésie: 1 Akénoie: 2
Dyskinésie: 3 Atrévoisie: 4

	TAPSE	16 mm	>17
s' tricuspidie	9.3 cm/s	>9.5	
FAC	%	>35	
Strain	%	>23	

OREILLETES DROITE

	Volume	82 ml	38.3 ml/m ²	H<39ml ²
Surface	22.3 cm ²	<18		

Voies caves supérieures (diamètre en mm)

	Expir.	Inspir.	Sniff

INDICATION: Patiente de 76 ans, hospitalisée pour suspicion NSTEMI. Coronarographie sans lésion coronaire. MINOCA? Evaluation fonction cardiaque.

Cet examen d'échogénéicité médiocre démontre les éléments suivants

VG non dilaté, non hypertrophié, de fonction systolique préservée (FE calculée à 57%) sans anomalie de la cinétique segmentaire détectable. Aplatissement systolo-diastolique du septum interventriculaire témoignant une surcharge en pression au niveau des cavités droites

Etat de la fonction diastolique non déterminable

OG d'aspect normal. OD dilatée avec un volume de 38 cc/m²

Valve aortique tricuspidie, discrètement sclérosée, sans sténose significative ni insuffisance

Valve mitrale discrètement sclérosée avec insuffisance jugée légère

VD dilaté avec une dysfonction globale jugée modérée

Valve tricuspide d'aspect normal, avec minime insuffisance

VCI non dilatée avec bonne fluctuation respiratoire

Probabilité élevée d'hypertension pulmonaire (gradient d'IT >46 mmHg). Présence de signes indirects d'HTP

Absence d'épanchement péricardique

Racine de l'aorte de taille normale

Septum interauriculaire d'aspect normal, sans shunt détectable par Doppler couleur

Valve pulmonaire d'aspect normal avec minime insuffisance

VALVE AORTIQUE		Sténose		Insuffisance grade 0		VALVE MITRALE		Insuffisance grade 1	
Vmax / VTI aorte		AVA (Vmax)	cm ²	Mécanisme		Grad moy	mmHg	Mécanisme	
Vmax / VTIivot	12	AVA (VTI)	cm ²	V contacts	mm	Planimétrie	cm ²	V contracta	mm
Diamètre LVOT	2.4 cm	Planimétrie	cm ²			Surf. PHT	cm ²	ERO	cm ²
Surface LVOT	4.52 cm ²	Grad max	4 mmHg	ERO	cm ²	Vol R	ml	Vol R	ml
Stroke volume	54 ml	Grad moy:	2 mmHg	Vol R	ml				
Stroke vol. index	25 ml/m ²	IP (DVI)		PHT IA	ms	D. anneau	mm	H. tenting	mm
		Zvz:	6.0	Vtd Croisse	cm/s	Anneau/FA	mm	Altre tenting	cm ²
		ELI:		Flux ao abdo					

ARTÈRE ET VALVE PULMONAIRE		Insuffisance grade 1		VALVE TRICUSPIDE	
Diamètre A Pulm	mm	V contracta	mm	Grad max flux d'IT	84 mmHg
T. accélération	80 ms	PISA @ 28cm/s	mm	Grad moyen	mmHg
Notch flux pulm.	oui	ERO	cm ²	Diamètre Anneau	mm
		Flux Vv hépatiques			

PULMONARY HYPERTENSION

Prevalence **1%** Global population

Pulmonary congestion in post-capillary PH

Right heart failure

Pulmonary vascular disease / obstruction in pre-capillary PH

CLINICAL CLASSIFICATION

Pulmonary arterial hypertension (PAH)

- Idiopathic/heritable
- Associated conditions

PH associated with left heart disease

- LpCPH
- CpcPH

PH associated with lung disease

- Non-severe PH
- Severe PH

PH associated with pulmonary artery obstructions

- CTEPH
- Other pulmonary obstructions

PH with unclear and/or multifactorial mechanisms

- Haematological disorders
- Systemic disorders

PREVALENCE

Rare

Very common

Common

Rare

Rare

THERAPEUTIC STRATEGIES

Medical therapy

- PAH drugs
- CCB in responders

Lung transplantation

IpcPH:

- Treatment of LHD*

CpcPH:

- Treatment of LHD*
- Potentially PAH drugs (trials)

PH-lung disease:

- Optimized care of underlying lung disease

Severe PH:

- Potentially: PAH drugs (trials)

Surgical therapy:

- PEA
- BPA

Medical therapy:

- PH drugs

Optimized treatment of underlying disease

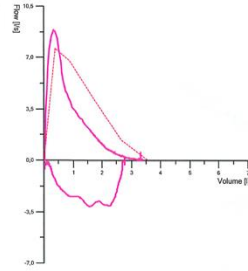
- Potentially: PAH drugs (trials)

Figure 1 Central illustration. BPA, balloon pulmonary angioplasty; CCB, calcium channel blocker; CTEPH, chronic thrombo-embolic pulmonary hypertension; CpcPH, combined post- and pre-capillary pulmonary hypertension; LpCPH, isolated post-capillary pulmonary hypertension; LHD, left heart disease; PAH, pulmonary arterial hypertension; PEA, pulmonary endarterectomy; PH, pulmonary hypertension. *Treatment of heart failure according to the ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure.²⁷ Treatment of left-sided valvular heart disease according to the 2021 ESC/EACTS Guidelines for the management of valvular heart disease.²⁸

CPET

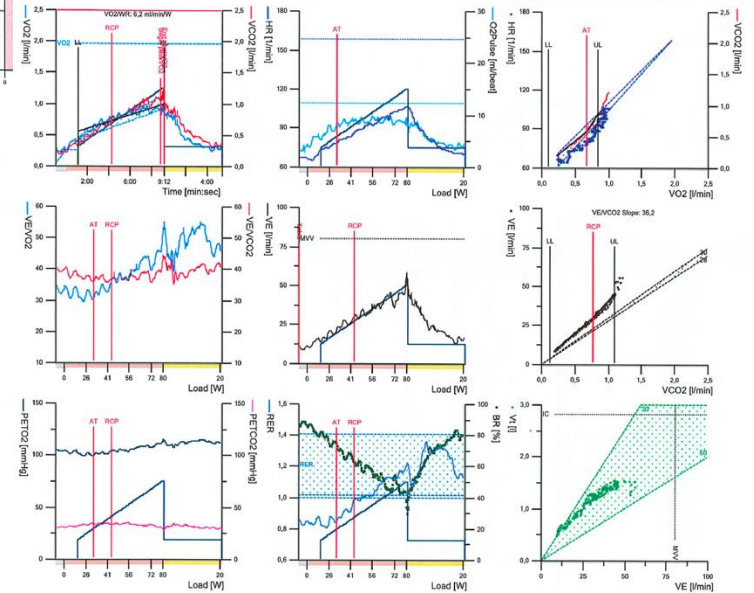


ERGOSPIROMETRIE

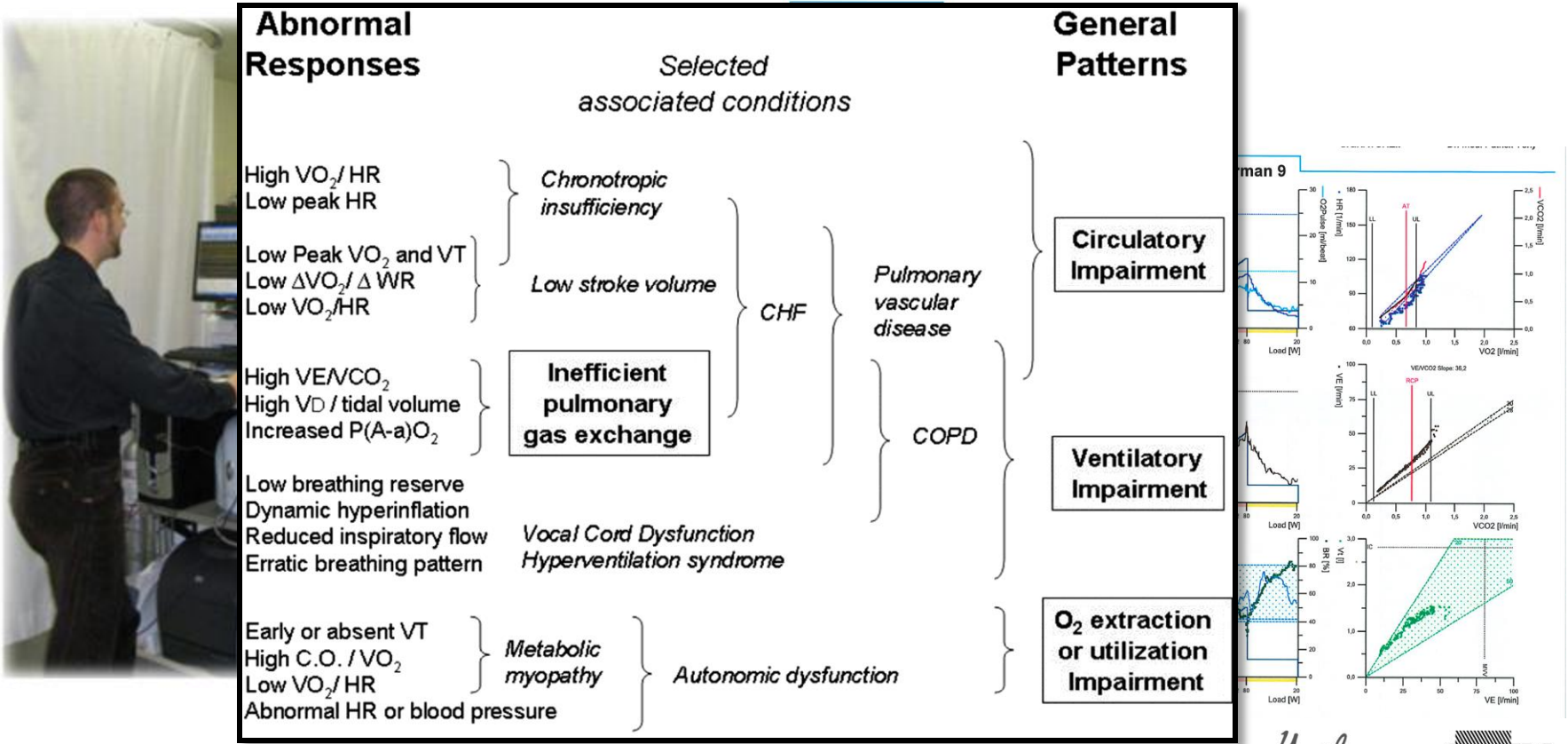


	Unit	Pred.	Pre	%Pred.
VC	l	3,68	3,40	92%
FEV1	l	2,81	2,29	82%
FEV1/FVC	%	76	68	89%
FEV1/VC	%	76	68	89%
PEF	l/s	7,61	8,84	116%
MEF75	l/s	6,74	4,33	64%
MEF50	l/s	3,98	1,80	45%
MEF25	l/s	1,35	0,38	28%

Wasserman 9



CPET



Take Home Messages

- Bilan complet (Anamnèse, status, ECG, NTproBNP) +/- ETT +/- examens dirigés (coronaires?)
- Dans l'HF_rEF: TITRER le traitement (4 piliers), le plus tôt le mieux, ne pas arrêter en cas d'amélioration de la FEVG. Substitution Fer IV
- Dans la HF_pEF: fréquente chez patients en FA, traitement iSGLT2, penser à dépister l'amyloidose
- Dépister des diagnostics moins fréquents: bigeminisme ventriculaire, insuffisance chronotrope, hypertension pulmonaire...
- Si après bilan initial le diagnostic n'est toujours pas clair: adresser le patient pour ergospirométrie