

I'm Going to Pump – You Up: The A to Z Continuum of Heart Failure Management

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2026 Cardiology Speaker
Skin, Bones, Hearts & Private Parts



Disclosures

- Investigator-Driven Research Grant, Abbott Labs, 2023-2026
- VAD Coordinator Professional Development Grant, ICCAC, 2024-2026

I will occasionally discuss patient scenarios – any pictures directly of patients are displayed following consent and will be noted

Objectives

- Heart Failure and Why it Matters
- Different Types of Heart Failure
- Heart Failure Symptomatology
- Evaluation Process for “HF” Symptoms
- HF Guideline Driven Medical Therapy – The Ins and Outs
- The Importance of Heart Failure Trajectory – The Pyramid Approach
- 90-Day Echocardiogram Re-evaluation
- Next Steps – DEVICES
 - Neuromodulation
 - Cardiomechs
- Heart Pumps, Transplants, Palliative Medicine – The T in the Road Meets
- Final PEARLS on Important Heart Failure Need to Knows

Heart Failure and Why it Matters



PREVALENT

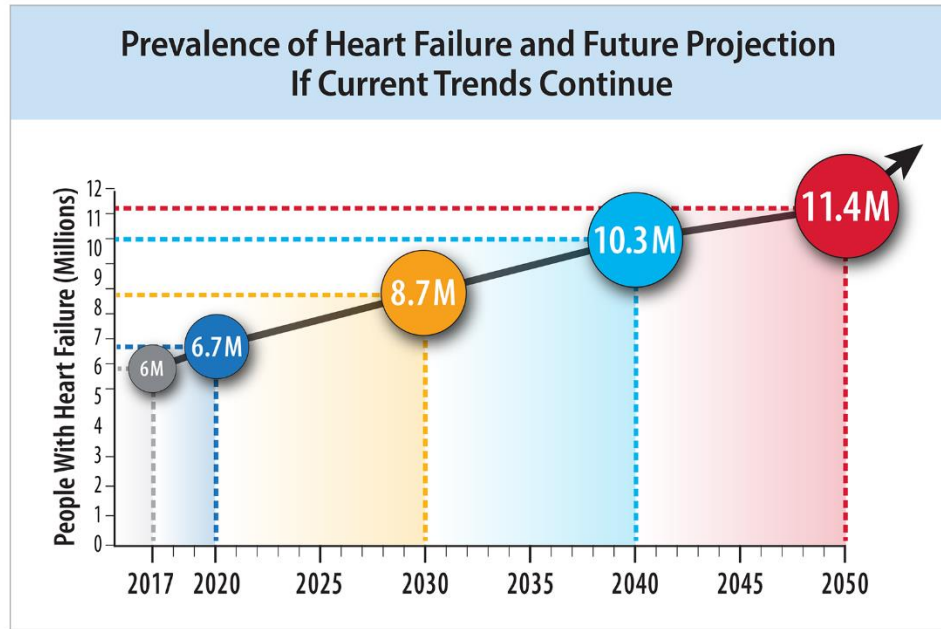


EXPENSIVE



NO CURE

Why Do We Care So Much?



HF = heart failure.

Data from Joynt Maddox KE, Elkind MSV, Aparicio HJ, Commodore-Mensah Y, de Ferranti SD, Dowd WN, et al. Forecasting the burden of cardiovascular disease and stroke in the United States through 2050—prevalence of risk factors and disease: A Presidential Advisory from the American Heart Association. *Circulation*. 2024 Jun 4.; Van Nuys KE, Xie Z, Tysinger B, Hlatky MA, Goldman DP. Innovation in heart failure treatment: life expectancy, disability, and health disparities. *JACC Heart Fail*. 2018; 6:401–9.; and Heidenreich PA, Albert NM, Allen LA, Bluemke DA, Butler J, Fonarow GC, et al. Forecasting the impact of heart failure in the United States: A policy statement from the American Heart Association. *Circ Heart Fail*. 2013; 6:606–19.

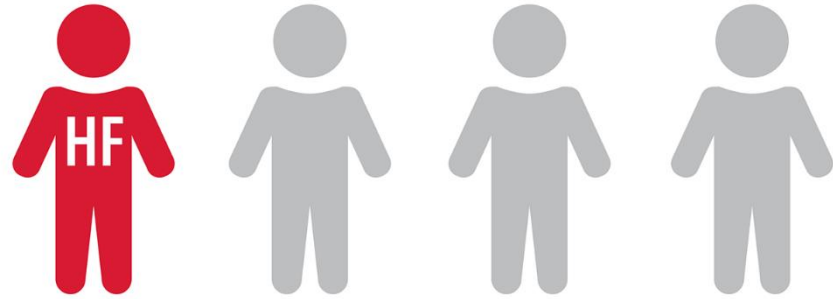
960,000
NEW CASES



EVERY
YEAR!



Lifetime Risk of Heart Failure



The lifetime risk of heart failure is 1 in 4 people.

HF=heart failure.

Data from Vasan RS, Enserro DM, Beiser AS, Xanthakis V. Lifetime risk of heart failure among participants in the Framingham Study. *J Am Coll Cardiol.* 2022; 79:250-63.

JCF Bozkurt et al DOI:10.1016/j.cardfail.2024.07.001

Over 11.4 million Americans are estimated to have HF by 2050, resulting in

\$22 billion

indirect costs attributed solely to HF

\$121 billion

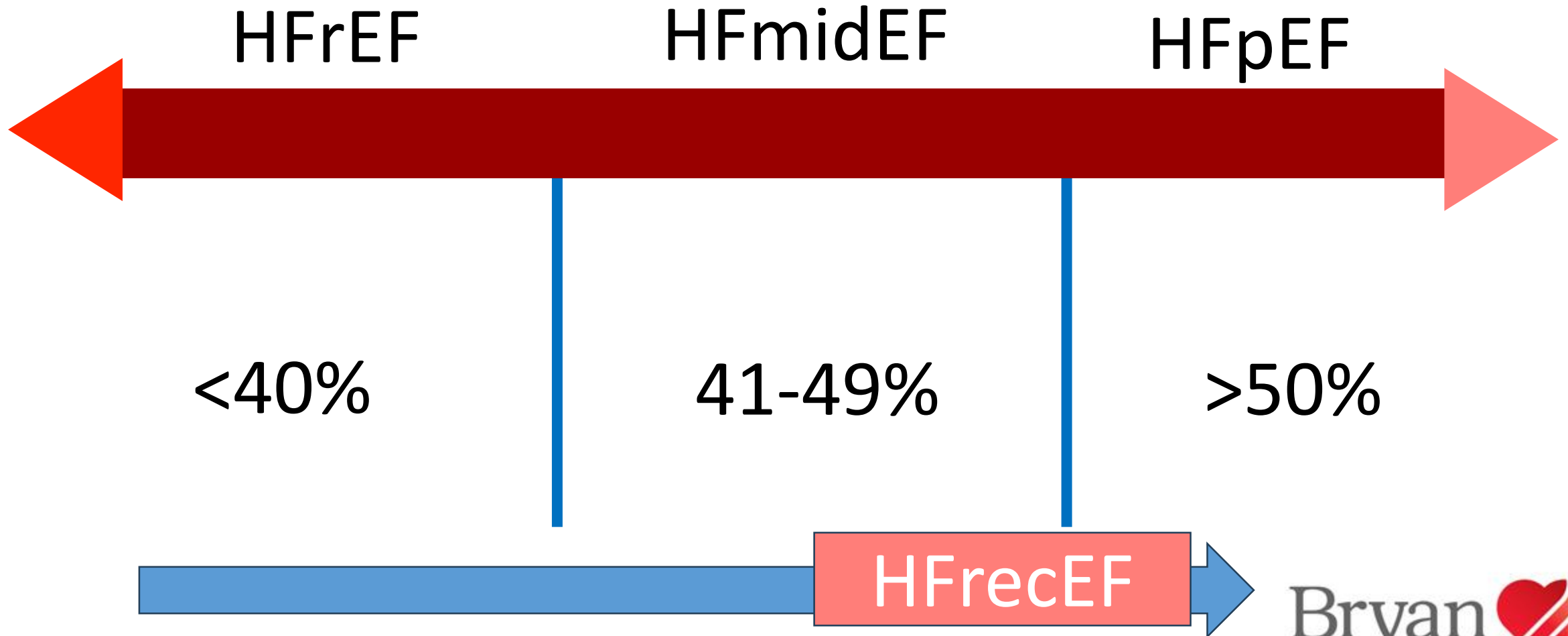
in direct medical costs attributed solely to HF

\$142 billion

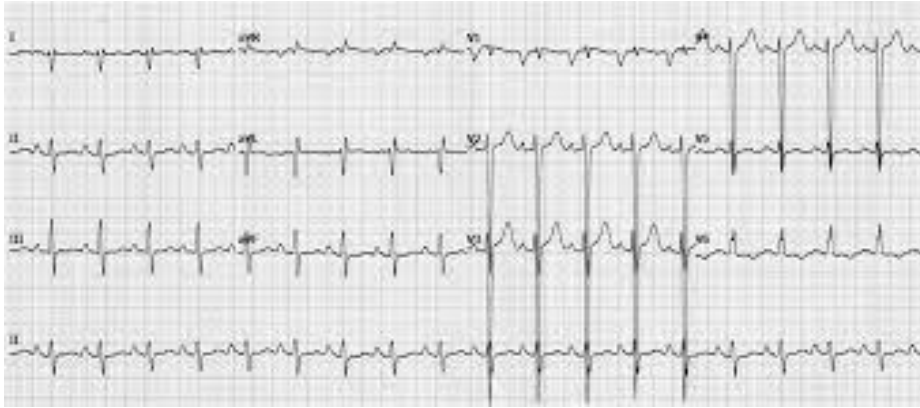
total costs attributed solely to HF

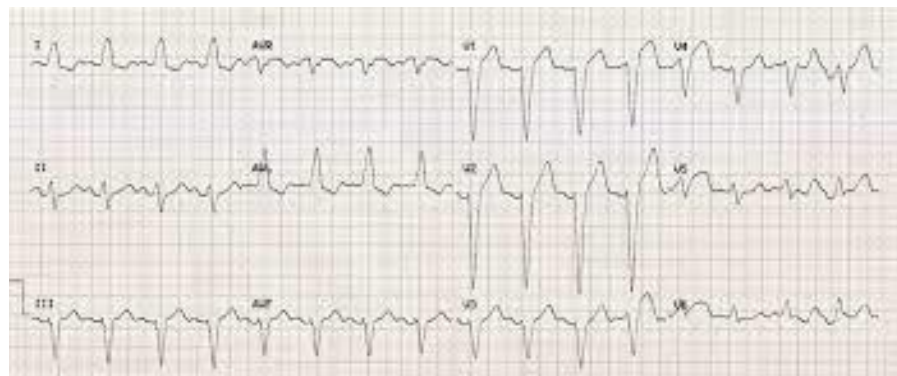


Different Types of Heart Failure

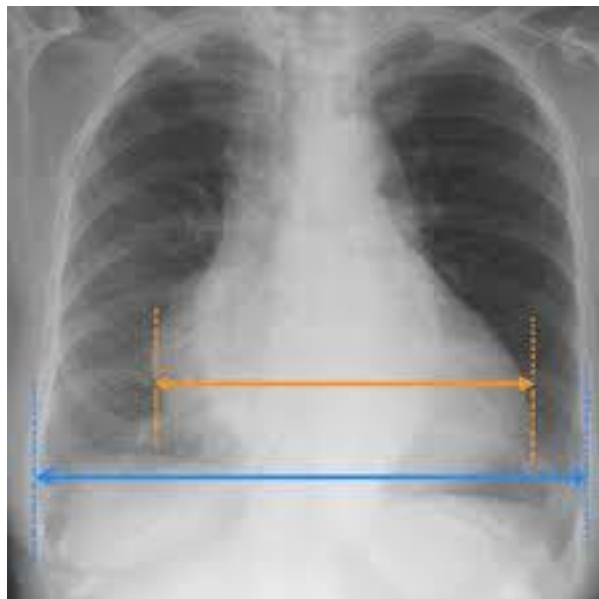


The Initial Diagnosis

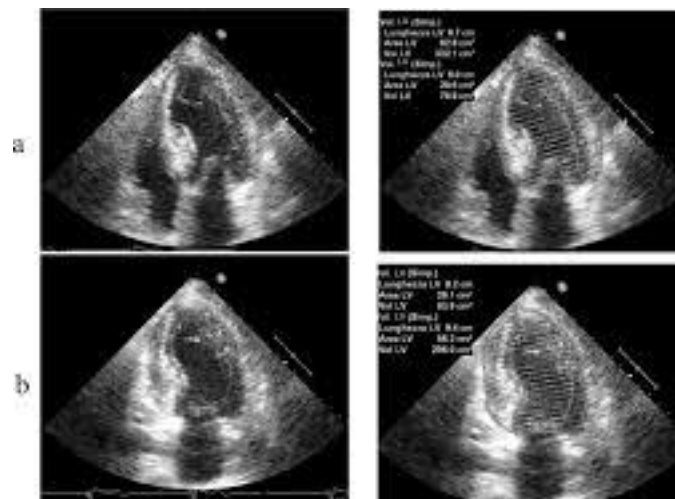




Atrial Fibrillation or
Conduction Changes



Enlarged
Heart



LVM assessed at 2D echocardiography = 237 g



> 200

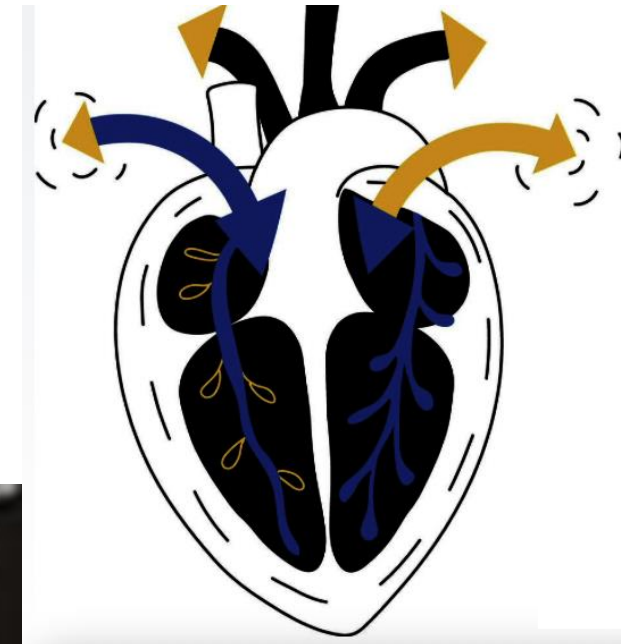
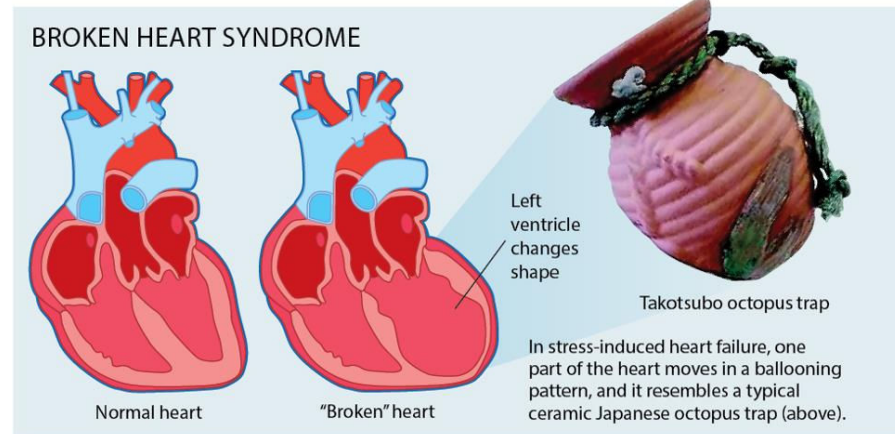
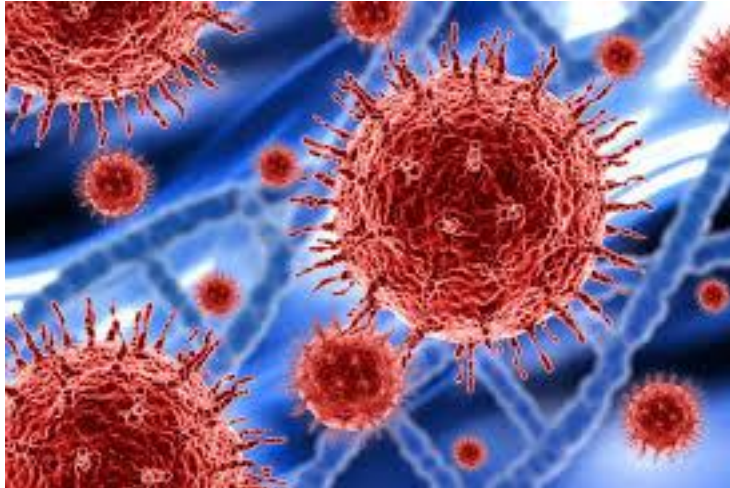
Function of the
Heart



What are Typical Causes of Heart Dysfunction?

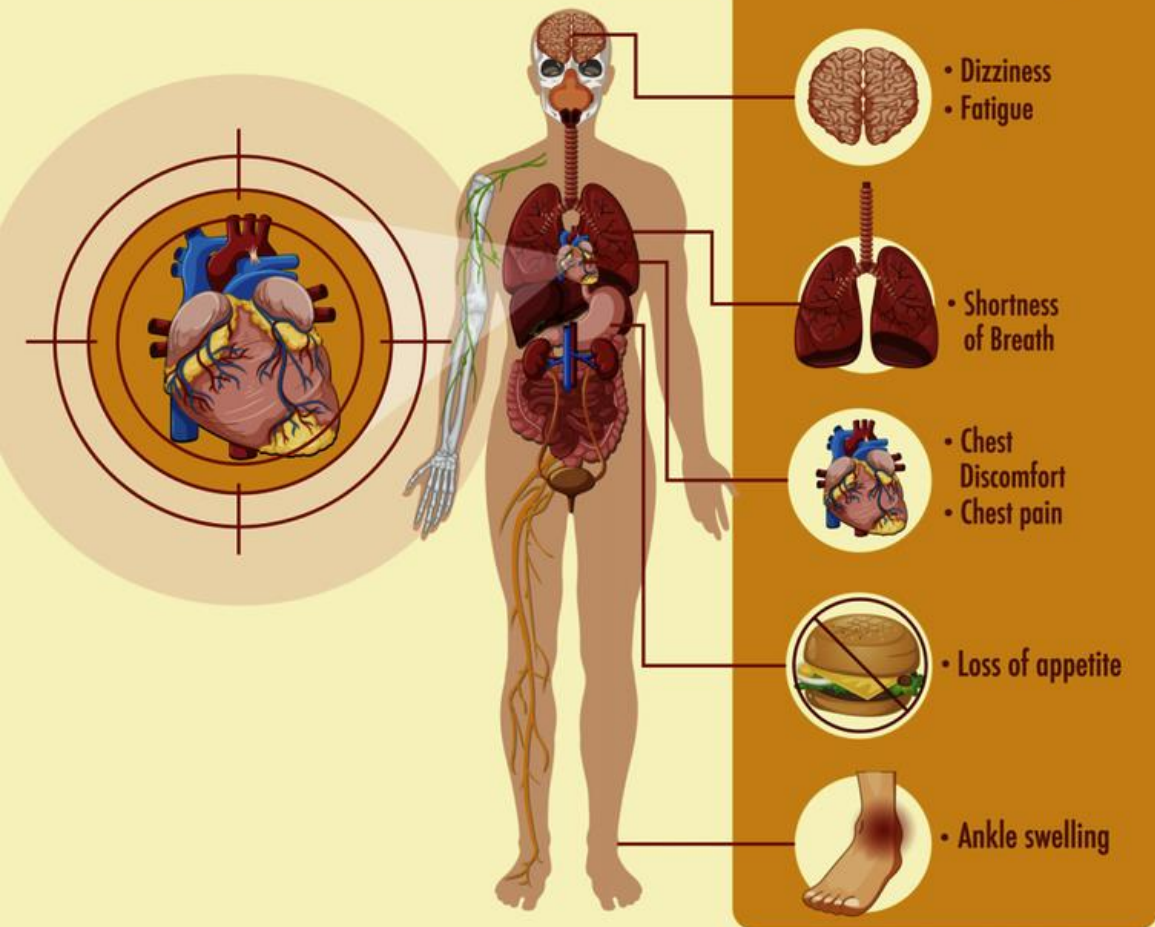


> 50



What Kind of Symptoms are Present in those with Heart Dysfunction?

HEART FAILURE SYMPTOMS



Low blood pressure, decreased output from the heart or increased diuretic use

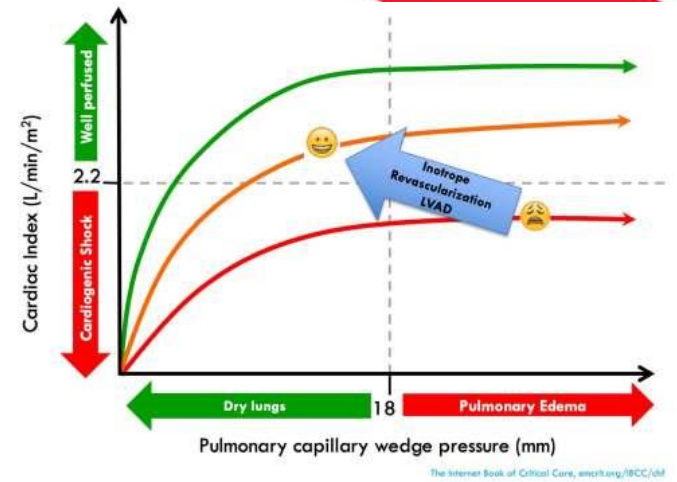
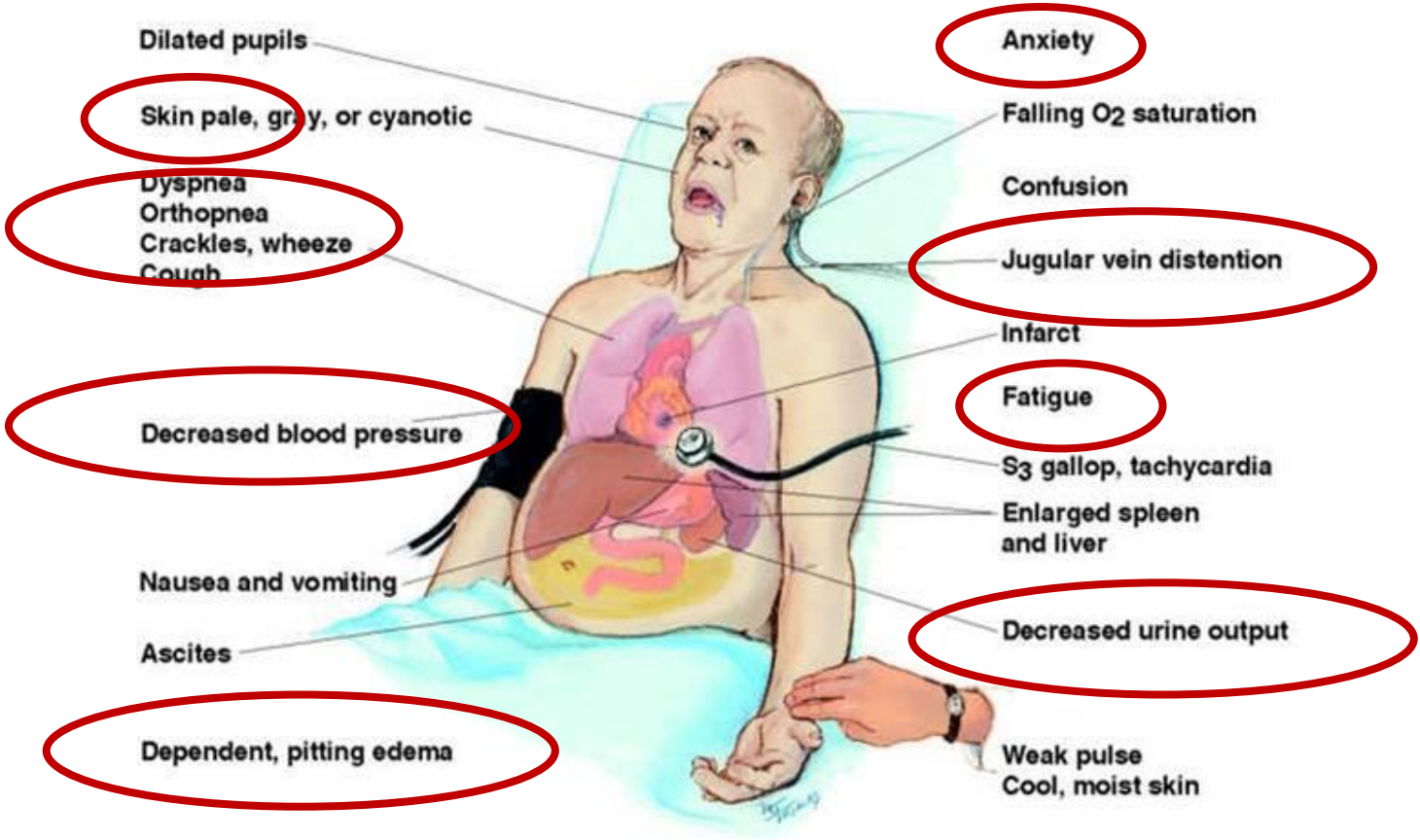
Too much volume circulating backwards to the lungs

Heart is working too hard (possible blockage) or High Blood Pressure

Not enough blood flow to the stomach for digestion

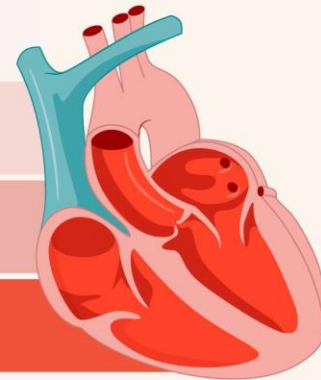
Too much salt/water and dysfunctional squeeze

Heart Failure Symptomatology

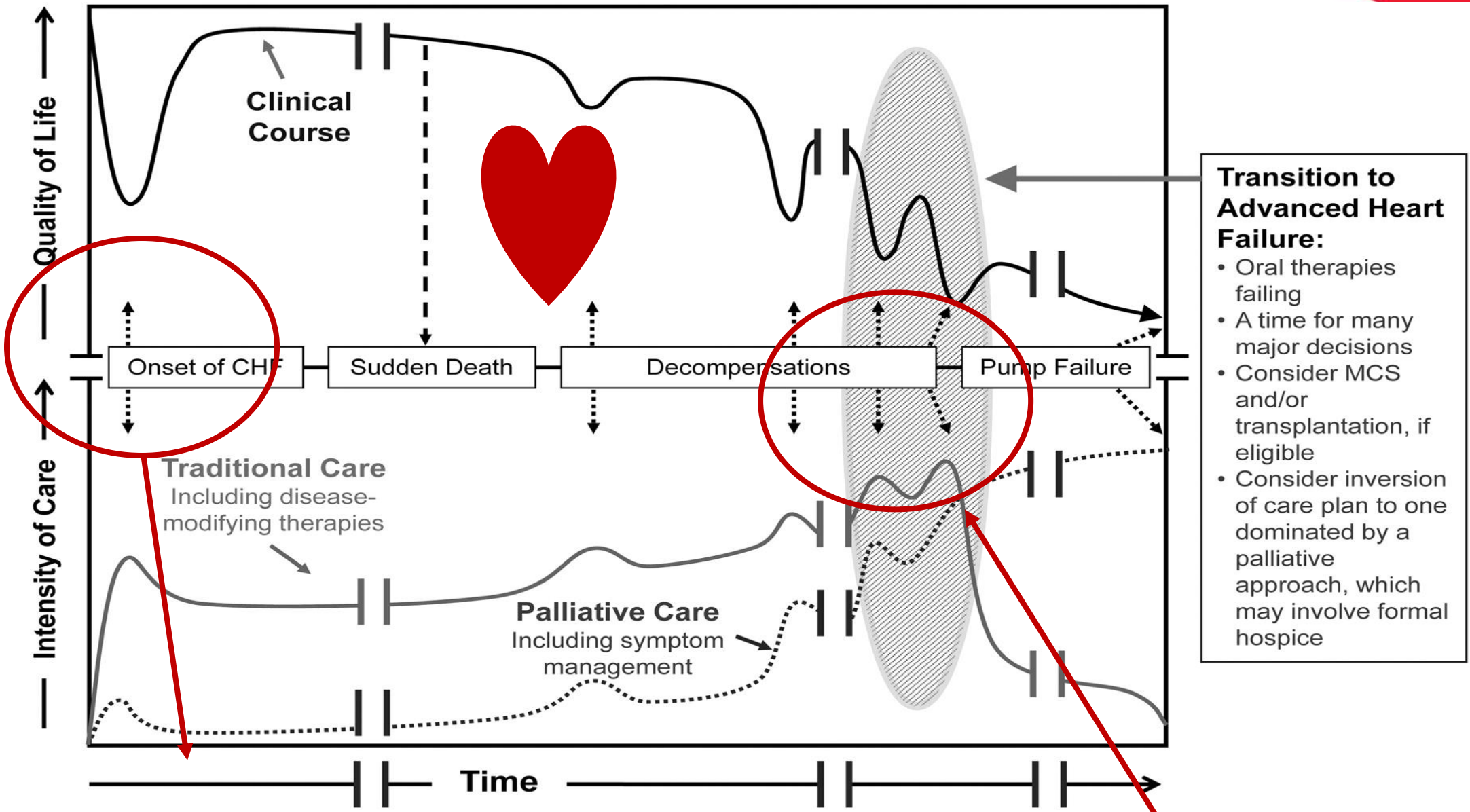


STAGES OF HEART FAILURE

- AT RISK**
Risk factors but no structural changes or symptoms
- PRE-HEART FAILURE**
Structural changes but no symptoms
- HEART FAILURE**
Symptoms like shortness of breath and fatigue
- ADVANCED HEART FAILURE**
Symptoms don't respond to treatment



healthline



A Better Way to Understand



Dry
Warm

Wet
Warm

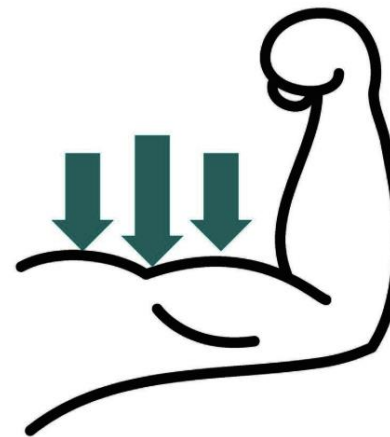
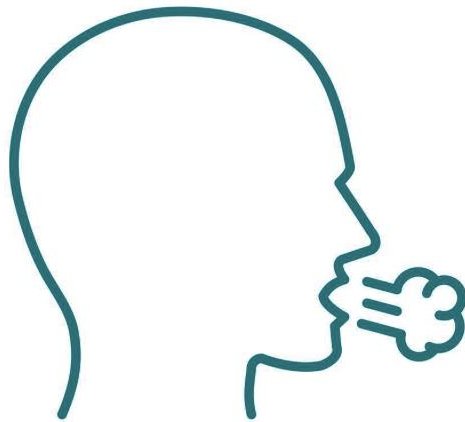


Dry
Cool

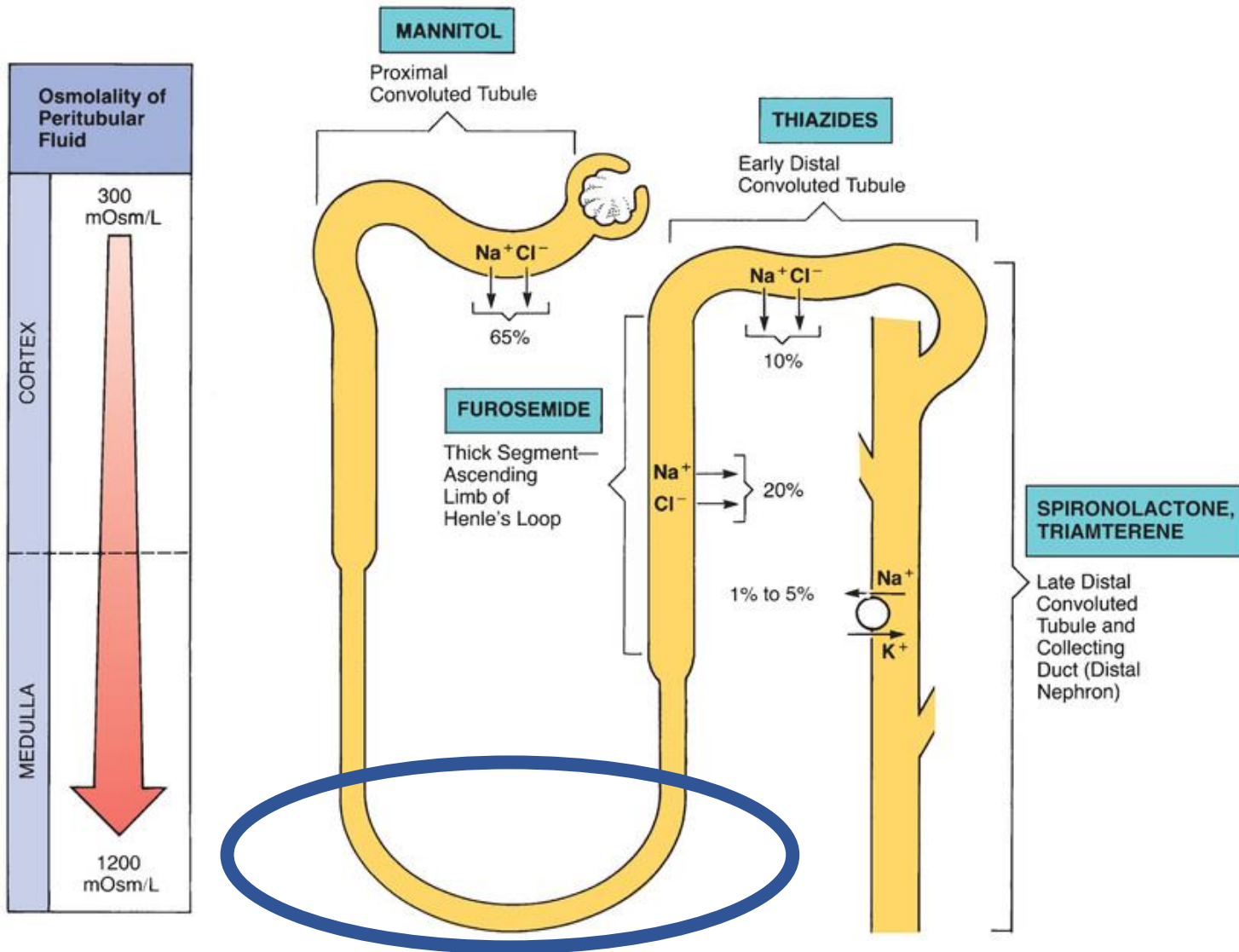
Wet
Cool



What Symptoms Will We See?



IV Lasix = Liquid GOLD



FUROSEMIDE (LASIX)

Hi, Lasix here . . . Furosemide to some of you. I may look lazy, but I can hang around in your body for six hours.

LASTS SIX

ORALLY
Diuresis occurs 30-60 minutes after ingestion.

IV
Diuresis occurs 2-5 minutes after administration. Peaks 30 minutes, tapers after 2 hours.

Side Effects:

- ☀️ ↓ BP
- ☀️ Photo-sensitivity
- 📈 ↑ Blood Glucose Level
- ⬇️ ↓ Potassium

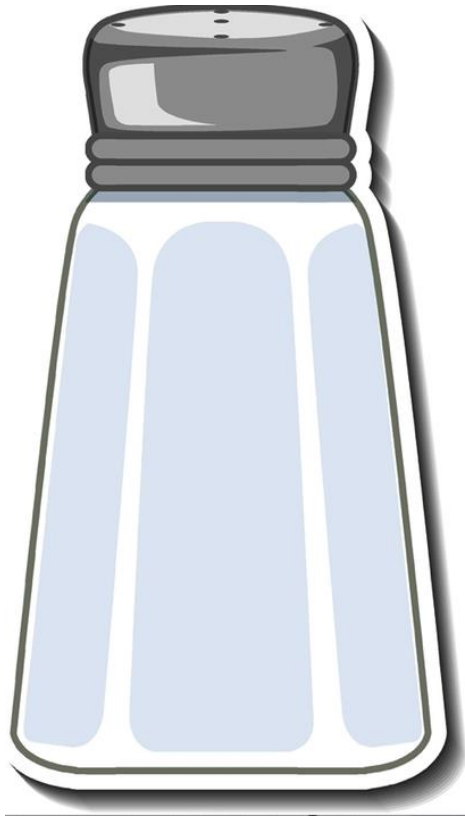
Uses:

- ★ Edema
- ★ Hypertension
- ★ Ascites

© 2017 Nursing Education Consultants, Inc.

Important Education

< 48 ounces of
fluid



1500mg or less



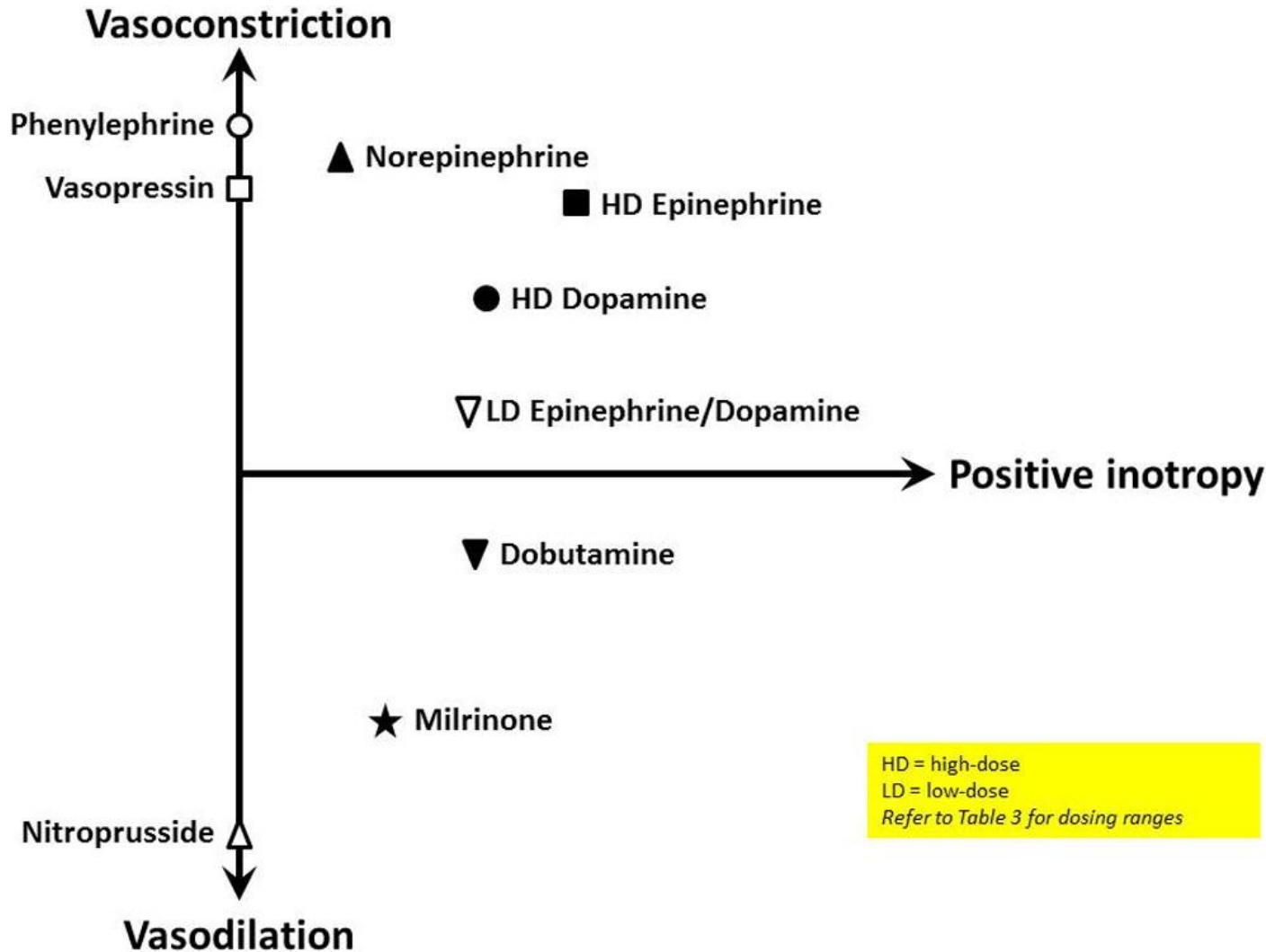
2# wt gain 1
day/3-5#s in 1
week

HF GDMT



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Use of Inotropes and Vasopressors = Fact or Fiction



HD = high-dose
LD = low-dose
Refer to Table 3 for dosing ranges



VASOCONSTRICTION
VASODILATION
INCREASED SQUEEZE

Direct inotropic effects

YES

NO

Peripheral vascular effects

Vasoconstriction

Inoconstrictors

Norepinephrine
Epinephrine
Dopamine

Subset I

Vasoconstrictors

Phenylephrine
Vasopressin

Subset II

VASOPRESSORS

Vasodilation

Inodilators

Dobutamine
Milrinone

Subset III

Vasodilators

Nitroglycerin
Nitroprusside
Nesiritide

Subset IV

INOTROPES

Subsets categorize vasoactive agents by presence or absence of inotropic effects and effects on vasculature





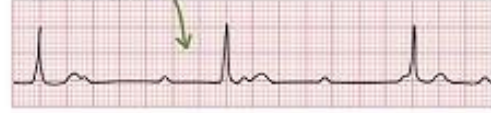
SVT



ATRIAL FLUTTER

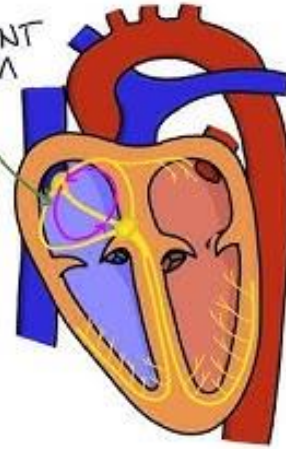


HEART BLOCK



PROLONGED QT

RE-ENTRANT RHYTHM



ARRHYTHMIAS

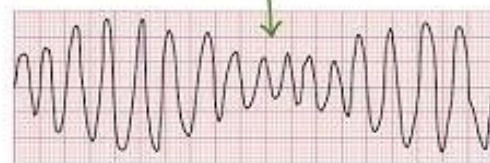
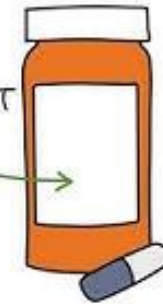


TORSADES DE POINTES

VENTRICULAR TACHYCARDIA



TREATMENT



VENTRICULAR FIBRILLATION





Vasopressors & Inotropes



Drugs with both vasopressor *and* inotropic effects (sometimes called inopressors)

Vasopressors

Epinephrine
Norepinephrine
Dopamine



Mnemonic:
Hormones released when the **END** is near

Pure vasopressors with no effects on cardiac contractility

Vasopressin
Angiotensin II
Phenylephrine



Mnemonic:
Very **A**ggressive **P**ressors

Purely inotropes that increase cardiac contractility

Inotropes:

Milrinone
Isoproterenol
Dobutamine

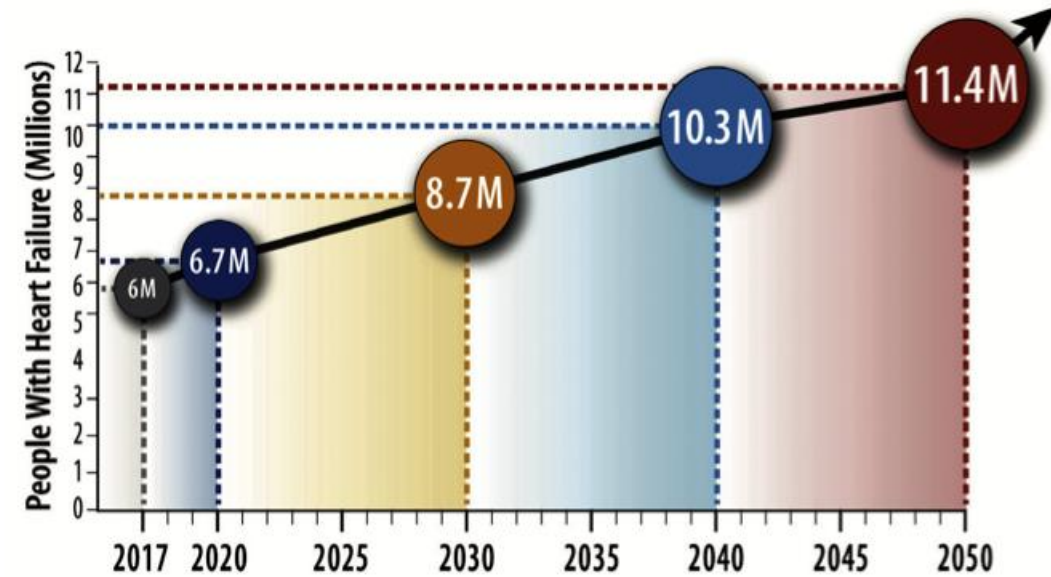
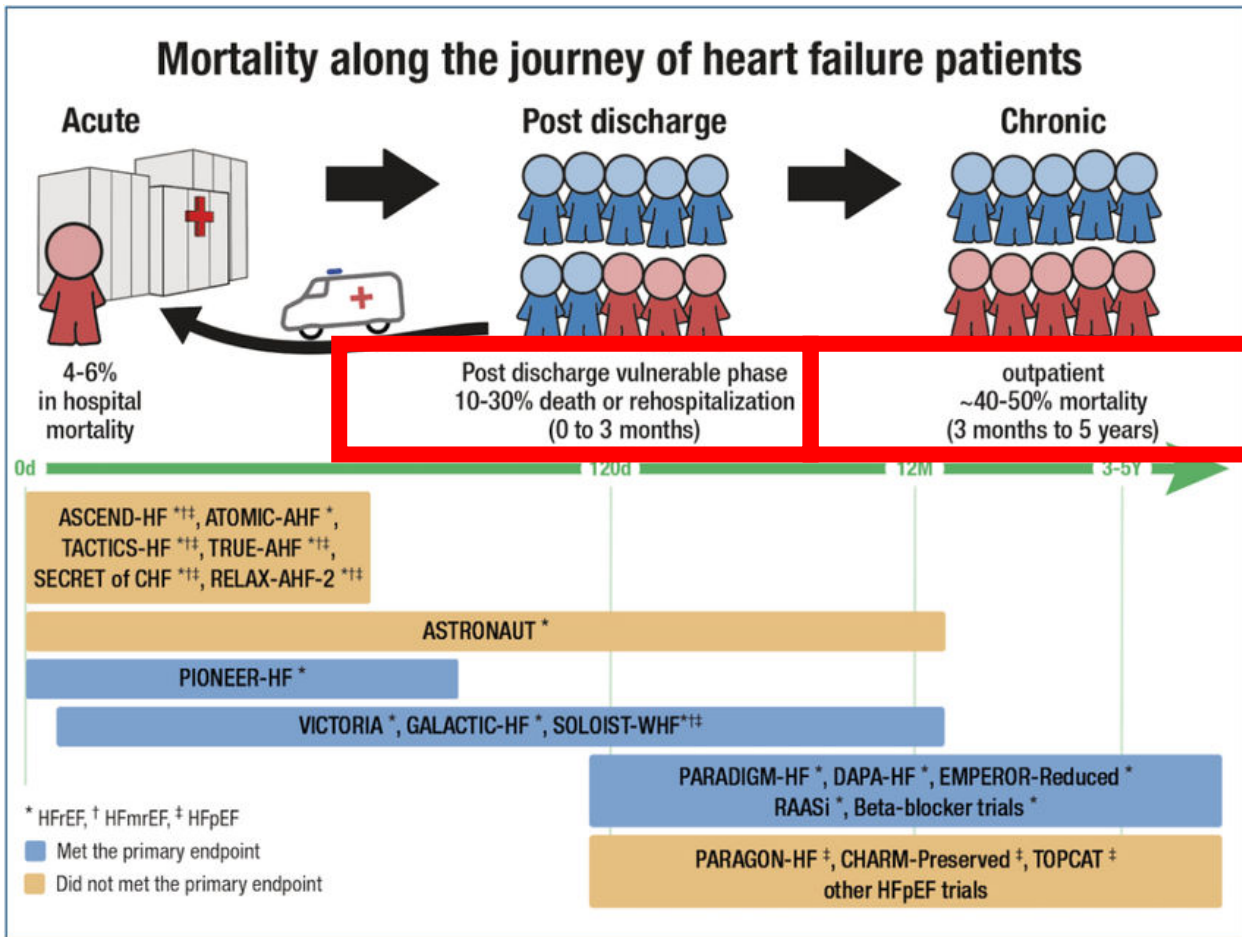


Mnemonic:
Must **I**ncrease **D**urability

@MEMORYPHARMSTUDY

<https://www.memory-pharm.com/vasopressors-and-inotropes%E2%81%A0/>

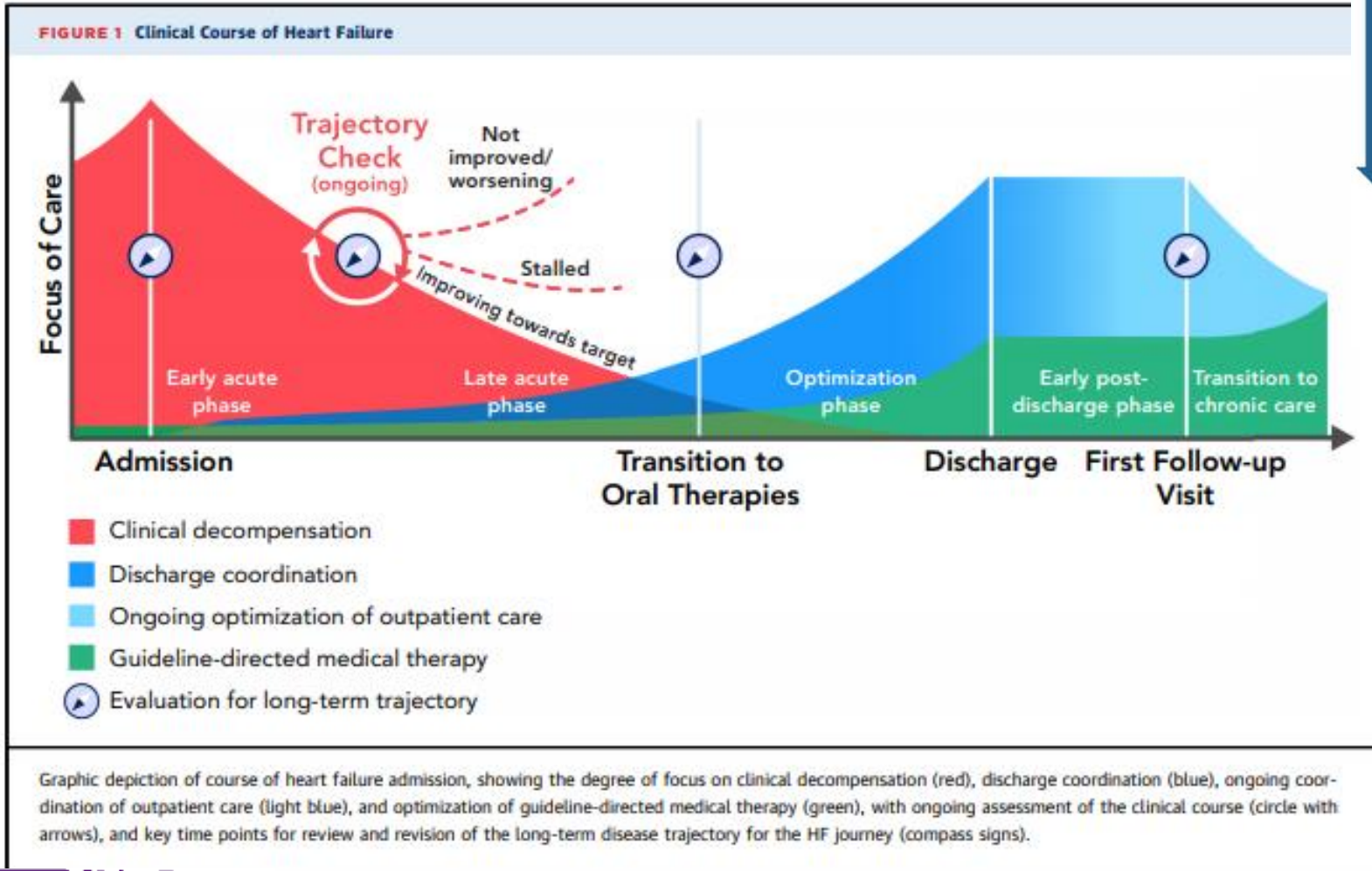
The Importance of Keeping Patients OUT of the Hospital



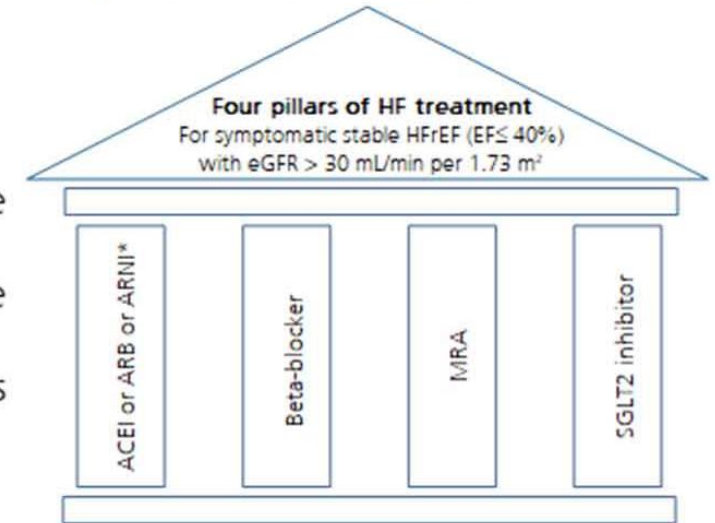
IMPROVE QUALITY OF LIFE



Follow Up Appointments



Initiate
Optimise
Reassess

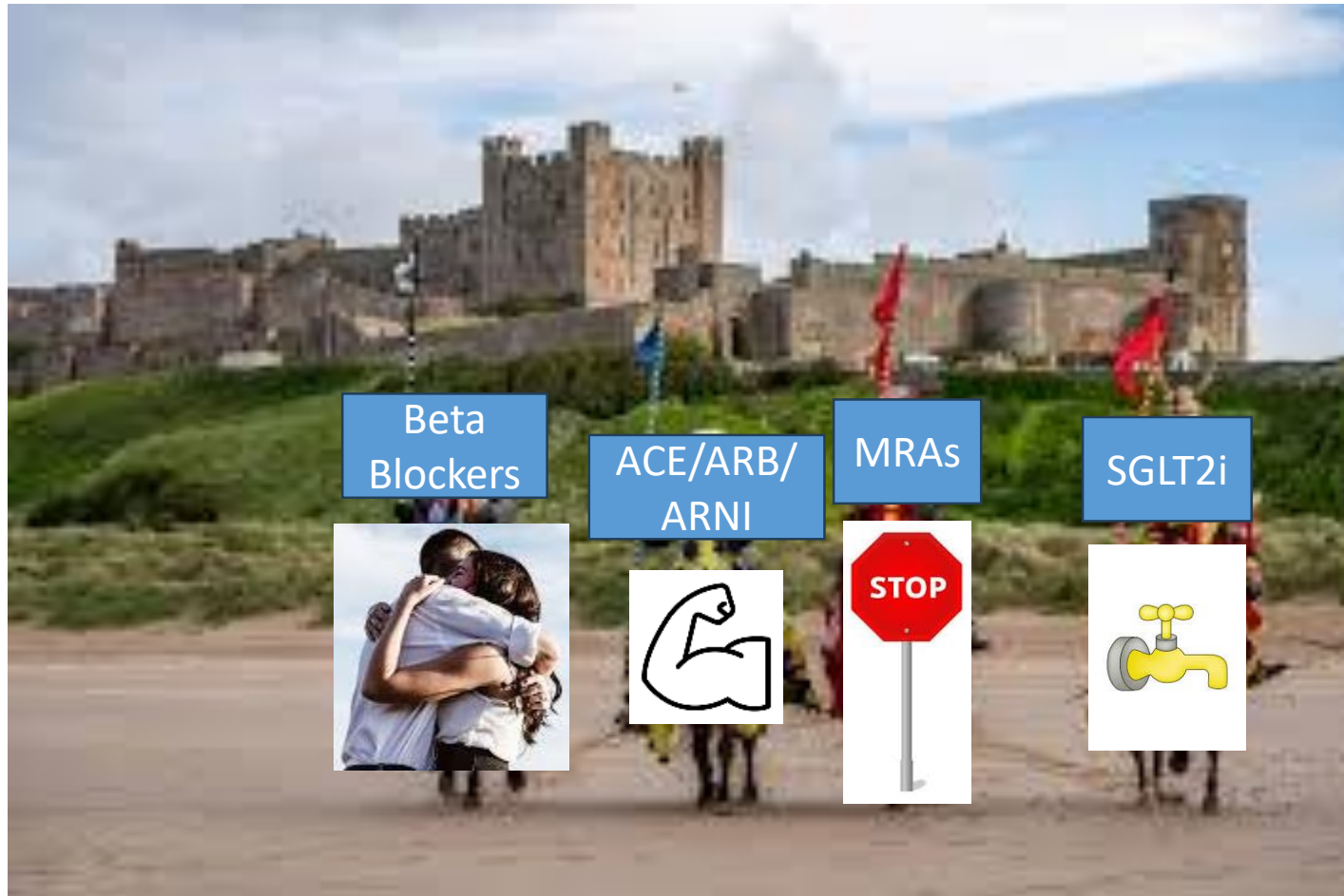


Shaw et al Open Heart. 2021

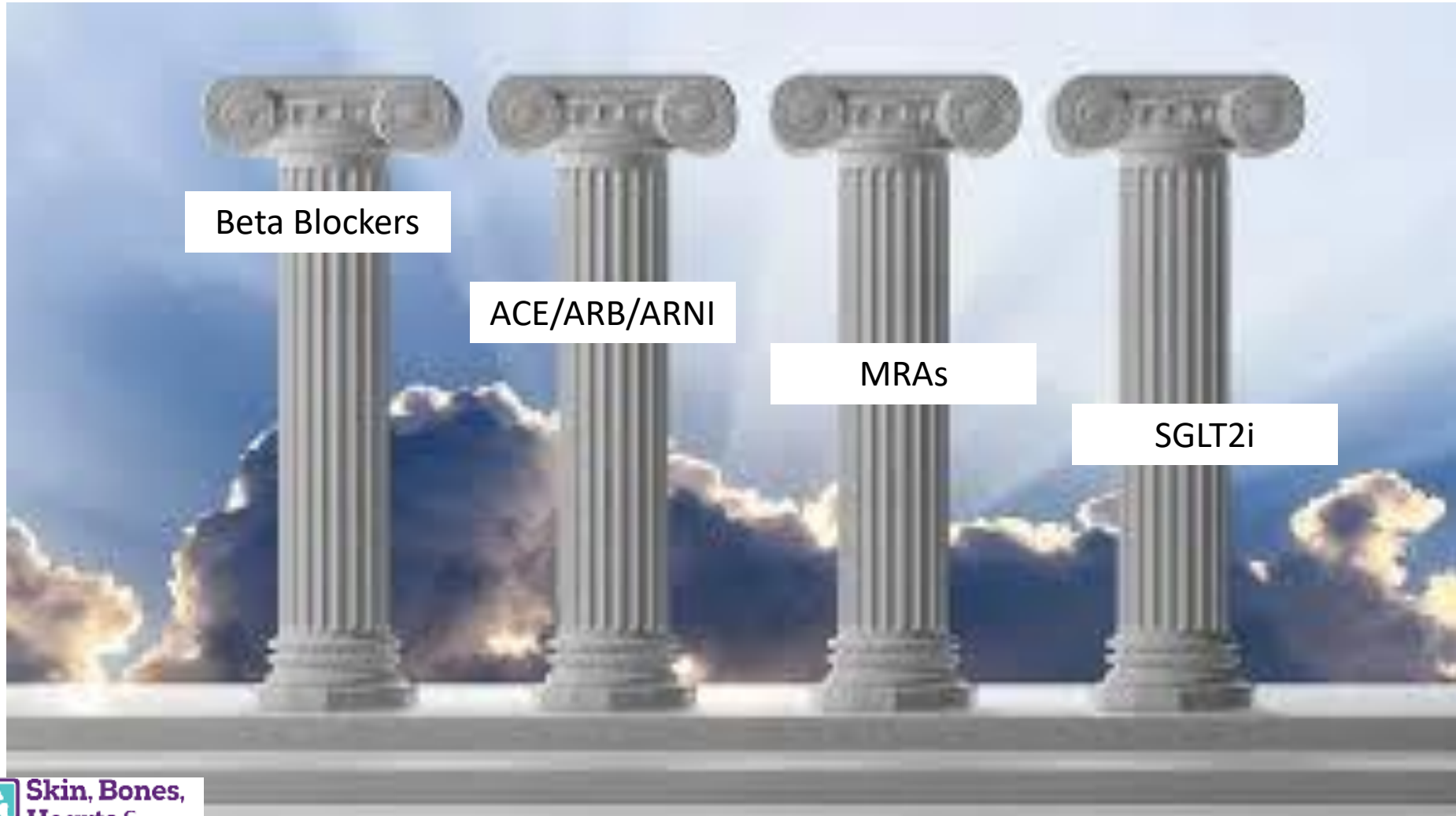


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HF Guideline Driven Medical Therapy – The Ins and Outs



Medications to Treat Heart Dysfunction



Beta Blockers

ACE/ARB/ARNI

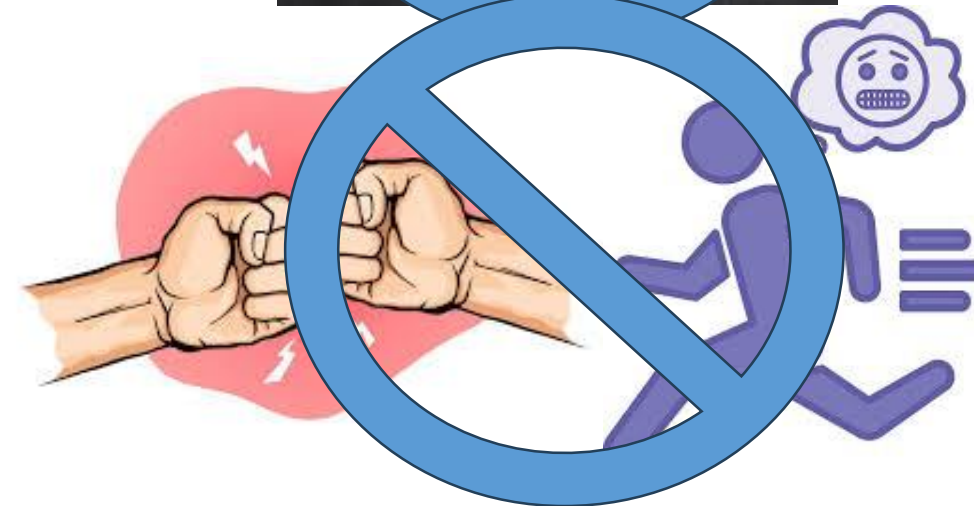
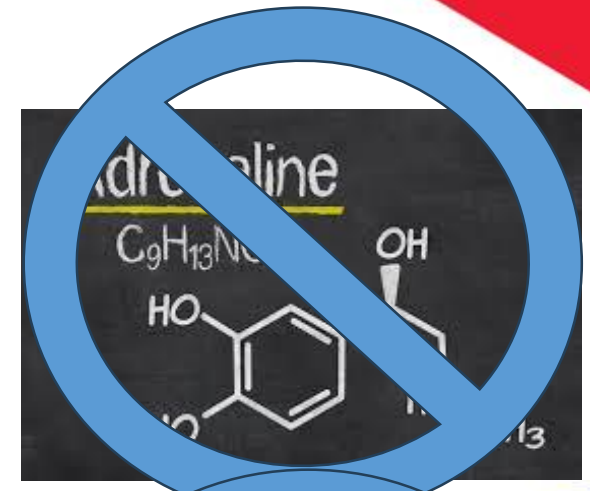
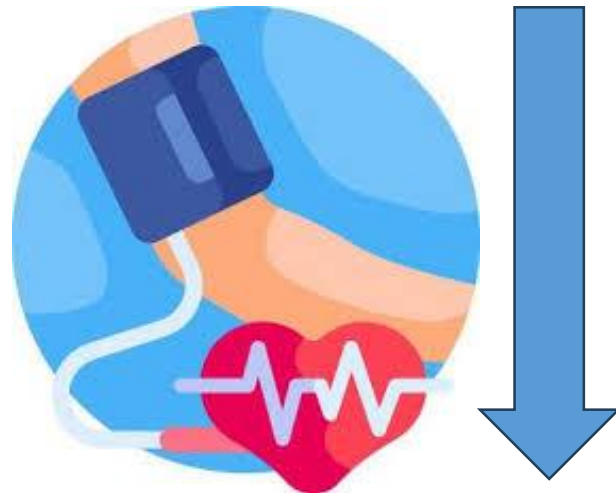
MRAs

SGLT2i

Beta-Blockers

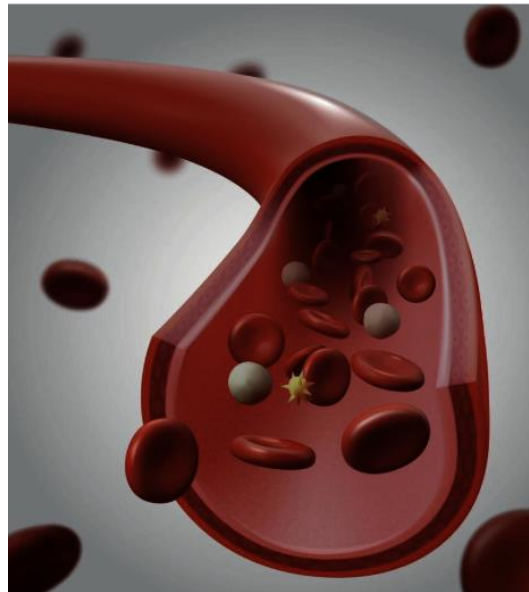
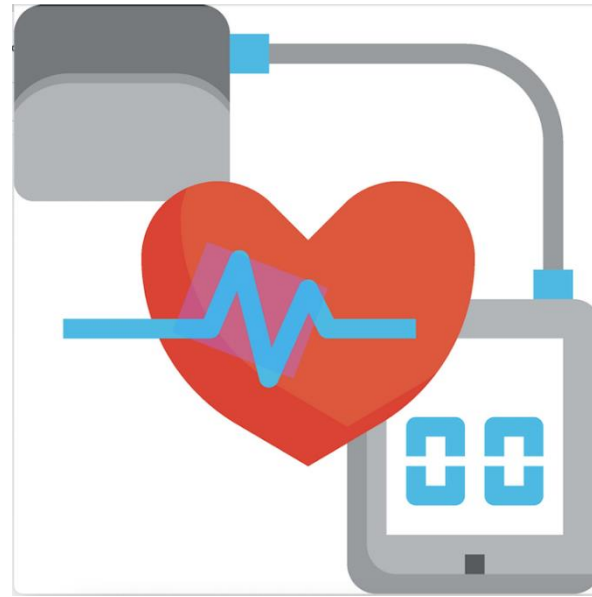
- Carvedilol (Coreg)
- Metoprolol Succinate (Toprol XL)
- Bisoprolol (Zebeta)

20-35 % decrease in mortality



ACE/ARB/ARNI

- Lisinopril, Enalapril, Ramipril, Captopril
- Losartan, Valsartan, Candesartan
- Entresto (Sacubitril/Valsartan)





RAS inhibition

Neprilysin inhibition

Decreased vasoconstriction

Increased vasodilation



Reduced sodium and water retention

Increased natriuresis/diuresis



Reduced hypertrophy and fibrosis

Reduced hypertrophy and fibrosis



A Bit More About Entresto

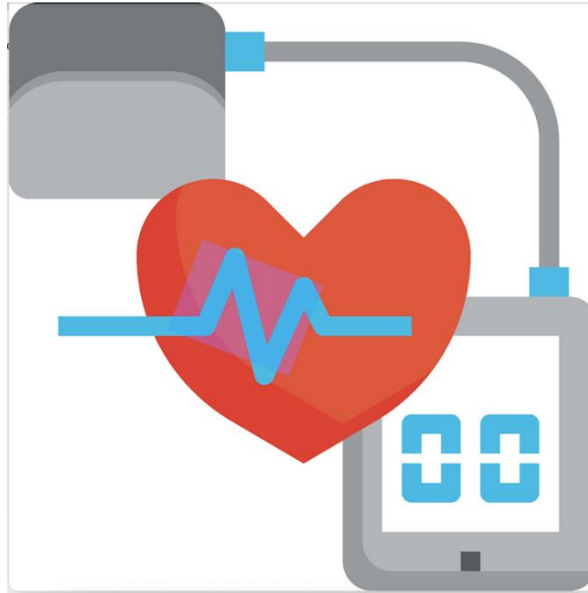


Mineralocorticoids (MRAs)

- **Aldactone**
(Spironolactone)

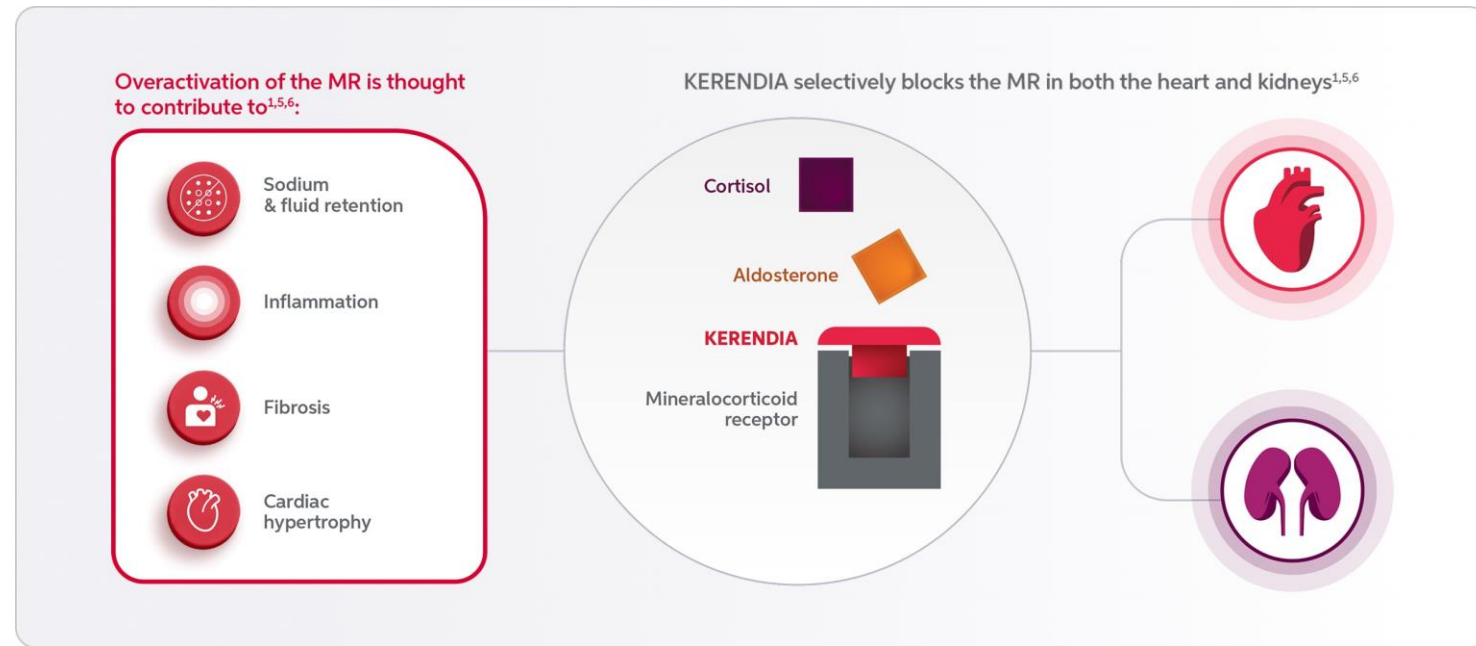
- **Eplerenone**
(Inspra)

- **Finerenone**
(Kerendia)



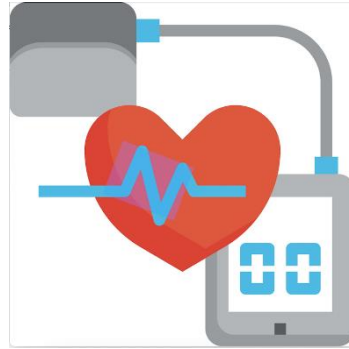
Finerenone (need to mention as indicated for HFmildEF)

- Decreases inflammation
- Cardiovascular and renal protective
- LVEF $\geq 40\%$
- FINEARTS-HF trial
 - Decreased worsening HF
 - Decreased death
- Watch HIGH Potassium levels



SGLT2-i (Sodium-Glucose Co-Transporter-2 Inhibitor)

- Empagliflozin (Jardiance)
- Dapagliflozin (Farxiga)
- Bexagliflozin (Brenzavvy)
- Canagliflozin (Invokana)



Corlanor (Ivabradine)

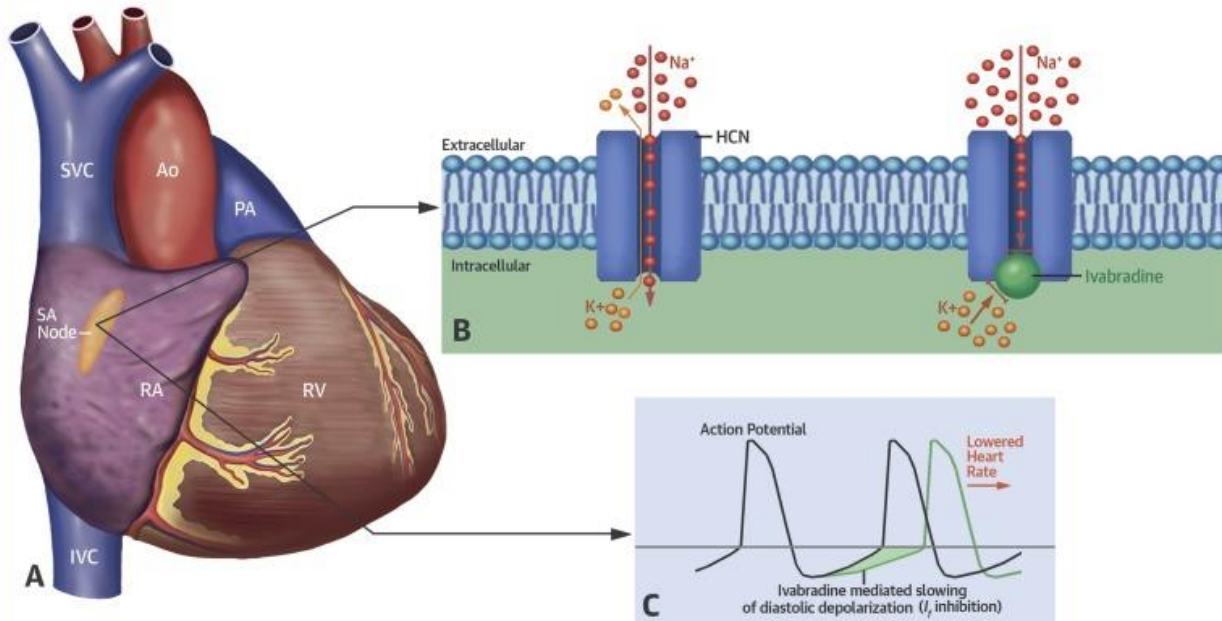
Indication

Drug Showcase

- * **CORLANOR** (ivabradine) is a cyclic nucleotide-gated channel blocker indicated to reduce hospitalization for worsening heart failure in patients with stable, symptomatic chronic heart failure with left ventricular ejection fraction $\leq 35\%$, who are in sinus rhythm with resting heart rate ≥ 70 beats per minute and either are on maximally tolerated doses of beta-blockers or have a contraindication to beta-blocker use.

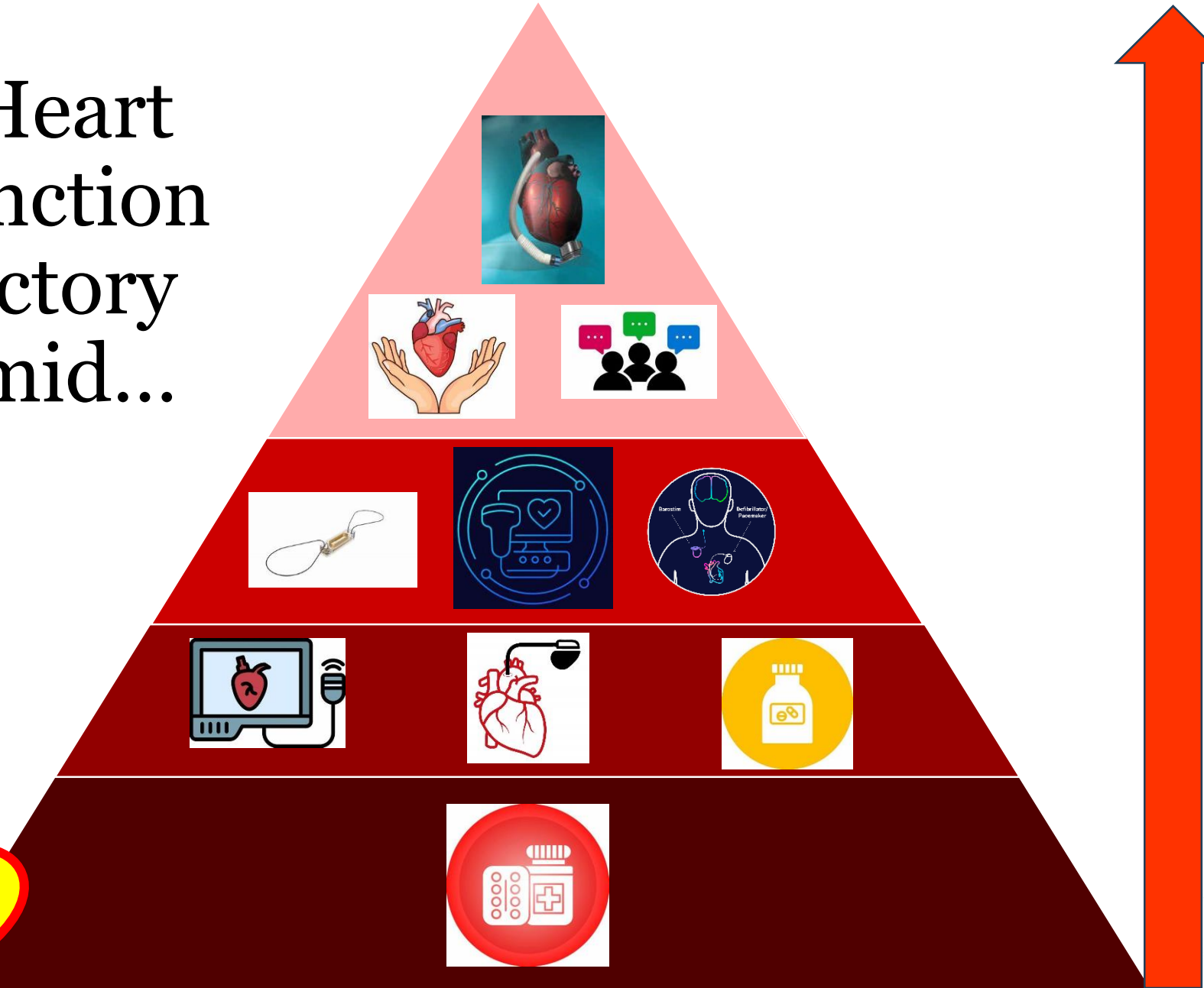
Renal & Urology News

CENTRAL ILLUSTRATION: Mechanism of Action of Ivabradine

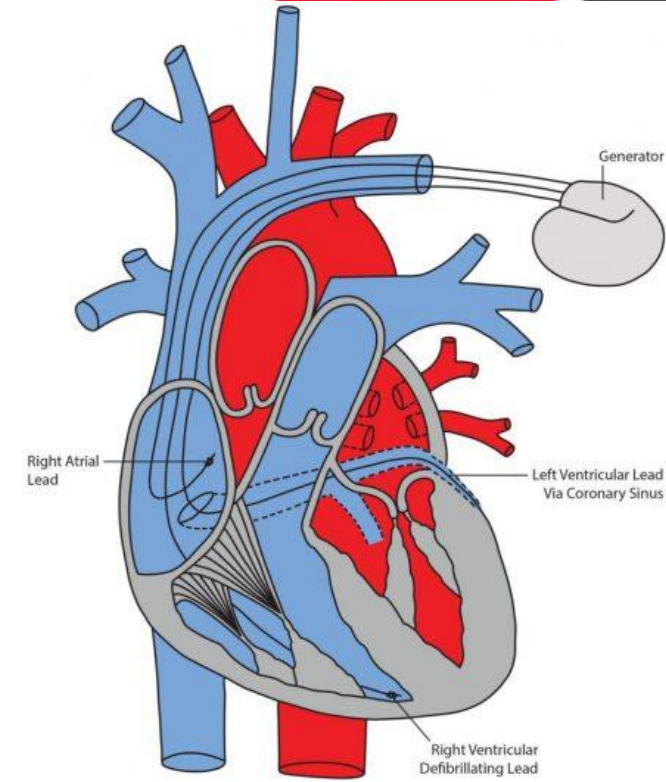
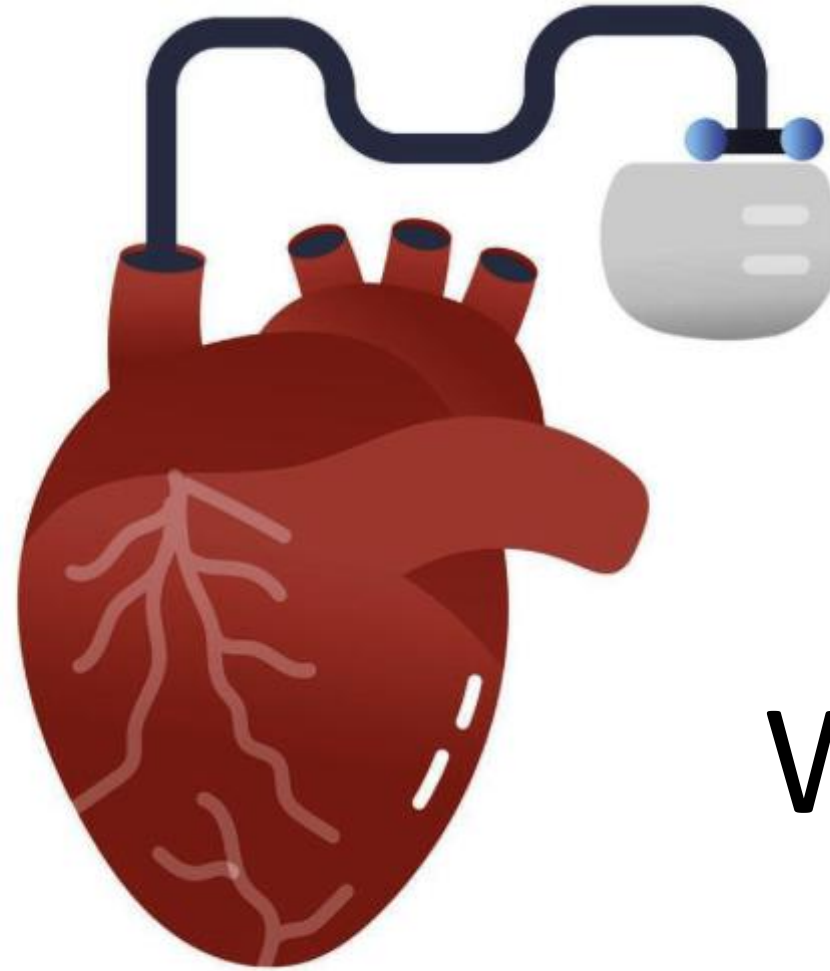


Koruth, J.S. et al. J Am Coll Cardiol. 2017;70(14):1777-84.

The Heart Dysfunction Trajectory Pyramid...



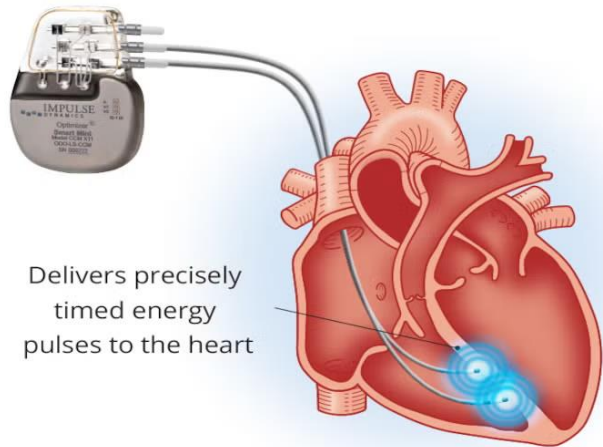
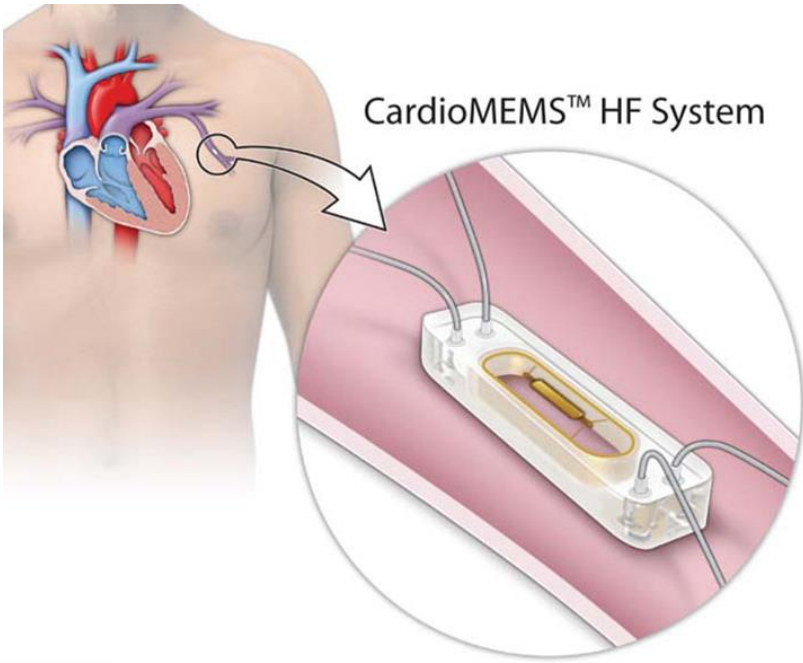
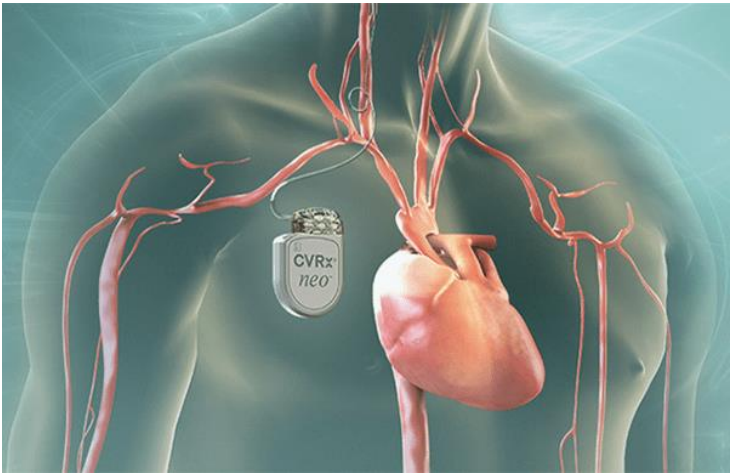
90-Day Recheck



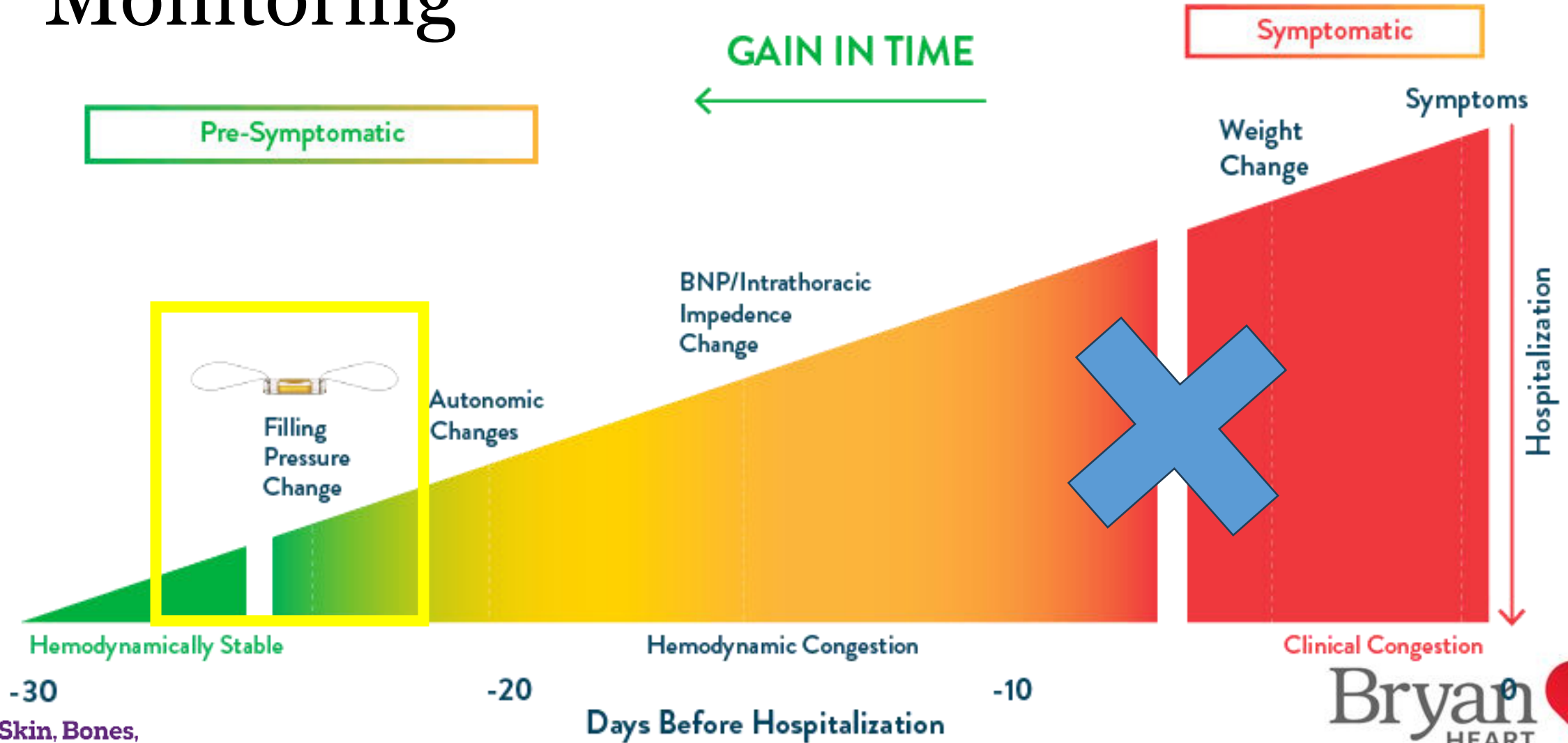
Wide QRS

<35%

Additional Tools in the Toolbox



Cardiomechs Pulmonary Artery Monitoring





PAd goal is set

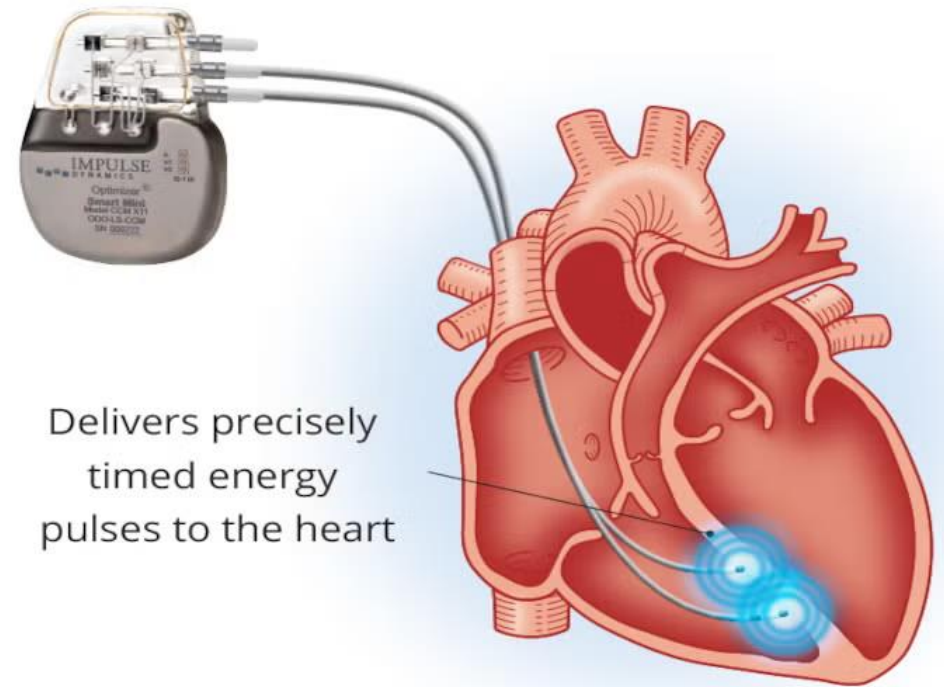


Neuromodulation

Barostim

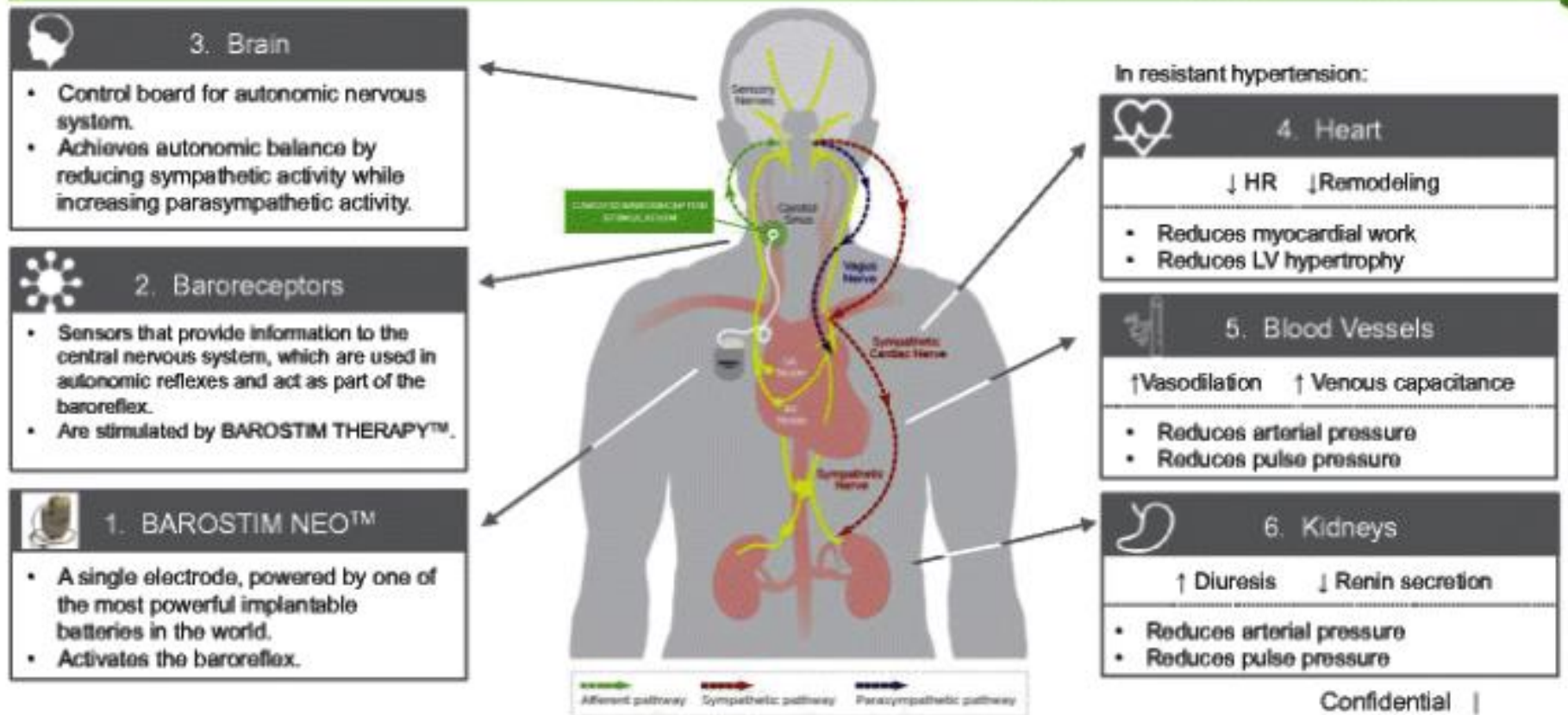


Optimizer CCM



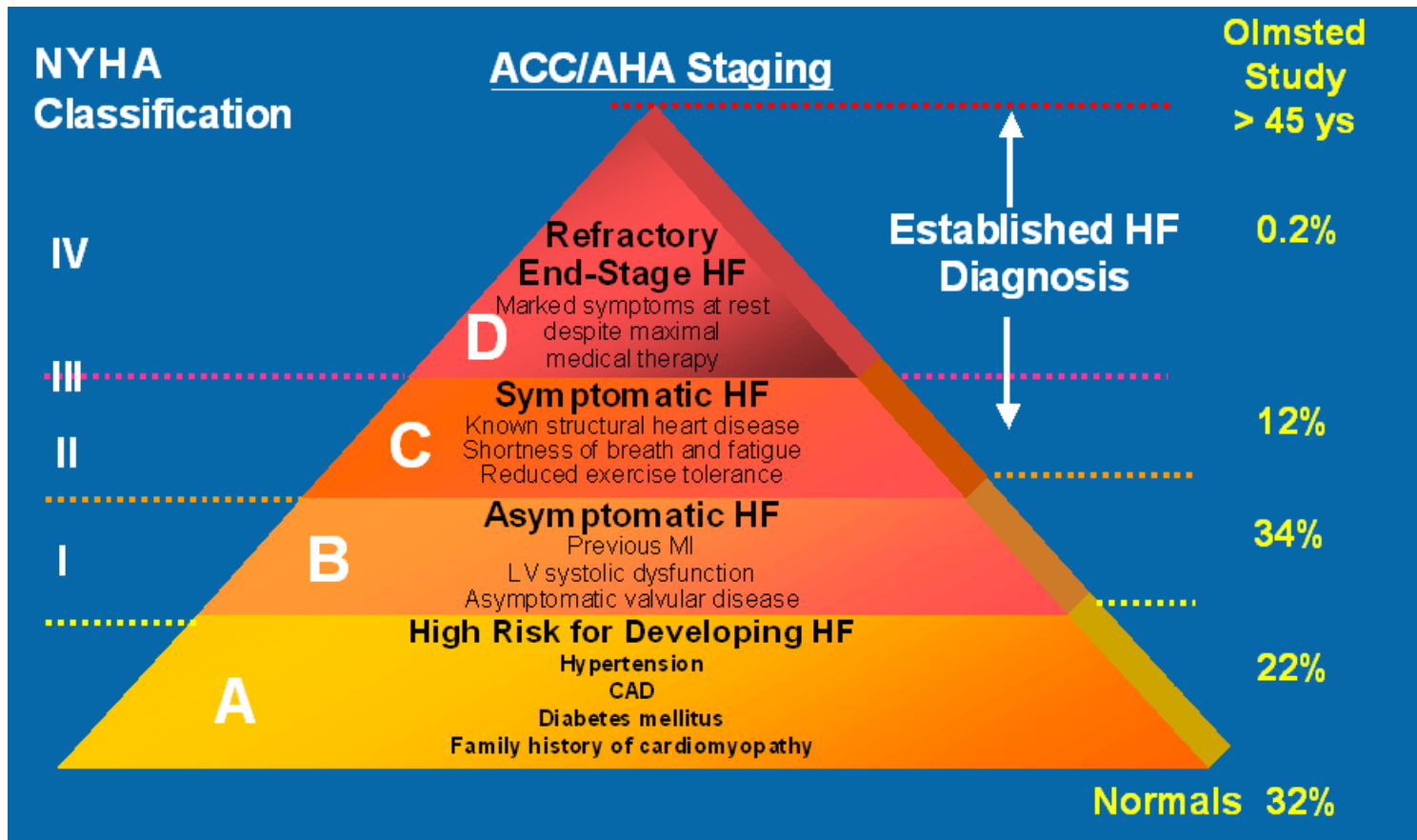
Delivers precisely
timed energy
pulses to the heart

Physiological Mechanism of Action



Carotid baroreceptor stimulation leads to physiological effects of the autonomic nervous system, with end-organ modulation on the heart, vasculature, and kidneys (courtesy of CVRx)

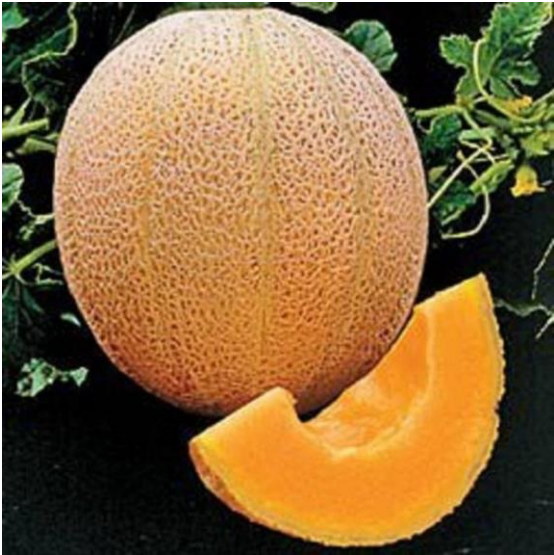
Advancement to Advanced HF



I	Need for inotropes
N	New York Heart Association Class IV
E	Worsening end-organ dysfunction
E	Ejection fraction <20%
D	Defibrillator shocks for ventricular arrhythmias
H	Recurrent HF hospitalizations
E	Escalating diuretic dose
L	Low blood pressure
P	Progressive intolerance of GDMT

Heart Pumps, Transplants, Palliative Medicine – The T in the Road Meets





LVAD technology has greatly improved



"It's not like the old days, is it?"



1998

HEARTMATE™ XVE LVAD

BTT 1998 | DT 2002

PULSATILE FLOW

First LVAD FDA approved for DT*



2008

HEARTMATE II™ LVAD

BTT 2008 | DT 2010

CONTINUOUS FLOW (AXIAL)

Over 26,000 patients implanted, with patients on therapy out to 5 and 10+ years¹



2017

HEARTMATE 3™ LVAD

BTT 2017 | DT 2018 | PEDIATRIC 2020

*CONTINUOUS FLOW (CENTRIFUGAL)
with Full MagLev™ Flow Technology*

Over 36,000 patients implanted, with patients on therapy out to 5+ years¹

BTT = Bridge to Transplant

DT = Destination Therapy

*This product is no longer commercially available.

1. Abbott. Based on clinical and device tracking data as of August 31, 2024.

MAT-2000124 v6.0 | Item approved for U.S. use only.

4-Feb-25

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HOW MANY HEART FAILURE PATIENTS IN THE U.S. ARE APPROPRIATE CANDIDATES FOR LVAD THERAPY?

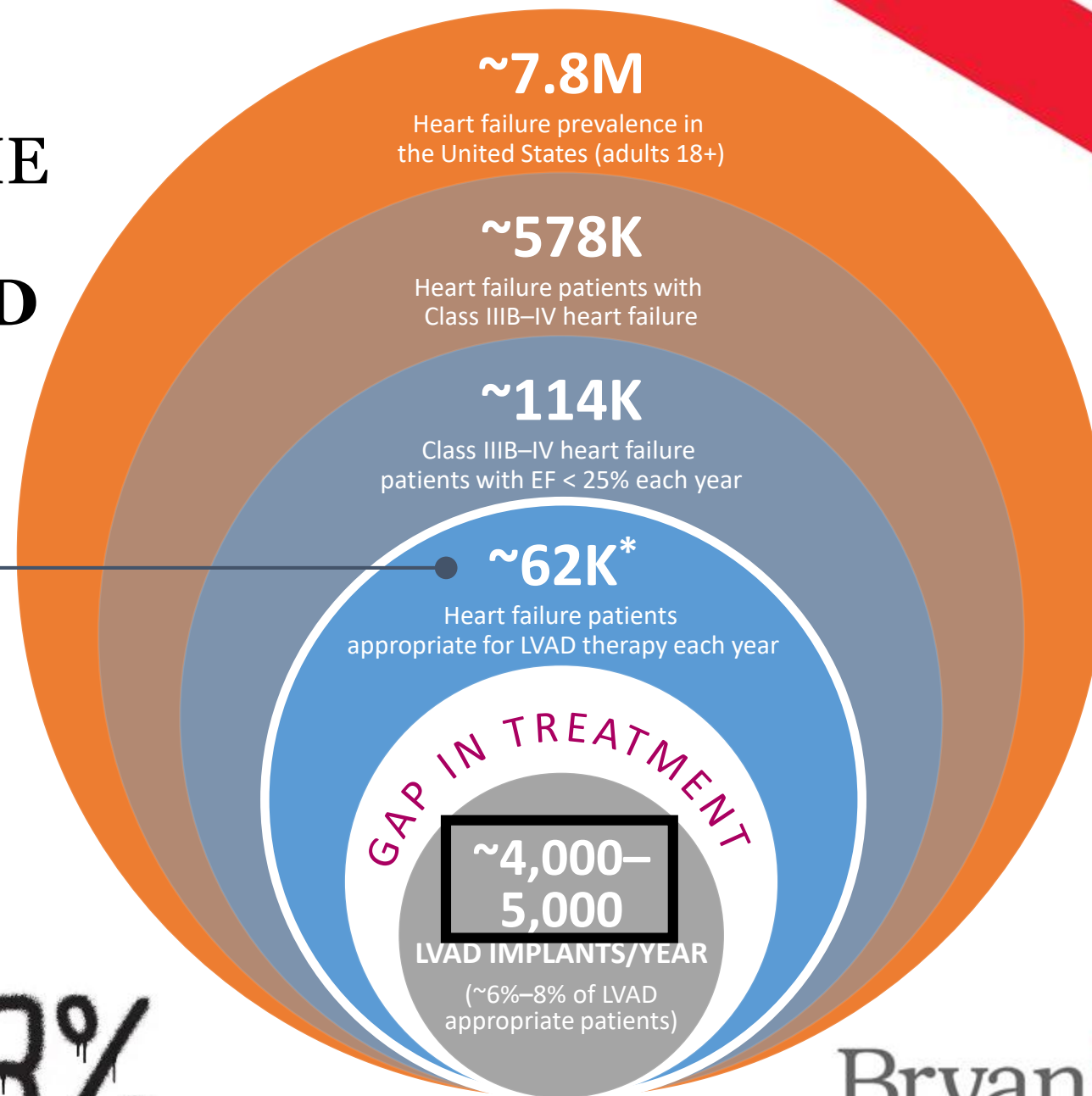
AN ESTIMATED 62K PATIENTS ARE APPROPRIATE FOR LVAD THERAPY EACH YEAR¹

Yet only ~6%–8% are receiving the benefits of LVAD therapy¹

***46% of Class IIIB–IV heart failure with EF < 25% excluded** for the following clinical and non-clinical factors:

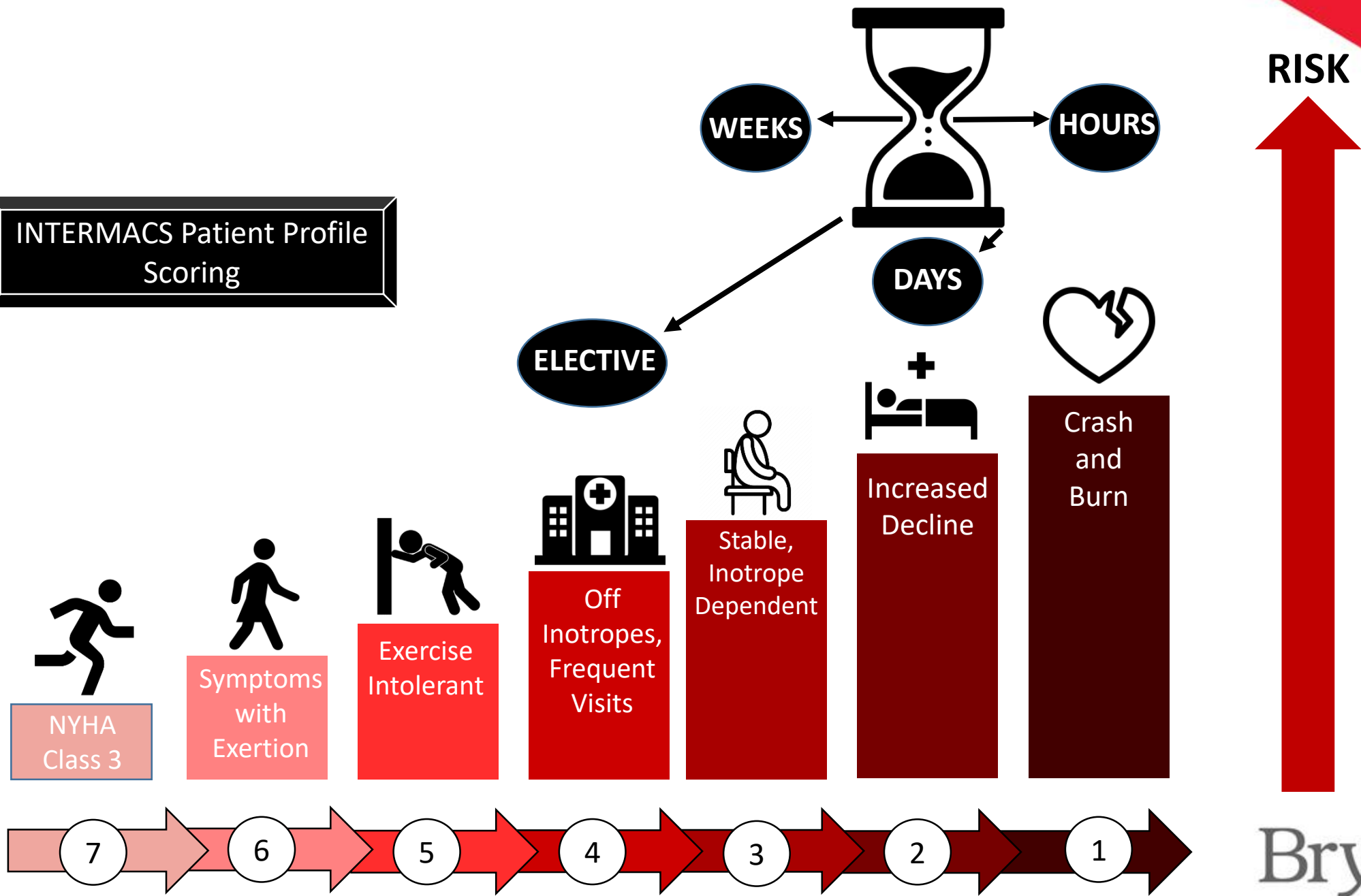
- End organ failure
- Anticoagulation intolerance
- Psychosocial risks
- Patient refusal
- Economic burden

8%

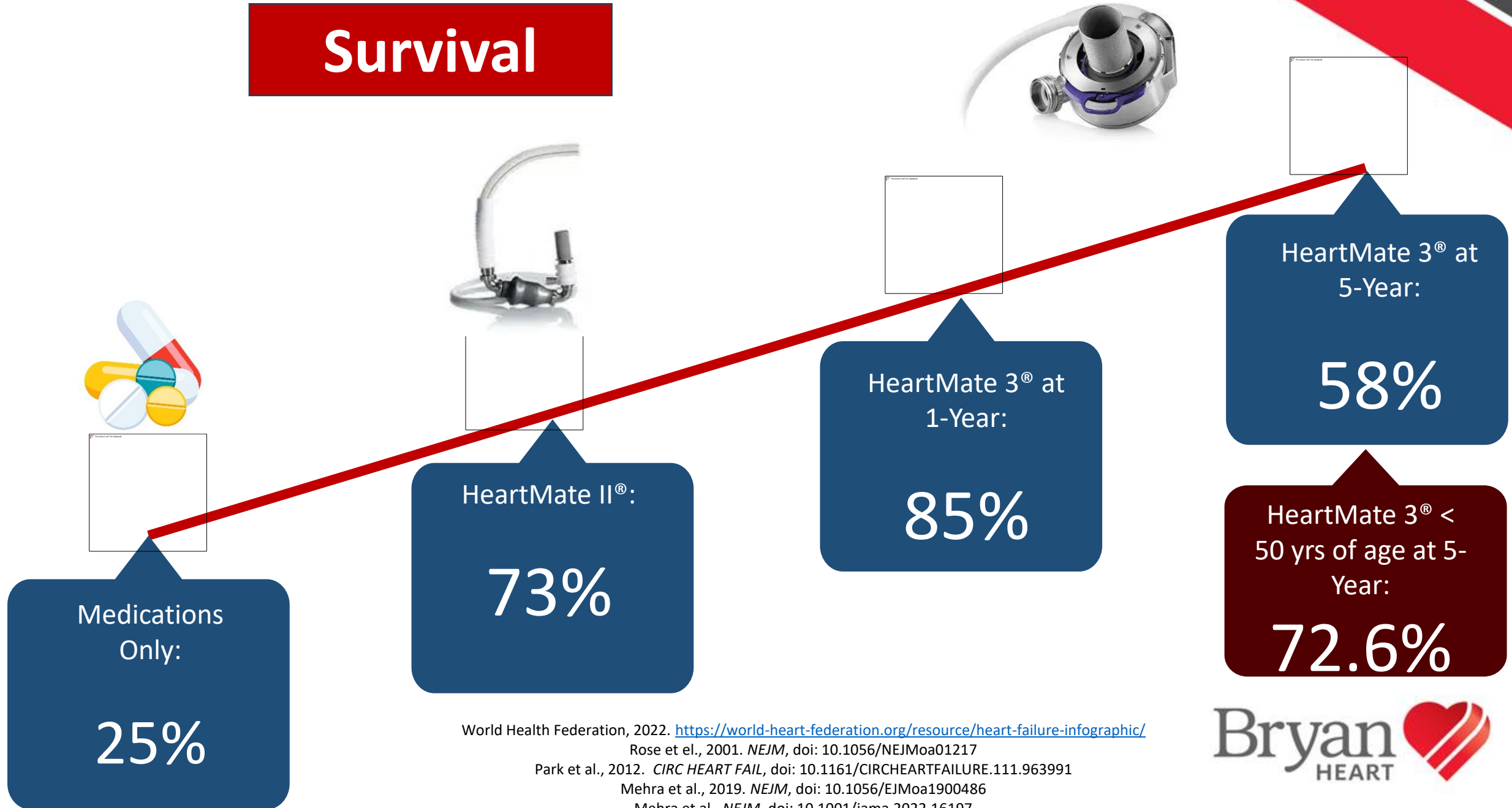


1. Abbott. Data on File. Abbott LVAD strategic market assessment report. May 2019.

INTERMACS Patient Profile Scoring



Survival



World Health Federation, 2022. <https://world-heart-federation.org/resource/heart-failure-infographic/>

Rose et al., 2001. *NEJM*, doi: 10.1056/NEJMoa01217

Park et al., 2012. *CIRC HEART FAIL*, doi: 10.1161/CIRCHEARTFAILURE.111.963991

Mehra et al., 2019. *NEJM*, doi: 10.1056/EJMoa1900486

Mehra et al., *NEJM*, doi: 10.1001/jama.2022.16197

Meyer et al. 2025. doi: [10.1016/j.athoracsur.2024.10.003](https://doi.org/10.1016/j.athoracsur.2024.10.003)

Transplant Updates

Approximately 3,300 patients are currently on the U.S. heart transplant waiting list

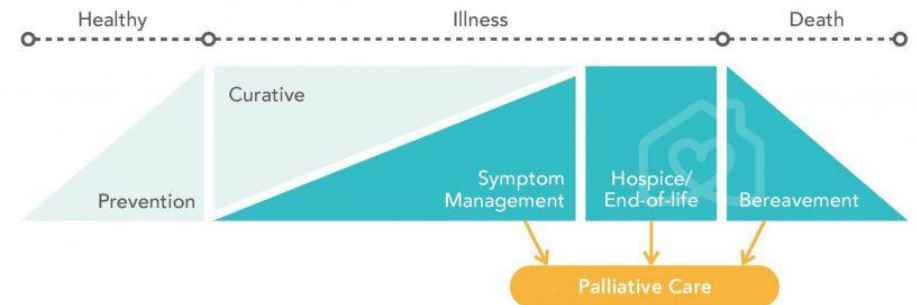
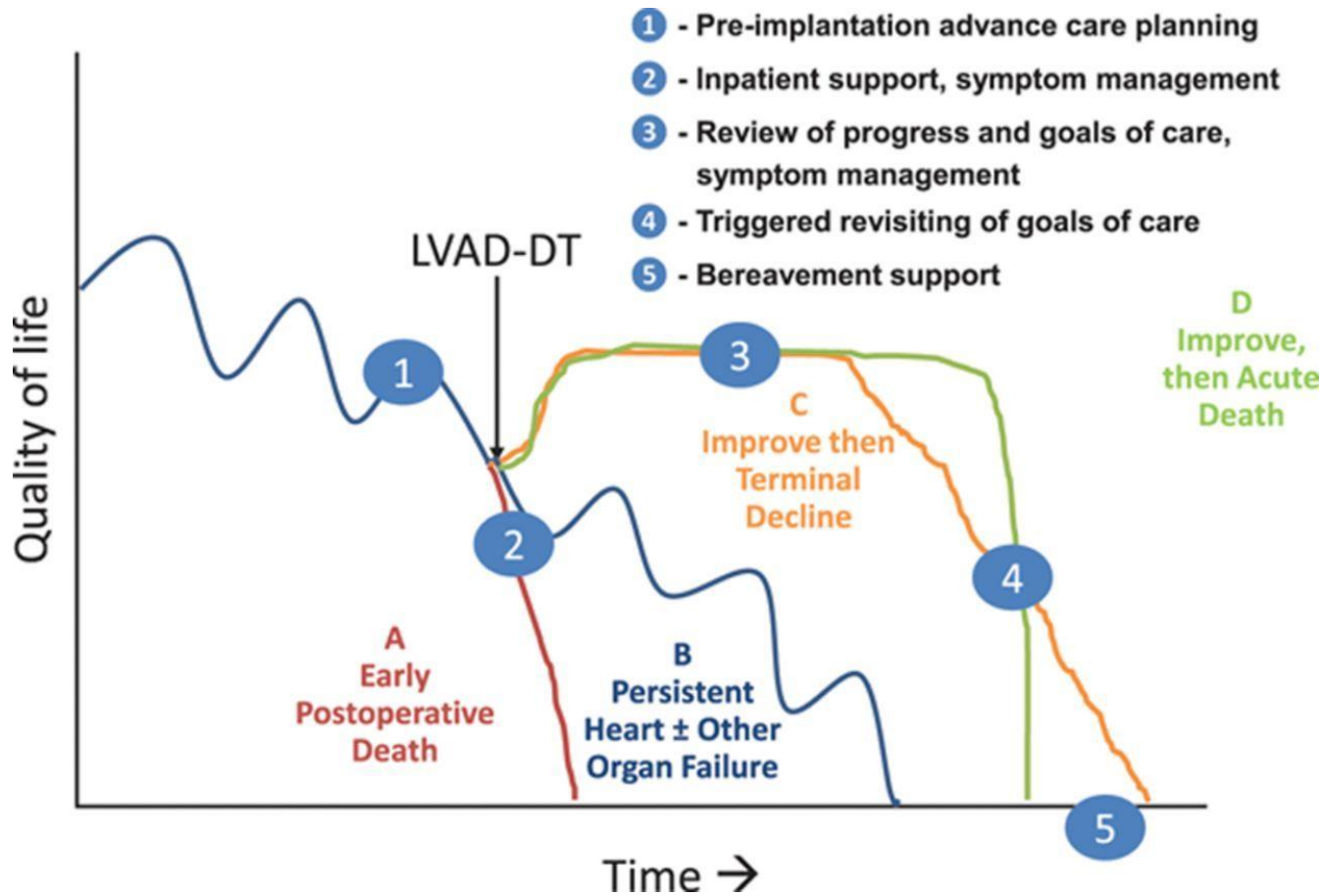
Roughly 600 people die each year while waiting for a heart transplant in the U.S.



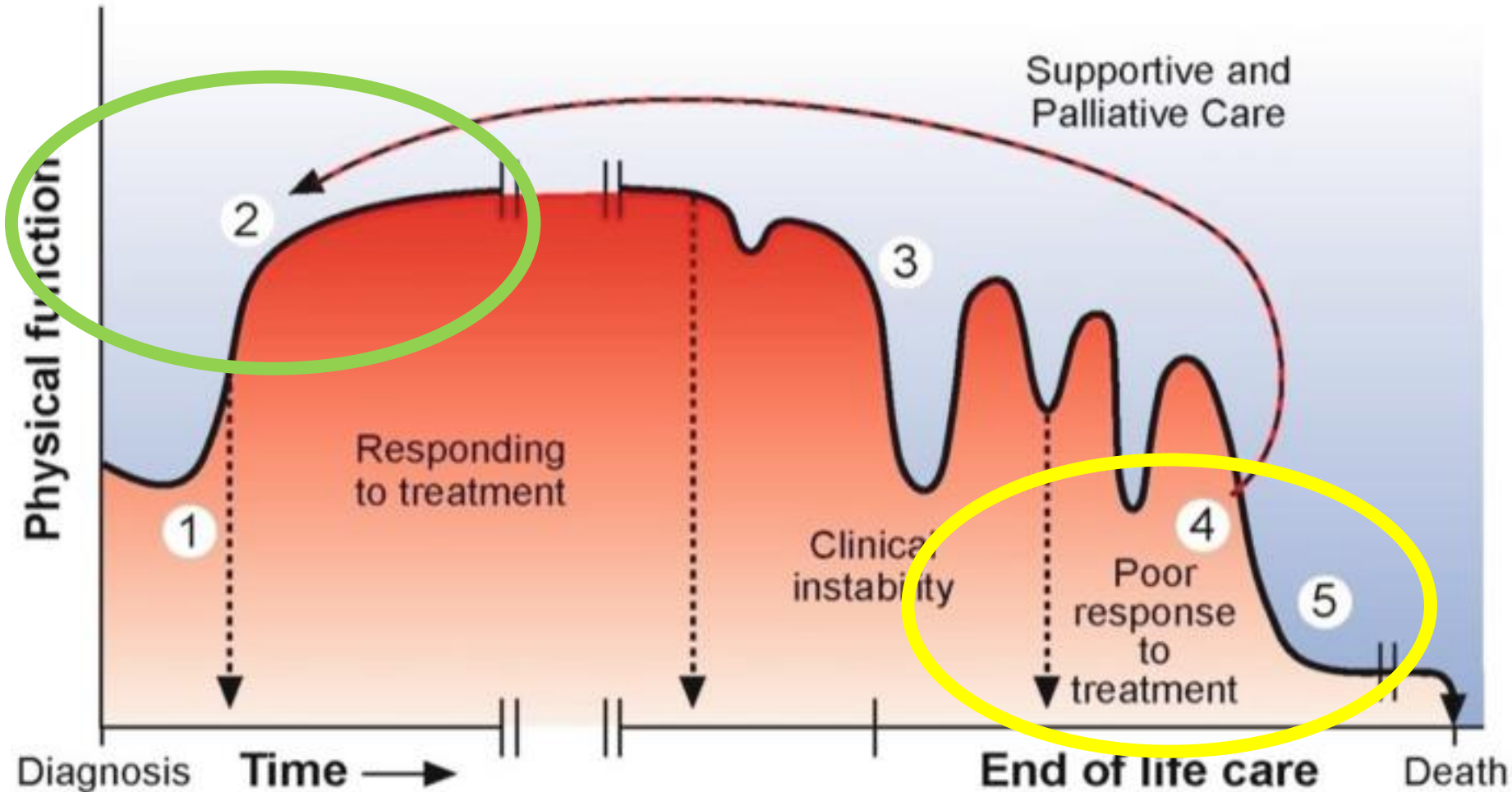
2006 Status	2018 Status	Indications
	1	ECMO ¹ Non-dischargeable VAD ² MVS with life threatening arrhythmia ²
	2	Non-dischargeable LVAD ² Percutaneous endovascular LVAD ² IABP ² VT/VF without MCS ² MCS with mechanical failure ² Dischargeable BiVAD/RVAD/TAH ²
1A	3	Dischargeable LVAD ³ High Dose inotrope / multiple inotropes requiring monitoring ² MCS with: <ul style="list-style-type: none"> • hemolysis² • pump thrombosis² • RV failure² • Infection⁶ • mucosal bleeding⁷ • aortic insufficiency⁸ ECMO ⁴ Non-Dischargeable LVAD ⁵ Percutaneous Endovascular LVAD ⁵ IABP ⁵
	4	Congenital heart disease ⁸ Hypertrophic cardiomyopathy ⁸ Restrictive cardiomyopathy ⁸ Dischargeable LVAD ⁸ Inotropes without monitoring ⁸ Intractable angina ⁸ Re-transplant ⁸
	5	Multi -organ transplant ⁹
2	6	All others ⁹



Introduction to Palliative Medicine for the Advanced HF Patient



The typical course of heart failure



- Sudden death event
- Transplant or ventricular assist device



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Final PEARLS...

- Heart Failure is costly > KEEP THEM OUT OF THE HOSPITAL
- Heart Failure is Treatable
- “FAILURE” is scary to patients > dysfunction is a more realistic term
- LOTS of options > talk early
- Refer to your Heart Failure teams > Co-Management works great
- Not every can handle the full kitchen sink of HF GDMT (especially the young ones)
- DON'T forget to ask about family history, drugs and alcohol, and timing of symptoms

Questions?



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