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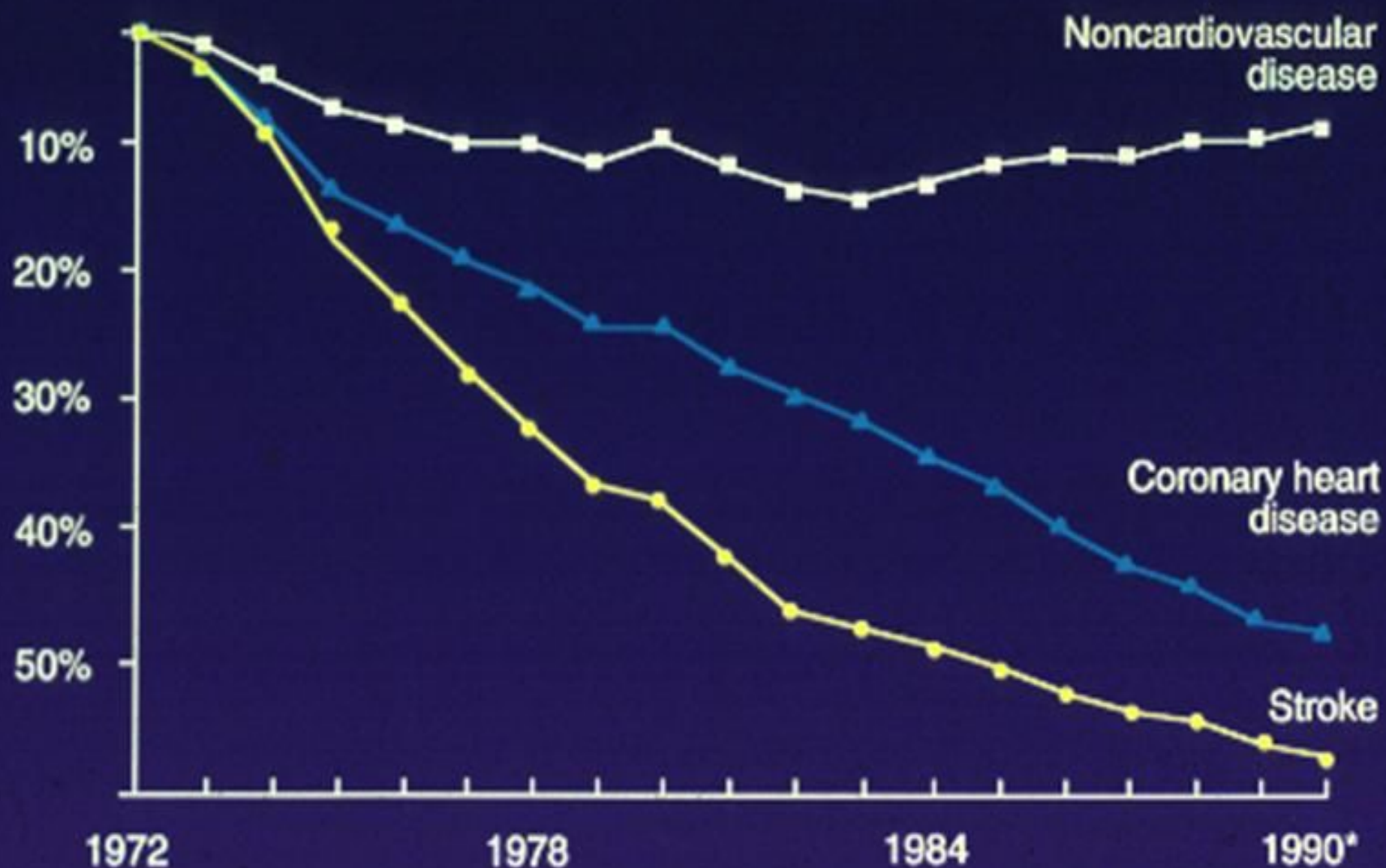
# Management of Chronic Congestive Heart Failure

*DR., dr. Muhammad Munawar SpJP(K), FACC, FESC, FSCAI*

Departemen Kardiologi dan Kedokteran Vaskular, FKUI  
Jakarta

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- Coronary heart disease mortality has declined steadily since 1972
    - New concepts
    - Early intervention
    - Excellent drugs
    - Advanced device treatment
  - Hospitalizations rates for CHF have increased

# Percent Decline in Age-Adjusted Mortality Rates Since 1972



\*Provisional data for 1990. NCHS data calculated by NHLBI.



# Congestive Heart Failure

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- **HF is a complex clinical syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the ventricle to **fill** with or **eject** blood.**

# Syndrome of CHF in the 1990s in US

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**For a substantial proportion of patients,  
causes are:**

- **Coronary artery disease**
- **Hypertension**
- **Dilated cardiomyopathy**

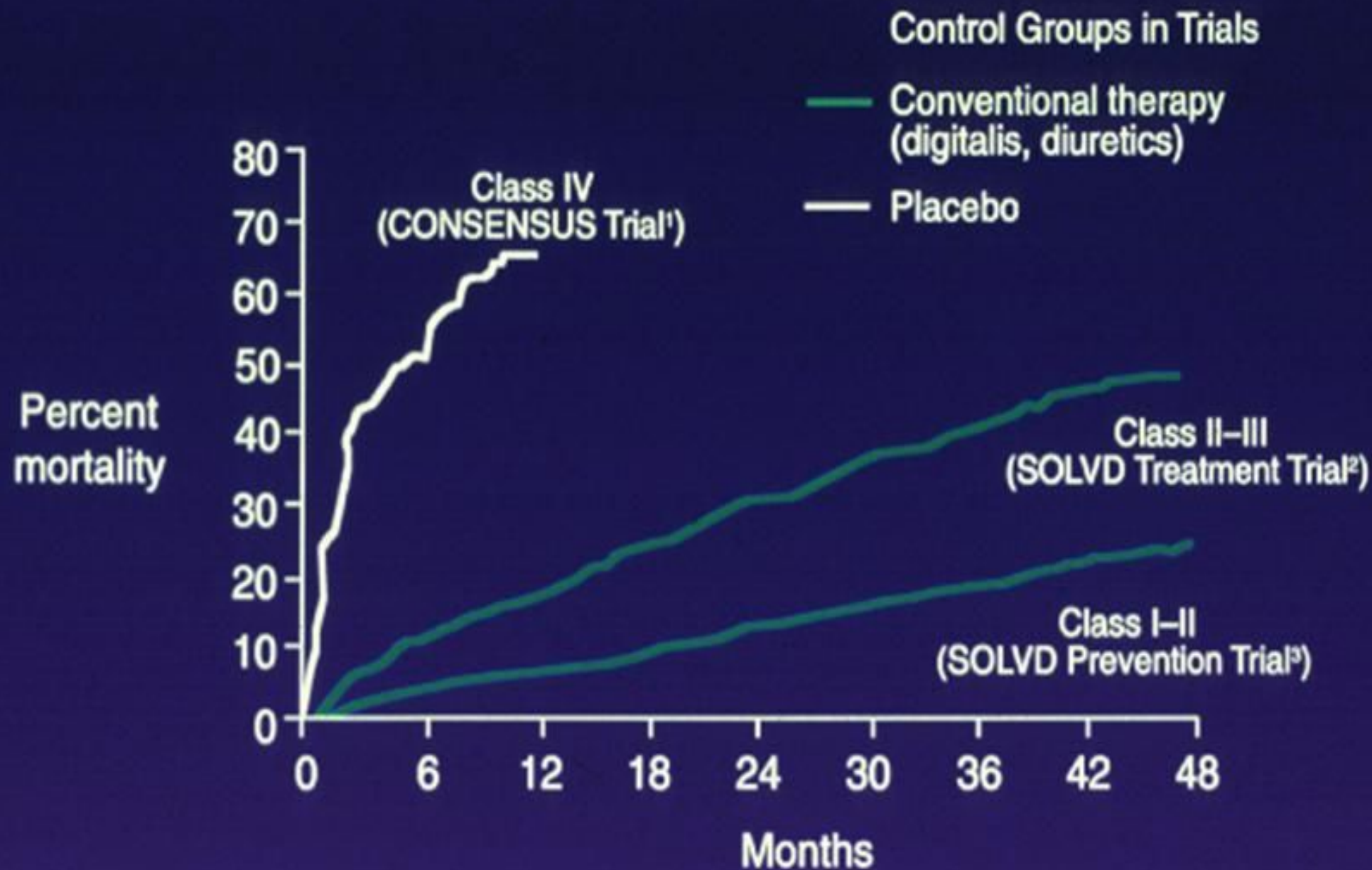
# CHF: Survival

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- Average 5-year survival 50%
- Survival in women better than in men
- Risk of death is 5 to 10% annually in patients with mild symptoms
- Risk of death is 30 to 40% annually in patients with severe symptoms



# Mortality by NYHA Functional Class



<sup>1</sup>The CONSENSUS Trial Study Group. *N Engl J Med.* 1987;316:1429-1435.

<sup>2</sup>The SOLVD Investigators. *N Engl J Med.* 1991;325:293-302.

<sup>3</sup>The SOLVD Investigators. *N Engl J Med.* 1992;327:685-691.

# Left Ventricular Failure

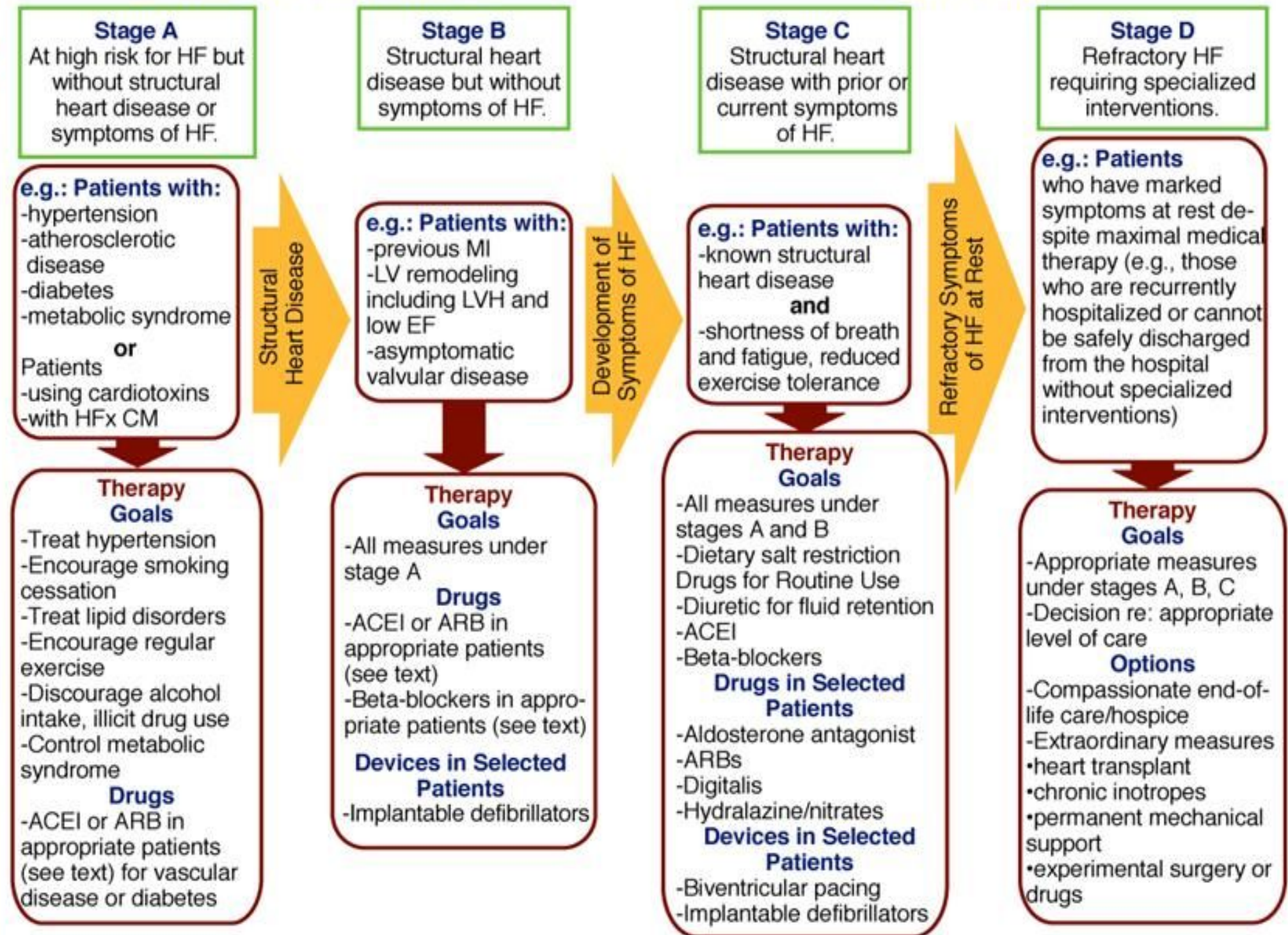
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- Systolic Dysfunction
- Diastolic Dysfunction
- Systolic and Diastolic Dysfunction



## At Risk for Heart Failure

## Heart Failure



# CHF: Clinical Presentation

## Cardinal Manifestations

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- Dyspnea
- Fatigue
- Fluid retention ( pulmonary and peripheral edema )



# CHF: Physical Findings

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- Pulsus alternans
- Elevated jugular venous pressure
- Displaced cardiac apical impulse
- Third heart sound
- Pulmonary rales
- Hepatomegaly
- Peripheral edema



# Diagnosis of CHF

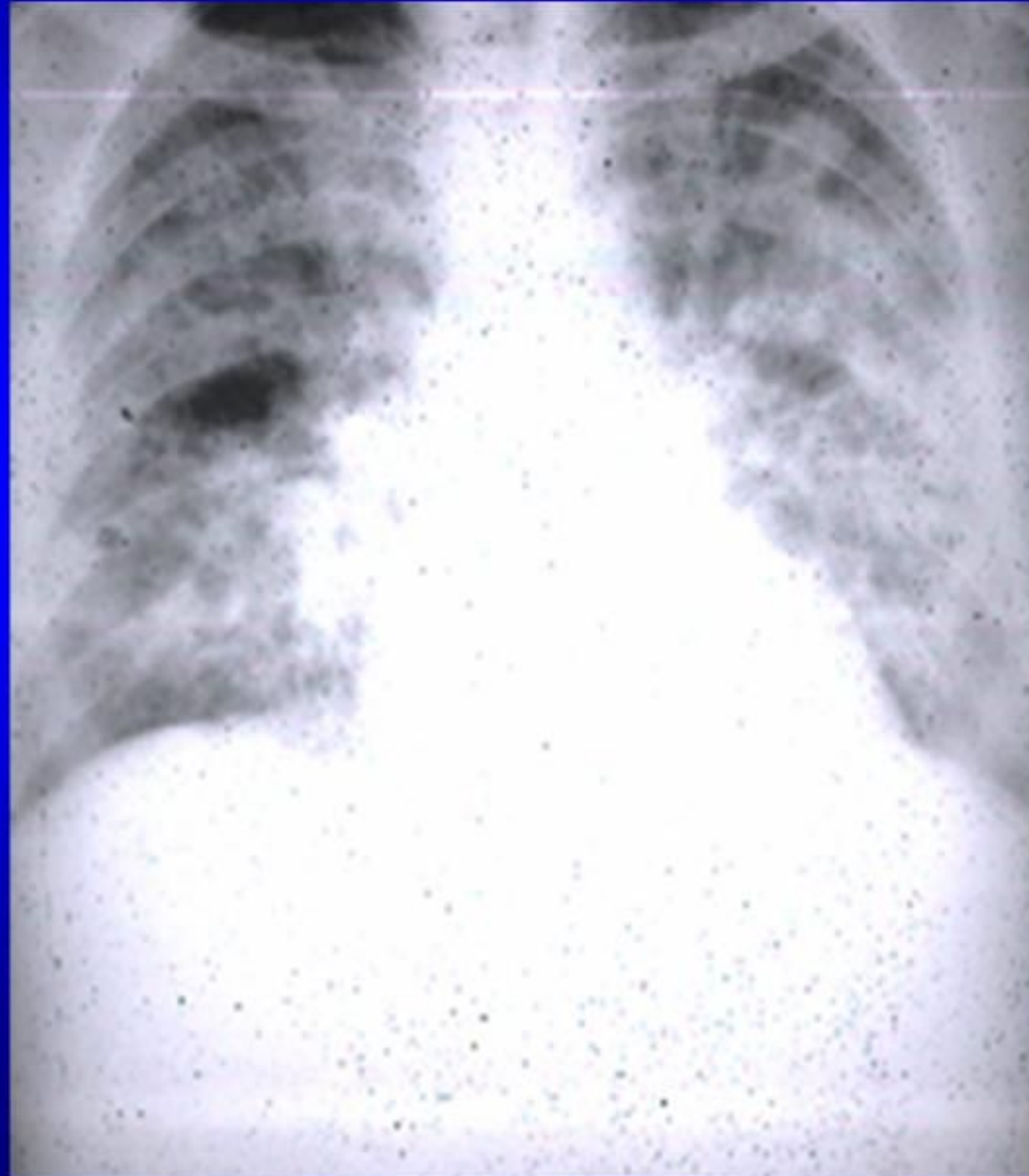
## Routine Tests

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- ECG
- Chest x-ray
- Echocardiogram

# Congestive Heart Failure

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# CHF: Echocardiogram

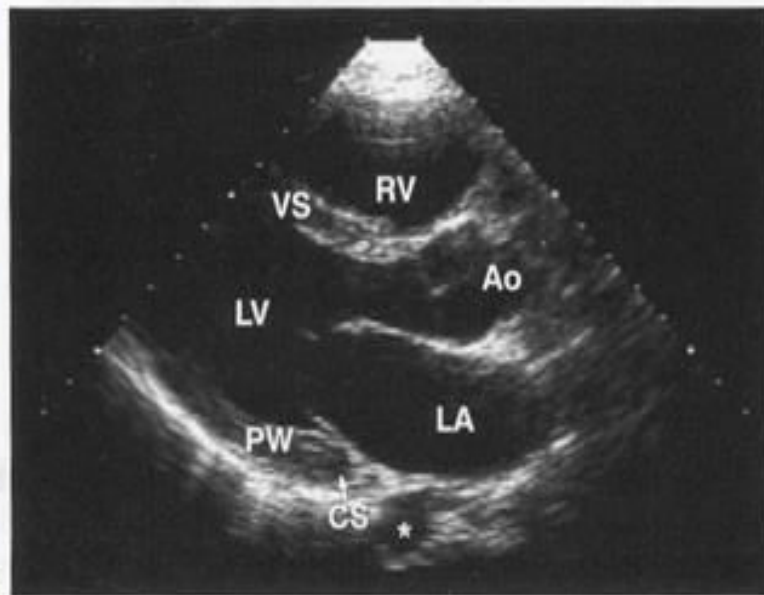
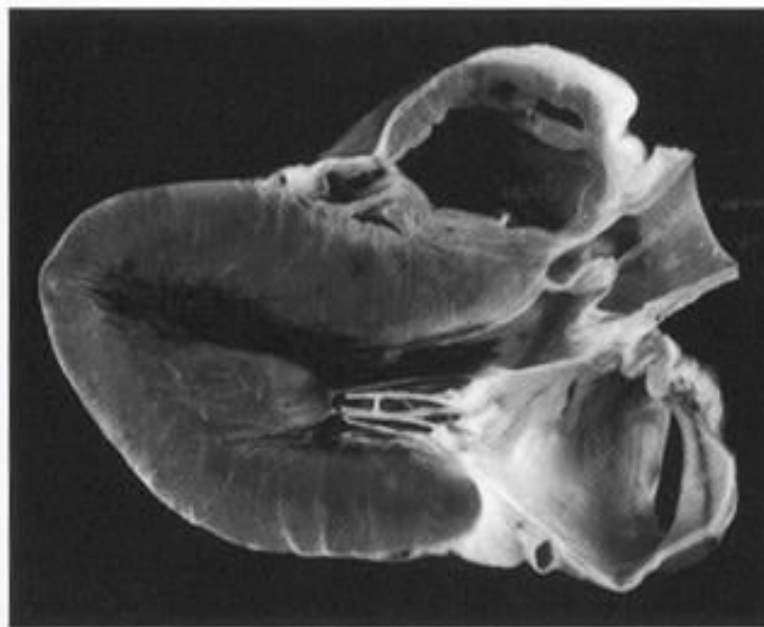
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- Chamber enlargement
- Wall motion abnormalities
- Diminished ejection fraction
- Possible LVH
- Possible valvular problems
- Assess diastolic dysfunction



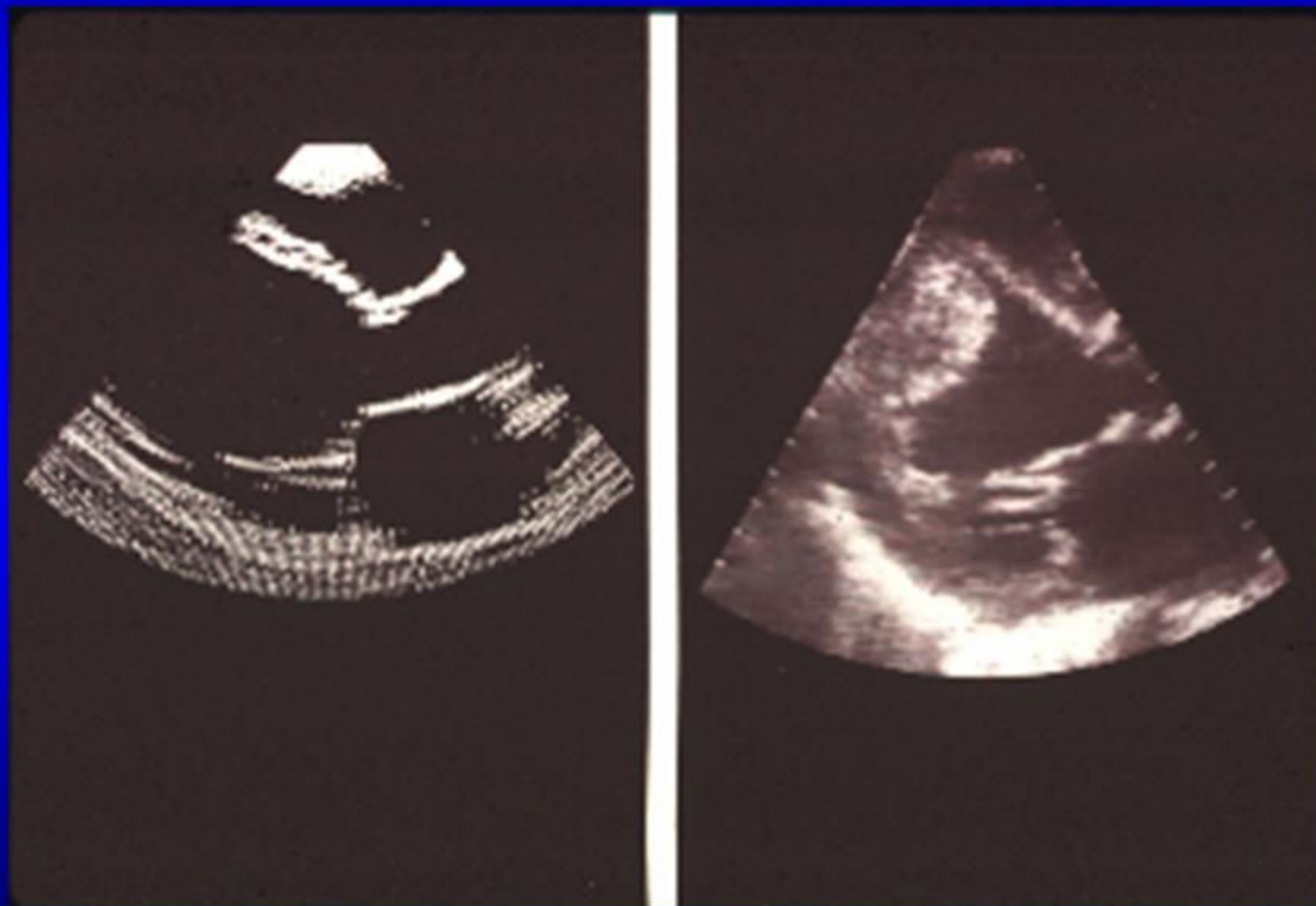
# Echocardiogram

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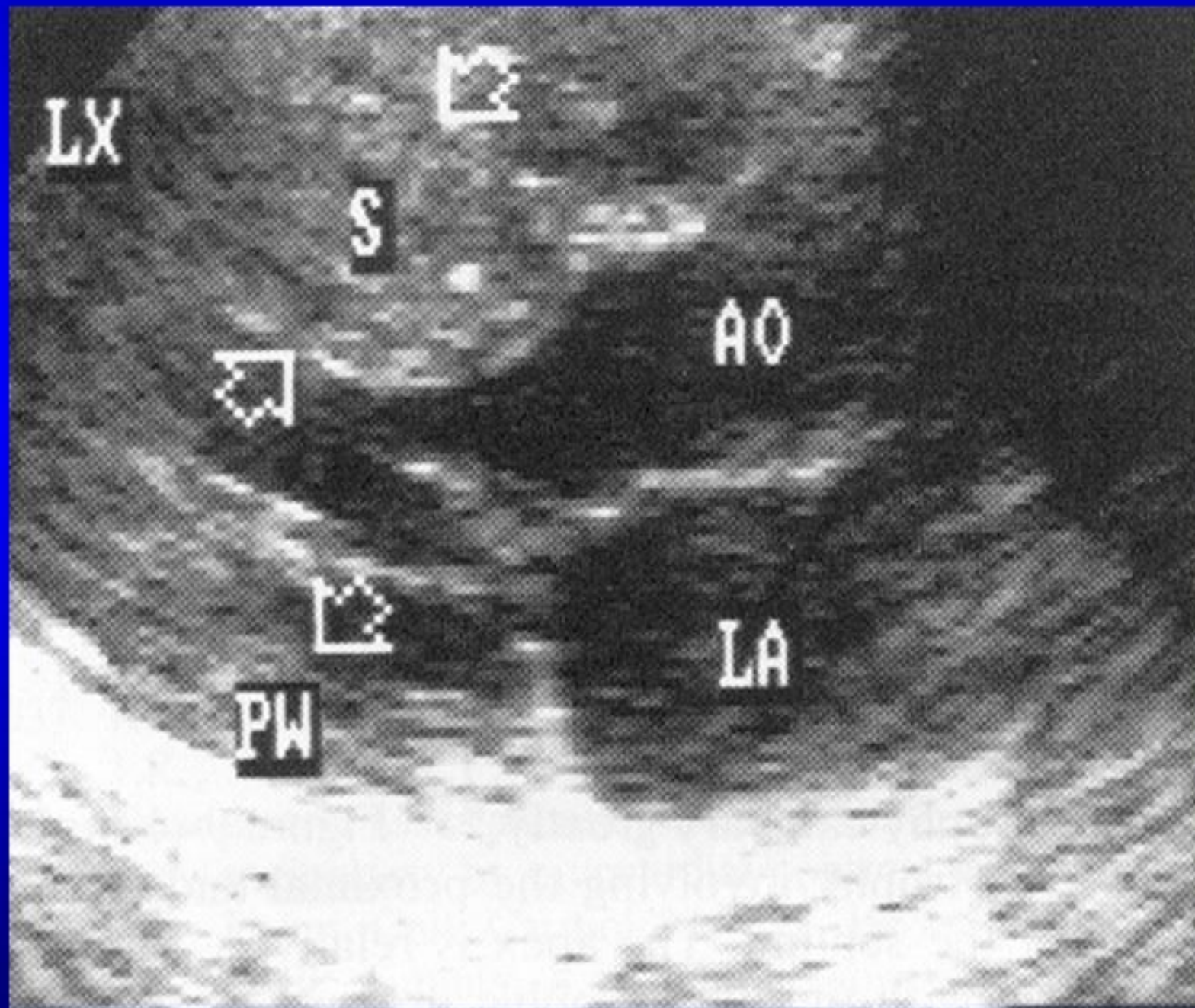
# Dilated Cardiomyopathy

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# Hypertrophic Cardiomyopathy

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# CHF: Treatment Goals

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- Improve symptoms
  - A. Enhance well-being and quality of life
  - B. Increase exercise tolerance
- Improve survival
  - A. Prevent progressive heart failure
  - B. Prevent sudden death
  - C. Prevent thromboembolic episodes

# CHF: Medical Management

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- Diuretics
- Digitalis
- ACE Inhibitors
- ARB
- Beta Blockers
- Spironolactone

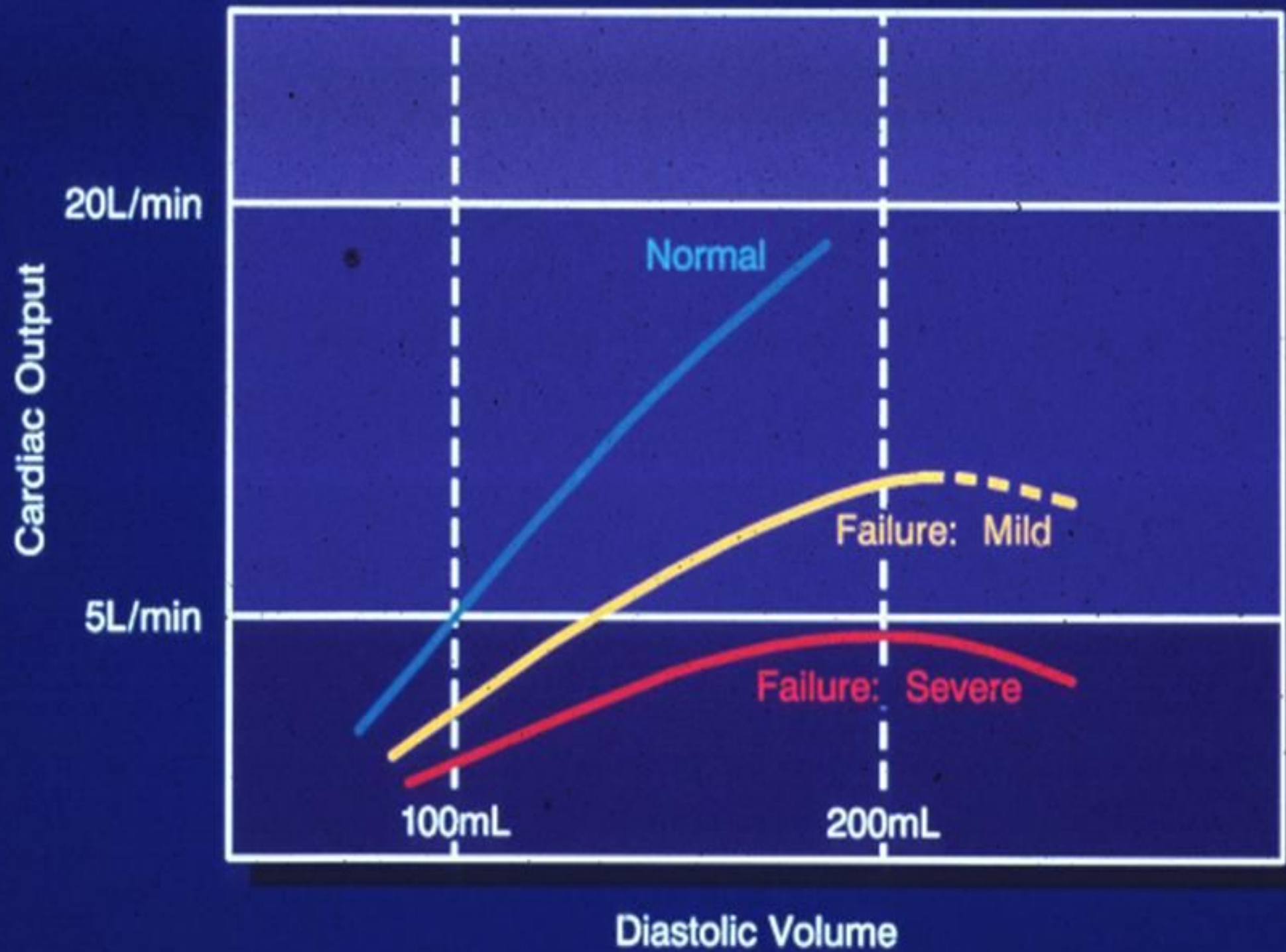
# CHF: Diuretics

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- Reduce volume overload
- Reduce sodium overload
- Preload reduction



# FRANK-STARLING LAW



## Oral Diuretics Recommended for Use in the Treatment of Fluid Retention in Chronic Heart Failure

Drug	Initial Daily Dose(s)	Maximum Total Daily Dose	Duration of Action
<b>Loop diuretics</b>			
Bumetanide	0.5 to 1.0 mg once or twice	10 mg	4 to 6 hours
Furosemide	20 to 40 mg once or twice	600 mg	6 to 8 hours
Torsemide	10 to 20 mg once	200 mg	12 to 16 hours
<b>Thiazide diuretics</b>			
Chlorothiazide	250 to 500 mg once or twice	1000 mg	6 to 12 hours
Chlorthalidone	12.5 to 25 mg once	100 mg	24 to 72 hours
Hydrochlorothiazide	25 mg once or twice	200 mg	6 to 12 hours
Indapamide	2.5 once	5 mg	36 hours
Metolazone	2.5 mg once	20 mg	12 to 24 hours
<b>Potassium-sparing diuretics†</b>			
Amiloride	5 mg once	20 mg	24 hours
Spiroinolactone	12.5 to 25 mg once	50 mg*	2 to 3 days
Triamterene	50 to 75 mg twice	200 mg	7 to 9 hours
<b>Sequential nephron blockade</b>			
Metolazone	2.5 to 10 mg once plus loop diuretic		
Hydrochlorothiazide	25 to 100 mg once or twice plus loop diuretic		
Chlorothiazide (IV)	500 to 1000 mg once plus loop diuretic		

mg indicates milligrams; IV, intravenous. \*Higher doses may occasionally be used with close monitoring. †Eplerenone, although also a diuretic, is primarily used in chronic heart failure as a suppressor of the renin-angiotensin-aldosterone system.



# CHF: Digoxin

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- Improves rest and exercise hemodynamics
- Attenuates neurohormal abnormalities
- Improves symptoms
- May result in fewer hospitalizations and ER visits
- Has unknown effects on mortality



# CHF: Digoxin

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- Useful in patients with CHF and supraventricular arrhythmias
- Useful in patients with systolic dysfunction
- Disadvantages include:
  - A. Narrow Rx range
  - B. Synergistic toxicity with hypokalemia
  - C. Drug interactions
  - D. Possible arrhythmogenesis

# CHF: ACE Inhibitors

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- Improve hemodynamic status
- Attenuate neurohumoral abnormalities
- Improve symptoms
- Reduce incidence of hospitalization
- Slow progression
- Reduce mortality

# CHF: ACE Inhibitors

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## Neurohormonal Changes

- Decreased angiotensin II
- Increased bradykinin
- Decreased or no change in aldosterone
- Decreased norepinephrine



## Cardiovascular Medications Useful for Treatment of Various Stages of Heart Failure (Slide 1 of 3)

Drug	Stage A	Stage B	Stage C
<b>ACE Inhibitors</b>			
Benazepril	H	-	-
Captopril	H, DN	Post MI	HF
Enalapril	H, DN	Asymptomatic LVSD	HF
Fosinopril	H	-	HF
Lisinopril	H, DN	Post MI	HF
Moexipril	H	-	-
Perindopril	H, CV Risk	-	-
Quinapril	H	-	HF
Ramipril	H, CV Risk	Post MI	Post MI
Trandolapril	H	Post MI	Post MI

CV Risk indicates reduction in future cardiovascular events; DN, diabetic nephropathy; H, hypertension; HF, heart failure; Asymptomatic LVSD, Asymptomatic left ventricular systolic dysfunction; Post MI, reduction in heart failure or other cardiac events following myocardial infarction.

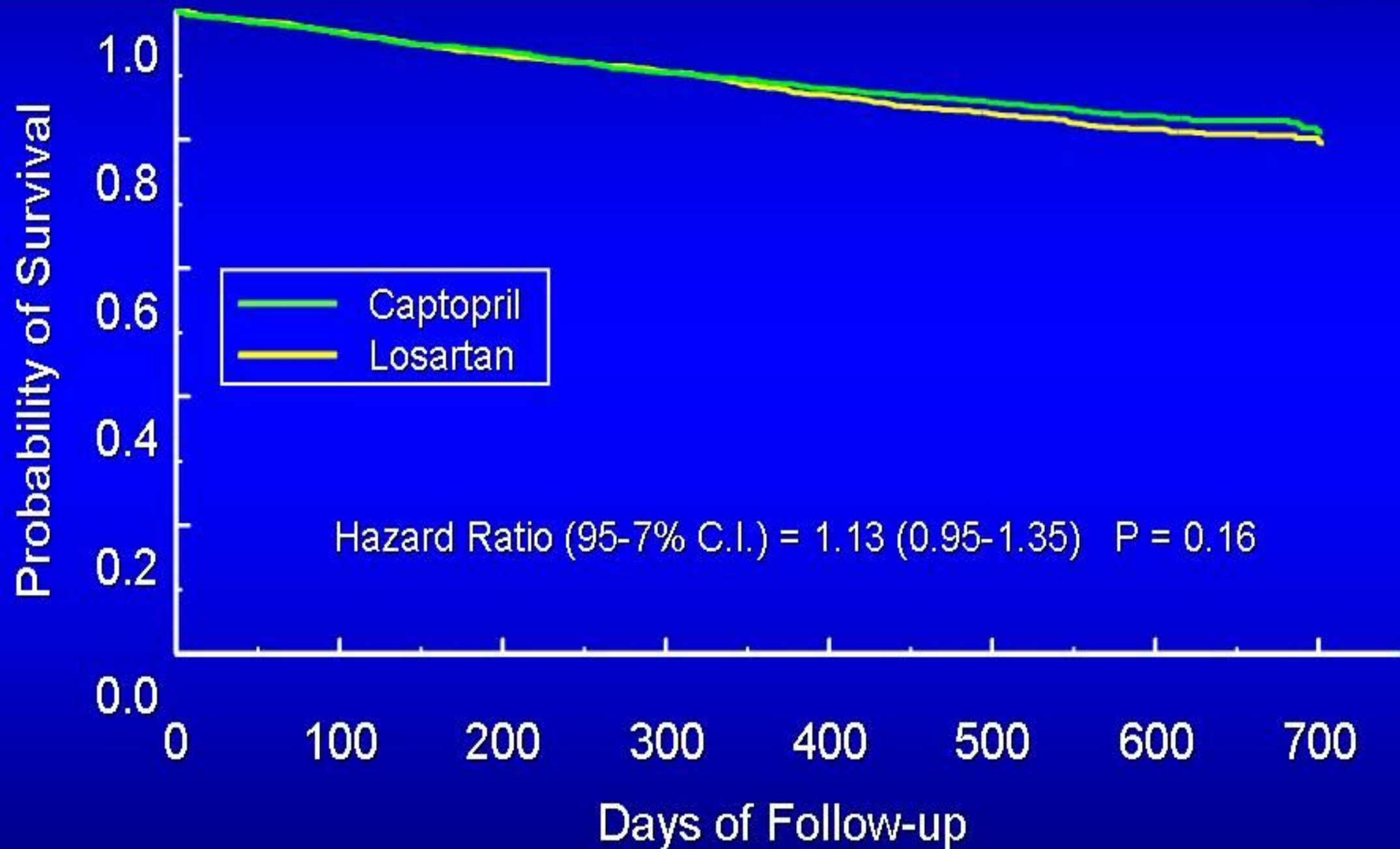
## Cardiovascular Medications Useful for Treatment of Various Stages of Heart Failure (Slide 2 of 3)

Drug	Stage A	Stage B	Stage C
<b>Angiotensin Receptor Blockers</b>			
Candesartan	H	-	HF
Eprosartan	H	-	-
Irbesartan	H, DN	-	-
Losartan	H, DN	CV Risk	-
Olmesartan	H	-	-
Telmisartan	H	-	-
Valsartan	H, DN	Post MI	Post MI, HF
<b>Aldosterone Antagonists</b>			
Eplerenone	H	Post MI	Post MI
Spirolactone	H	-	HF

CV Risk indicates reduction in future cardiovascular events; DN, diabetic nephropathy; H, hypertension; HF, heart failure; Asymptomatic LVSD, Asymptomatic left ventricular systolic dysfunction; Post MI, reduction in heart failure or other cardiac events following myocardial infarction.

# ELITE II

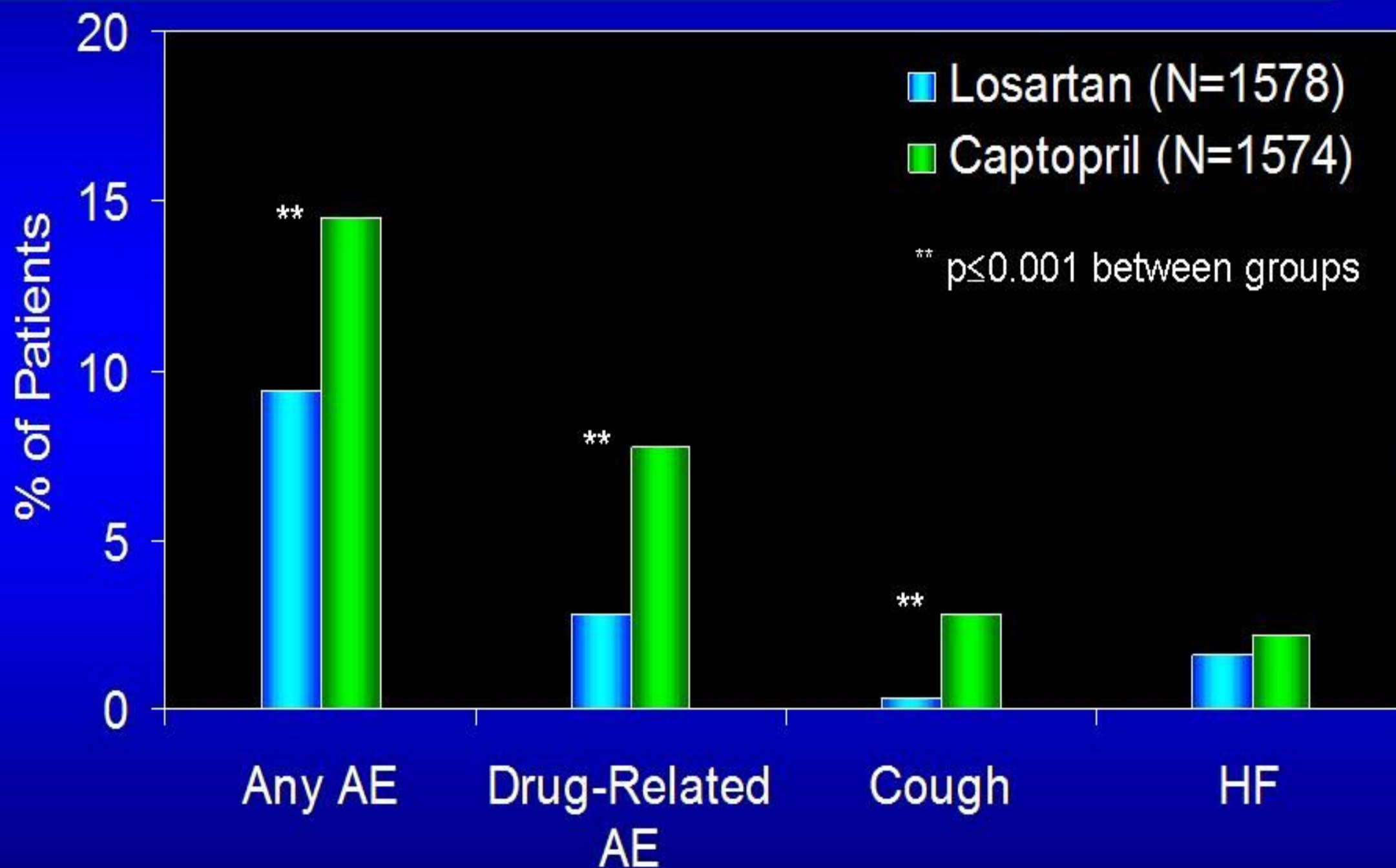
Primary Endpoint: All-Cause Mortality





# ELITE II

## Withdrawal for Adverse Experience (Excluding Death)



# ELITE II

## Discussion

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- Losartan was not superior to captopril in improving survival in elderly heart-failure patients, but was significantly better tolerated.
- Based on extensive randomized, placebo-controlled observations, ACE inhibitors should be the initial treatment for heart failure, although angiotensin II receptor antagonists may be useful to block the renin angiotensin aldosterone system when ACE inhibitors are not tolerated.



# CHF: Beta Blockers

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- Acutely depresses myocardial function  
(pharmacological)
- Chronically improves myocardial function  
(biological)



# CHF: Beta Blockers

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Improve symptoms and clinical class

- Degree of benefit appears to relate to degree of disability before treatment

Reduce Mortality

- 5 trials with metoprolol/bisoprolol
- 5 trials with carvedilol

# CHF: Beta Blockers

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- Should be used in all stable Class II/III patients unless contraindicated
- Treatment should not be initiated in patients with acutely decompensated CHF
- Clinical response may take 2 to 3 months

# CHF: Beta Blockers

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## Risks of Treatment

- Hypotension
- Fluid retention and worsening CHF
- Bradycardia and heart block



## Cardiovascular Medications Useful for Treatment of Various Stages of Heart Failure (Slide 3 of 3)

Drug	Stage A	Stage B	Stage C
<b>Beta Blockers</b>			
Acebutolol	H	-	-
Atenolol	H	Post MI	-
Betaxolol	H	-	-
Bisoprolol	H	-	HF
Carteolol	H	-	-
Carvedilol	H	Post MI	HF, Post MI
Labetalol	H	-	-
Metoprolol succinate	H	-	HF
Metoprolol tartrate	H	Post MI	-
Nadolol	H	-	-
Penbutolol	H	-	-
Pindolol	H	-	-
Propranolol	H	Post MI	-
Timolol	H	Post MI	-
<b>Digoxin</b>	-	-	HF

CV Risk indicates reduction in future cardiovascular events; DN, diabetic nephropathy; H, hypertension; HF, heart failure; Asymptomatic LVSD, Asymptomatic left ventricular systolic dysfunction; Post MI, reduction in heart failure or other cardiac events following myocardial infarction.

# CHF: Diastolic Dysfunction

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- Difficult to treat
- Diuretics for volume overload. Avoid volume depletion
- Prevent tachycardia
- Rate-limiting calcium channel blockers first choice
- Beta 1 beta blockers second choice

# CHF: Diastolic Dysfunction

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## Benefits of Calcium Channel Blockers

- Slowing of heart rate
- Reduction of MVO<sub>2</sub>
- Control of BP
- Regression of LVH
- Dilation of coronary microcirculation
- Amelioration of intracellular calcium overload



# CHF: Diastolic Dysfunction

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## Benefits of Beta Blockers

- Slowing of heart rate
- Reduction of MVO<sub>2</sub>
- Control of blood pressure
- Regression of LVH

# **Stage C Therapy**

## **(Reduced LVEF with Symptoms)**

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### **Cardiac Resynchronization**

**Patients with LVEF less than or equal to 35%, sinus rhythm, and NYHA functional class III or ambulatory class IV symptoms despite recommended, optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than 120 ms, should receive cardiac resynchronization therapy unless contraindicated.**



# Stage C Therapy

## (Reduced LVEF with Symptoms)

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### Cardiac Resynchronization

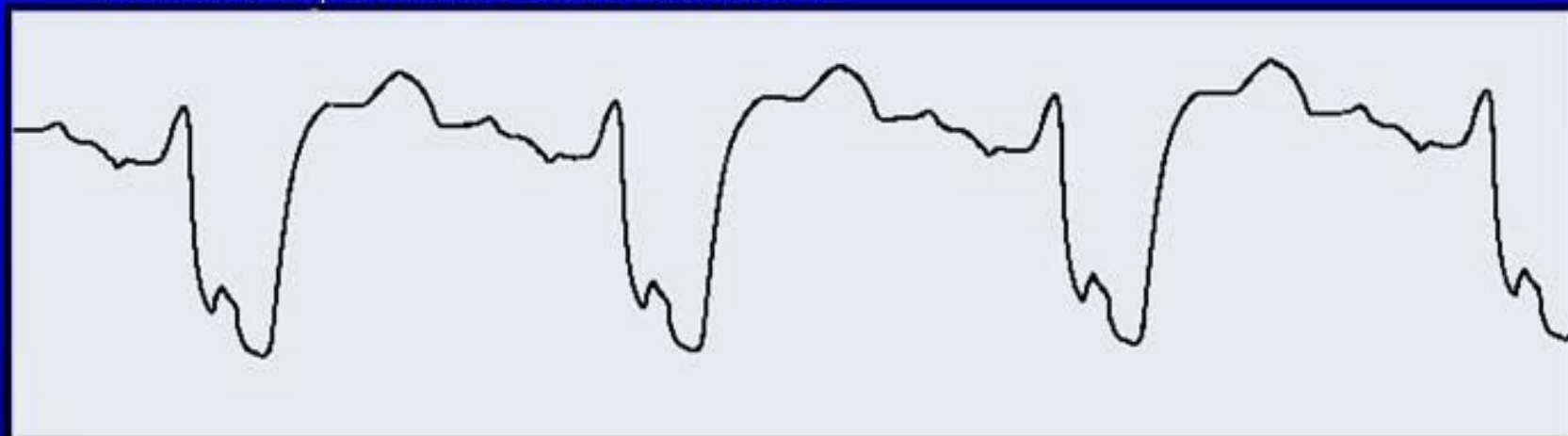
Patients with LVEF less than or equal to 35%, sinus rhythm, and NYHA functional class III or ambulatory class IV symptoms despite recommended, optimal medical therapy and who **have cardiac dyssynchrony, which is currently defined as a QRS duration greater than 120 ms**, should receive cardiac resynchronization therapy unless contraindicated.



# Ventricular Dysynchrony

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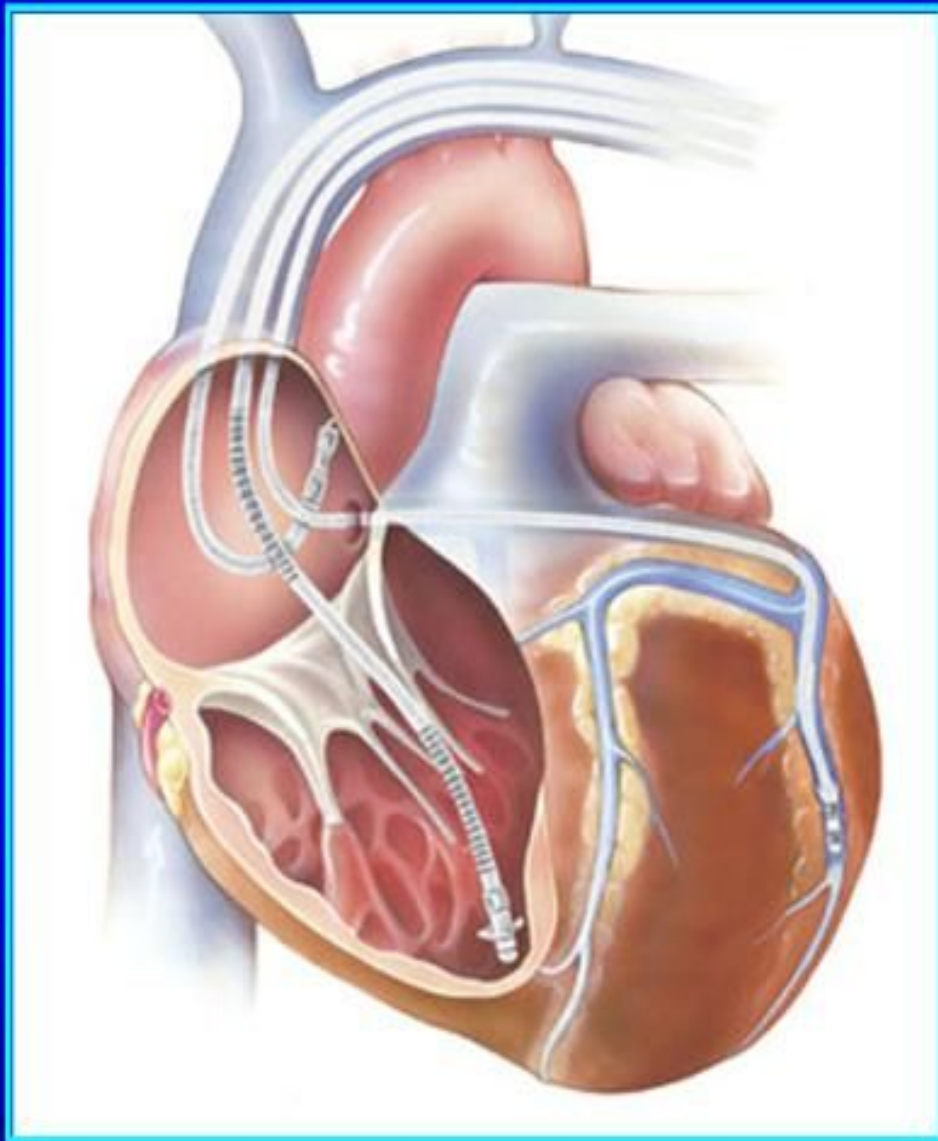
- Abnormal ventricular conduction resulting in a mechanical delay
  - Wide QRS (IVCD); typically LBBB morphology
  - Poor systolic function



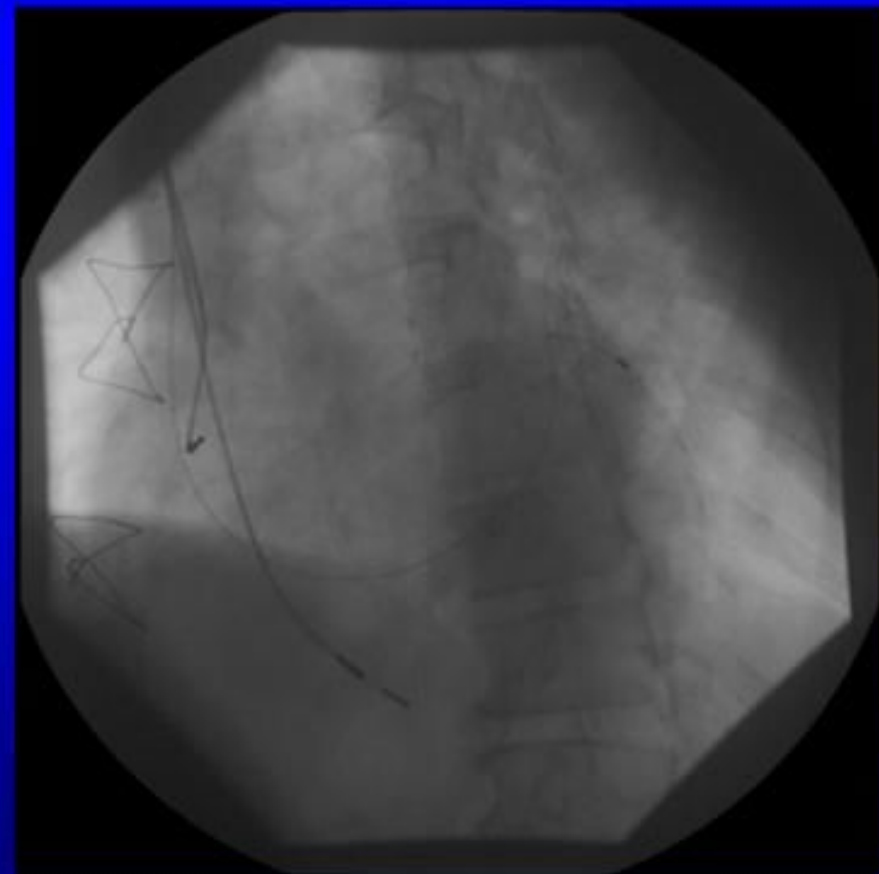
ECG depicting interventricular conduction delay

# Over-the-wire design

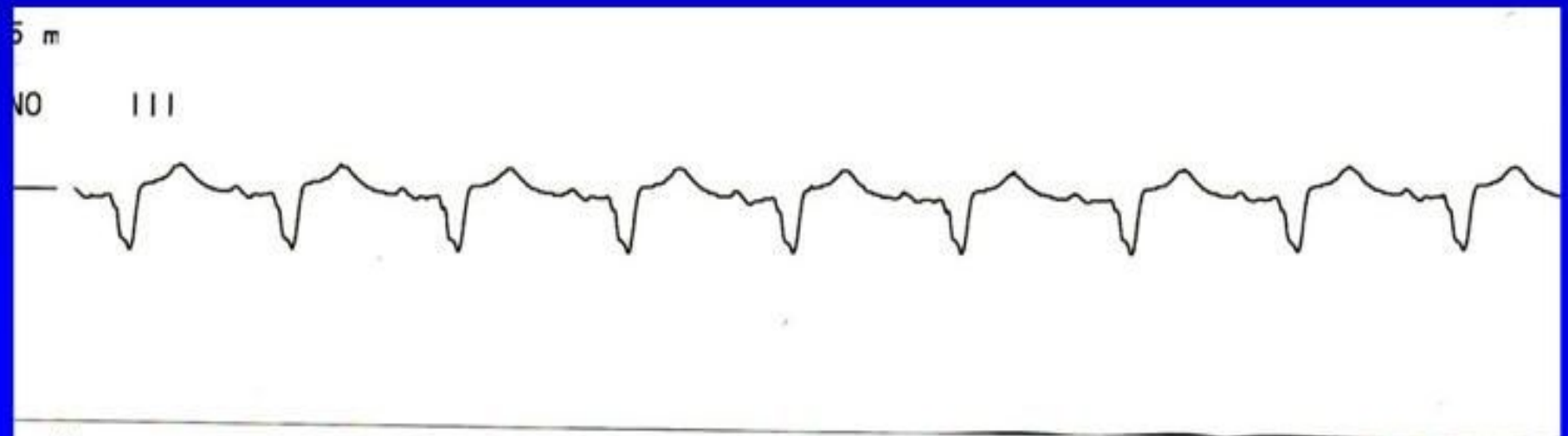
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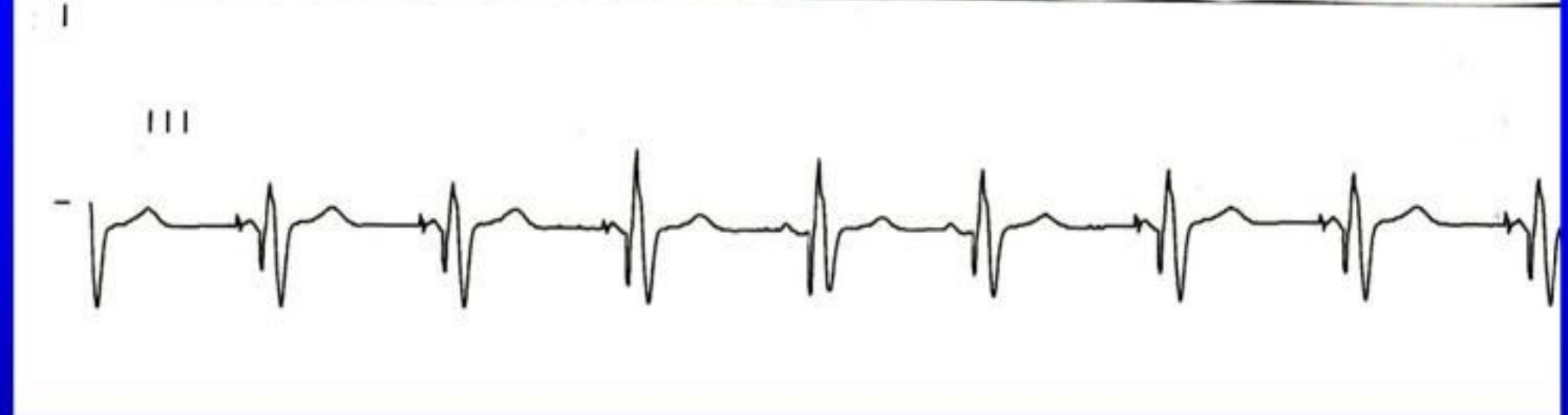
- Precision for selective lead positioning
- Tracks over a .014-inch standard guide wire



Pre-CRT



Post-CRT

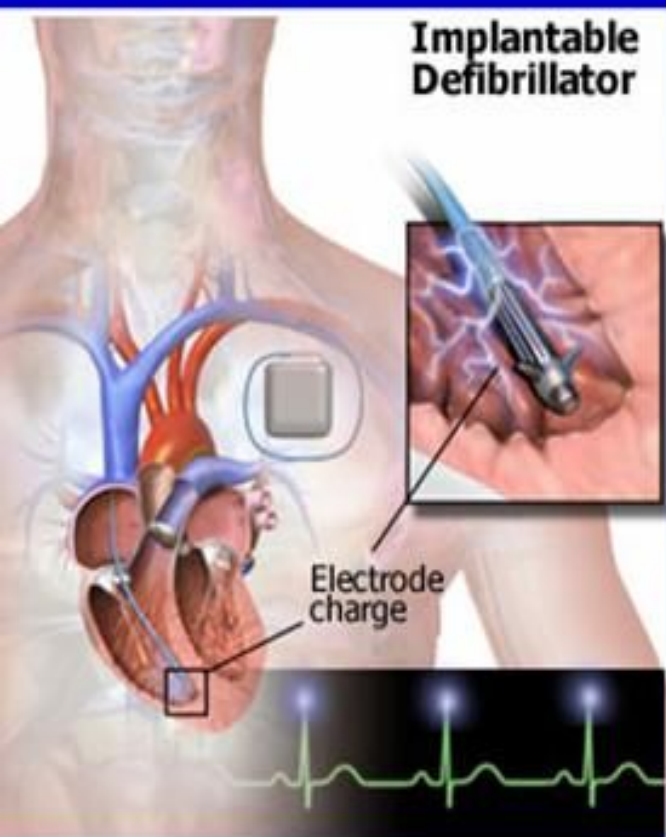




# Stage C Therapy

(Reduced LVEF with Symptoms)

## Implantable Cardioverter-Defibrillators (ICDs)



An ICD is recommended as secondary prevention to prolong survival in patients with current or prior symptoms of HF and reduced LVEF who have a history of cardiac arrest, ventricular fibrillation, or hemodynamically destabilizing ventricular tachycardia.

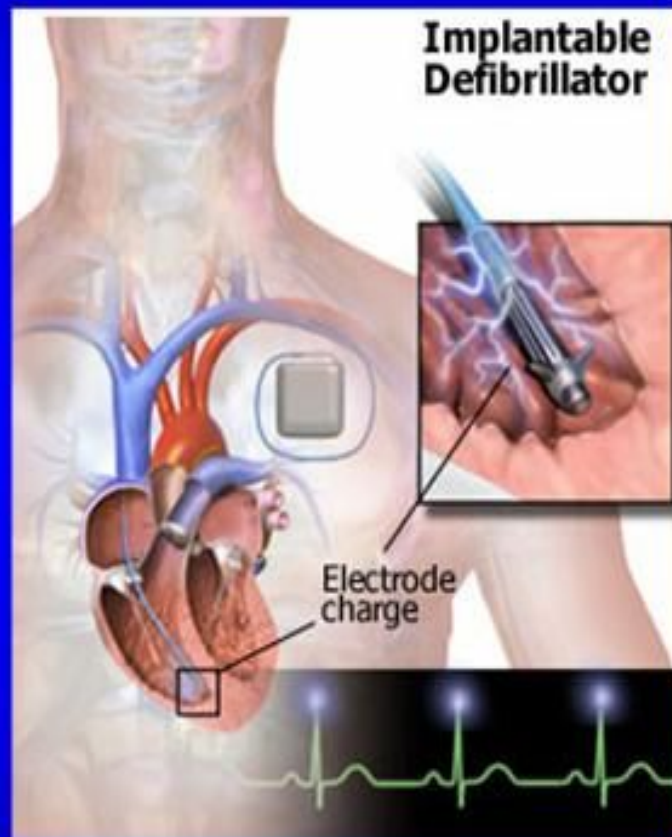
ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in sudden cardiac death in patients with ischemic heart disease who are at least 40 days post-MI, have an LVEF less than or equal to 30%, with NYHA functional class II or III symptoms while undergoing chronic optimal medical therapy, and have reasonable expectation of survival with a good functional status for more than 1 year.



# Stage C Therapy

## (Reduced LVEF with Symptoms)

### ICDs (cont'd)

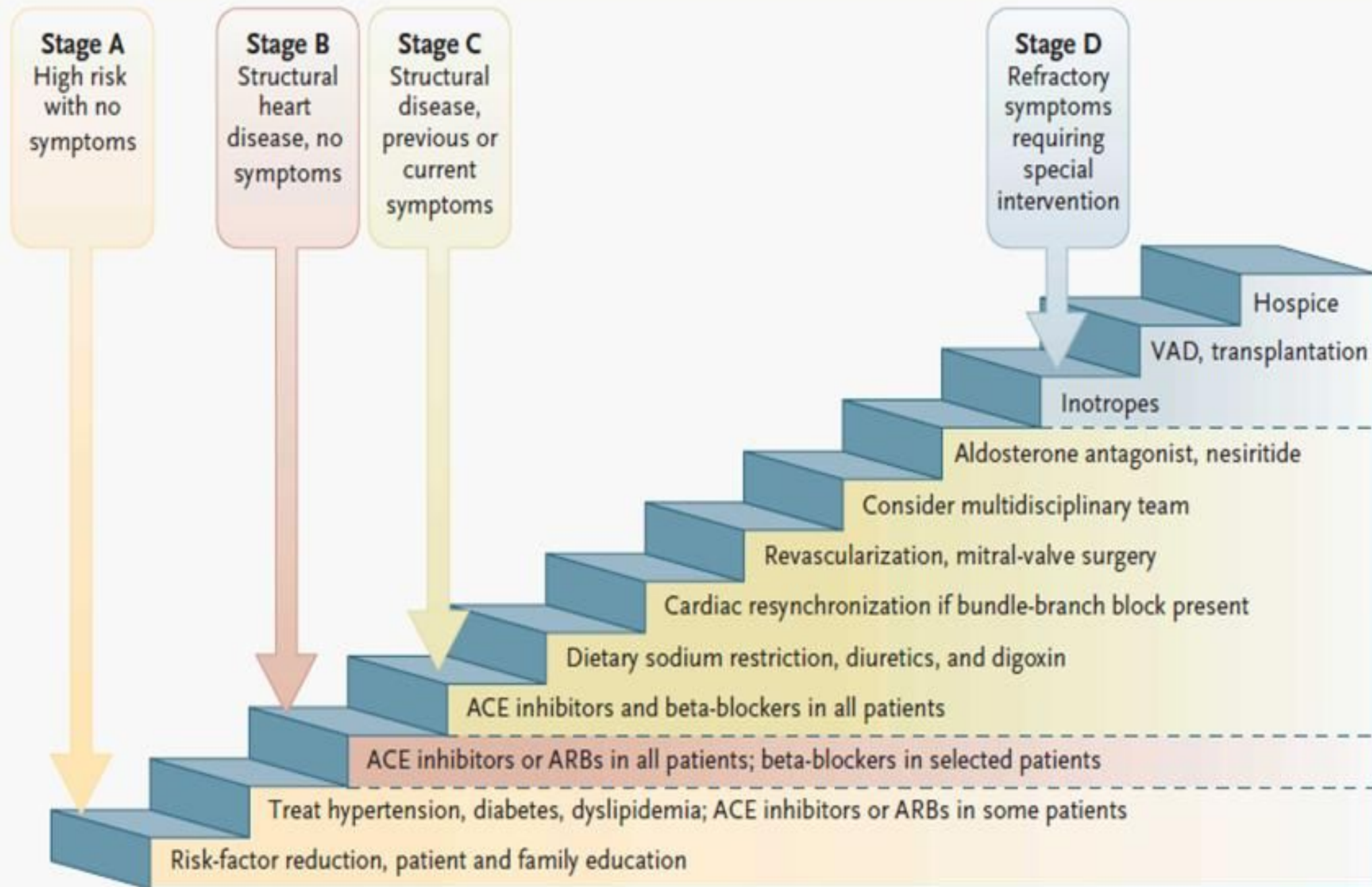


ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in sudden cardiac death in patients with **nonischemic cardiomyopathy** who have an LVEF less than or equal to 30%, with NYHA functional class II or III symptoms while undergoing chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year.

Placement of an ICD is reasonable in patients with **LVEF of 30% to 35%** of any origin with NYHA functional class II or III symptoms who are taking chronic optimal medical therapy and who have reasonable expectation of survival with good functional status of more than 1 year.



# Conclusion





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Thank You