
Management of Chronic Heart Failure in General Practice

Paul Smith

Consultant Cardiologist

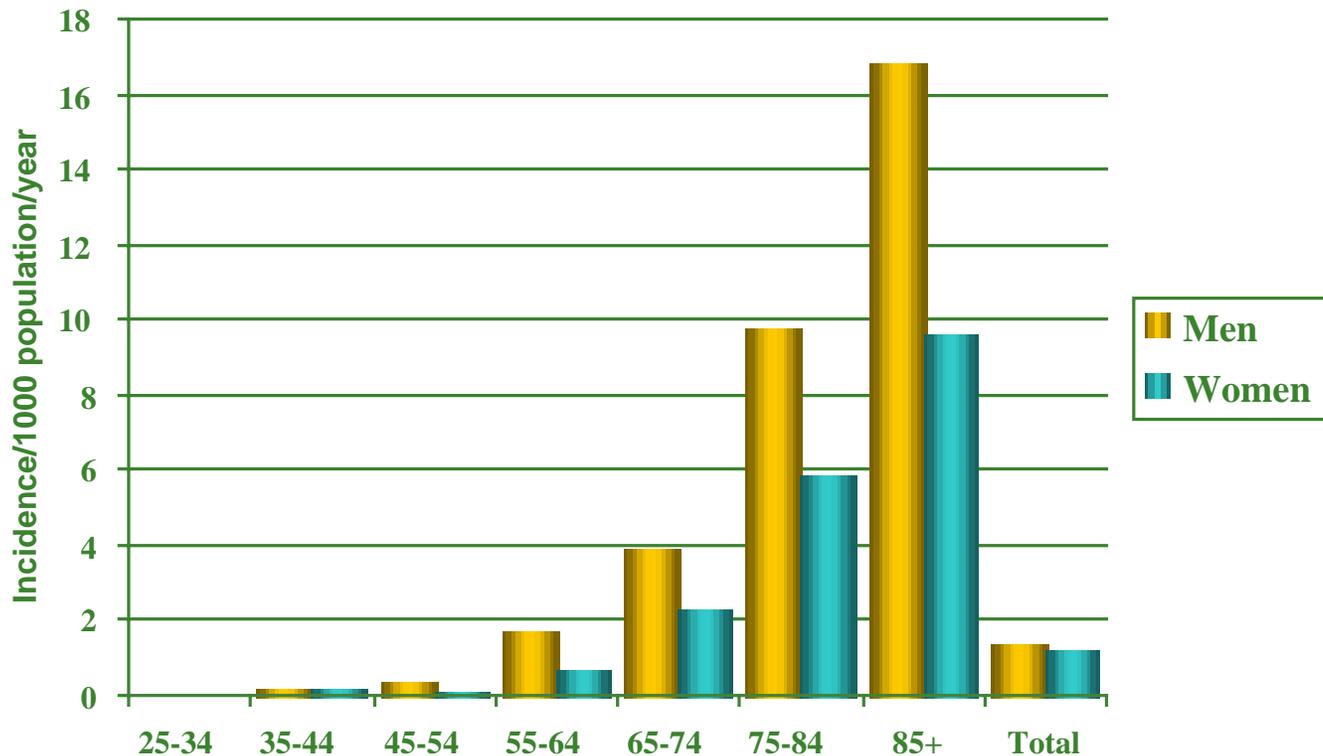
Bradford Royal Infirmary

Presentation Overview

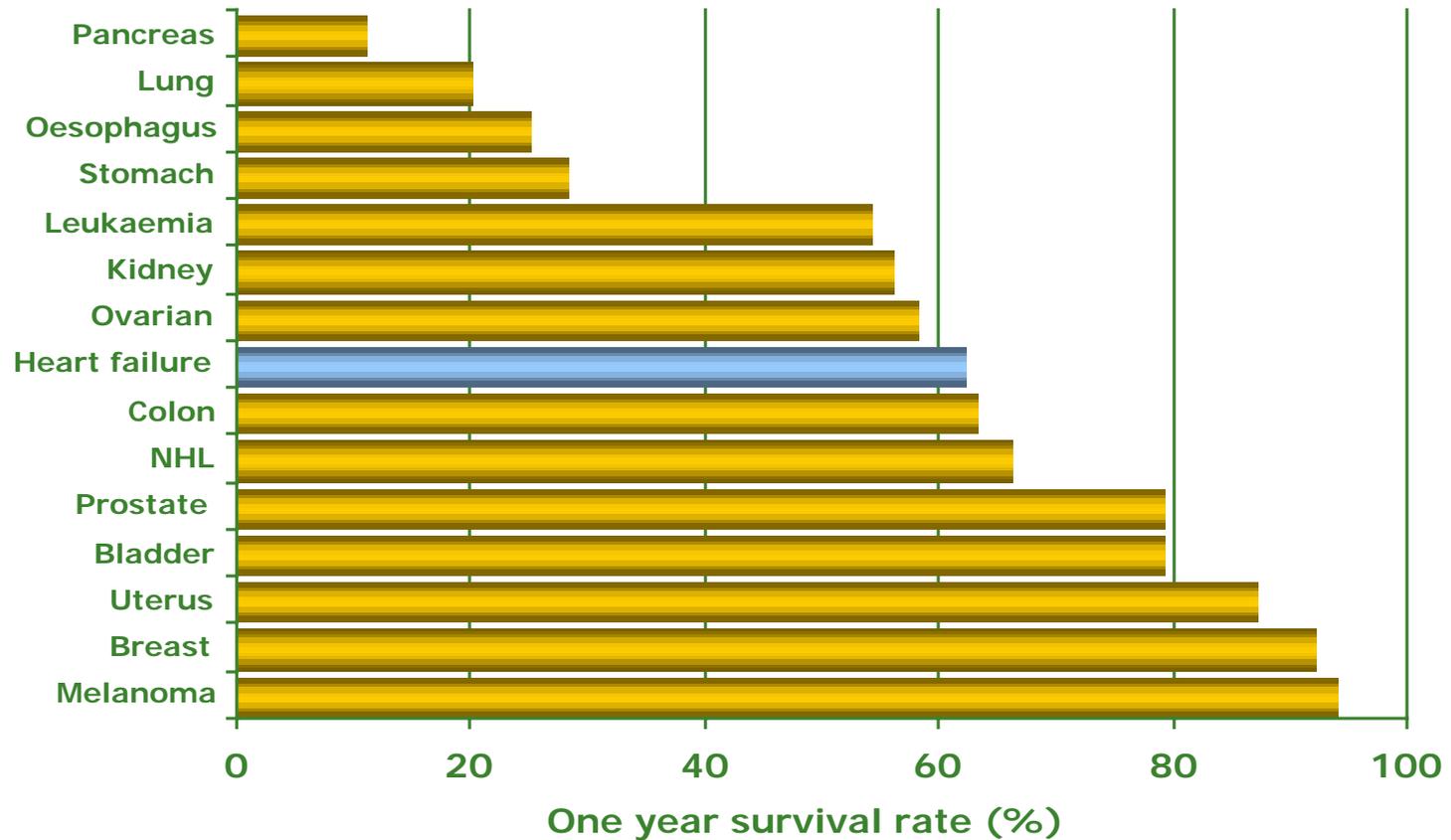
- Prevalence and impact
 - Assessment of heart failure patient
 - Aetiology and Pathophysiology
 - Modern management of heart failure
 - Monitoring and chronic disease management
 - When to refer for Specialist advice
 - Brief overview of cardiac resynchronisation therapy
-

The Incidence of Heart Failure

- Heart failure affects 1-2% of adult UK population
- Incidence of 5-10 cases per 1000 population per year



Heart Failure is Bad News!



Heart Failure is Costly



- 5% of all medical admissions
- £716M per annum
- 1.8% of total NHS budget
- 70% due to hospitalisations
- Heart failure “the growing epidemic”
- Admissions predicted to rise by 50% over the next 25 years

Chronic Heart Failure

“Heart failure is a complex syndrome that can result from any structural or functional cardiac disorder that impairs the pumping ability of the heart”

Stages in the Development of Heart Failure

Increasing severity

| | Stage | Patient Description |
|---|---|---|
| A | High risk for developing heart failure (HF) | <ul style="list-style-type: none">■ Coronary artery disease■ Hypertension■ Diabetes mellitus, obesity■ Family history of cardiomyopathy |
| B | Asymptomatic HF | <ul style="list-style-type: none">■ Previous myocardial infarction■ Left ventricular systolic dysfunction■ Asymptomatic valvular disease |
| C | Symptomatic HF | <ul style="list-style-type: none">■ Known structural heart disease■ Shortness of breath and fatigue■ Reduced exercise tolerance |
| D | Refractory end-stage HF | <ul style="list-style-type: none">■ Marked symptoms at rest despite maximal medical therapy (e.g., those who are recurrently hospitalised or cannot be safely discharged from hospital without specialised interventions) |



Diagnosing Heart Failure

- Shortness of breath on exertion
- Fatigue (exercise intolerance)
- Orthopnoea
- Paroxysmal nocturnal dyspnoea
- Fluid retention

...symptoms are non-specific and present in many other conditions!

Masquerading as Heart Failure

- Obesity
 - Venous insufficiency
 - Drug induced ankle swelling
 - Chest disease - pulmonary embolic disease
 - Angina
 - Hypoalbuminaemia
 - Renal or hepatic disease
 - Depression/anxiety
 - Severe anaemia or thyroid disease
 - Bilateral renal artery stenosis
-

Diagnosing Heart Failure

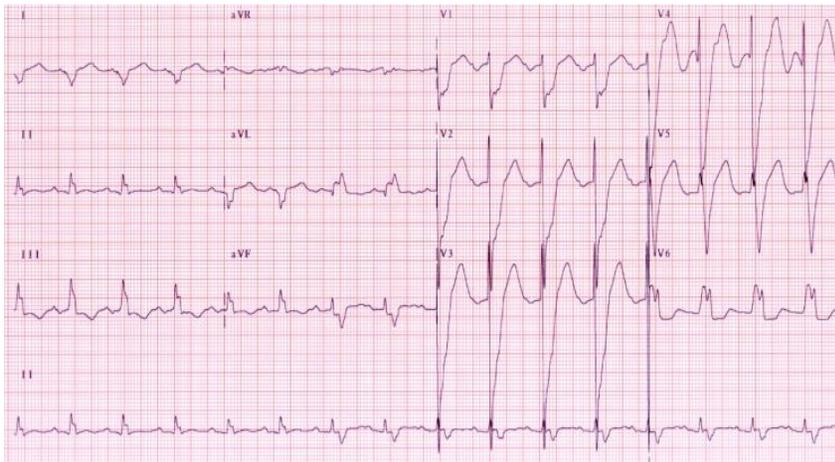
- The most specific signs are:
 - Laterally displaced apex beat
 - Elevated JVP
 - Third heart sound
- Less specific signs include:
 - Basal crackles
 - Peripheral oedema
 - Hepatic engorgement
 - Tachycardia

....signs are insensitive and may not be present!

Heart Failure - baseline investigations

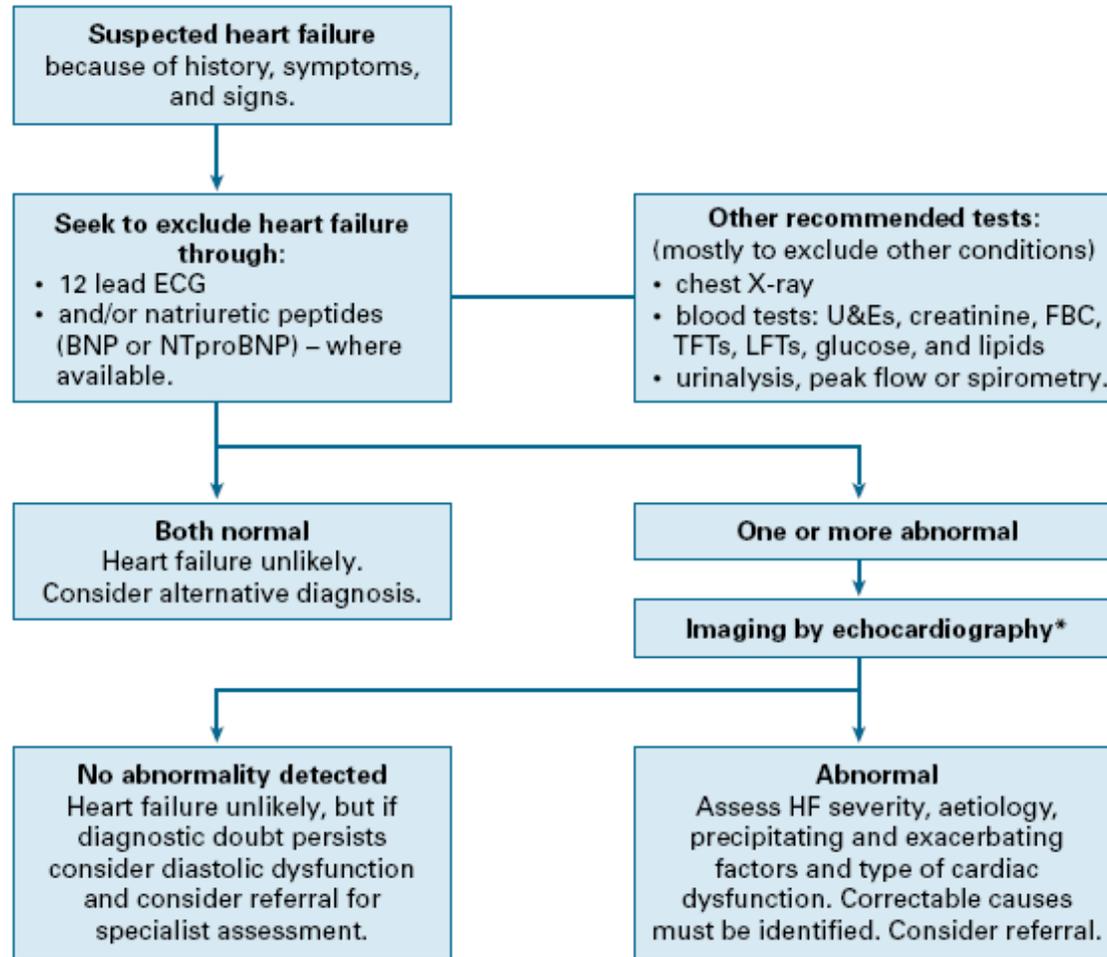


- FBC, U+E, LFT, TFT, glucose, lipids
- NT-pro-BNP (if available)



- Abnormal in over 90%
- LBBB, Q waves
- LVH
- AF
- ST/T wave changes
- VE, NSVT

Heart Failure Diagnostic Pathway

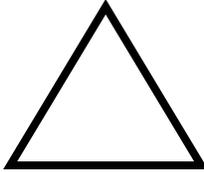


No investigation for heart failure has 100% negative predictive value.
If clinical suspicion remains high then specialist referral recommended

Echocardiography

- Single most effective tool in the diagnosis of heart failure
- Provides information on structure and function of cardiac chambers, valves and pericardium
- EF useful measure of LV systolic dysfunction
- Reports should provide information in clinical context
- Other imaging modality may need to be considered for obese and chronic lung disease





LVF/CCF

- Heart failure is not a complete diagnosis
 - Requires more than stating whether syndrome present or not
 - The following should be considered:
 - Underlying cardiac condition
 - Severity of the syndrome
 - Estimation of prognosis
 - Precipitating and exacerbating factors
 - Co-morbidity
 - Aetiology
-

Impact of Comorbidities on Heart Failure Treatment

| Comorbidity | Comments |
|--|--|
| COPD/Asthma | β Blockers are contraindicated in reversible airways disease. |
| Renal failure (creat > 200 μ mol/l) | ACEi and ARBs may be contraindicated |
| Thyroid | Severe thyroid disease may cause/precipitate HF |
| PVD | High index of suspicion of RAS |
| Urinary frequency | α blockers may cause fluid retention and hypotension. Diuretics may not be tolerated. |
| Gout | Exacerbated by diuretics. Avoid NSAID's. |

NYHA Classification

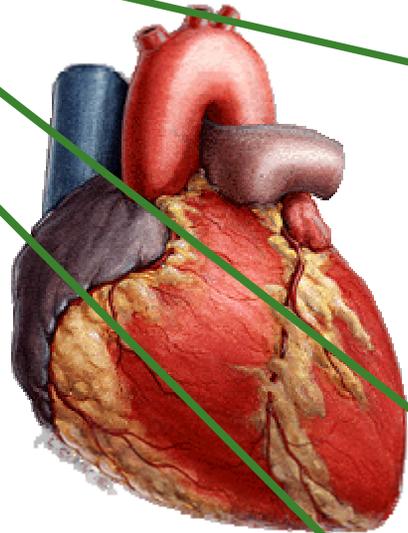
| NYHA functional class | Definition | Diagnosed HF cases % |
|-----------------------|---|----------------------|
| NYHA 1 | No limitation: ordinary physical exercise does not cause dyspnoea or fatigue. | 0 |
| NYHA 2 | Slight limitation of physical activity. Patients are comfortable at rest. Ordinary physical activity results in breathlessness, fatigue, palpitations or angina (symptomatically mild heart failure). | 69 |
| NYHA 3 | Marked limitation of physical activity: comfortable at rest but dyspnoea washing and dressing, or walking from room to room (symptomatically moderate heart failure). | 15 |
| NYHA 4 | Severe limitation of physical activity: dyspnoea at rest, with increased symptoms with any level of physical activity (symptomatically severe heart failure). | 16 |

Aetiology of Heart Failure

95%

Hypertensive heart disease

IHD



Valvular heart disease

**Dilated CMP
(idiopathic, viral,
alcohol, chemotherapy)**

Rare causes:

- postpartum
- tachy-cardiomyopathy
- infiltrative -
haemochromatosis, amyloidosis,
sarcoidosis
- muscle disorders (myotonic
dystrophy, muscular dystrophy)
- infective (HIV)
- inherited disorders
- endocrine (phaeo,
hyperthyroid, acromegaly)

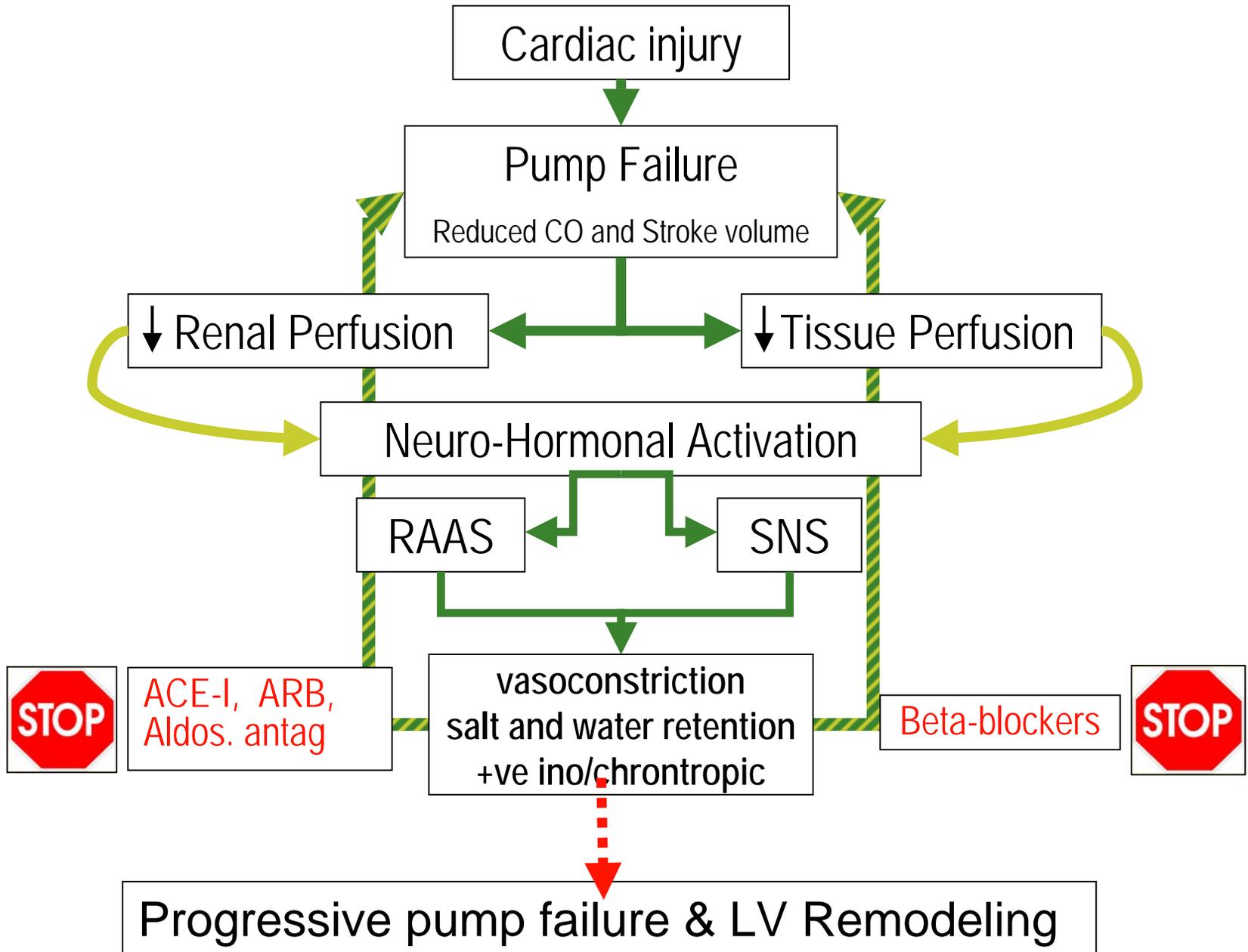
Compensatory Mechanisms

- Body “sensing” poor perfusion as hypovolaemia
- Mechanisms evolved to save our ancestors

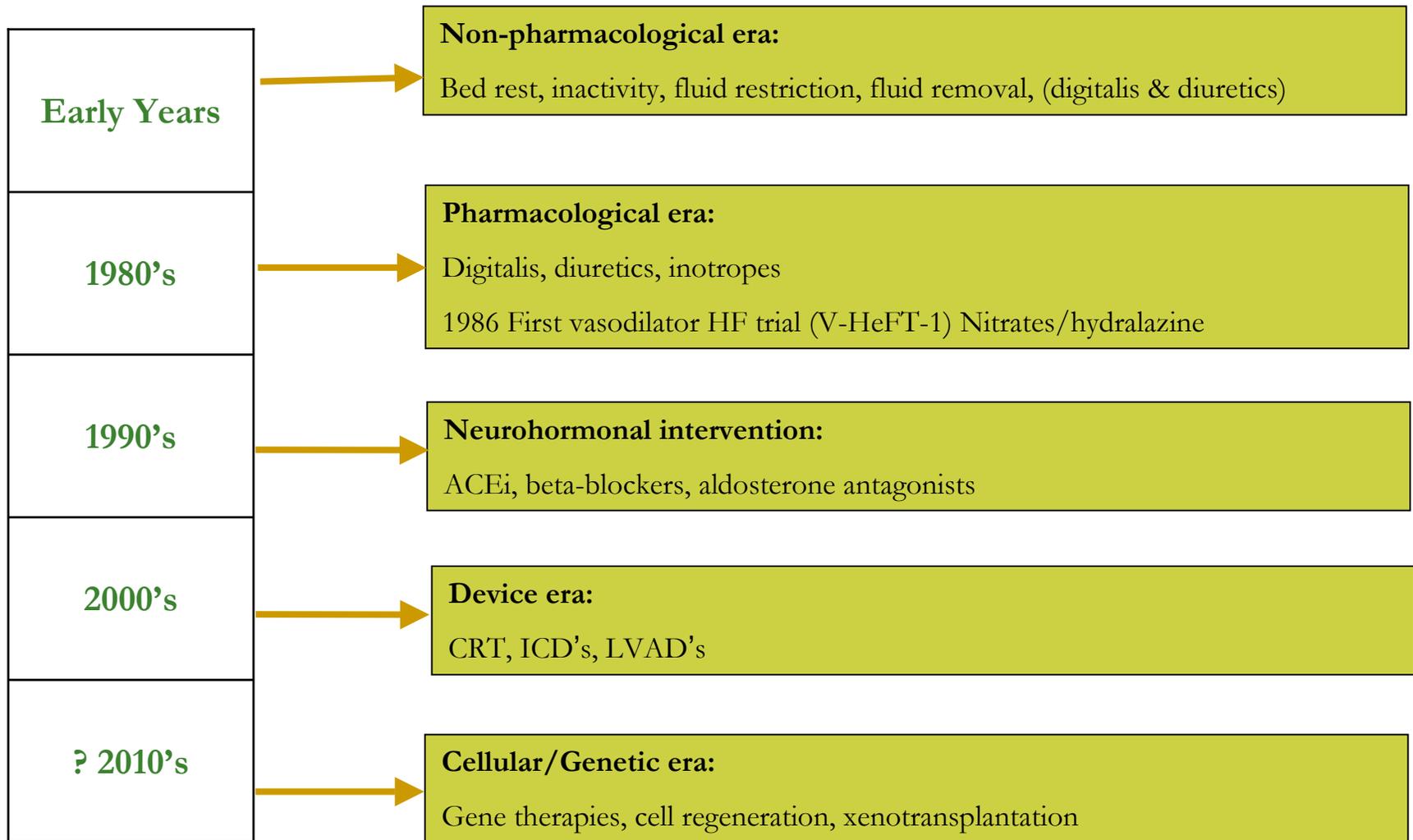
| <i>Response</i> | <i>Short term Effects</i> | <i>Long term Effects</i> |
|---------------------------------|---|---|
| Salt and water retention | Augments preload | Pulmonary congestion/ oedema in proximal bed |
| Vasoconstriction | Maintains BP for perfusion of vital organs | Exacerbates pump dysfunction (inc. afterload) increases cardiac energy expenditure |
| Sympathetic Stimulation | Increases HR and ejection fraction Peripheral vasoconstriction | Increases energy expenditure and risk of sudden arrhythmia and death * |

MAJOR CAUSE OF POOR LONG TERM OUTCOMES

Heart Failure Vicious Cycle



Heart Failure Management Timeline



Modern Management of Heart Failure

Aims of therapy in heart failure:

- Improve life expectancy
- Improve quality of life

The relative importance of these varies:

- between patients
 - over time
-

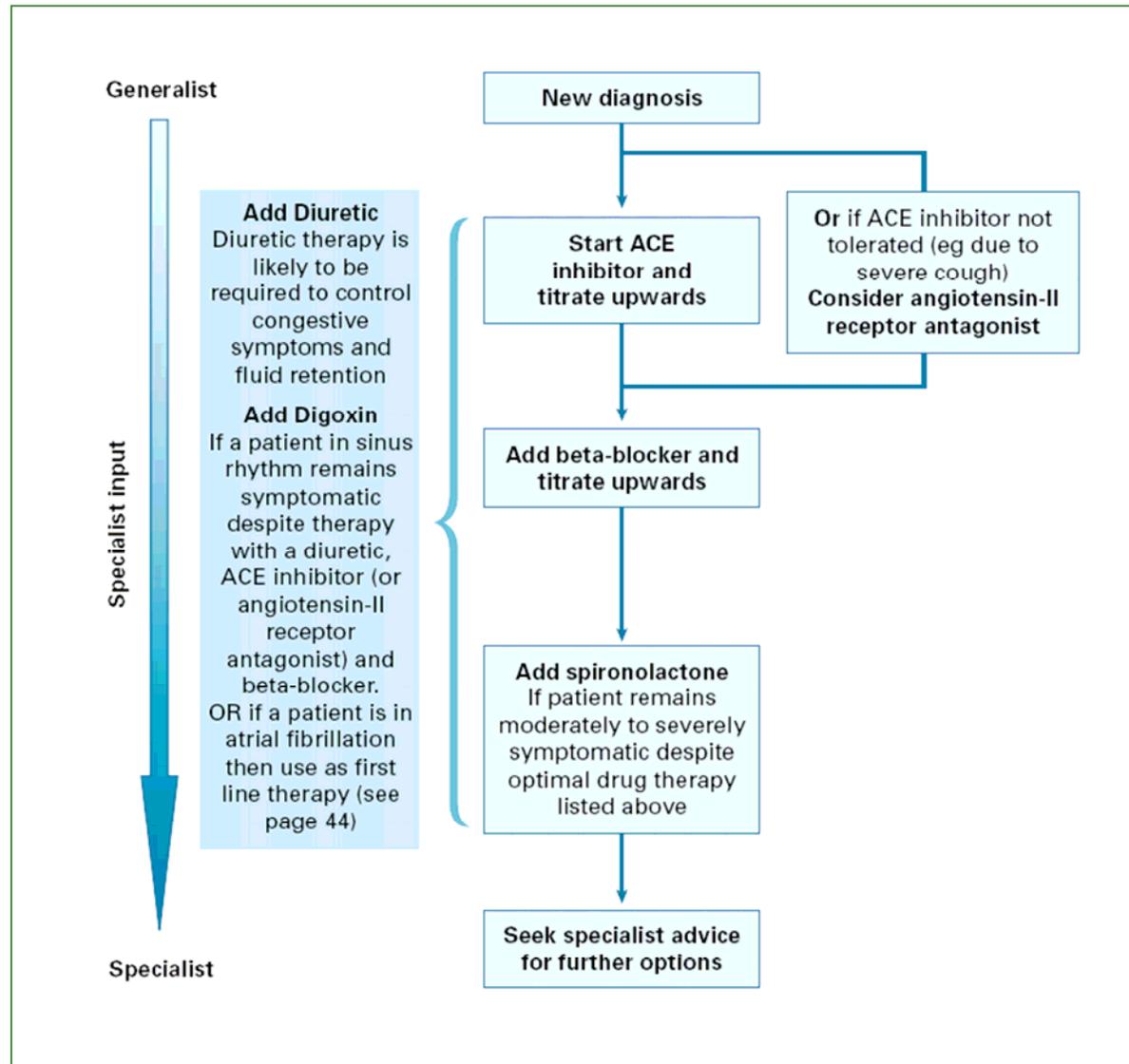
Modern Management of Heart Failure

- Multidisciplinary approach
 - Lifestyle measures
 - Patient education/support
 - Weight control (volume status)
 - Dietary modification (salt, alcohol)
 - Reducing fluid intake
 - Smoking cessation
 - Exercise and rehabilitation
 - Influenza vaccination
 - Pharmacological therapy – what to use and what to avoid!
 - Devices and surgery
-

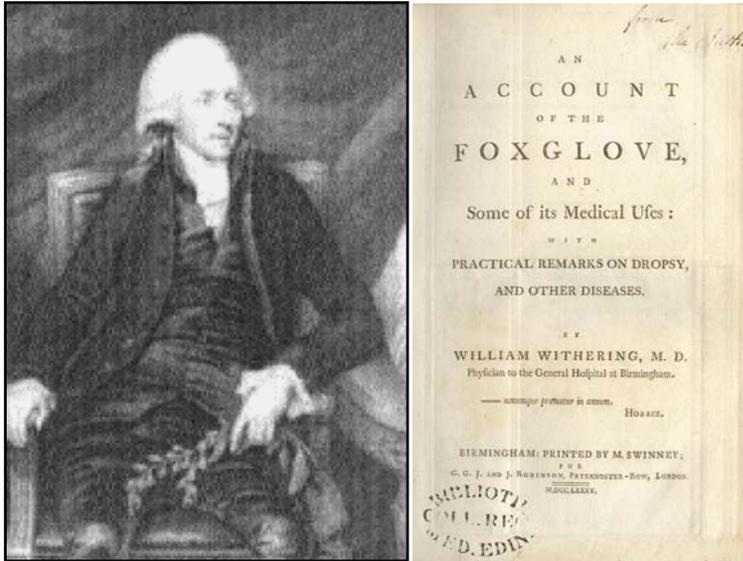
Drug Therapy in Heart Failure

- Diuretics
 - Neurohormonal antagonists
 - ACE inhibitors
 - Beta blockers
 - Aldosterone antagonists
 - Angiotensin receptor blockers
 - Digoxin
 - Other drugs
 - Nitrates/hydralazine
 - Amiodarone
 - Warfarin
 - Aspirin
-

Treatment Algorithm for the Management of CHF



Digoxin



- Oldest established drug treatment for HF
- Extract of Foxglove (*Digitalis purpurea*)
- 1785 William Withering
- Narrow therapeutic window
- Arrhythmias and GI side effects common

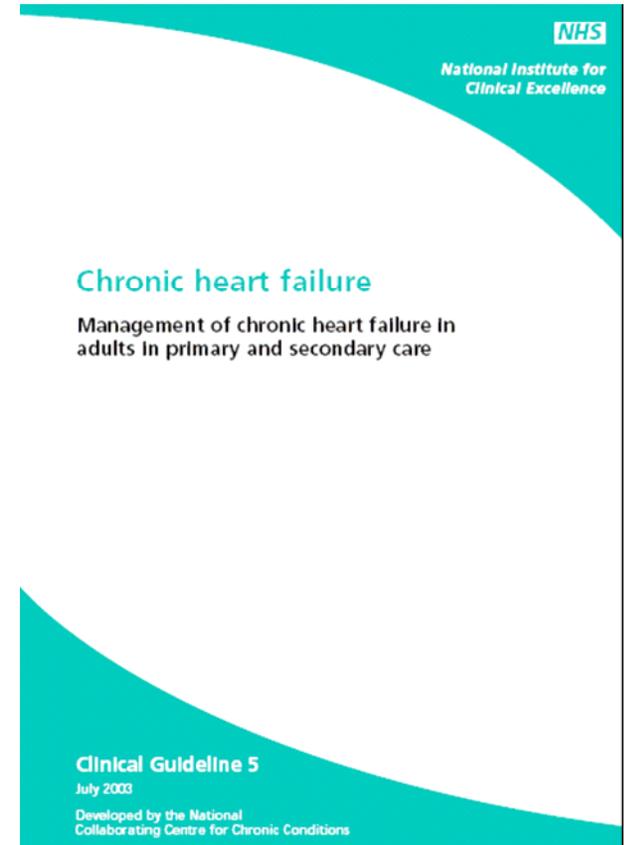


DIG Trial 1997 (Digoxin 250µg od.)

- No mortality benefit
- Significant reduction in hospitalisations due to worsening HF

Digoxin

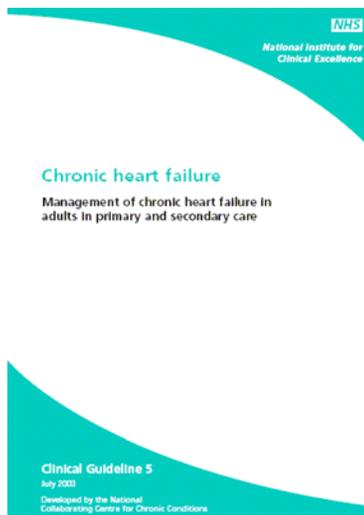
- Digoxin is recommended for:
 - i. Worsening or severe heart failure due to LV systolic dysfunction despite ACE inhibitor, beta-blocker and diuretic therapy
 - ii. Patients with AF and any degree of heart failure



NICE, 2003

Diuretics

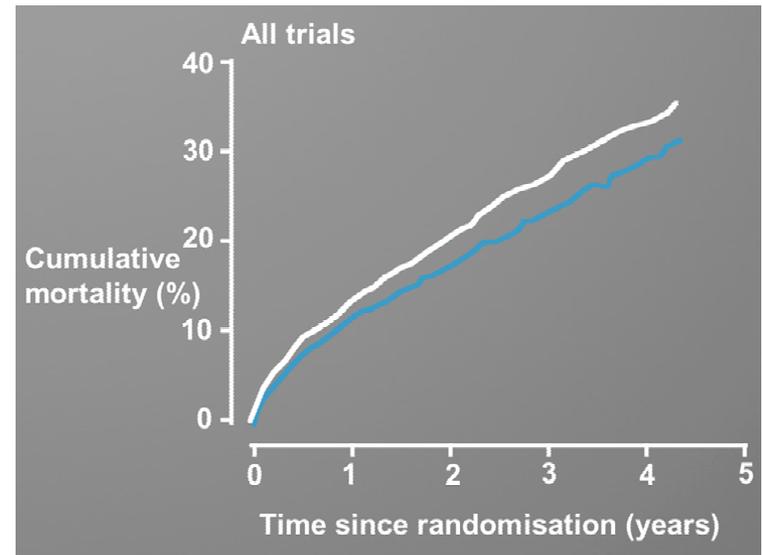
- 1920 Organomercurial diuretics first used
- 1958 Thiazide diuretics introduced
- Useful in the acute setting and in the overloaded patient
- Rapid relief of congestive symptoms
- Exacerbate RAA system due to diuresis and natriuresis
- No evidence for mortality benefit, no effect on disease progression
- Need to up and down titrate according to symptoms



“Diuretics should be routinely used for the relief of congestive symptoms and fluid overload in patients with heart failure”

ACE Inhibitors (1)

- First ACE inhibitor - Captopril synthesised in 1977
- Undisputable evidence of reduction in mortality in chronic HF
- Review of data from 5 RCT's
- Compared with placebo. ACEi reduce
 - Mortality ($p < 0.0001$)
 - Readmission ($p < 0.0001$)
 - Reinfarction ($p < 0.0001$)
- Benefit occurs early (30 days)



Flather *et al.*, Lancet 2000

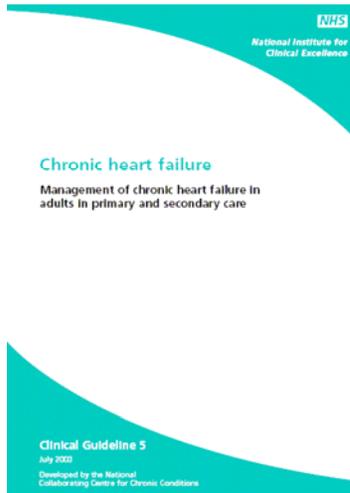
ACE Inhibitors (2)

- in symptomatic heart failure patients:
 - CONSENSUS 1987 (First ACEi trial - Enalapril 20mg bd)
 - SOLVD 1990
 - ATLAS 1999 (High v Low dose Lisinopril)

 -in post infarct heart failure:
 - SAVE 1991 (Captopril 50mg tds)
 - AIRE 1993 (Ramipril 5mg bd)
 - TRACE 1995 (Trandolapril 4mg od)

 -and in asymptomatic patients with LV dysfunction:
 - SOLVD 1990 (prevention arm)
 - TRACE 1995
 - SAVE 1991
-

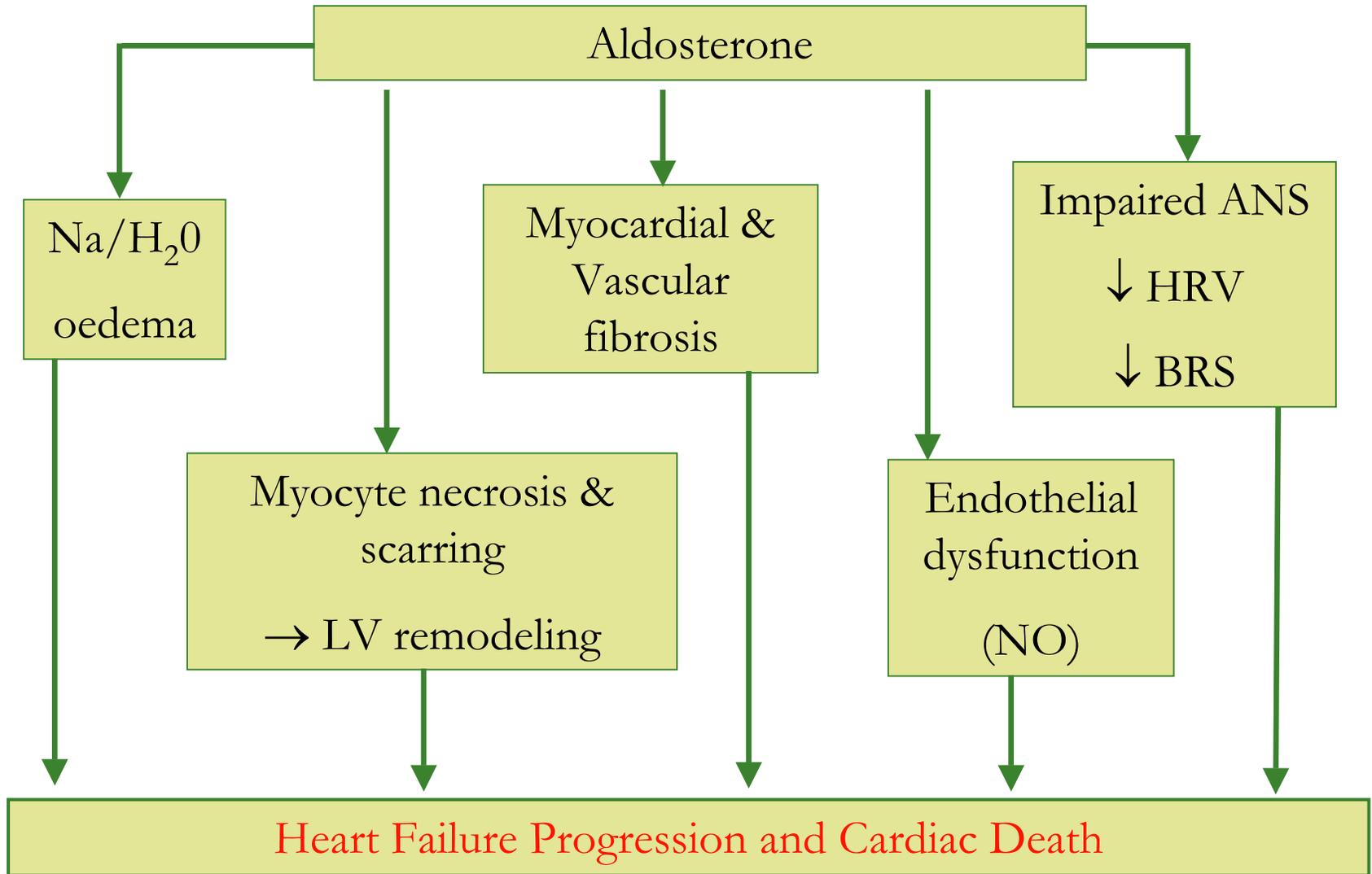
ACE inhibitors (3)



“all patients with heart failure due to LV systolic dysfunction should be considered for treatment with an ACEi”

- start with low dose
- aim for trial target dose or highest tolerated dose
- Remember, some ACEi is better than none
- Symptomatic low BP (stop other vasodilators \pm diuretics)
- Monitor creatinine and electrolytes
- Rise in creatinine of 30% is probably acceptable

Aldosterone & Heart Failure



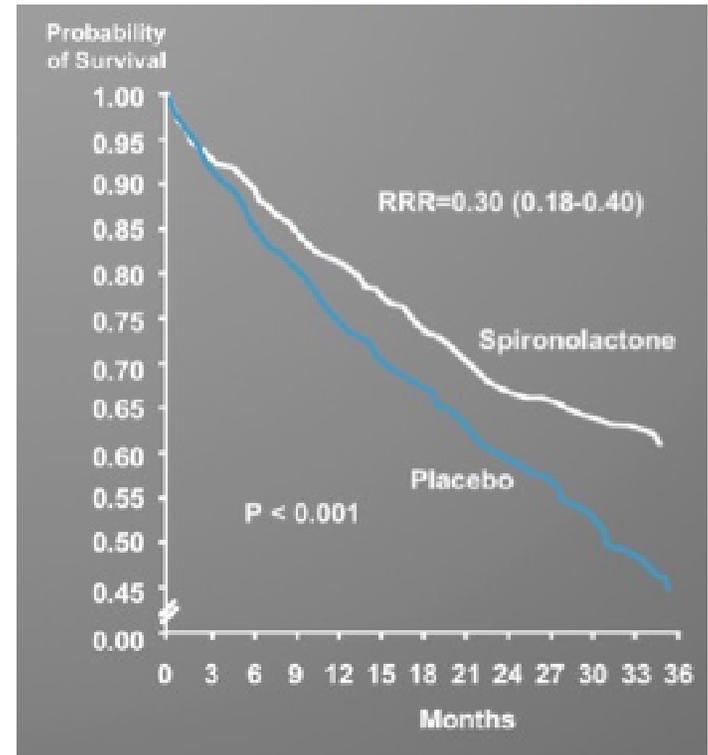
Aldosterone Antagonists

2 currently available:

- Spironolactone
- Eplerenone

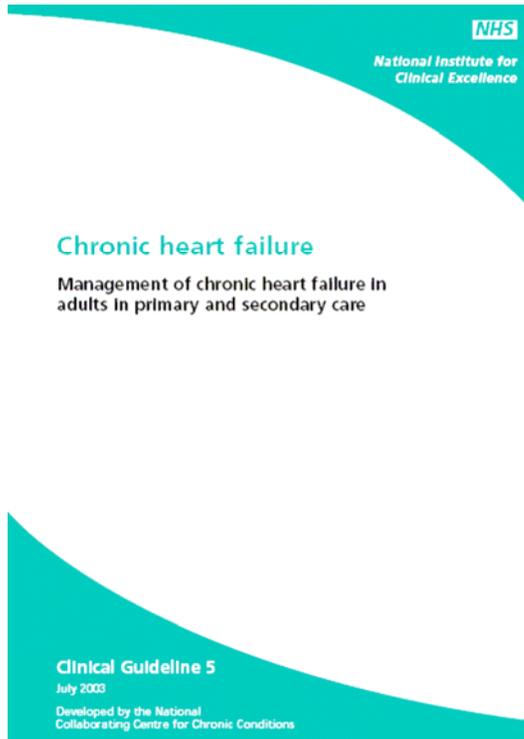
Spironolactone

- RALES trial 1999 (25mg od)
- NYHA III/IV on ACEi, diuretic ± digoxin
 - 30% RRR in death
 - 35% RRR in hospitalisation



N Engl J Med 1999;**341**:709-17

NICE Recommendations on Spironolactone



“Heart failure patients who remain moderate-severely symptomatic despite OMT should be prescribed spironolactone at a dose of 12.5 - 50mg daily”

- Symptom improvement in weeks - months
- Monitor Potassium & Creatinine
- If hyperkalaemia occurs, halve dose
- S.E. Breast discomfort +/- gynaecomastia

Aldosterone antagonist for heart failure post MI



AMI, LVEF \leq 40%, Clinical HF, Standard Therapy

**Eplerenone
25–50 mg od
n = 3319**

**Randomise 3–14 Days
Post-AMI
1012 Deaths**

**Placebo
n = 3313**

Primary End Points:

- All-cause mortality
- CV mortality/CV hospitalisation*

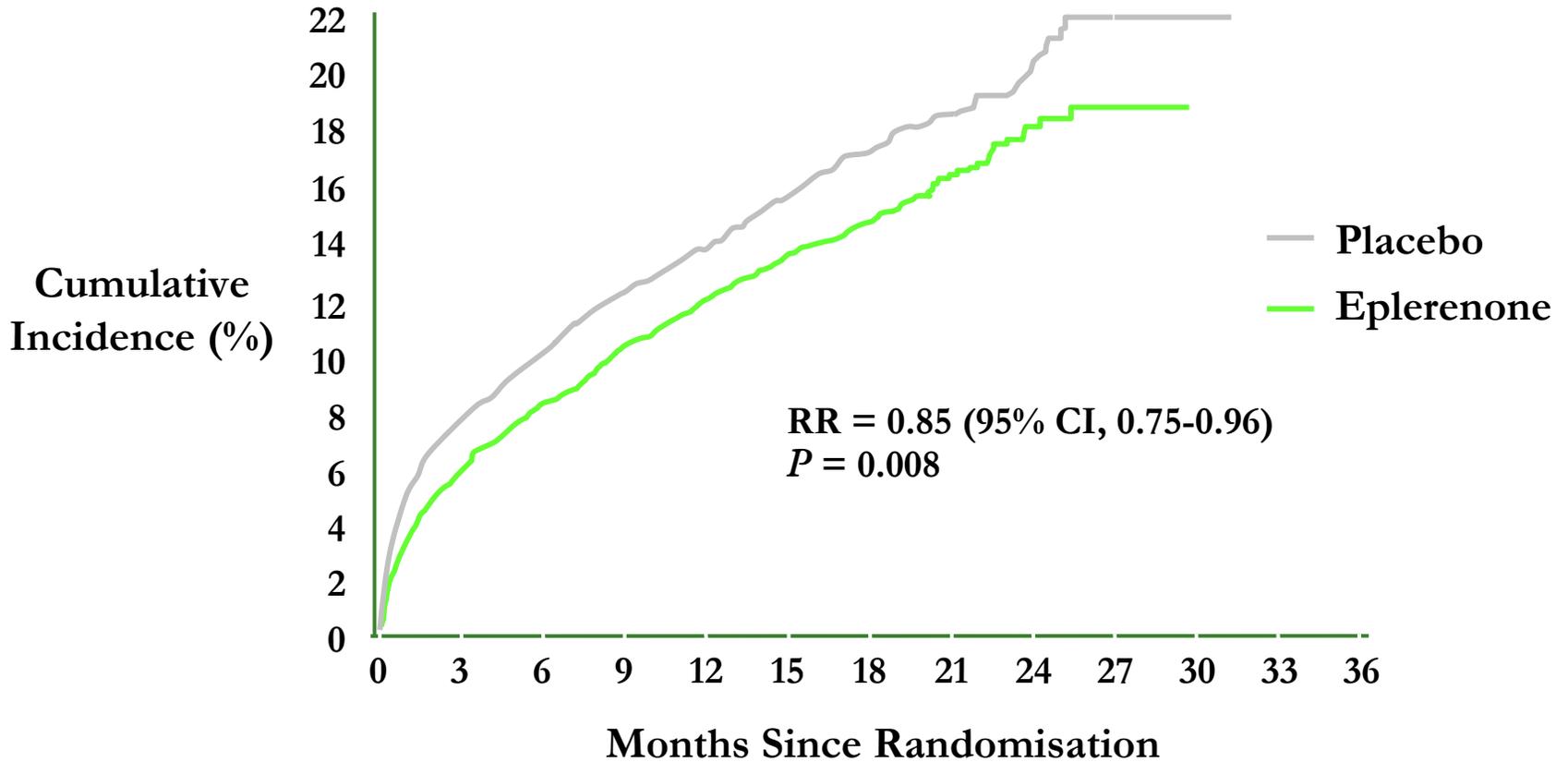
Secondary End Points:

- CV mortality
- All-cause mortality/all-cause hospitalisations
- CV hospitalisations

*CV hospitalisation = hospitalisation for heart failure, MI, stroke, or ventricular arrhythmia

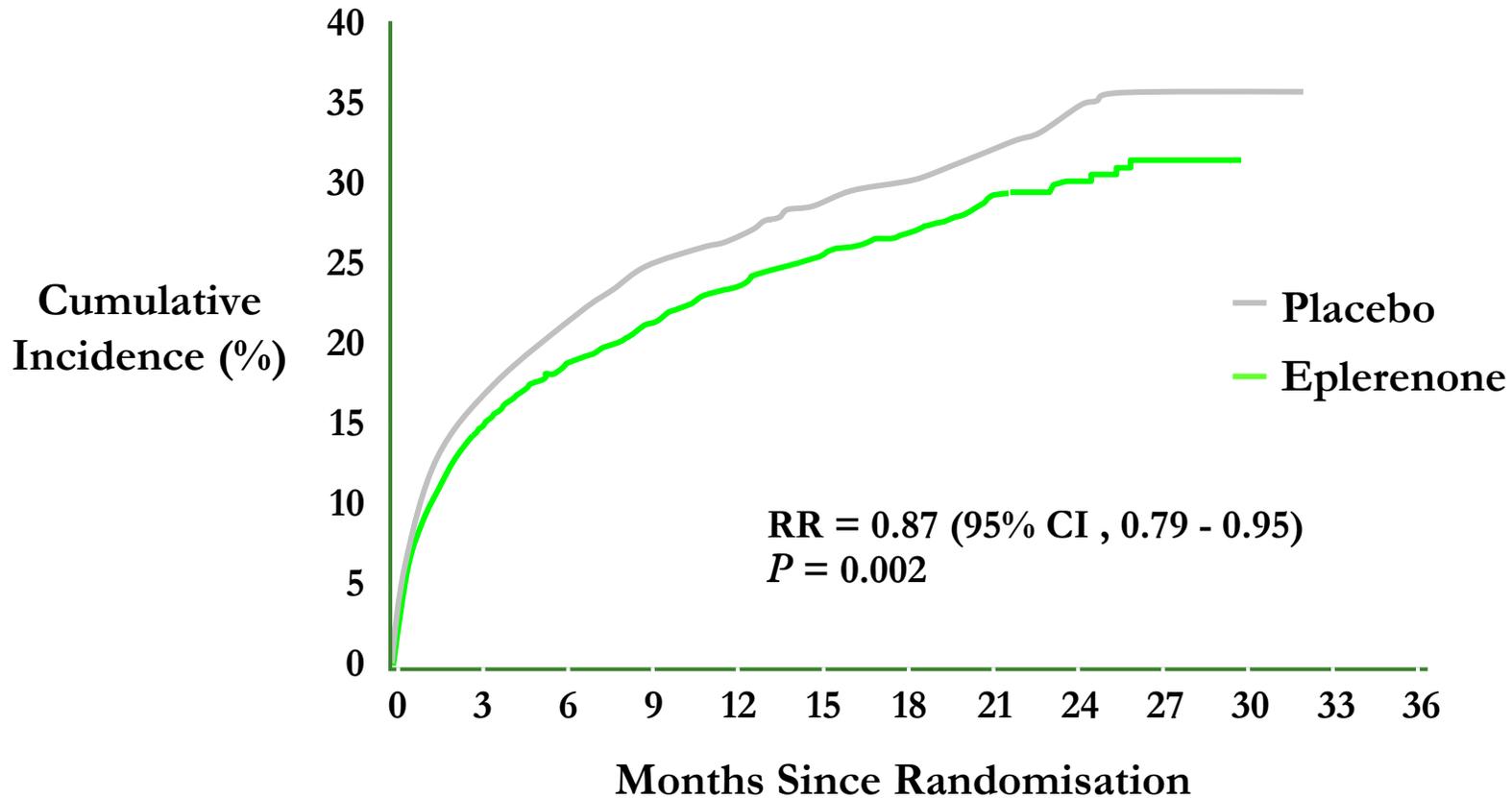


All-Cause Mortality





CV Mortality/Hospitalisation



Summary: Aldosterone antagonists

- ACE inhibitors and ARB's do not adequately suppress aldosterone levels, leading to aldosterone 'escape'
 - When added to conventional therapy in HF aldosterone receptor antagonists are cardioprotective
 - ↓ all-cause mortality
 - ↓ cardiac mortality
 - ↓ hospitalisations for heart failure
 - These benefits are in addition to those conferred by ACE inhibitors
-

Aldosterone antagonists: -

- Spironolactone or Eplerenone?

- Licensed for different indications
 - No evidence for beneficial effect of Spironolactone in heart failure post MI
 - No evidence for beneficial effect of Eplerenone in CHF
 - 10% incidence of gynaecomastia with Spironolactone
 - Similar problems with hyperkalaemia
 - Eplerenone significantly more expensive
-

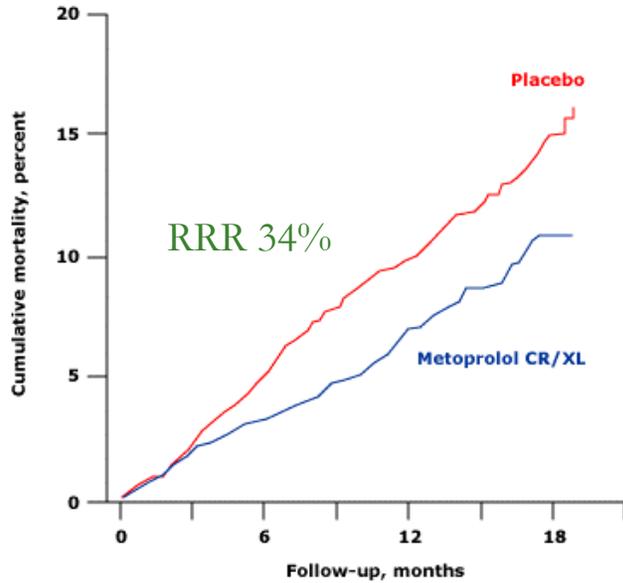
Beta Blockers in Heart Failure

- β blockers protect against plasma Norepinephrine/Epinephrine
- More patients in trials with beta-blockers than ACEi

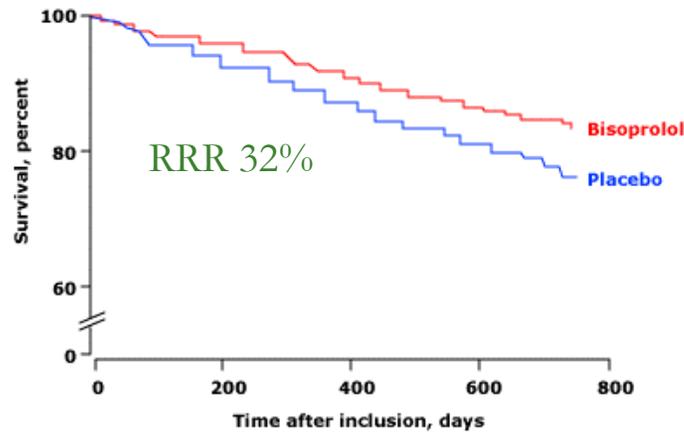
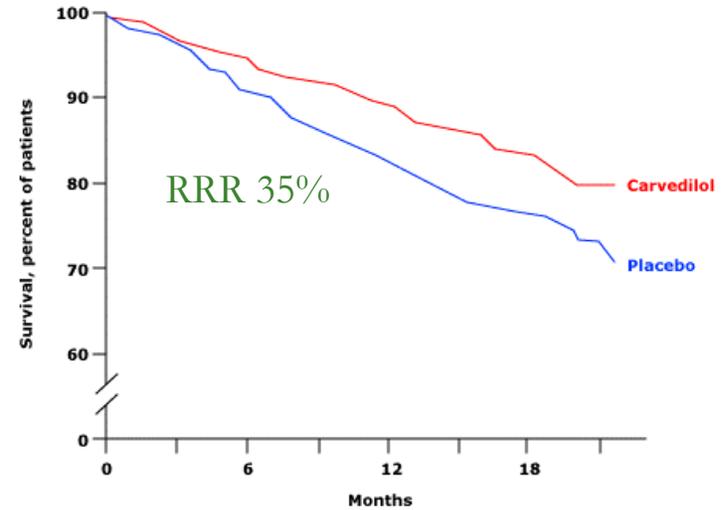
| Name | Drug | Year | n |
|--------------------------|-----------------------------------|------|------|
| MDC | Metoprolol tartrate 100-150mg/day | 1993 | 383 |
| MERIT-HF | Metoprolol succinate 200mg od | 1999 | 3991 |
| US Carvedilol HF Program | Carvedilol 25-50mg bd | 1996 | 1094 |
| CIBIS II | Bisoprolol 10mg 0d | 1999 | 2647 |
| COPERNICUS | Carvedilol 25-50mg bd | 2000 | 2289 |

Beneficial effects of Beta Blockers

MERIT-HF



COPERNICUS

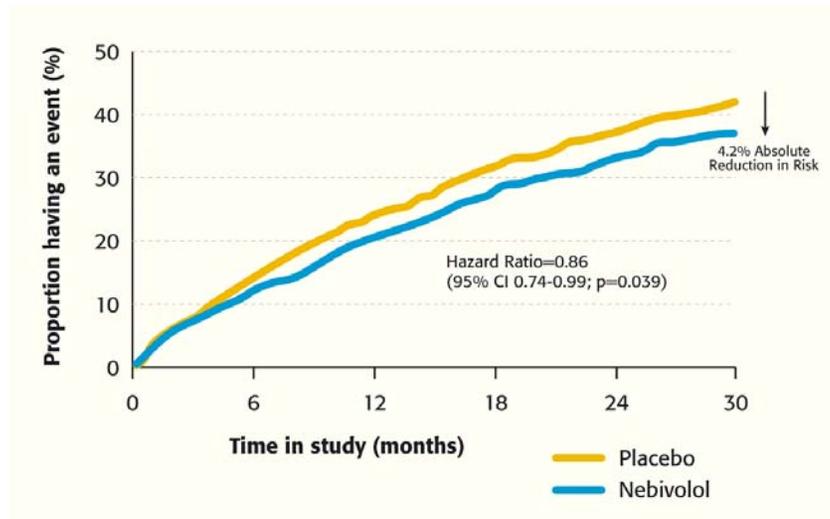


CIBIS II

..... and in the Elderly?

SENIORS Trial (2005)

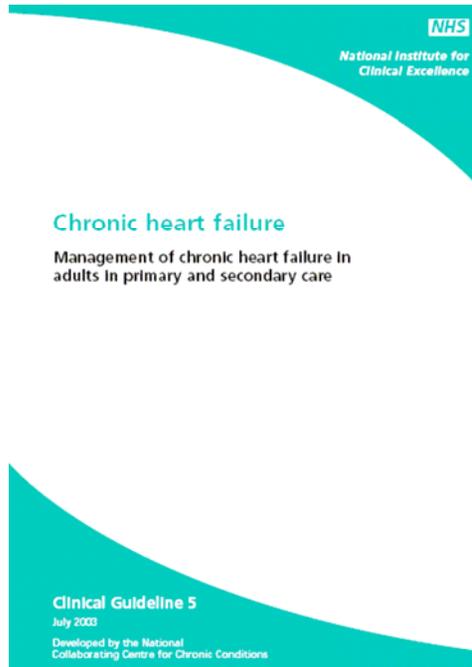
- First HF outcome trial restricted to elderly (mean age 76 yrs)
- Nebivolol (Long acting, cardioselective, vasodilating properties)



Nebivolol initiated at 1.25mg. Target 10mg od.

Beta blockers and heart failure

“all patients with heart failure should be considered for treatment with a beta blocker”



Which beta blocker, and what dose?

- Stick to beta blocker with evidence base
- 3 licensed in UK (Carvedilol, Bisoprolol & Nebivolol)

Bisoprolol (β_1 selective).

Carvedilol (Mixed α_1 , β_1 , β_2 antag)

Nebivolol (β_1 selective & Vasodil. ? via NO)

- What dose? - “Start low, go slow”
- Aim for trial doses (or max tolerated)
- Some better than none!

Beta blockers - practical advice

- Initiate slowly, in stable patients (i.e. no congestion)

- B blocker or ACEi first?

CIBIS III - Mild-moderate HF

bisoprolol or enalapril first

No difference in mortality / hospitalisation

- What if increasing congestion?

Double diuretic, if no better halve β blocker (? stop in short term)

- What if profound fatigue/bradycardia?

Unusual. Halve dose, reassess

- Inform patients:

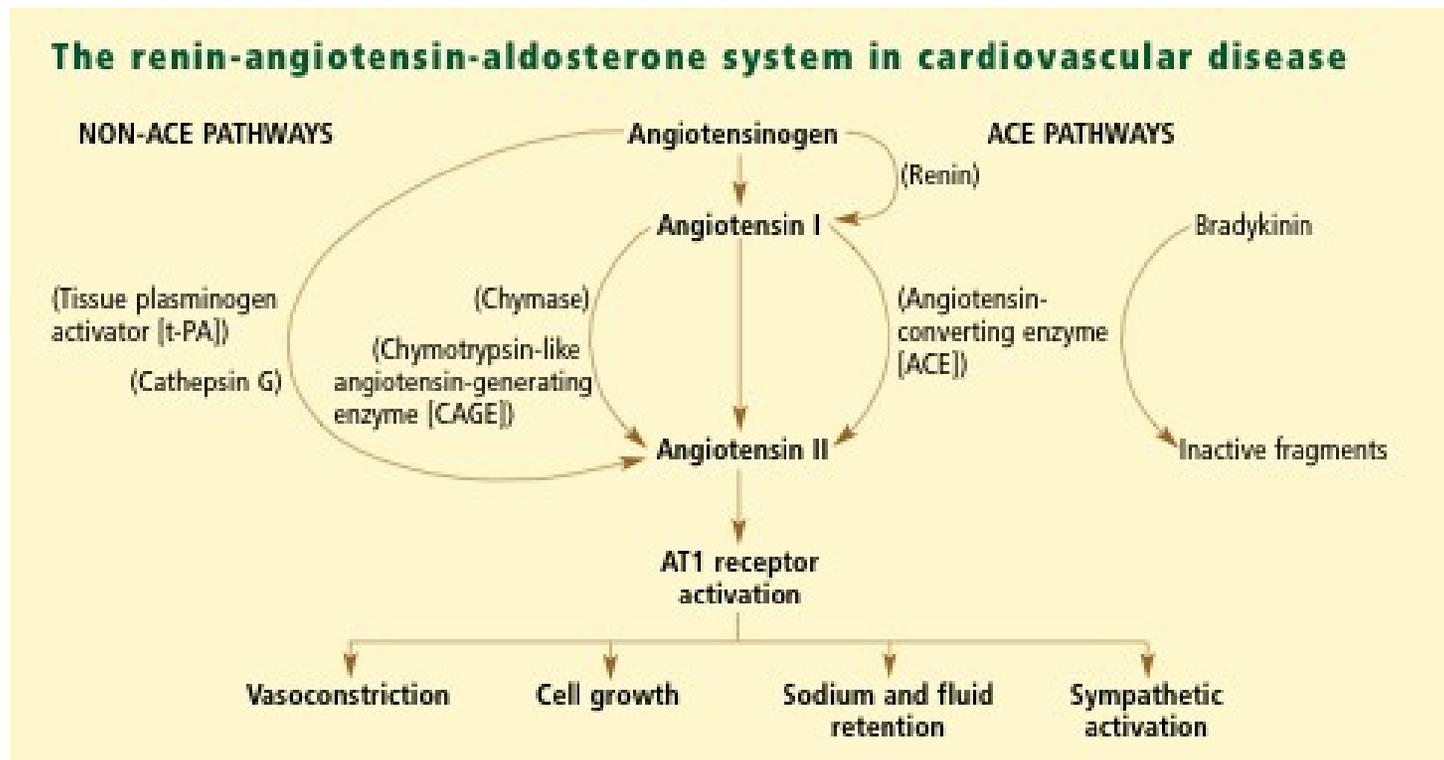
Primary aim of Rx is to prevent worsening HF & \uparrow survival

If symptoms do improve, it can take weeks - months

Temporary deterioration of symptoms in 20 - 30%

Angiotensin Receptor Blockers

- ACEi fail to block RAS completely
- ARB's prevent binding of angiotensin II to type 1 receptor



Angiotensin Receptor Blockers

Chronic Heart Failure Trials

- ELITE II 2000 (non inferiority to ACEi, better tolerated)
- VALHeFT 2002 (ARB + ACEi ↓ hospitalisations, but not mortality)

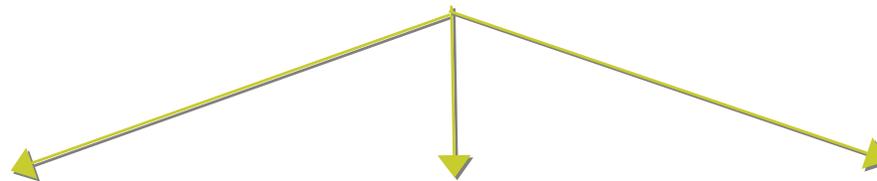
Post MI heart failure trials

- OPTIMAAL 2002 (ACEi better at reducing mortality)
 - VALIANT 2003 (ARB similar to ACEi at reducing mortality)
-

CHARM Trial

7,601 patients with heart failure

3 Individual component randomized trials with the ARB candesartan (4 or 8 mg/day, titrated to target dose of 32 mg) or placebo



CHARM Added

- Patients with LVEF <40% and treated with an ACE-inhibitor

CHARM Alternative

- Patients with LVEF <40% and ACE-inhibitor intolerant

CHARM Preserved

- Patients with LVEF >40% with or without ACE-inhibitor

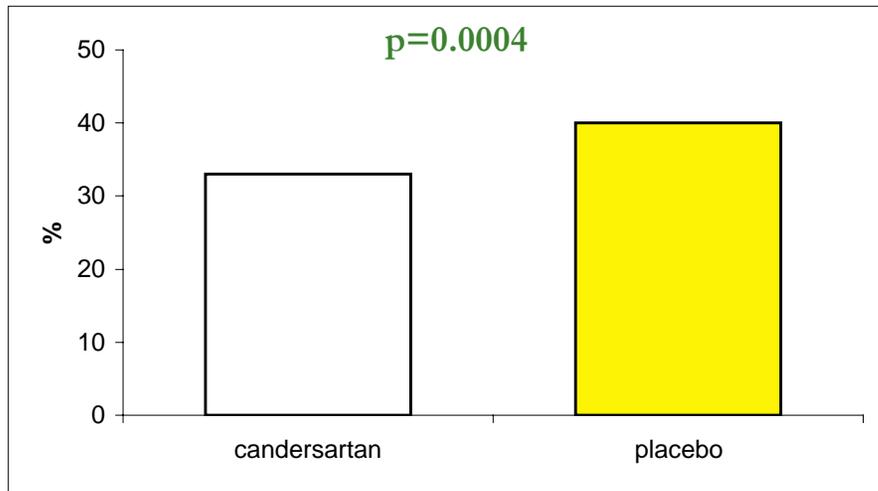
Endpoints (follow-up minimum 2 years):

- Primary – Component trials: cardiovascular mortality or HF hospitalization
- Primary – Overall trial results: All-cause mortality

CHARM TRIAL

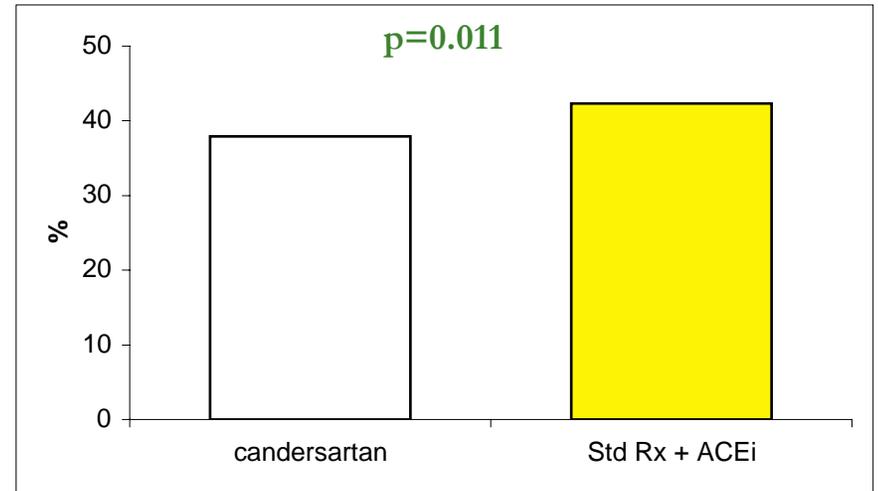
Alternative Trial

CV Mortality or
CHF hospitalization



Added Trial

CV Mortality or
CHF hospitalization



Angiotensin Receptor Blockers - Summary

- ARB's are a good alternative to ACEi in symptomatic patients intolerant to ACEi to improve morbidity and mortality
- ARB's can be considered in combination with ACEi in patients who remain symptomatic, to reduce mortality and hospitalisation for HF (CHARM-added).

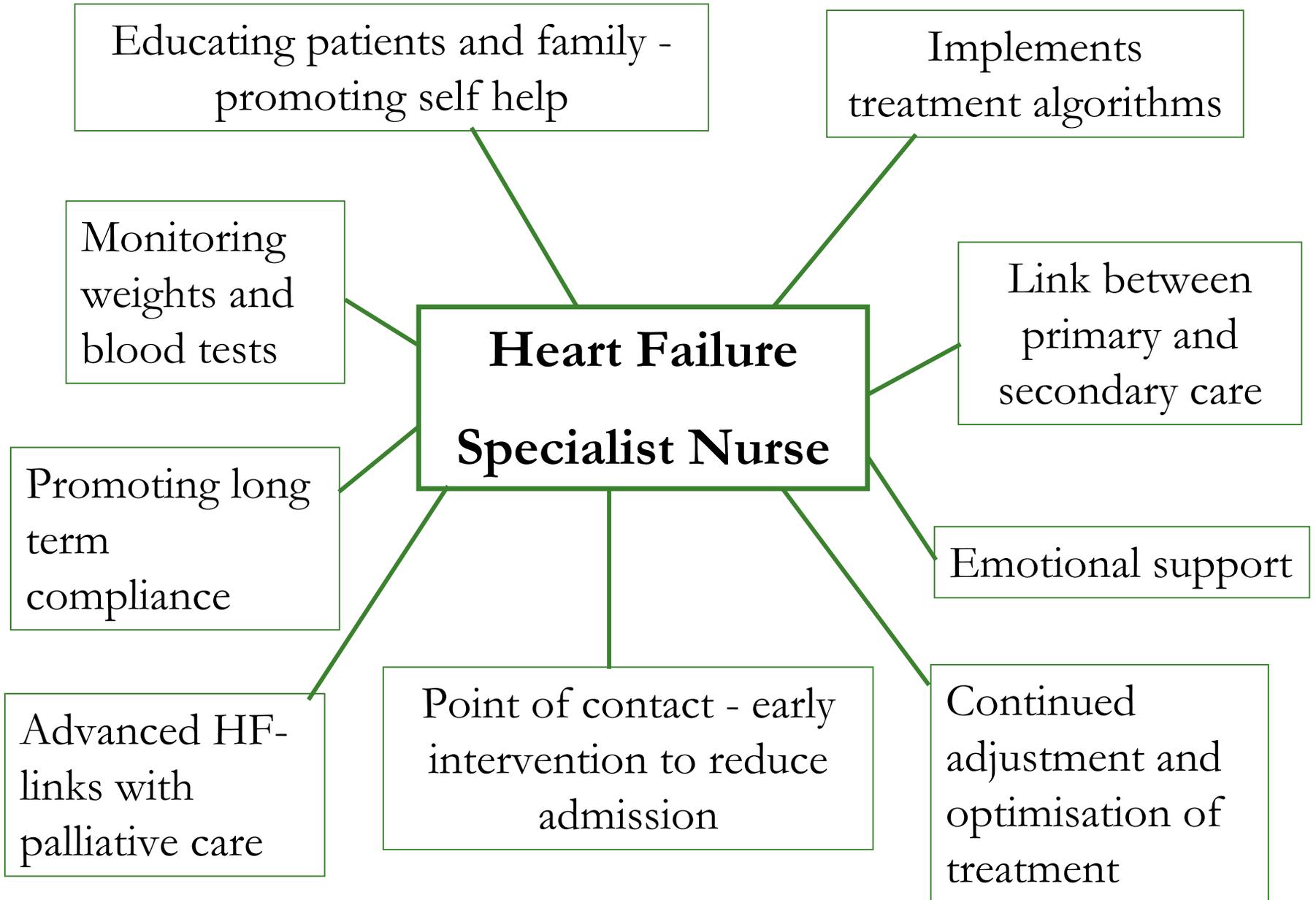
European Society of Cardiology CHF guidelines. 2005.



Heart Failure Chronic Disease Management

Follow up interval should be *maximum* of 6 months

- Functional capacity – History / NYHA class / QOL / 6MW / CPX
 - Assessment of fluid status – weight / L+S BP / clinical examination
 - Assessment of cardiac rhythm – clinical examination, ECG
 - Laboratory assessment – minimum U+E's
 - Management plan – compliance with diet, fluid, exercise, lifestyle
 - Co-medications – check all medications (prescribed and OTC)
 - Medical complications – angina, depression, renal failure, anaemia
-



Patient Self Monitoring

- Patients can monitor their volume status by daily weighing and adjustment of diuretic regime.
 - Requires education and support
 - Patients taught to recognise early signs of decompensation and how to seek professional help
 - Key role for Heart Failure Specialist Nurse (education & support)
-

Drugs to avoid in Heart Failure

- Anti-inflammatory medication (NSAIDs, COX 2 inhibitors)
 - Class 1 antiarrhythmic agents (e.g. flecainide, lignocaine)
 - Calcium channel antagonists
 - Rate limiting non-dihydropyridine (verapamil, diltiazem)
 - First generation dihydropyridine (nifedipine)
 - Tricyclic antidepressants
 - Lithium
 - St Johns Wort
 - Cautious use of steroids
-

Depression: Common and important

- Consider depression in all patients with heart failure
 - Prevalence of 30% in non-hospitalised HF patients
 - Diagnosis more common in those with physical symptoms and poorer physical functioning
 - Depressive symptoms strongly linked with worse outcome
 - But, risk/benefit of antidepressants carefully
-

When to Refer to a Specialist?

- Diagnostic uncertainty
 - Heart failure due to valve disease
 - Heart failure due to diastolic dysfunction
 - Advanced heart failure (NYHA class III and IV)
 - Severely impaired LV
 - Patients with significant co-morbidity
 - Symptomatic arrhythmia
 - Women planning pregnancy
 - HF no longer manageable in home setting
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Cardiac Resynchronisation Therapy

- an option in advanced heart failure

What is it?

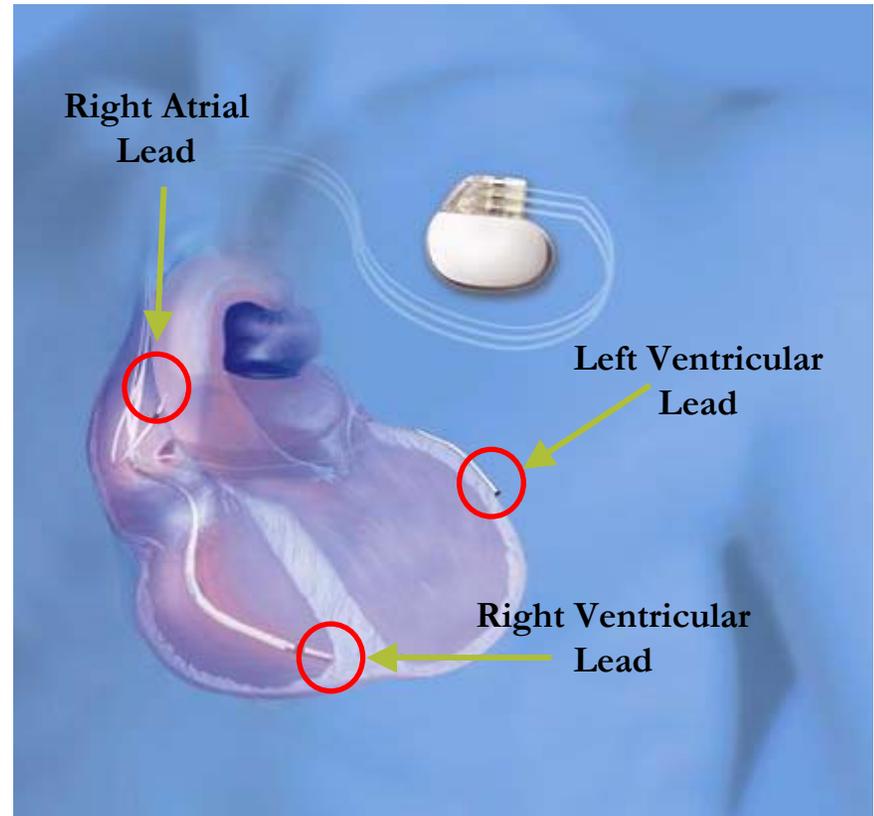
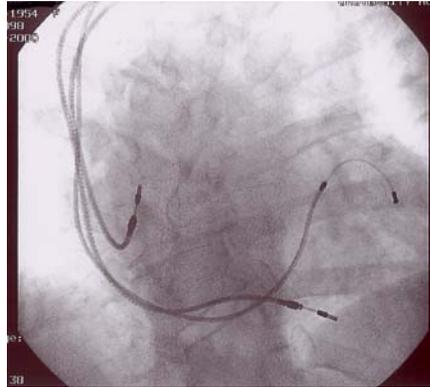
- Cardiac Resynchronisation Therapy (CRT), or, BiV Pacing
 - CRT first described in 1980's
 - Introduced clinically a decade later
 - Routine pacemaker implant (local anaesthetic)
 - With or without ICD capability
-

Achieving Cardiac Resynchronisation

**Goal: Atrial synchronous
biventricular pacing**

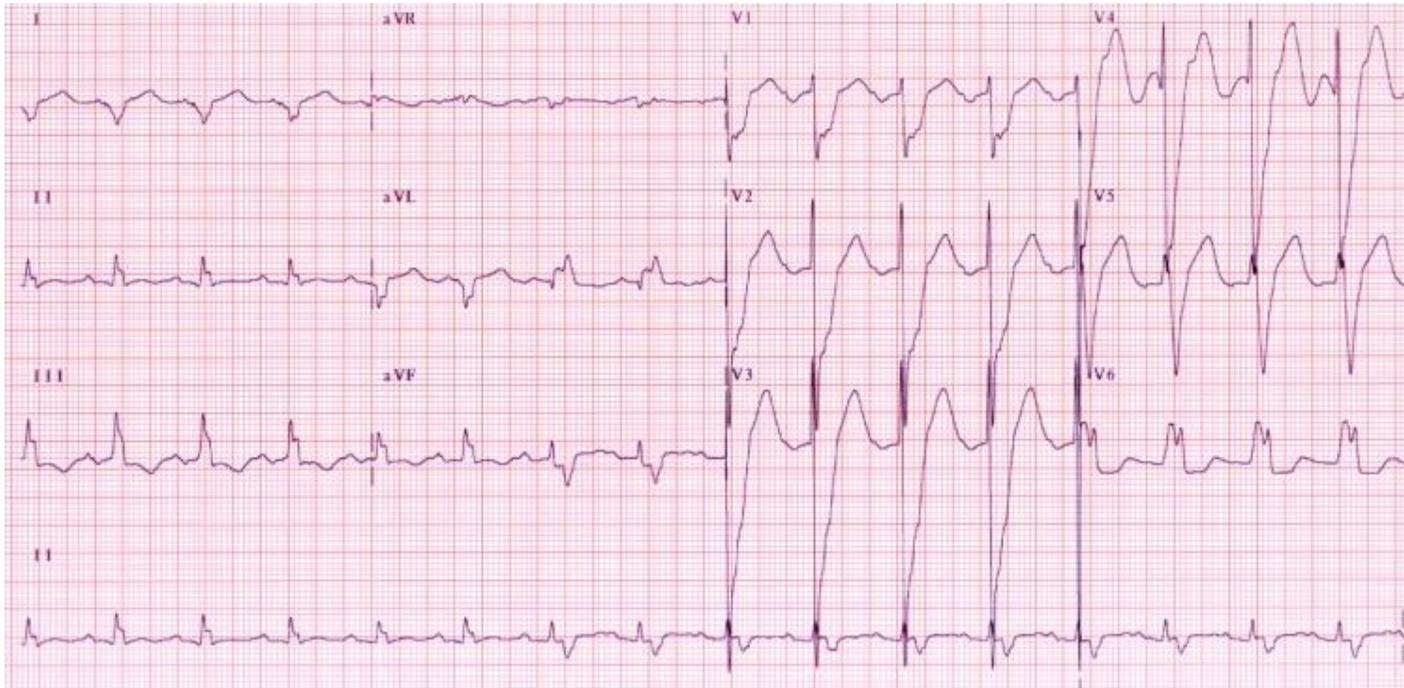
**Transvenous approach for left
ventricular lead via coronary sinus**

Back-up epicardial approach

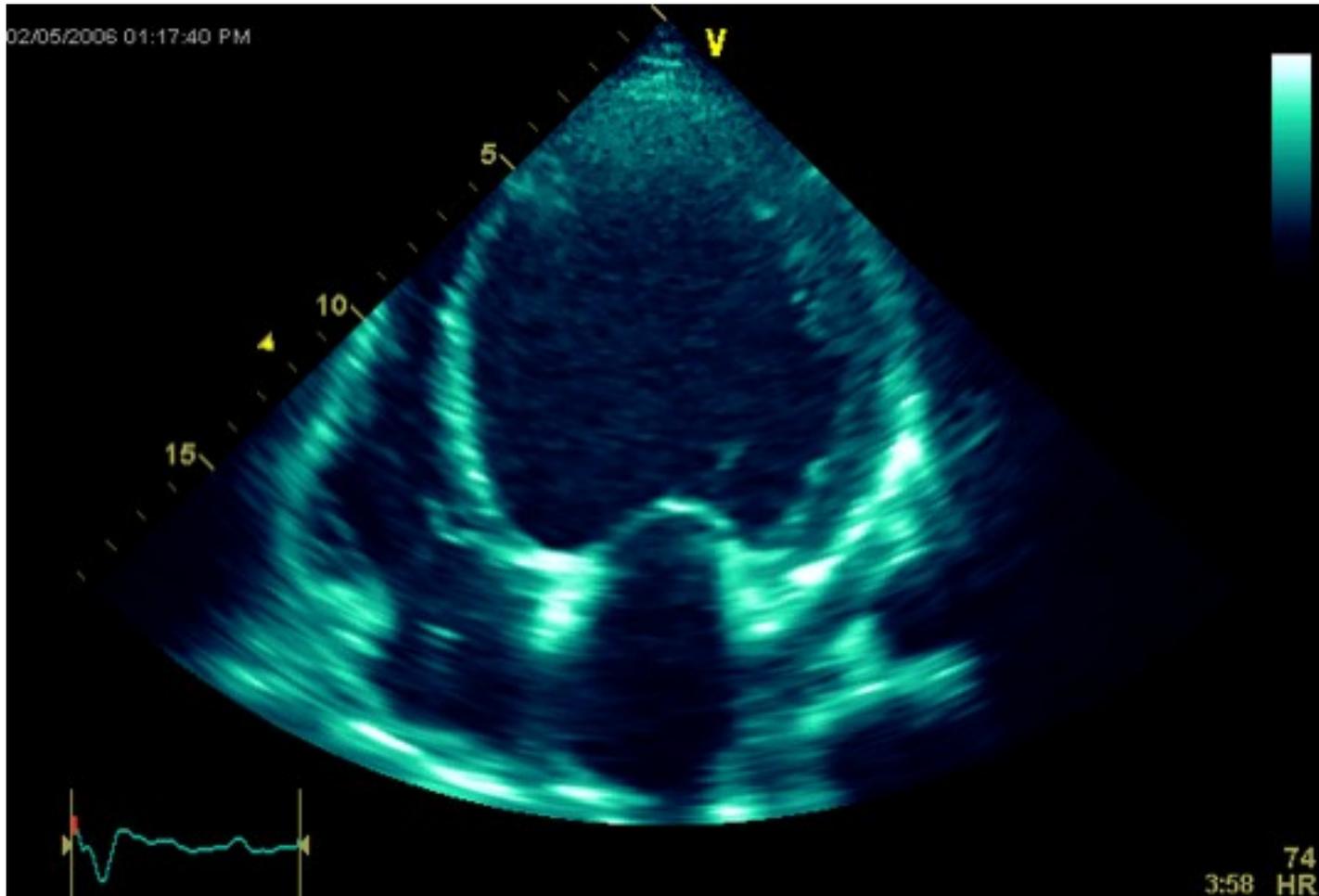


Why do it?

- LBBB occurs in approx 30% of HF patients.
- LBBB is an independent predictor of increased mortality in HF
- Delayed LV activation (His-Purkinje system / conduction block / fibrosis)



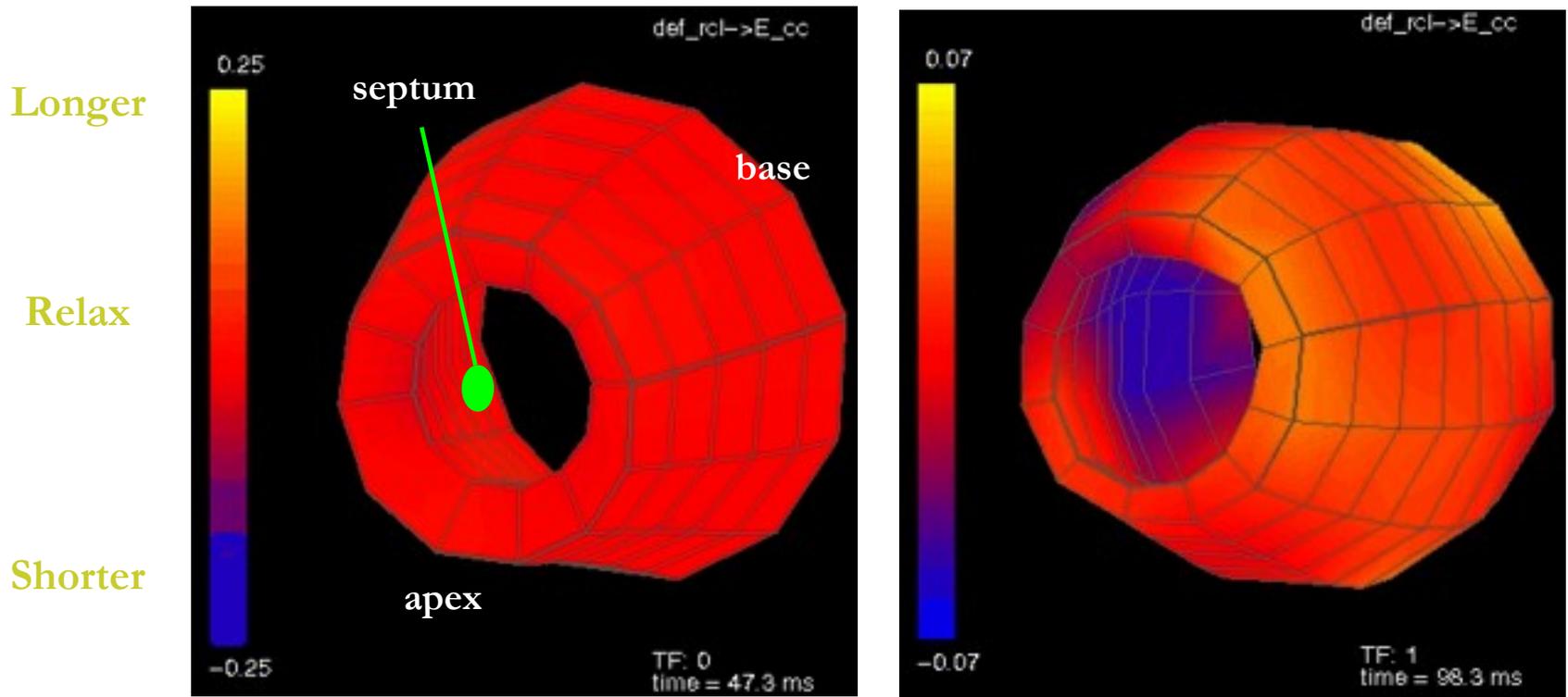
Mechanical Dyssynchrony



Mechanical Dyssynchrony is Bad News!

- Early septal contraction → pressure low → no ejection
- Late postero-lateral contraction → paradoxical stretch
(early contracting segments)
- Early / late contraction = “wasted work”
- Increased time in IVC and IVR.
- Reduced ejection / diastolic filling time
- Increased global / regional wall stress
- Increased myocardial O₂ consumption
- Protracted mitral regurgitation (LV dilatation / lateral papillary muscle)

Abnormal local wall strain in LBBB

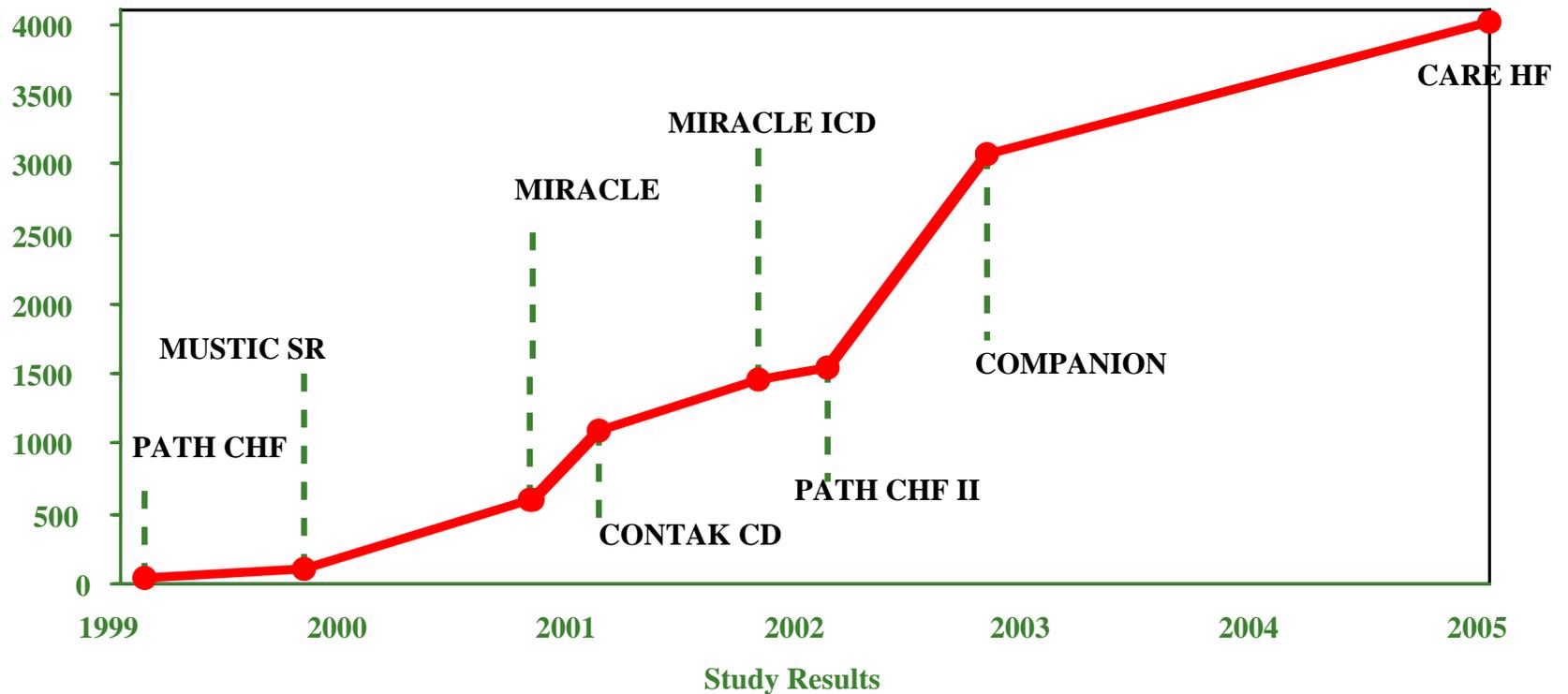


Normal

LBBB

What are the benefits of CRT?

Cumulative Enrollment in CRT Randomised Trials



Proven Benefits of CRT

Improves patient's functional status

- ↑ 6 min walk distance by ~ 20%
- ↓ NYHA class by 0.5-0.8 points (58% v 37% ↓ by at least 1 class)
- ↑ VO2 Max: by 10-15%
- QOL (MLWHF) - Significantly improved (8.4 points)

Improves “pump” function

- 26% ↓ in LVESV at 18 months
- Significant reduction in MR regurgitant area
- Approx 6% ↑ in EF

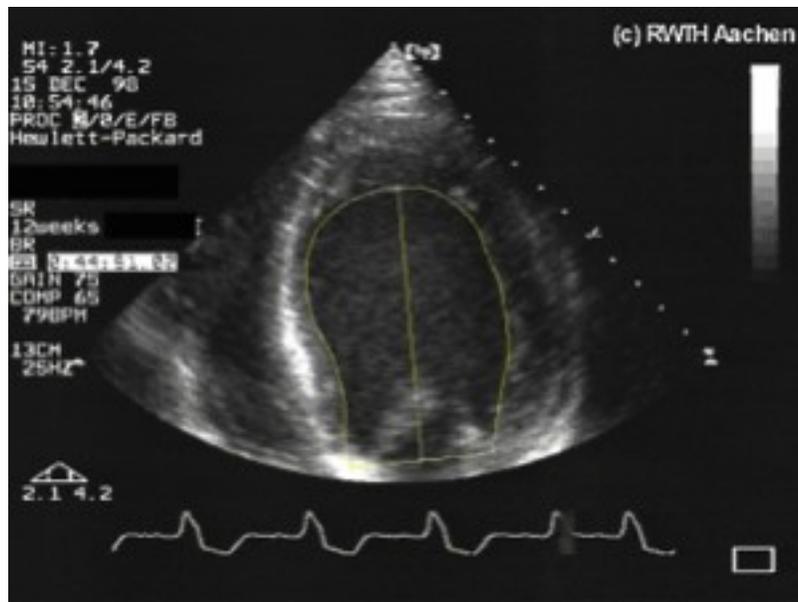
Reduces Hospitalisation

- ↓ relative risk of admission for worsening CCF by 52%

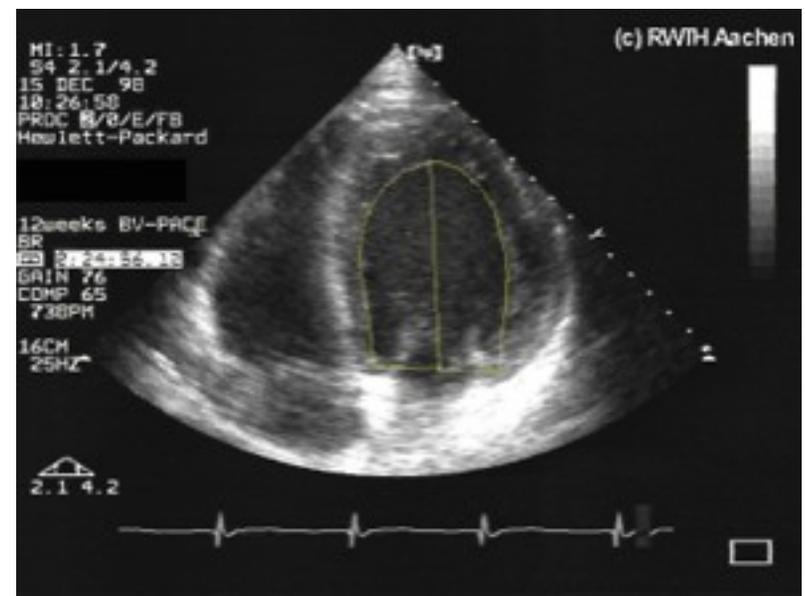
Reduces cardiovascular mortality

- Relative risk reduction of 40% in all cause mortality
-

Response to CRT



Pre CRT

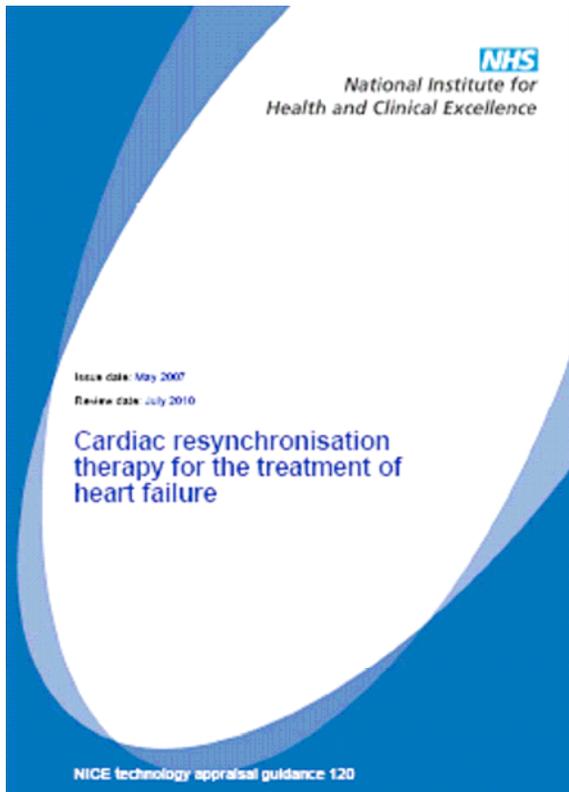


Post CRT

What's the catch?

- Procedural risk (PTX, infection, lead displacement)
 - 5% failure to deploy LV lead
 - Of those successfully implanted - 30% of patients do not respond.
 - i. Viable myocardium (cannot pace scar tissue)
 - ii. Shot ventricular function (RV / LV)
 - iii. QRS is imperfect marker for mechanical dyssynchrony
 - iv. LV lead position
-

Who benefits from CRT?



- NYHA Class III or ambulatory Class IV
- LVEF $\leq 35\%$
- Sinus rhythm
- Optimal medical therapy
- Evidence of
 - QRS ≥ 150 msec
 - or, 120-149 msec with Echo evidence

Questions

