Heart failure: Local solutions for a growing problem

Dr Andrew Hannah
Consultant Cardiologist
ARI
What is heart failure?

• “A clinical syndrome comprising of dyspnoea, fatigue or fluid retention due to cardiac dysfunction, either at rest or on exertion, with accompanying neurohormonal activation.”
  
  Braunwald E.

• heart failure is NOT a final diagnosis and the term should be qualified by the underlying structural abnormality and cause

  - heart failure due to severe aortic stenosis
  - heart failure due to LV systolic dysfunction.... due to IHD or due to inherited dilated cardiomyopathy etc etc
The size of the problem

- Prevalence of heart failure 1 - 2% of adult population and asymptomatic LVSD 0.4 - 2%

- Prevalence and incidence increase with age
  - mean age of HF patient 74 years
  - prevalence approx. 8-10% in over 75s have heart failure

- Approximately 80,000 cases in Scotland or 8,000 in Grampian

- Prevalence and incidence are increasing...

- ageing pop, better survival post MI/CHF
Incidence of cardiac failure by age and sex: 30 year follow-up, Framingham Study.
Projected HF prevalence in Scotland

Figure 2  Projected population prevalence and annual number of general practitioner (GP) consultations for heart failure in Scotland, 2000 to 2020. Number of individuals with heart failure and number of GP consultations for heart failure (men, squares; women, circles).
The one-year survival rate for heart failure is worse than that for cancer of the breast, uterus, prostate & bladder.


NHL = Non-Hodgkins lymphoma
Heart failure: What are we trying to achieve?

• Improved quality and length of life for patients

• Reduced hospitalisations and re-admissions
How might we achieve this?

• Make an accurate diagnosis in a timely fashion
• Perform appropriate investigations: to determine aetiology and prognosis
• Education: patients, relatives and healthcare professionals
• Evidence based drug therapy for all
• Appropriate selection for device therapy (CRT / ICD)
  – or surgery
  – or cardiac transplantation
Heart failure can be easy to diagnose...
but usually it is difficult to diagnose on clinical grounds alone

- Studies show diagnosis incorrect in approx. 40-50% of cases *
- Chest crepitations, oedema, tachycardia – not specific
- S3, ↑JVP, displaced apex – insensitive, poor inter-observer agreement
- Many patients have symptoms only – dyspnoea, fatigue are non specific

- Therefore objective evidence of cardiac dysfunction mandatory.........usually by echo initially
- But we cannot cope with the volume of echo referrals...600/month at ARI alone

Are ‘screening’ tests the answer?

• 12 Lead ECG
  – LVSD unlikely if ECG normal (85-90% sensitive)
  – Problems with confidence of interpretation in primary care, must be entirely normal or else loses reliability.
  – Low specificity
  – May be normal in other causes of HF
• BNP (brain (B-type) natriuretic peptide)
  – Simple blood test – no subjective interpretation difficulties (cw ECG)
  – LVSD virtually excluded if ‘normal / low’
  – Much better specificity than the ECG
  – ‘Real world’ cost approx. £20 per test
Grampian BNP pilot

- NT-pro-BNP: more stable than BNP with equally good evidence base
- Different (higher) normal range
- Pilot commencing in Grampian Dec 2011 linking the test with the open access echo service

- Future funding will be dependent on proving cost effectiveness and/or improved patient care
BNP diagnostic Pathway Flowchart

Suspected heart failure in patient not known to have HF and no other indication for echocardiography

Clinical examination, ECG, CXR, U+Es, LFTs, TFTs, Glu, FBC

Send open access echo request AND blood for NTproBNP (yellow top tube)

- NTproBNP <400pg/ml
- NTproBNP 400-2000pg/ml
- NTproBNP >2000pg/ml

NTproBNP result and appropriate pathway communicated to GP within 2 weeks

- HF unlikely: not for open access echo. Consider other causes
- HF possible: For open access echo
- HF likely: high risk result For fast track cardiology clinic
LV systolic dysfunction: not a final diagnosis

- IHD related LVSD: infarcted, ‘stunned’, ‘hibernating’??
- Dilated cardiomyopathy (LVSD with ‘normal’ coronary arteries)
  - Inherited: dilated, hypertrophic, ARVC, isolated non compaction
  - Toxins: drugs, alcohol,
  - Infections: prior and acute
  - Immune mediated: viral, peripartum, autoimmune
  - Endocrine: thyroid, phaeochromocytoma
  - Metabolic/infiltrative: amyloid, haemachromatosis, sarcoid, mitochondrial disease
  - muscular dystrophy related
  - Obesity related, diabetic, ESRF
- Tachycardia related cardiomyopathy:
  - AF/flutter, ventricular ectopic related, PJRT type SVTs
- Valvular heart disease related LVSD
Improving prognosis in LVSD heart failure
Grading of heart failure

<table>
<thead>
<tr>
<th>NYHA class</th>
<th>Exercise tolerance</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No limitation</td>
<td>No symptoms during usual activity</td>
</tr>
<tr>
<td>II</td>
<td>Mild limitation</td>
<td>Comfortable with rest or with mild exertion</td>
</tr>
<tr>
<td>III</td>
<td>Moderate limitation</td>
<td>Comfortable only at rest</td>
</tr>
<tr>
<td>IV</td>
<td>Severe limitation</td>
<td>Any physical activity brings on discomfort and symptoms occur at rest</td>
</tr>
</tbody>
</table>
Pharmacological treatment of chronic heart failure (due to LV systolic dysfunction)

- ACE inhibitors: uptitrated to max tolerated dose
- Betablockers: bisoprolol or carvedilol ....max tolerated dose
- Aldosterone receptor blockers: spironolactone, eplerenone
- ARBs: if ACE I intolerant. Candesartan/valsartan
- Stop agents that exacerbate HF: NSAIDs, verapamil, diltiazem, doxazosin, dronedarone, class I AADs, glitizones
- Loop diuretics: as low a dose as possible to achieve euvolaemia
- Warfarin if AF
- Ivabradine: for some patients in SR if HR>70 despite max tolerated BB
- Hydralazine / ISDN if ACEI/ARB intolerant
- Digoxin: sometimes in AF rarely in SR
Betablockers in Heart failure

- US carvedilol trials - NYHA I-III (IV)
  - n=1094, 4 separate trials, 65% RRR in mortality
- CIBIS II - bisoprolol - NYHA II-III
  - n=2647, mortality 11.8% v 17.3% (p<0.0001)
- MERIT - metoprolol CR/XL - NYHA II-III
  - improved mortality, morbidity and LVEF

- Betablockers reduce ABSOLUTE annual mortality by 6-8%
Carvedilol reduces risk of death or cardiovascular hospitalisation

38% reduction in death or hospitalisation

p<0.001

Packer et al, NEJM 1996
Aldosterone receptor blockade

Spironolactone 25mg or
eplerenone 25-50mg
Spironolactone in NYHA III-IV
RALES: All-Cause Mortality

Risk reduction 30%
95% CI (18%-40%)
p < 0.001

Aldosterone receptor antagonist +
ACE inhibitor + loop diuretic ± digitalis

Placebo + ACE inhibitor +
loop diuretic ± digitalis

**EMPHASIS-HF: Eplerenone in NYHA II heart failure**

- NYHA II
- LVEF <30% (severe)
- LVEF 30-35% if QRS >130ms

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Eplerenone (%)</th>
<th>Placebo (%)</th>
<th>Adjusted hazard ratio (95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular death/heart-failure hospitalization</td>
<td>18.3</td>
<td>25.9</td>
<td>0.63 (0.54–0.74)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiovascular death</td>
<td>10.8</td>
<td>13.5</td>
<td>0.76 (0.61–0.94)</td>
<td>0.01</td>
</tr>
<tr>
<td>Heart-failure hospitalization</td>
<td>12.0</td>
<td>18.4</td>
<td>0.58 (0.47–0.70)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hospitalization for hyperkalemia</td>
<td>0.3</td>
<td>0.2</td>
<td>1.15 (0.25–5.31)</td>
<td>0.85</td>
</tr>
</tbody>
</table>
Safely prescribing spironolactone /eplerenone: avoiding hyperkalaemia

• Check renal function and potassium before starting
• Repeat U+Es after 1 week, then 1 month (2 weeks if renal dysfunction or K+ >5)
• Check U+Es 3 monthly
• Reduce/withhold if K+ >5.5, reintroduce at ½ dose
• Advise patients to temporarily stop spiro/epler if intercurrent illness such as D+V / N+V / reduced fluid intake and inform GP/HFSN: must check U+Es
A well treated LVSD patient in 2011…in Grampian….

- **Diuretic** — BFZ or loop: as low a dose as required
- **ACE I** — NYHA I-IV, max. tolerated dose
- **BB** — NYHA I-IV: carvedilol, bisoprolol - stable, compensated HF, start low, go slow: aim for 25mg BD (50mgbd if >85kg) or 10mgOD respectively
- **Spironolactone 25mg** – NYHA III-IV, watch potassium/renal function
- **Spironolactone or eplerenone** – NYHA II with severe LVSD esp if LBBB
- **Candasartan/valsartan** – good alternatives to ACE I if ACE I intolerant.

- Hydralazine/nitrate if ACE I/ARB intolerant (usually renal failure)
- Ivabradine: if HR >70bpm despite max tolerated BB, and particularly consider in asthmatic patients
Beyond pharmacological therapy

CRTs and ICDs
Cardiac resynchronisation therapy (CRT) – the theory

• In patients with CHF and LBBB not only is there poor LV contraction but dyssynchronous contraction
• LBBB patients have a poorer prognosis: increased rate of HF and sudden arrhythmic deaths

• Cardiac resynchronisation therapy can improve these factors and increase cardiac performance
  – Biventricular pacing +/- ICD
CRT (cardiac resynchronisation therapy): Biventricular pacemaker
CARE-HF
n=813, NYHA III-IV LVSD and LBBB

• **Death/hosp for MACE**: 224 (55%) in medical and 159 (39%) in CRT (HR 0.63, 0.51-0.77 p<0.001)

• **Death**: 120 (30%) in medical and 82 (20%) in CRT (HR 0.64, 0.48-0.85)

• **Death and HF hosp**: 191 (47%) in medical group vs 118 (29%) in CRT (HR 0.54, 0.43-0.68 p<0.01)
Which patients should be considered for CRT?

- NYHA III-IV despite maximum (tolerated) medical therapy
- No major co-morbidity likely to be fatal in next 6-12 months or likely to be major contributor to poor QOL/SOB
- Evidence of conduction abnormalities (ideally LBBB)
- Age is not a contraindication
Mechanisms of death in CHF

No of deaths:
- NYHA II: n = 103
- NYHA III: n = 232
- NYHA IV: n = 27

Implantable cardioverter defibrillators: ICDs

- Implanted as per a pacemaker: local anaesthesia and sedation
- RV lead has a shocking coil and generator has defibrillator capacity
- Once inserted VF induced and device tested

- Secondary prevention well established: what about primary prevention?
Reduction In All-cause Mortality with ICDs: Trials Summary

<table>
<thead>
<tr>
<th>Trial</th>
<th>Relative Reduction in Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MADIT¹</td>
<td>54%</td>
</tr>
<tr>
<td>MUSTT²</td>
<td>55%</td>
</tr>
<tr>
<td>MADIT-II³</td>
<td>31%</td>
</tr>
<tr>
<td>COMPANION⁴</td>
<td>36%</td>
</tr>
<tr>
<td>SCD-HeFT⁵</td>
<td>23%</td>
</tr>
</tbody>
</table>


*Denotes average follow-up times.
What does NICE recommend?

- Ischaemic cardiomyopathies, >4 weeks post MI, NYHA < IV
- LVEF <35 % and NSVT on holter and inducible VT on EP testing
- LVEF<30% and QRS>120ms
Reducing HF admissions: why and how?
Hospitalisation for decompensated HF: an important event

- c10% in-hospital mortality
- Mean 12-14 days in hospital stay
- c30% readmission rate by 3 months
- c15% 3 month mortality

Table 8: Outcome

<table>
<thead>
<tr>
<th>Data available</th>
<th>Readmissions within 12 weeks</th>
<th>Patients readmitted within 12 weeks</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>For heart failure*</td>
<td>With heart failure*</td>
</tr>
<tr>
<td>Northern Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>1249</td>
<td>496</td>
<td>84</td>
</tr>
<tr>
<td>Ireland</td>
<td>263</td>
<td>48</td>
<td>7</td>
</tr>
<tr>
<td>Finland</td>
<td>458</td>
<td>448</td>
<td>32</td>
</tr>
<tr>
<td>Sweden</td>
<td>535</td>
<td>328</td>
<td>70</td>
</tr>
<tr>
<td>Denmark</td>
<td>182</td>
<td>63</td>
<td>6</td>
</tr>
</tbody>
</table>

*For heart failure means heart failure coded in the first position/with heart failure means heart failure coded in the second or third position.
*Number of patients in whom status alive or dead was recorded (98% of enrolled patients for whom baseline data were received.)
Healthcare Improvement Scotland (QIS) and SPSP recommendations for in-patients with HF

1. Evidence based drug therapies

2. HF specialist nurse review

3. HF ‘specialist’ review: treat acute decompensation/consider precipitating factors/ consider specialist investigation, drug therapy optimisation and consider CRT device if appropriate
HF Specialist Nurse Intervention

Time to first event (death from any cause or hospital admission for heart failure) in usual care and nurse intervention groups

Blue et al BMJ 2001; 323: 715-8
The role of the heart failure specialist nurse

- Patient education
  - Compliance, fluid balance awareness, daily weights, exercise, reduced anxiety
- Optimisation of drug therapy
- Contact point for patients

- All these contribute to less decompensations and earlier presentation: results in fewer hospitalisations and shorter admissions
Scottish National HF Audit 2008: n=1235
Table 9  Age-adjusted in-hospital mortality rates by specialty

<table>
<thead>
<tr>
<th>Specialty</th>
<th>N</th>
<th>Mean age (years)</th>
<th>Deaths (% dead)</th>
<th>Odds ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiology</td>
<td>400</td>
<td>72.4</td>
<td>13.0%</td>
<td>Reference</td>
<td>-</td>
</tr>
<tr>
<td>Care of the elderly</td>
<td>51</td>
<td>84.4</td>
<td>19.6%</td>
<td>1.07</td>
<td>0.9</td>
</tr>
<tr>
<td>General</td>
<td>760</td>
<td>78.4</td>
<td>20.0%</td>
<td>1.36</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Grampian strategy to reducing re-admissions

• Starting point:
• 30% re-admission rate for decompensated HF at 3 months
• 17.7% in hospital mortality rate (national audit)

  – HFSN review during admission and early post discharge
  – Inpatient review /management by cardiologist / HF specialist
  – Avoid stopping important drugs during decompensations esp betablockers
  – Accurate, informative (and legible) interim DC letters
  – GP review early post discharge
  – Good patient education: self management, daily weight
  – Optimise drug therapy post discharge
  – ‘Early’ cardiology clinic review for most
  – Consider CRT devices in timely fashion
Trial trends in 1 year mortality in NYHA III/IV CHF

- **CONSENSUS** (1987)
- **RALES** (1999)
- **COPERNICUS** (2001)
- **CARE-HF** (2005)

Legend:
- **green** = placebo
- **blue** = therapy
HFSN referrals 2011

Patient Referrals

Number of individuals

Jan | Feb | Mar | Apr | May | Jun
2011

0 | 5 | 10 | 15 | 20 | 25 | 30 | 35
Reasons for optimism in Grampian?

• Improved diagnostic pathway with BNP
• Fastrack HF clinic for those at ‘high risk’
• HFSN referrals are up dramatically, hopefully leading to improved early post discharge care and fewer re-admissions
• Renewed focus on HF in primary care: QOF pathway for HF finalised yesterday
• Active CRT service in ARI: improving pathways of care will result in higher referral rates
‘Nothing personal, Dr Crippen, but I thought I’d try it on the cat first.’