

# Acute heart failure

Martin Radvan



# What we will talk about?

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- Pathophysiology
- Clinical signs
- Diagnosis
- Therapy



# Definition

- Acute heart failure (AHF) is generally defined as the rapid development or change of symptoms and signs of heart failure that requires urgent medical attentionis
- No new mediaction for last 30 years



# Definition

- Symptoms related to pulmonary congestion due to elevated left ventricle filling pressures with or without low cardiac output



# Definition

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- De novo x acute decompensation of chronic heart failure
- Cardiogenic shock



# Epidemiology

- No1 reason for hospitalisation in people older than 65 years
- 65-75% known HF before hospitalisation
- 25-55% preserved ejection fraction (HFpEF)



# Diagnosis

- Anamnesis
- Clinical signs
- Examination: perfusion and volume status
- ECG
- Echocardiography
- Labs
- X-ray, CT, coronarography, etc.



# Signs and symptoms

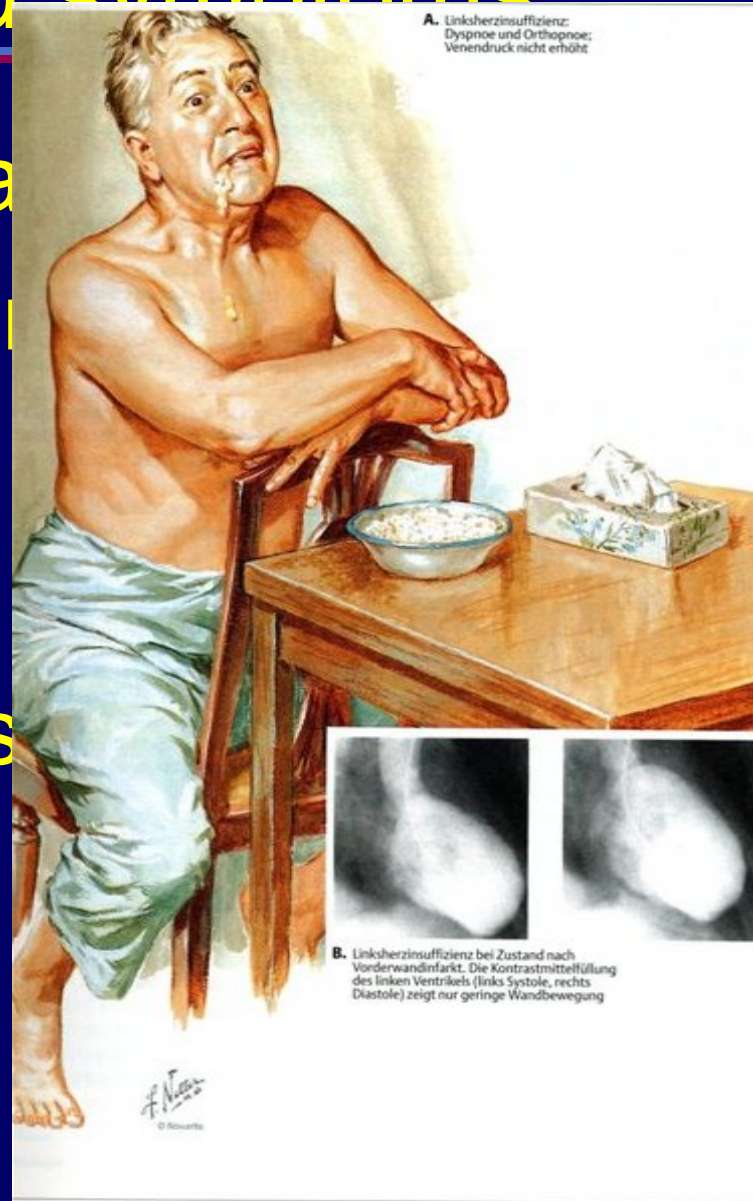
- noisy syndrome, rapid developement
- elevated jugular venous pressure
- pulmonary edema
- +S3 (gallop)
- pulmonary crackles
- peripheral oedema
- orthopnoe



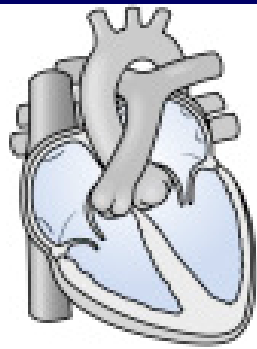


# Signs and symptoms

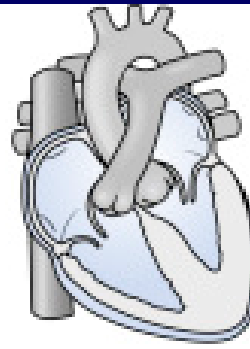
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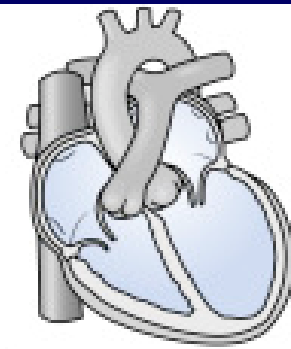
Substrate



Normal



Structural heart disease



Chronic heart failure

Triggers

Hypertension, ACD, arrhythmias, infections, renal dysfunction, nonadherence, medications

Amplifying mechanisms

**Myocardial**

- Decreased CO
- Diastolic dysfunction
- Myocyte injury
- Mitral regurgitation
- Ventricular interdependence
- Tachycardia

**Renal**

- Sodium and volume retention
- Acute kidney injury
- RAAS activation

**Vascular**

- Endothelial dysfunction
- Increased arterial stiffness
- Vasoconstriction
- Afterload contractility mismatch
- Volume redistribution
- Capillary leakiness

**Neurohormonal**

- RAAS activation
- SNS activation
- Oxidative stress
- Inflammation

Congestion

End-organ dysfunction



## Suspected acute heart failure

History/examination  
(including blood pressure and respiratory rate)

Chest X-ray

Echocardiogram or NP (or both)

Blood chemistry

ECG

Oxygen saturation

Full blood count

Simultaneously  
assess for

Ventilation/  
systemic  
oxygenation  
inadequate?<sup>a</sup>

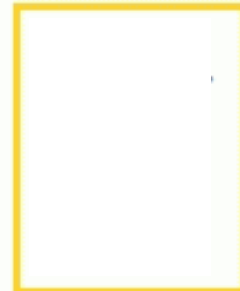
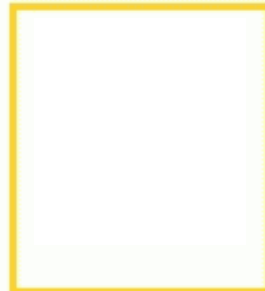
Life-threatening  
arrhythmia/  
bradycardia?<sup>b</sup>

Blood pressure  
<85 mmHg  
or shock<sup>c</sup>

Acute  
coronary  
syndrome<sup>d</sup>

Acute  
mechanical  
cause/severe  
valvular disease<sup>e</sup>

Urgent  
action  
if present



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- Oxygen
- NIV
- ETT and  
invasive  
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- Mechanical circulatory support (e.g. IABP)



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- Coronary reperfusion
- Antithrombotic therapy



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- Mechanical circulatory support (e.g. IABP)

- Coronary reperfusion
- Antithrombotic therapy

- Echocardiography
- Surgical/  
percutaneous intervention







ESC GUIDELINES

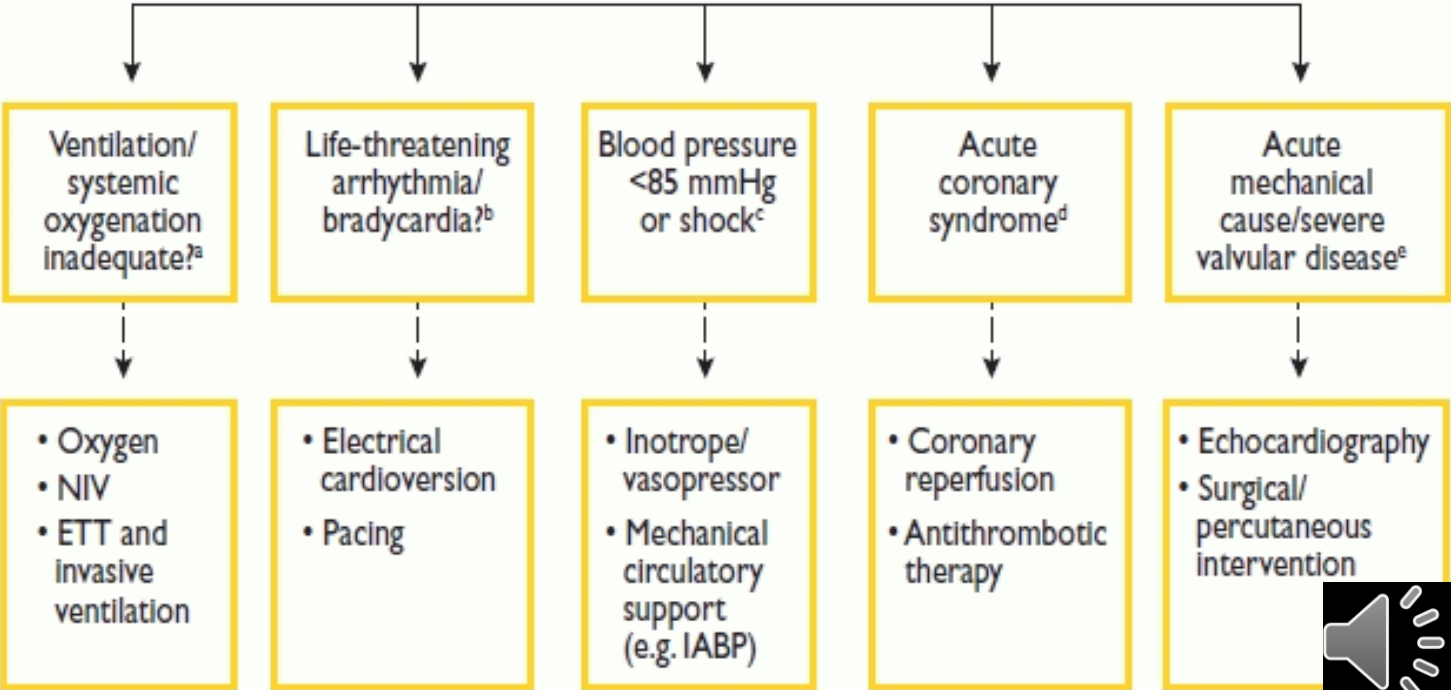
# ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012

The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC

Suspected acute heart failure

- respiratory rate)
- ECG
- Oxygen saturation
- Full blood count

Simultaneously assess for



# Pathophysiology

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Dry-warm

Dry-cold

Wet –warm

Wet-cold



# Pathophysiology

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**Dry-warm**

Well perfused, normovolemic

**Dry-cold**

Hypoperfused, hypovolemic

**Wet –warm**

Congestion, well perfused

**Wet-cold**

Congested, hypoperfused



# Pathophysiology

---

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~~Well-perfused, normovolemic~~

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# Pathophysiology

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Congested, hypoperfused



# Pathophysiology

## ~~Dry-warm~~

~~Well perfused, normovolemic~~

## Wet –warm

Congestion, well perfused

Diuretics, vasodilators

## Dry-cold

Hypoperfused, hypovolemic

Water challenge, inotropes

## Wet-cold

Congested, hypoperfused

Inotropes, MCS



# Pathophysiology – Forrester classification (PCWP, CI)

## ~~Dry-warm~~

~~Well perfused, normovolemic~~

## Dry-cold

Hypoperfused, hypovolemic

Water challenge, inotropes

## Wet –warm

Congestion, well perfused

Duoretics, vasodilators

90-95%

## Wet-cold

Congested, hypoperfused

Inotropes, MCS

5-10%



# PCWP, CI

## PCWP

Invasive vs. non-invasive  
measurment

Pressure in left atrium

Volume status

## Cardiac index

Invasive vs. Non-invasive  
measurment

2,2L/min/m<sup>2</sup>

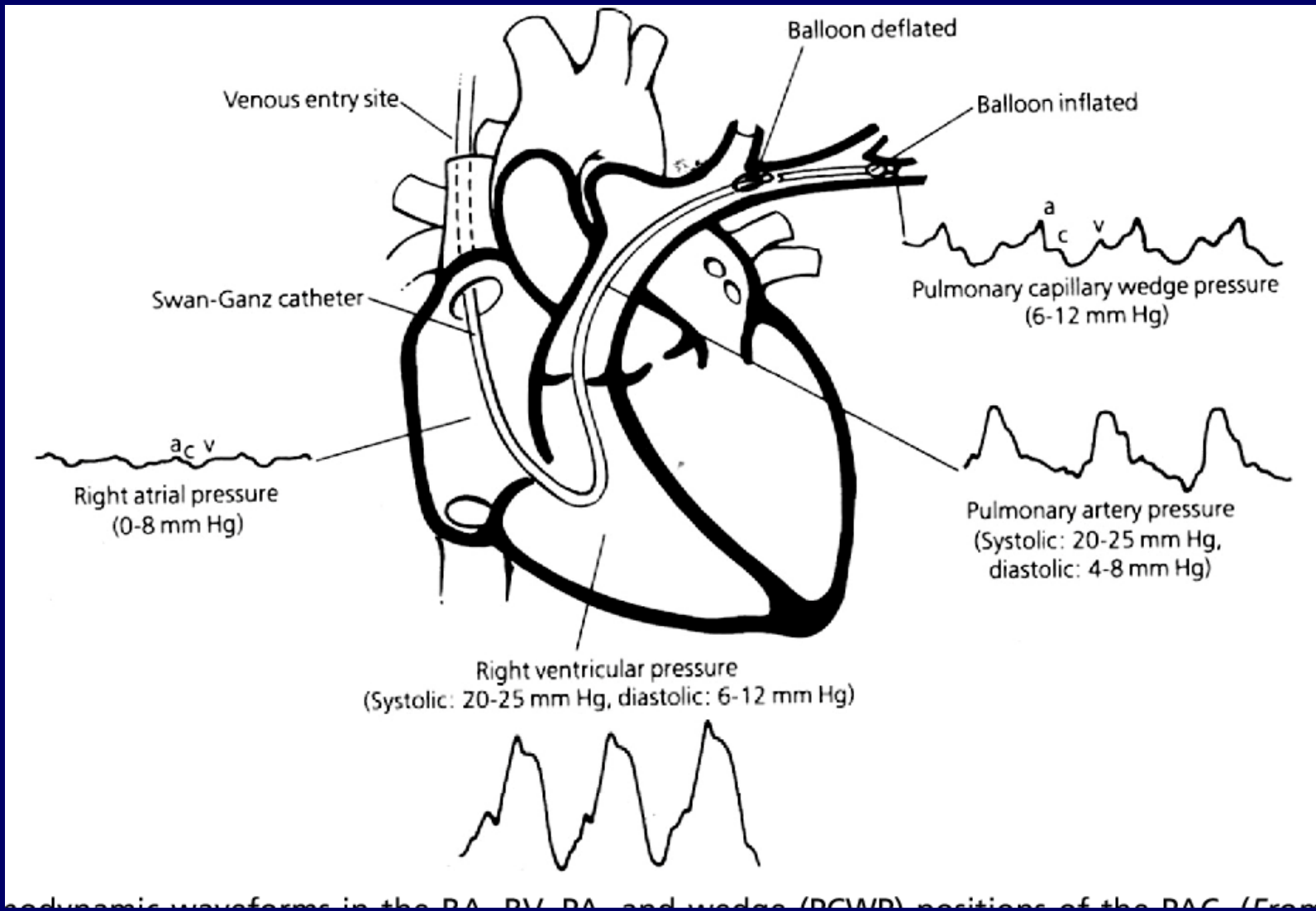
Cardiac output

Degree of perfusion





# PCWP, CI

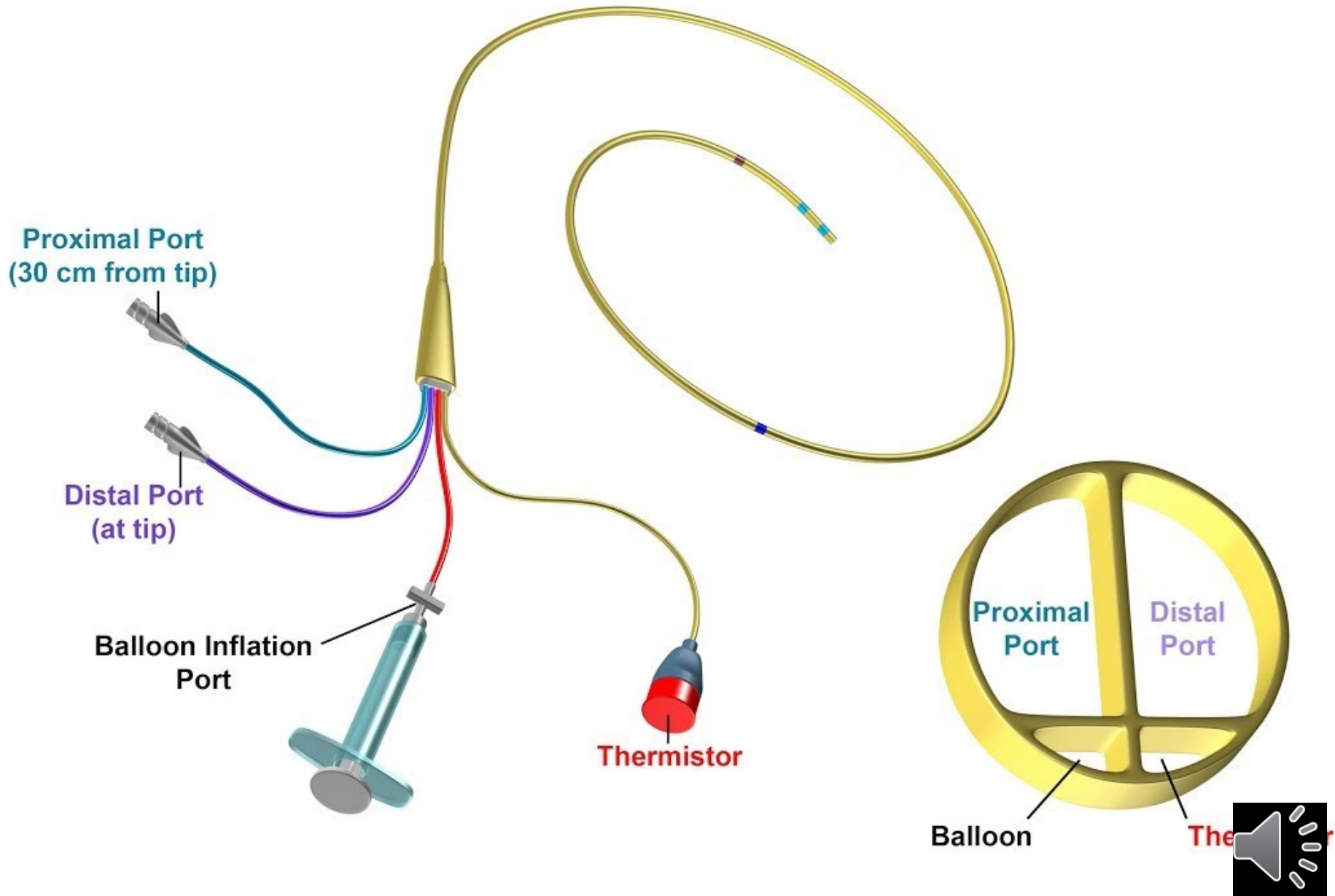


ive

odynamic waveforms in the RA, RV, PA, and wedge (PCWP) positions of the PAC. (From



# PCWP CI



# PCWP, CI

## PCWP

Invasive vs. non-invasive  
measurement

Pressure in left atrium

Volume status

## Cardiac index

Invasive vs. non-invasive  
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2,2L/min/m<sup>2</sup>

Cardiac output

Degree of perfusion



# Labs

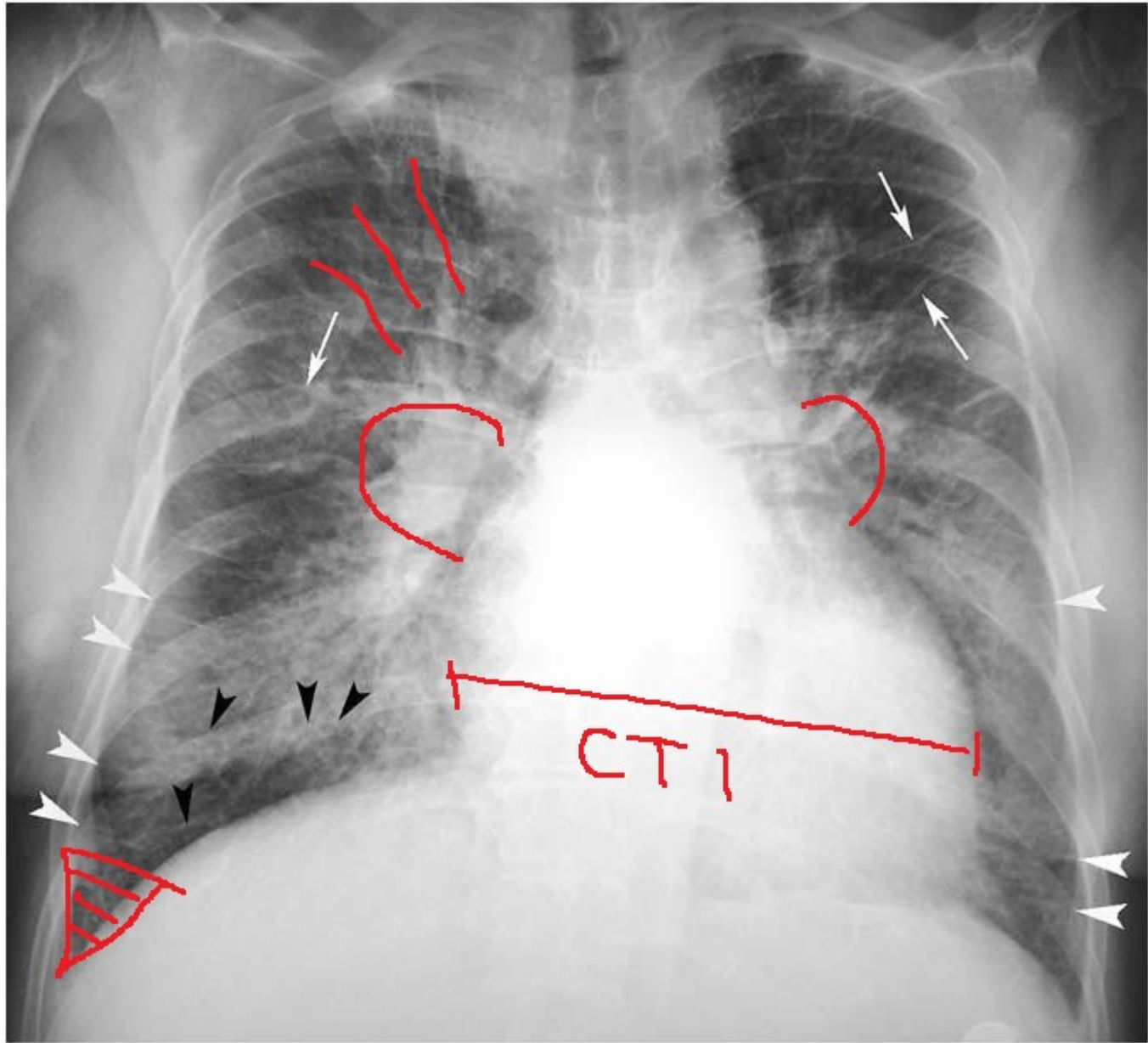
- ECG – rarely normal
- X-ray: congestion, normal heart size
- Echocardiography – heart, lungs
- BNP, NT-proBNP, troponin



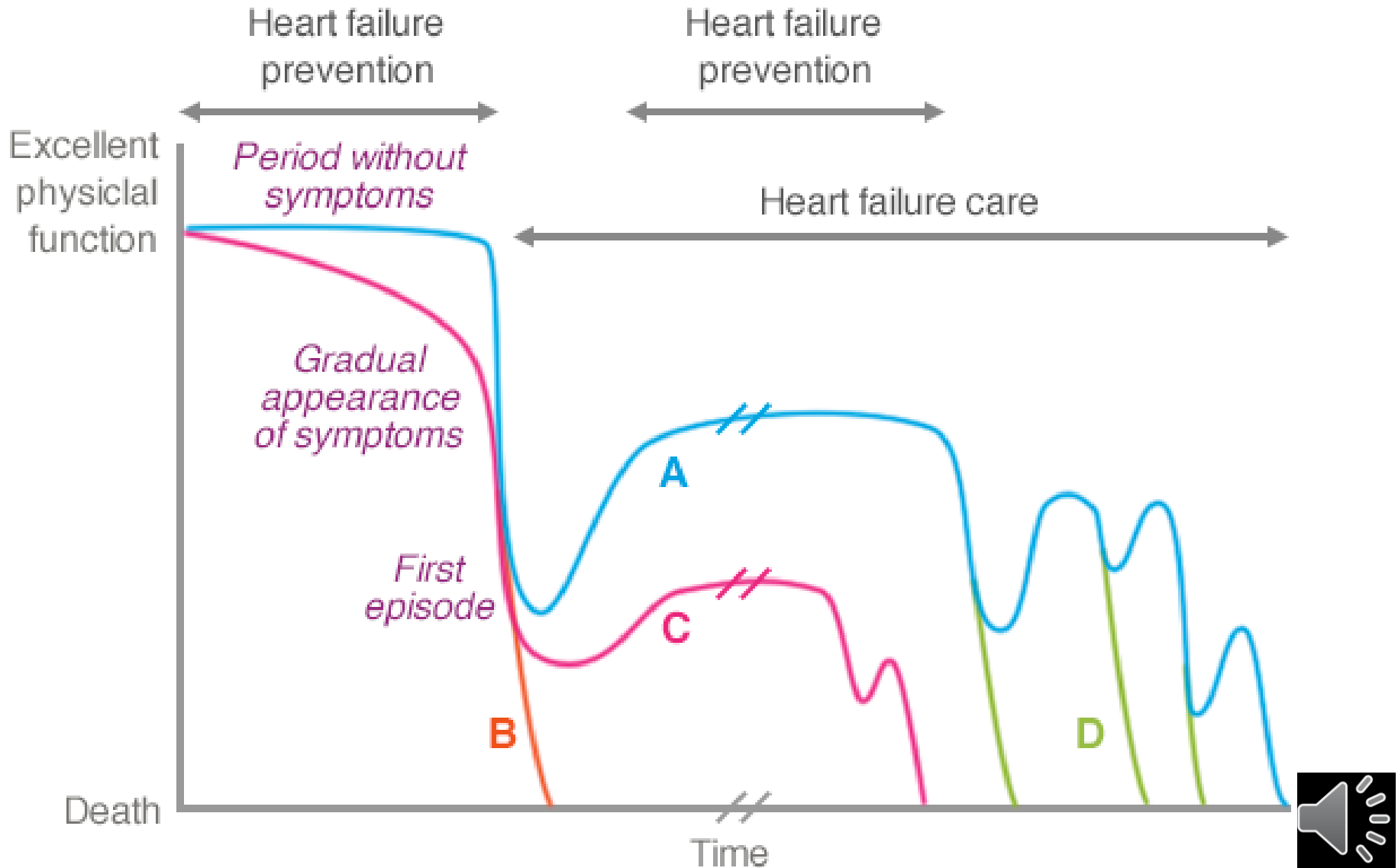
- EC
- X-ra
- BN



- EC
- X-r
- BN



# Clinical course



# Pulmonary aedema





# Therapy of pulmonary aedema?

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# Therapy of pulmonary aedema

- Oxygen
- Morphin
- Vasodilatation (blood pressure control)
- Furosemide
- Therapy of the cause



# Classifications

INTERMACS level	NYHA Class	Description	Device
1. Cardiogenic shock "Crash and burn"	IV	Haemodynamic instability in spite of increasing doses of catecholamines and/or mechanical circulatory support with critical hypoperfusion of target organs (severe cardiogenic shock).	ECLS, ECMO, percutaneous support device
2. Progressive decline despite inotropic support "Sliding on inotropes"	IV	Intravenous inotropic support with acceptable blood pressure but rapid deterioration of renal function, nutritional state, or signs of congestion.	ECLS, ECMO, LVAD
3. Stable but inotrope dependent "Dependent stability"	IV	Haemodynamic stability with low or intermediate doses of inotropics, but necessary due to hypotension, worsening of symptoms, or progressive renal failure.	LVAD
4. Resting symptoms "Frequent flyer"	IV ambulatory	Temporary cessation of inotropic treatment is possible, but patient presents with frequent symptom recurrences and typically with fluid overload.	LVAD
5. Exertion intolerant "Housebound"	IV ambulatory	Complete cessation of physical activity, stable at rest, but frequently with moderate fluid retention and some level of renal dysfunction.	LVAD
6. Exertion limited "Walking wounded"	III	Minor limitation on physical activity and absence of congestion while at rest. Easily fatigued by light activity.	LVAD / Discuss LVAD as option
7. "Placeholder"	III	Patient in NYHA Class III with no current or recent unstable fluid balance.	Discuss LVAD as option



# Cardiogenic shock

- Acute HF in naive patients
- Myocardial injury
- Arrhythmia
- Valvular disease
- Obstructive shock
- Tamponade
- ...



# Diagnosis

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# Pharmacotherapy of cardiogenic shock

- Inotropes: noradrenalin, dobutamin, adrenalin, milrinon, levosimendan
- Ultrafiltration
- Furosemide
- Therapy of the cause

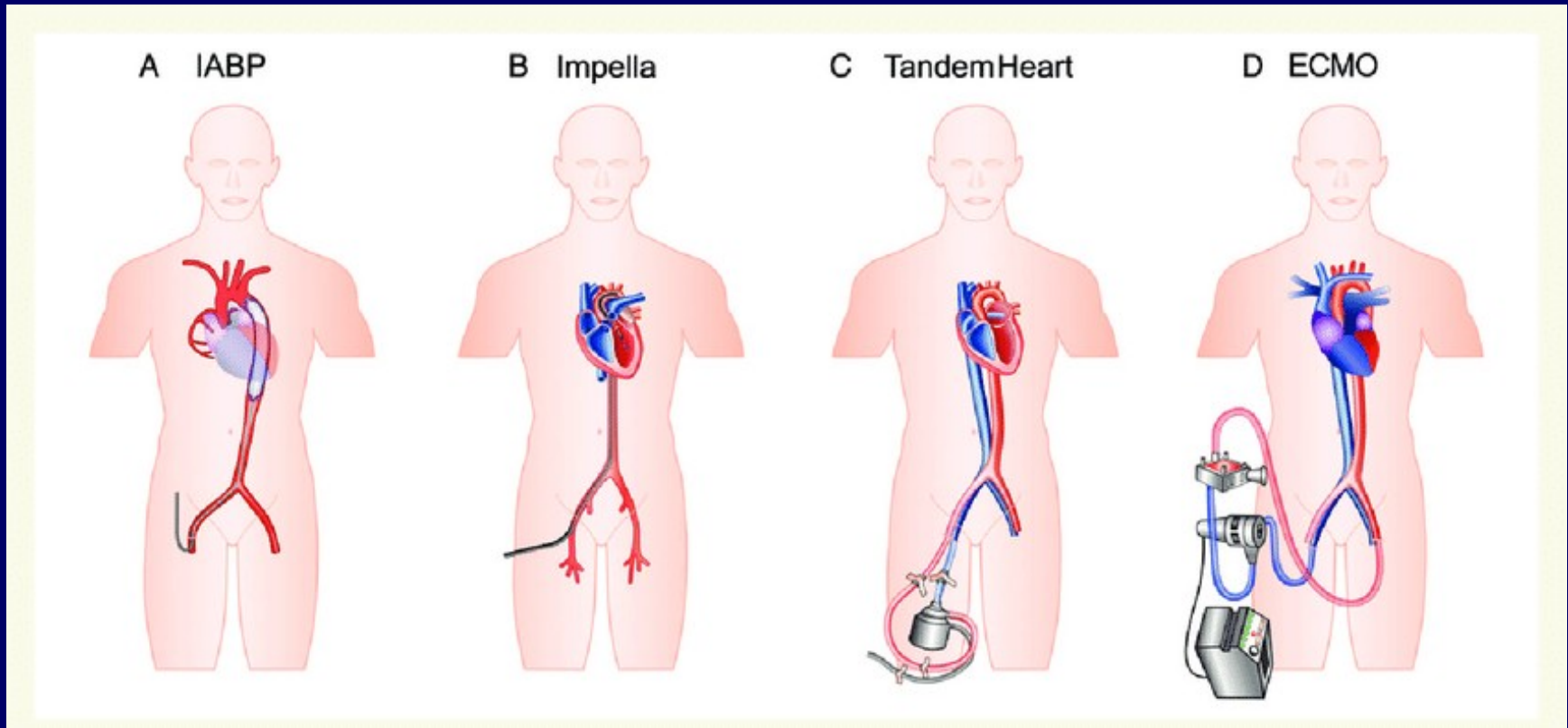


# MCS

- Intra-aortic balloon counterpulsation
- LVAD
- Total artificial heart
- ECMO
- Impella
  
- Bridge to recovery/decision/transplantation
- Destination therapy



# MCS

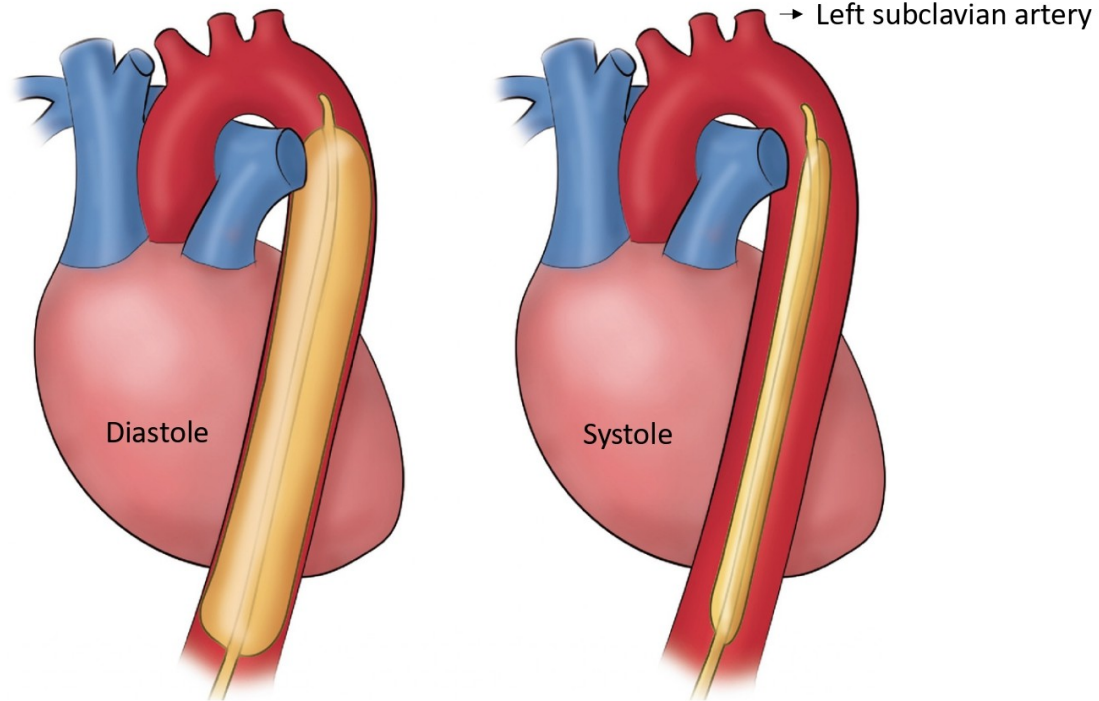


- Bridge to recovery/decision/transplantation
- Destination therapy



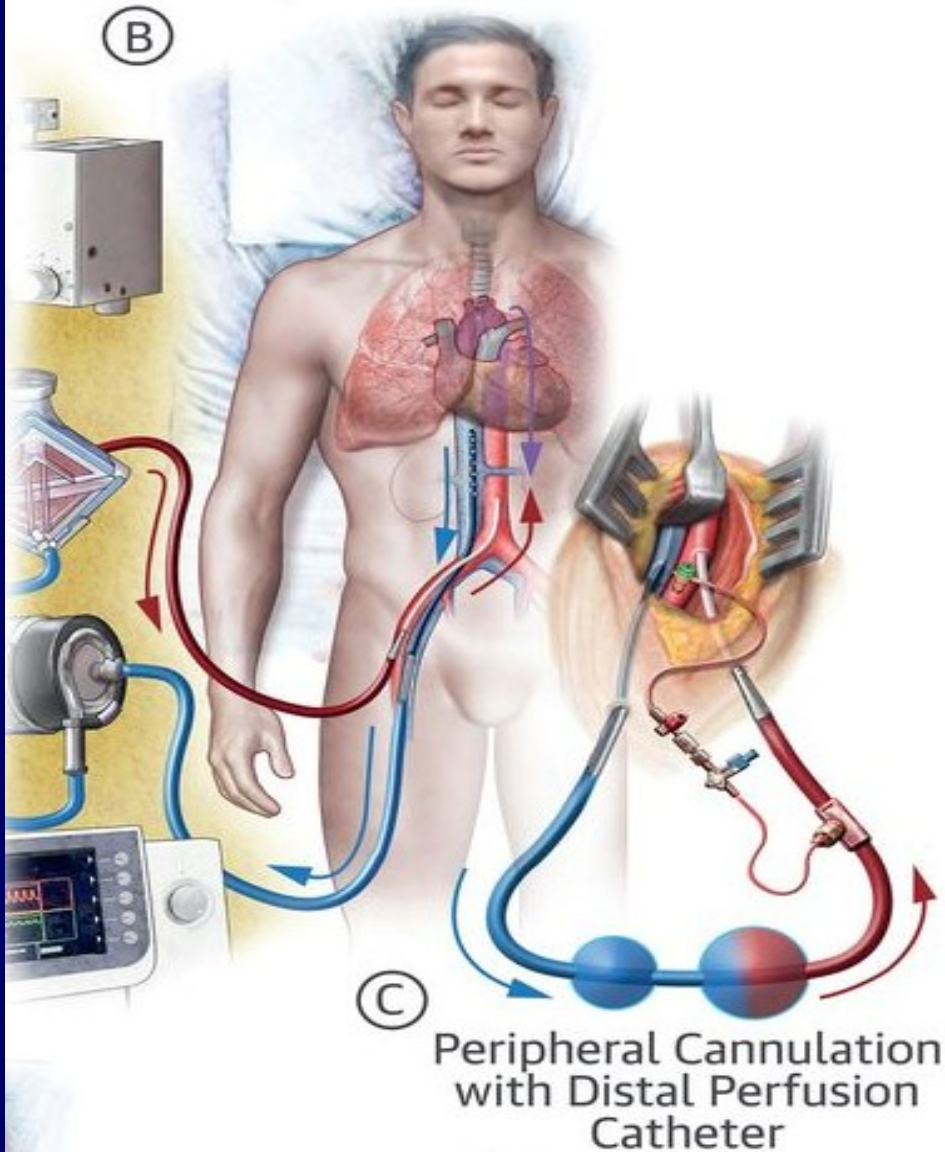


# IABC



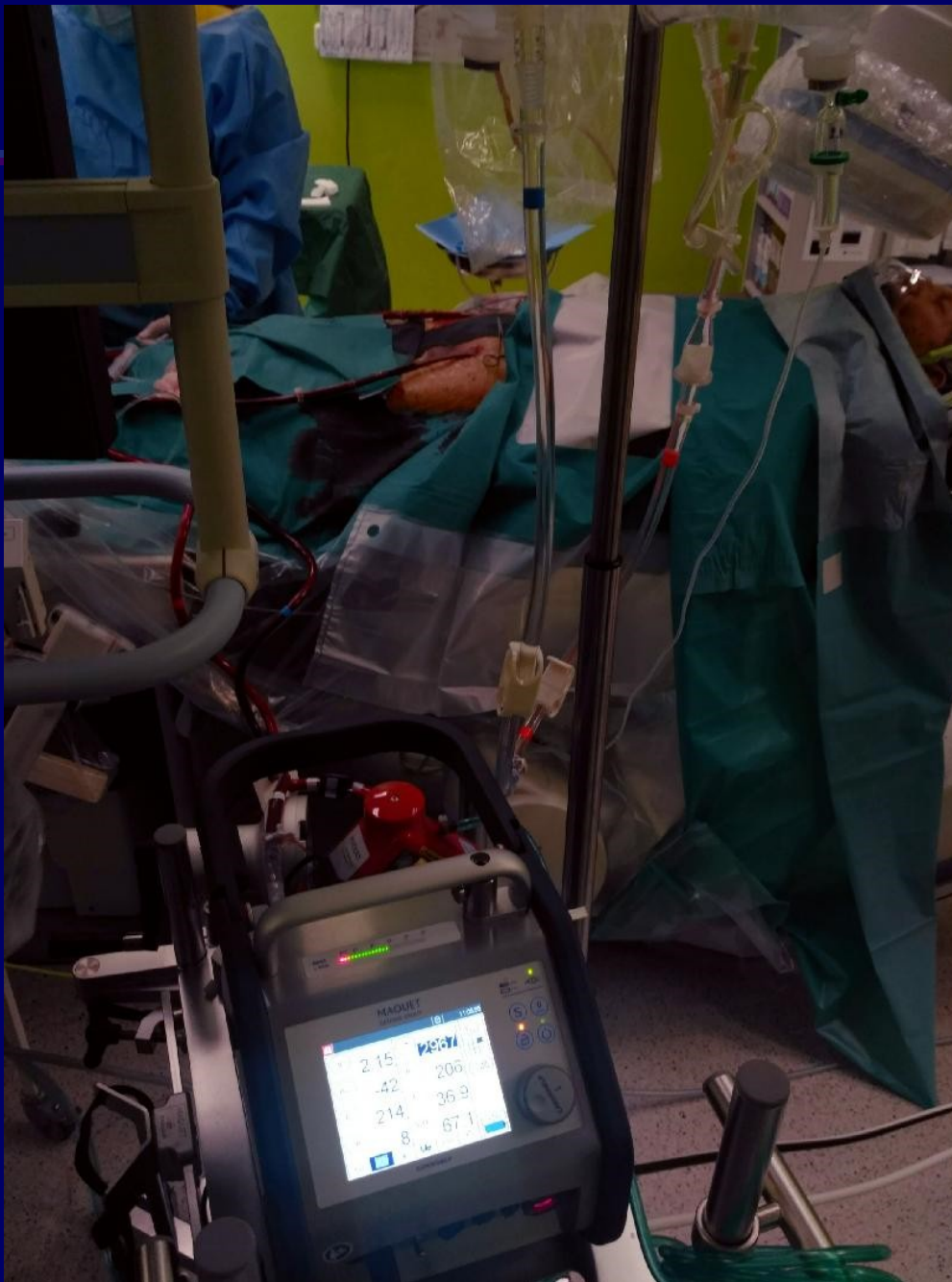
# ECMO

## Peripheral Cannulation

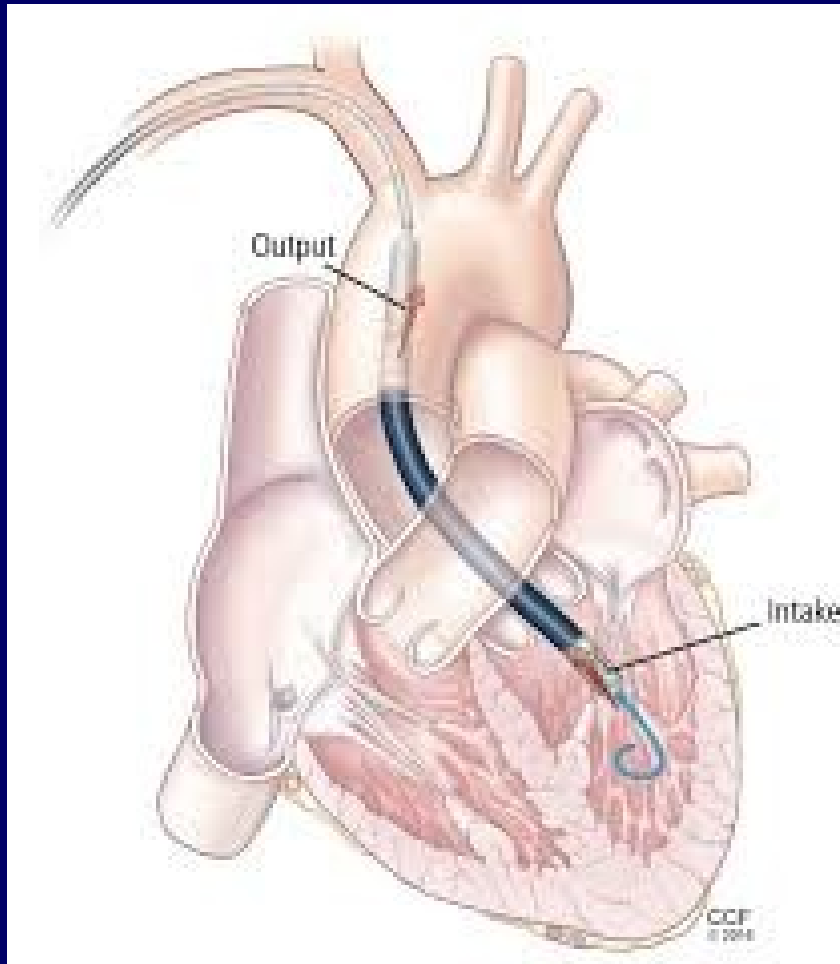


# ECMO

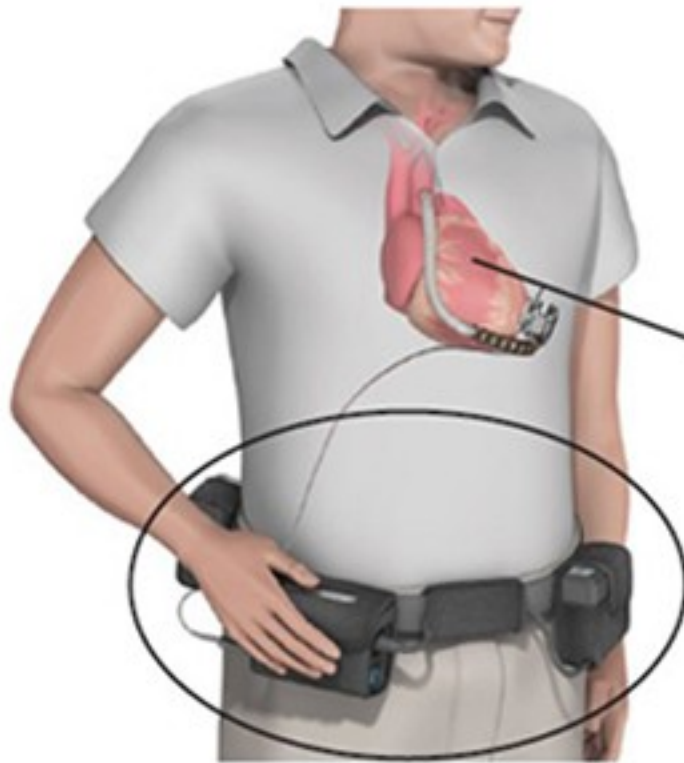




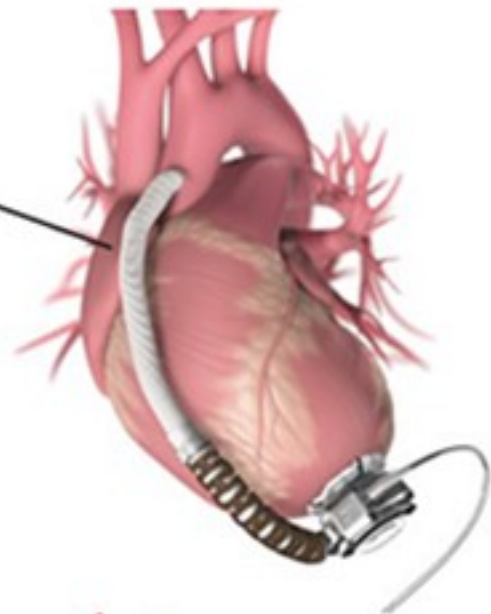
# Impella



# LVAD



**External components**



**Internal components**



# Transplantation

- Age?
- Life expectancy (except heart)
- Spiroergometry  $\text{VO}_2\text{max}$
  
- Imunosuppression
- Rejection, infection
- Vasculopathy of the graft



# Conclusions

- Acute HF in naive patients
- Acute decompensation of chronic HF
- Fluid and perfusion status
- Cause of HF/decompensation
- Early goal directed echocardiography
- Early therapy
- Early recognition of therapy failure







# Your blood pressure

is a little high

Thanks for the attention

