Heart Failure Management and Prognosis

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Presentation

- Chronic or Subacute.
- **Acute.**

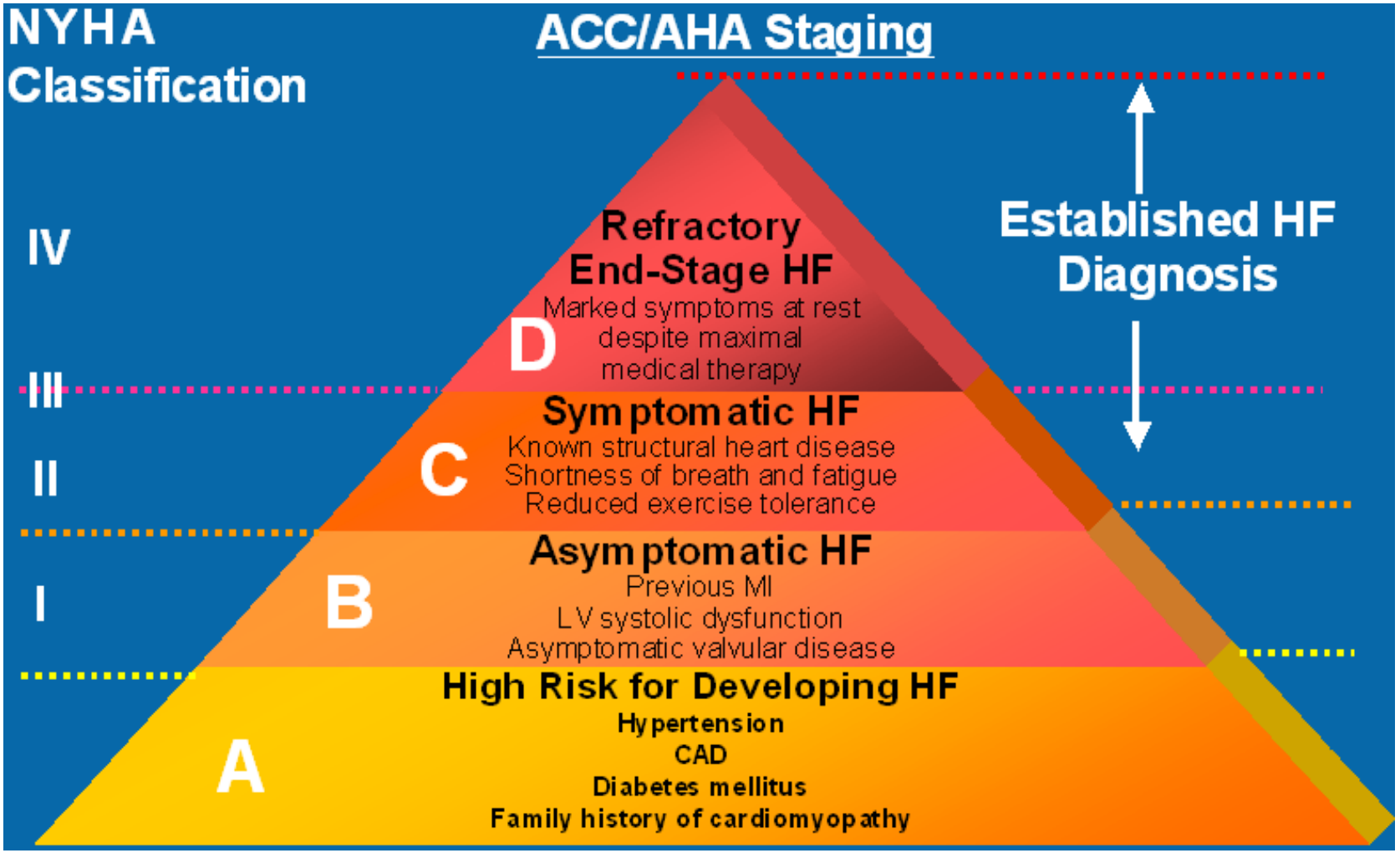
Management

- Correction of reversible causes
  - Ischemia
  - Valvular heart disease
  - Thyrotoxicosis, anemia and other high output status
  - Shunts
  - Arrhythmia
    - Tachy. Like : A fib, flutter or Brady. Like : CHB.
  - Medications
    - Ca channel blockers, some antiarrhythmics, NSAIDs,

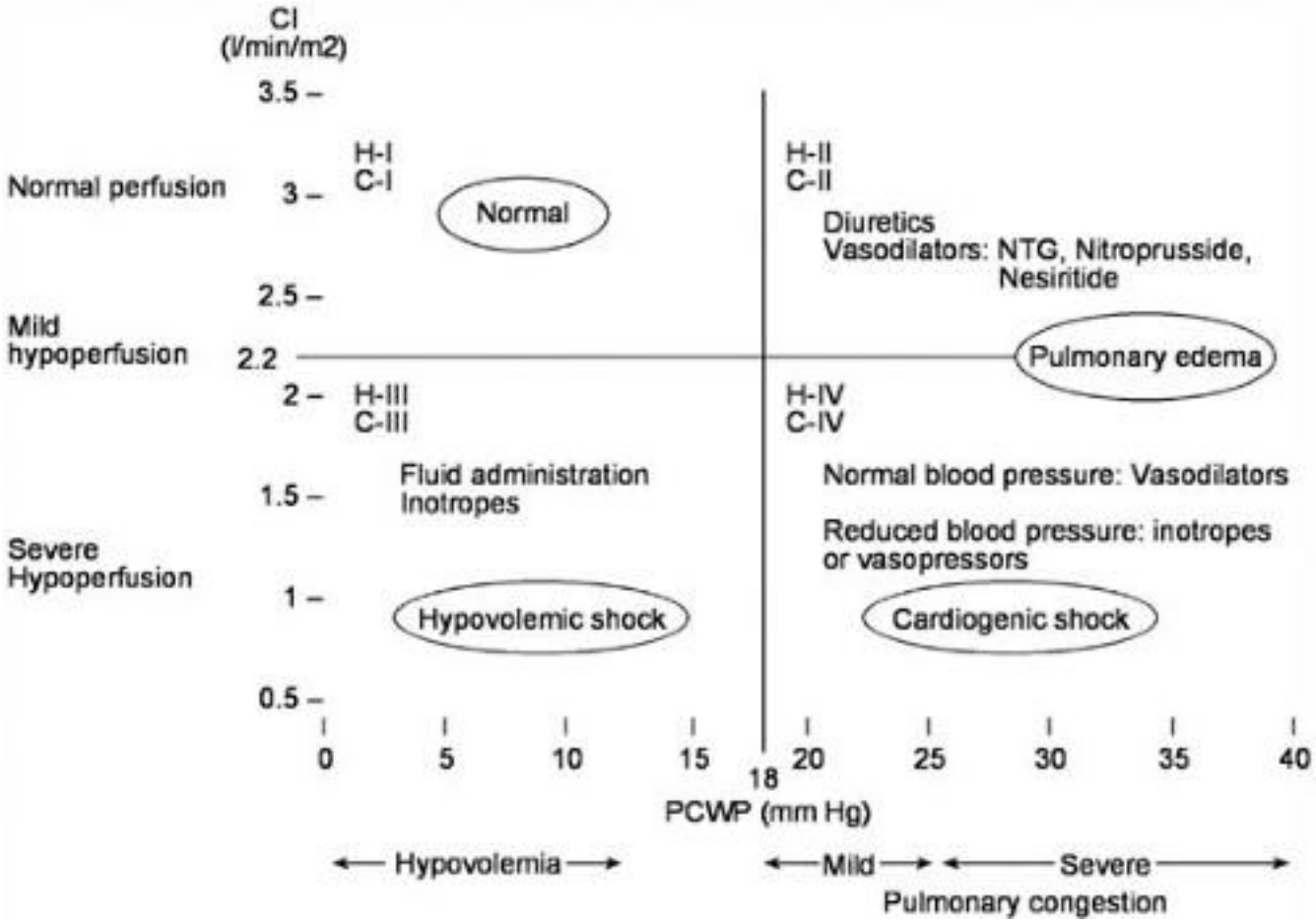
Management tools

- Life style modifications:
  - Diet, Fluid intake, exercise, Smoke cessation, Wt.
- Pharmacological interventions:
  - Oral medication.
  - Immunization.
- Surgical interventions:
  - Device therapy.
  - Assisting devices.
  - Transplant.

Stages of Heart Failure



Forrester Classification



Am J Cardiol 1977;39:137–145

Forrester Classification

		Congestion at Rest	
		No	Yes
Low Perfusion at rest	No	Warm & Dry	Warm & Wet
	Yes	Cold & Dry	Cold & Wet

Eur J Heart Fail. 1999 Aug;1(3):251-7.

Diet and Activity

- Salt restriction (2g of Na = 5 g NaCL)
- Fluid restriction (1.5 to 2 L / day) about 8 cups
- Daily weight (tailor therapy)
- Gradual exertion programs (rehabilitation program)

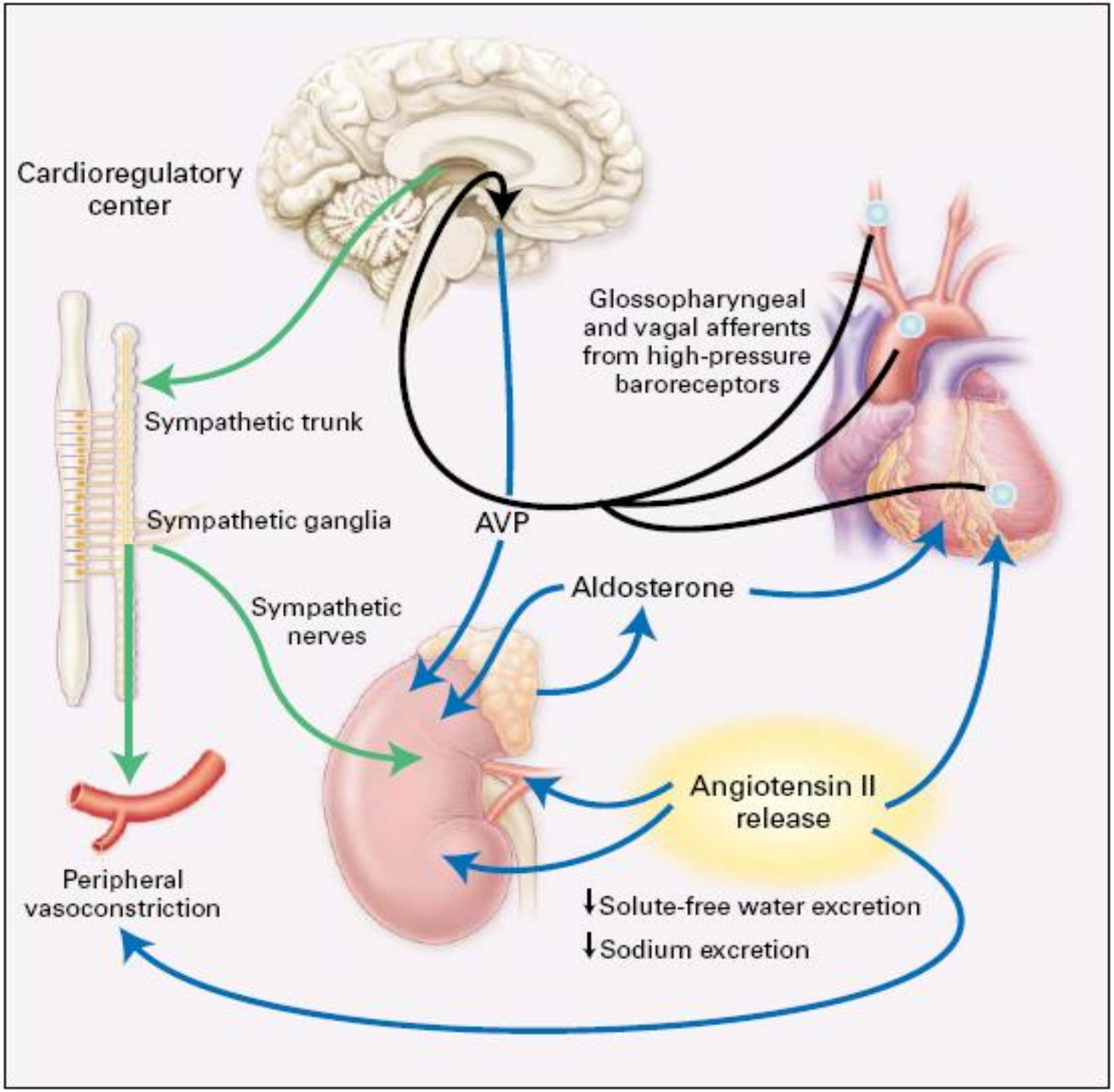

Cardioregulatory center
Glossopharyngeal and vagal afferents from high-pressure baroreceptors
Sympathetic trunk
Sympathetic ganglia
AVP
Aldosterone
Sympathetic nerves
Angiotensin II release
Peripheral vasoconstriction
↓Solute-free water excretion
↓Sodium excretion

Table 7.2 Evidence-based doses of disease-modifying drugs in key randomized trials in heart failure with reduced ejection fraction (or after myocardial infarction)

	Starting dose (mg)	Target dose (mg)
ACE-I		
Captopril[a]	6.25 *t.i.d.*	50 *t.i.d.*
Enalapril	2.5 *b.i.d.*	10–20 *b.i.d.*
Lisinopril[a]	2.5–5.0 *o.d.*	20–35 *o.d.*
Ramipril	2.5 *o.d.*	10 *o.d.*
Trandolapril[a]	0.5 *o.d.*	4 *o.d.*
Beta-blockers		
Bisoprolol	1.25 *o.d.*	10 *o.d.*
Carvedilol	3.125 *b.i.d.*	25 *b.i.d.*[d]
Metoprolol succinate (CR/XL)	12.5–25 *o.d.*	200 *o.d.*
Nebivolol[c]	1.25 *o.d.*	10 *o.d.*
ARBs		
Candesartan	4–8 *o.d.*	32 *o.d.*
Valsartan	40 *b.i.d.*	160 *b.i.d.*
Losartan[b,c]	50 *o.d.*	150 *o.d.*
MRAs		
Eplerenone	25 *o.d.*	50 *o.d.*
Spironolactone	25 *o.d.*	50 *o.d.*
ARNI		
Sacubitril/valsartan	49/51 *b.i.d.*	97/103 *b.i.d.*
If-channel blocker		
Ivabradine	5 *b.i.d.*	7.5 *b.i.d.*

ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker; ARNI = angiotensin receptor neprilysin inhibitor; b.i.d. = bis in die (twice daily); MRA = mineralocorticoid receptor antagonist; o.d. = omne in die (once daily); t.i.d. = ter in die (three times a day).

[a]Indicates an ACE-I where the dosing target is derived from post-myocardial infarction trials.

[b]Indicates drugs where a higher dose has been shown to reduce morbidity/mortality compared with a lower dose of the same drug, but there is no substantive randomized, placebo-controlled trial and the optimum dose is uncertain.

[c]Indicates a treatment not shown to reduce cardiovascular or all-cause mortality in patients with heart failure (or shown to be non-inferior to a treatment that does).

[d]A maximum dose of 50 mg twice daily can be administered to patients weighing over 85 kg.

Table 7.3 Doses of diuretics commonly used in patients with heart failure

Diuretics	Initial dose (mg)		Usual daily dose (mg)	
Loop diuretics[a]				
Furosemide	20–40		40–240	
Bumetanide	0.5–1.0		1–5	
Torasemide	5–10		10–20	
Thiazides[b]				
Bendroflumethiazide	2.5		2.5–10	
Hydrochlorothiazide	25		12.5–100	
Metolazone	2.5		2.5–10	
Indapamide[c]	2.5		2.5–5	
Potassium-sparing diuretics[d]				
	+ACE-I/ ARB	-ACE-I/ ARB	+ACE-I/ ARB	-ACE-I/ ARB
Spironolactone/ eplerenone	12.5–25	50	50	100–200
Amiloride	2.5	5	5–10	10–20
Triamterene	25	50	100	200

ACE-I = angiontensin-converting enzyme inhibitor, ARB = angiotensin receptor blocker.

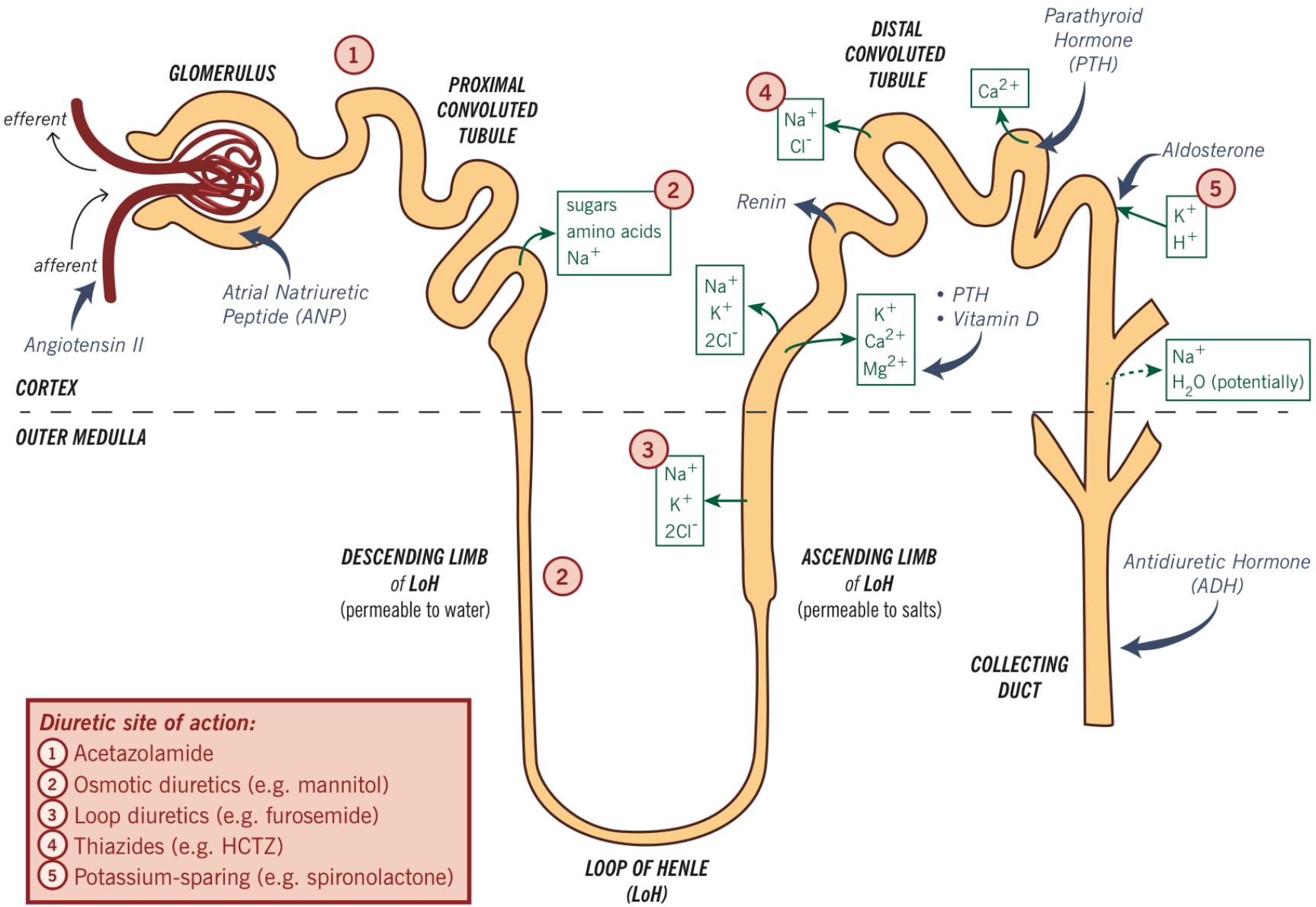
[a]Oral or intravenous; dose might need to be adjusted according to volume status/weight; excessive doses may cause renal impairment and ototoxicity.

[b]Do not use thiazides if estimated glomerular filtration rate <30 mL/min/1.73 m^2, except when prescribed synergistically with loop diuretics.

[c]Indapamide is a non-thiazide sulfonamide.

[d]A mineralocorticoid antagonist (MRA) i.e. spironolactone/eplerenone is always preferred. Amiloride and triamterene should not be combined with an MRA.

Hormones Acting on the Nephron / Diuretics and Their Site of Action



Diuretic site of action:

1. Acetazolamide
2. Osmotic diuretics (e.g. mannitol)
3. Loop diuretics (e.g. furosemide)
4. Thiazides (e.g. HCTZ)
5. Potassium-sparing (e.g. spironolactone)

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Diuretic Therapy

- The most effective symptomatic relief
- Mild symptoms
  - HCTZ
  - Chlorthalidone
  - Metolazone
  - Block Na reabsorbtion in loop of henle and distal convoluted tubules
  - Thiazides are ineffective with GFR < 30 --/min

Diuretics (cont.)

- **Side Effects**
  - Pre-renal azotemia
  - Skin rashes
  - Neutropenia
  - Thrombocytopenia
  - Hyperglycemia
  - ↑ Uric Acid
  - Hepatic dysfunction

Diuretics (cont.)

- **More severe heart failure → loop diuretics**
  - **Lasix** (20 – 320 mg QD), Furosemide
  - **Bumex** (Bumetanide 1-8mg)
  - **Torsemide** (20-200mg)
- **Mechanism of action**: Inhibit chloride reabsorption in ascending limb of loop of Henle results in natriuresis, kaliuresis and metabolic alkalosis
- **Adverse reaction:**
  - pre-renal azotemia
  - Hypokalemia
  - Skin rash
  - ototoxicity

K^+ Sparing Agents

- **Triamterene & amiloride** – acts on distal tubules to ↓ K secretion
- **Spironolactone** (Aldosterone inhibitor)

  recent evidence suggests that it may improve survival in CHF patients due to the effect on renin-angiotensin-aldosterone system with subsequent effect on myocardial remodeling and fibrosis

Inhibitors of renin-angiotensin-aldosterone system

- Renin-angiotensin-aldosterone system *activation is early in the course of heart failure and plays an important role in the progression of the syndrome*
- Angiotensin converting enzyme inhibitors
- Angiotensin receptors blockers
- Spironolactone

Angiotensin Converting Enzyme Inhibitors

- They block the R-A-A system by inhibiting the conversion of angiotensin I to angiotensin II → vasodilation and ↓ Na retention
- ↓ Bradykinin degradation ↑ its level → ↑ PG secretion & nitric oxide
- ACE Inhibitors were found to improve survival in CHF patients
  - Delay onset & progression of HF in pts with asymptomatic LV dysfunction
  - ↓ cardiac remodeling

Side effects of ACE inhibitors

- Angioedema
- Hypotension
- Renal insuffiency
- Rash
- Cough

Angiotensin II receptor blockers

- Has comparable effect to ACE I
- Can be used in certain conditions when ACE I are contraindicated (angioneurotic edema, cough)

Angiotensin Receptor-Neprilysin inhibitor (ARNi)

- Recent FDA approval (2015)
- The only product available (valsartan/sacubitril)
- Valsartan = ARB
- Sacubitril = prodrug for sacubitrilat
  Inhibit neprilysin which breakdown the vasoactive peptides.
- Used if patient LVEF <= 35% and still symptomatic with ACE/ARB
- In this specific group of patients it improves M&M.

I_f- Channel blocker

- Ivabradine ; Inhibit the Na inflow during the SA nodel action potential phase 4.
- Degrease the heart rate.
- Only use it if HR not controlled by BB and remains > 70 bpm and the patient has sinus rhythm.
- In this group if patients it improve M&M.

Digitalis Glycosides (Digoxin, Digitoxin)

- The role of digitalis has declined somewhat because of safety concern
- Studies have shown that digitals does not affect mortality in CHF patients but causes significant:
  - Reduction in hospitalization
  - Reduction in symptoms of HF


VITCENT

Digitalis (cont.)
Mechanism of Action

- +ve inotropic effect by ↑ intracellular Ca & enhancing actin-myosin cross bride formation (binds to the Na-K ATPase → inhibits Na pump → ↑ intracellular Na → ↑ Na-Ca exchange
- Vagotonic effect
- Arrhythmogenic effect

Digitalis Toxicity

- Narrow therapeutic to toxic ratio
- Non cardiac manifestations
  - Anorexia,
  - Nausea, vomiting,
  - Headache,
  - Xanthopsia sotoma,
  - Disorientation

Digitalis Toxicity

- **Cardiac manifestations**
  - Sinus bradycardia and arrest
  - A/V block (usually 2nd degree)
  - Atrial tachycardia with A/V Block
  - Development of junctional rhythm in patients with a fib
  - PVC's, VT/ V fib (bi-directional VT)

Digitalis Toxicity Treatment

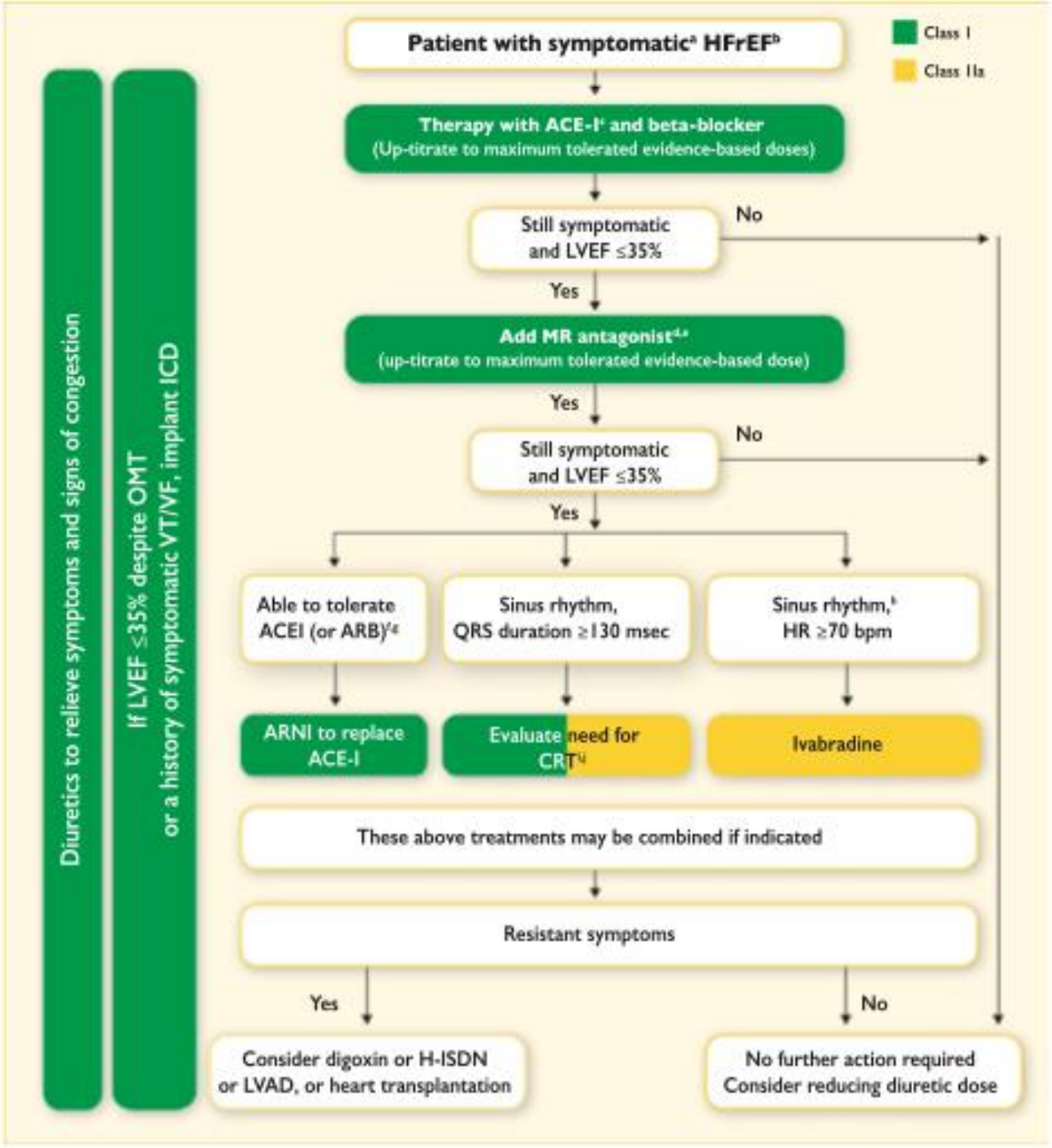
- Hold the medications.
- Observation.
- In case of A/V block or severe bradycardia → atropine followed by temporary PM if needed.
- In life threatening arrhythmia → digoxin-specific fab antibodies.
- Lidocaine and phenytoin could be used – try to avoid D/C cardioversion in non life threatening arrhythmia.

β Blockers

- Has been traditionally contraindicated in pts with CHF
- Now they are the main stay in treatment on CHF & may be the only medication that shows substantial improvement in LV function
- In addition to improved LV function multiple studies show improved survival
- The only contraindication is severe decompensated CHF

Vasodilators

- **Reduction of afterload** by arteriolar vasodilatation (hydralazin) → reduce LVEDP, O_2 consumption,improve myocardial perfusion, stroke volume and COP
- **Reduction of preload** By venous dilation (Nitrate) → ↓ the venous return →↓ the load on both ventricles.
- Usually the maximum benefit is achieved by using agents with both action.



ESC 2016 Heart Failure guidelines

Positive inotropic agents

- These are the drugs that improve myocardial contractility (β adrenergic agonists, dopaminergic agents, phosphodiesterase inhibitors),

  Dopamine, Dobutamine, Milrinone, Amrinone

- Several studies showed ↑ mortality with oral inotropic agents
- So the only use for them now is in acute sittings as cardiogenic shock

Anticoagulation (Warfarin)/NOAC

- Atrial fibrillation
- H/o embolic episodes
- Left ventricular apical thrombus

Antiarrhythmics

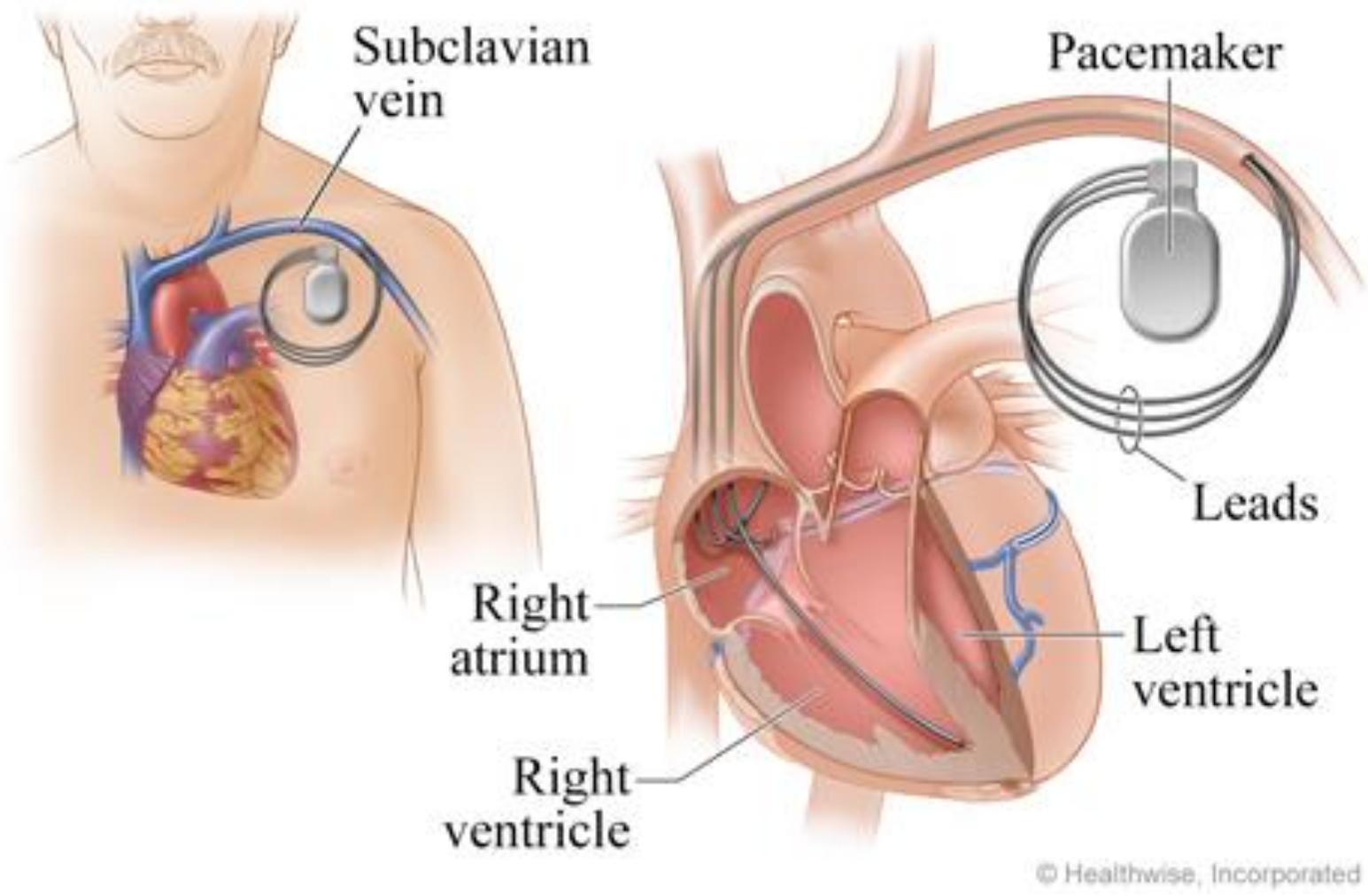
- Most common cause of SCD in these patients is ventricular tachyarrhythmia
- Patients with h/o sustained VT or SCD → ICD implant

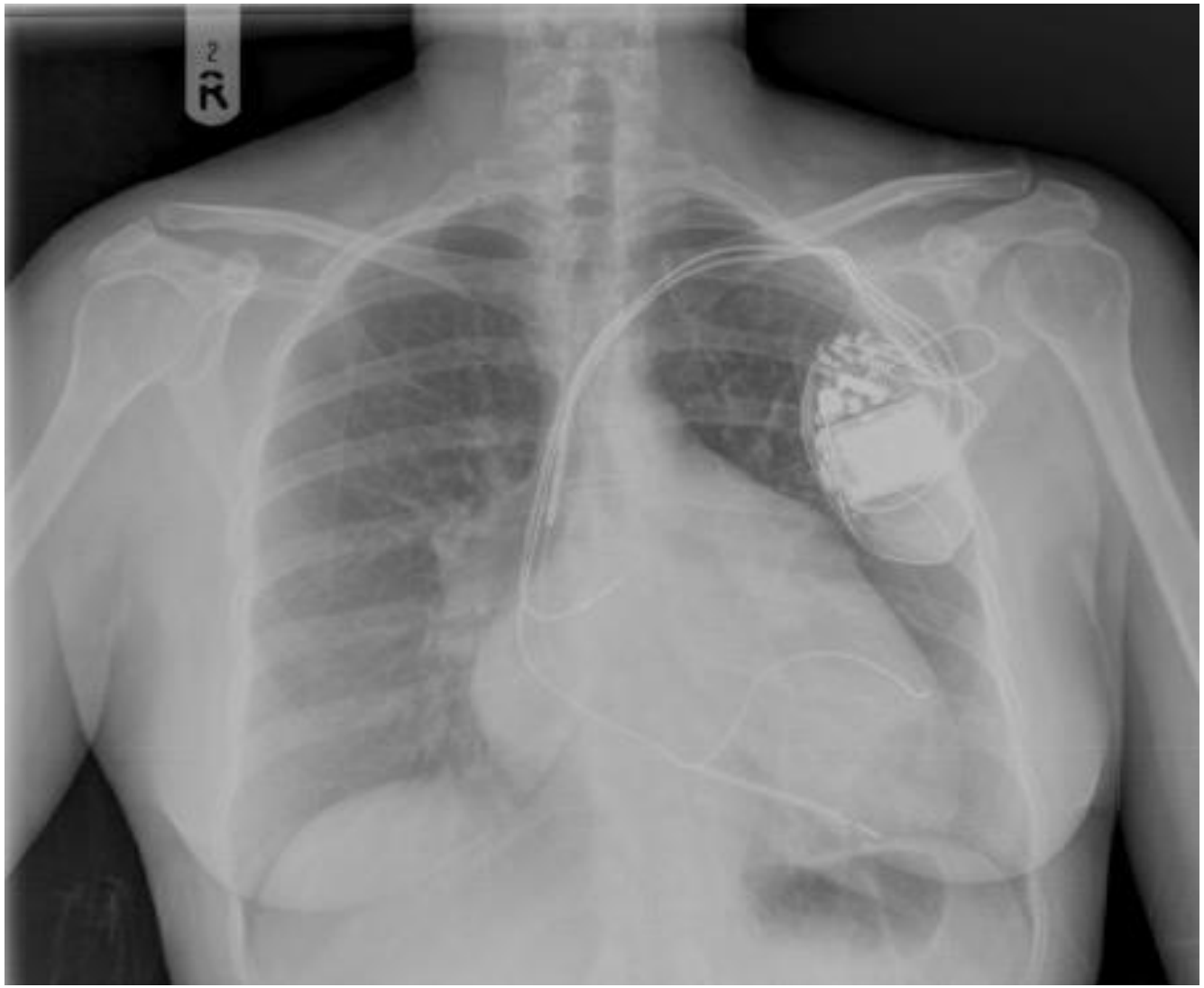
Antiarrhythmics (cont.)

- Patients with non sustained ventricular tachycardia
  - Correction of electrolytes and acid base imbalance.

Biventricular Pacing

- **Biventricular pacing** (only in patient with Wide QRS complexes & CHF).


Subclavian vein
Pacemaker
Leads
Right atrium
Left ventricle
Right ventricle
© Healthwise, Incorporated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Assisting devices

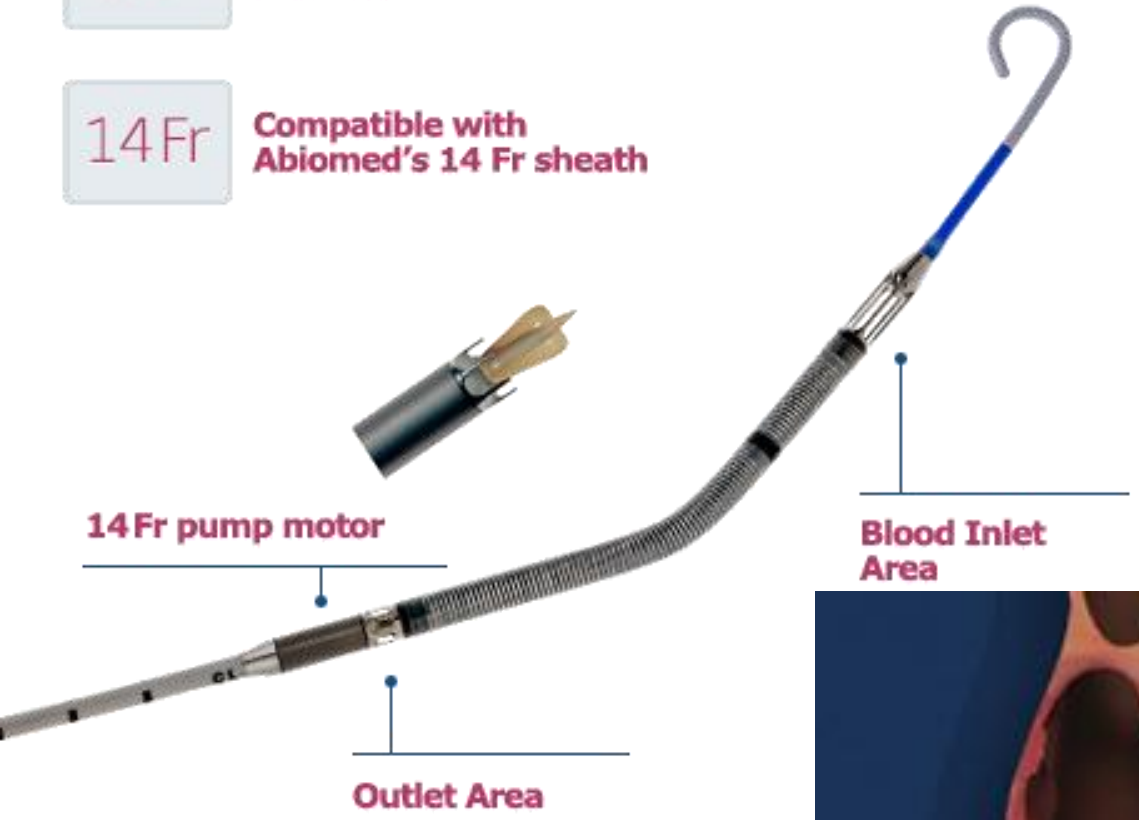
- Temporary ventricular assist devices.
- Implantable ventricular assist devices.

9Fr

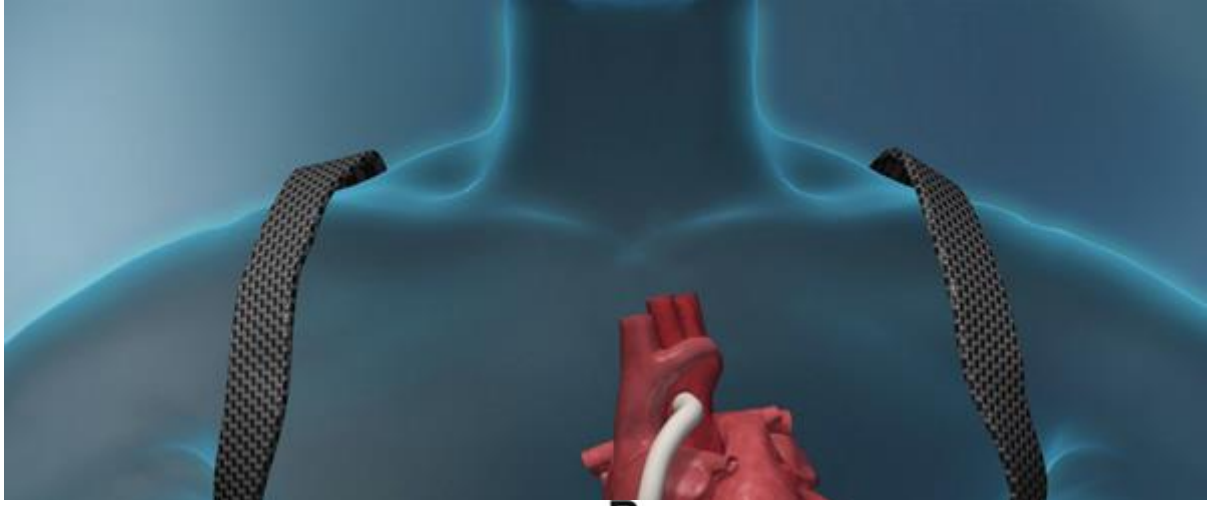
Catheter Diameter

14Fr

Compatible with Abiomed's 14 Fr sheath

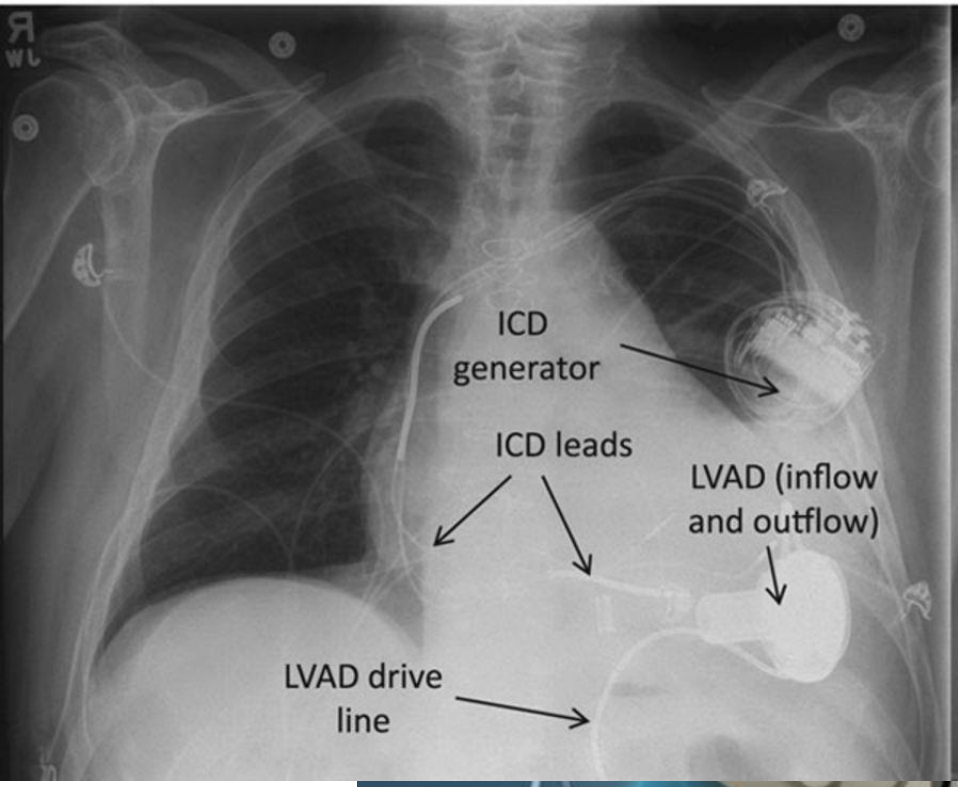


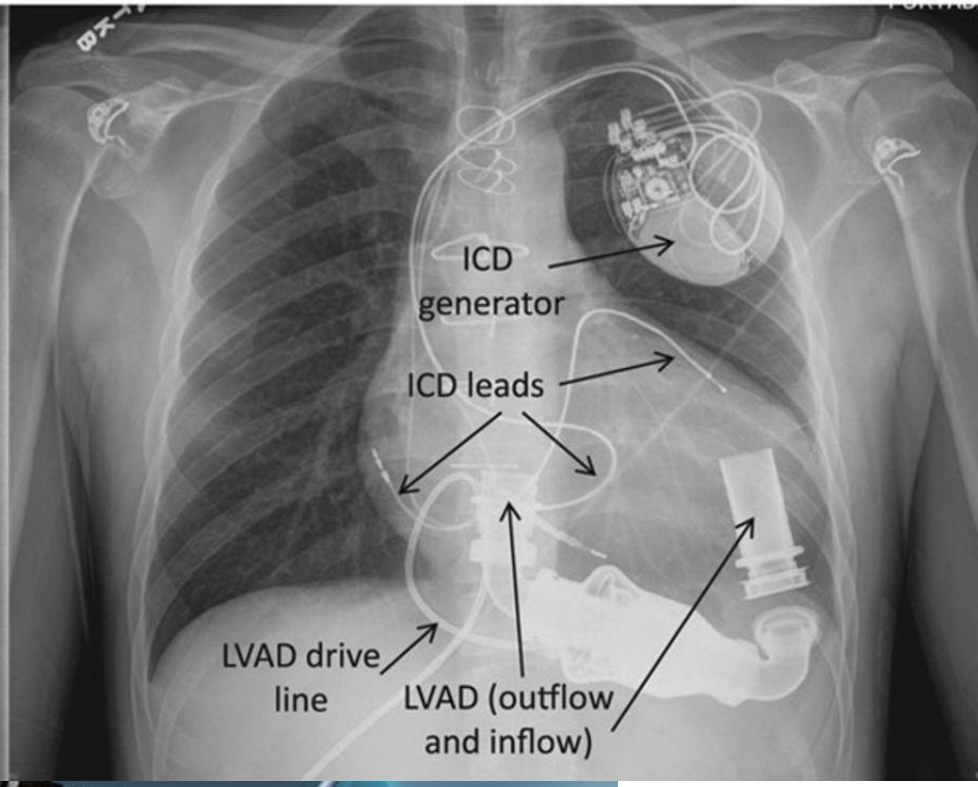
September 2012, received FDA 510(k) clearance



A

B


ICD
generator
ICD leads
LVAD (inflow
and outflow)
LVAD drive
line


ICD
generator
ICD leads
LVAD drive
line
LVAD (outflow
and inflow)

Cardiac Transplant

- It has become more widely used since the advances in immunosuppressive treatment.
- Survival rate:
  - 1 year 80% - 90%
  - 5 years 70%

Prognosis

- Annual mortality rate depends on patients symptoms and LV function.
- 5% in patients with mild symptoms and mild ↓ in LV function.
- 30% to 50% in patient with advances LV dysfunction and severe symptoms.
- 40% – 50% of death is due to SCD.