The Breathless Patient
and how to manage Heart Failure

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Approach to diagnosis

1a. History
1b. History - Risk Factors

2. Examination

3. Investigations : initial
4. Investigations : secondary
History of presenting complaint –

Onset of symptoms:-

Cough & sputum

Heart failure:-

Subacute – days or weeks

Pulmonary disease:-

Subacute - days or weeks

Symptoms requiring immediate action/A&E:-

Acute onset of severe SoB

Consider Pneumothorax, Pulmonary Embolus, Acute LVF, Acute Pneumonia

Wheeze

Cough and sputum rare in CCF, occasionally in acute LVF – pink frothy - rare

Wheeze does not occur in CCF or in acute LVF – (cardiac asthma overstated+)

Cough and sputum common in respiratory disease,

Wheeze is common in respiratory disease
### Features in the history of presenting complaint that don’t help differentiate

<table>
<thead>
<tr>
<th>Orthopnoea and disturbed sleep</th>
<th>Heart Failure</th>
<th>Pulmonary disease</th>
<th>Symptoms that don’t differentiate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopnea &amp; disturbed sleep – in acute exacerbations of chronic heart failure</td>
<td>Orthopnea &amp; disturbed sleep – in acute exacerbations of COPD or acute asthma</td>
<td>Orthopnea &amp; disturbed sleep</td>
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<tr>
<td>Ankle oedema in decompensated CCF</td>
<td>Ankle oedema in cor pulmonale of COPD</td>
<td>Ankle oedema is mostly due to prolonged sitting or Ca2+ blockers Amlodipine</td>
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<tr>
<td>Chest pain recently days/weeks ago</td>
<td>Pleuritic chest pain currently</td>
<td></td>
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<tr>
<td>Risk Factors</td>
<td>Heart Failure</td>
<td>Pulmonary disease</td>
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<tr>
<td>PMH of system disease:-</td>
<td>PMH of Cardiac disease eg:-MI, CABG, stents, valve, AFib</td>
<td>PMH of pneumonia/chest infections,</td>
<td></td>
</tr>
<tr>
<td>The usual risk factors:-</td>
<td>Tobacco:- low relevance</td>
<td>Tobacco:- high relevance</td>
<td></td>
</tr>
<tr>
<td>Tobacco</td>
<td>HT, DM_{II}, - high relevance</td>
<td>HT, DM_{II} - low relevance</td>
<td></td>
</tr>
<tr>
<td>HT &amp; DM_{II}</td>
<td>Alcohol excess – relevant</td>
<td>Alcohol excess – low relevance</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>Age: not useful</td>
<td>Age: not useful</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>- old HTensive pts</td>
<td>- young pts with recent viral myocarditis</td>
<td></td>
</tr>
<tr>
<td>Heart Rhythm</td>
<td>Murmurs</td>
<td>Unilateral or Bilateral resp signs</td>
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<tr>
<td>Heart failure</td>
<td>AFib common &amp; can cause SoB</td>
<td>Chest is clear in CCF, in acute LVF bilateral basal creps of pulm oedema</td>
<td></td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>AFib uncommon</td>
<td>Usually there are bilateral signs in COPD, unilateral in pneumonia</td>
<td></td>
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<tr>
<td>Heart sounds quiet, murmurs uncommon</td>
<td>Heart sounds audible, murmurs more common</td>
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</tbody>
</table>
Examination

Crepitations or crackles

Heart failure
- Acute LVF bilat fine inspiratory crepitations

Pulmonary disease
- Pulm fibrosis-medium end-insp crackles
- Infection/COPD–, coarse localised crackles
## Investigations in Primary care

<table>
<thead>
<tr>
<th></th>
<th>Cardiac</th>
<th>Respiratory</th>
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</thead>
<tbody>
<tr>
<td><strong>ECG</strong></td>
<td>ECG – usually abnormal (a normal ECG excludes heart failure)</td>
<td>ECG – usually normal, may have signs of Right Heart strain – cor pulmonale in severe chronic resp disease</td>
</tr>
<tr>
<td><strong>Pulse oximetry</strong></td>
<td>In normal range in CCF, maybe hypoxic in acute LVF</td>
<td>Usually in low range of normal or below after exertion</td>
</tr>
<tr>
<td><strong>Peak Expiratory Flow meter</strong></td>
<td>PEFR normal</td>
<td>PEFR abnormal</td>
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</tbody>
</table>
Normal ECG
Abnormal ECG – old Inf MI
Abnormal ECG – recent Ant MI
Abnormal ECG - LBBB
Atrial Flutter
Atrial Fibrillation
Effects of Hypertension

ECG: LVH
Secondary Investigations

If ECG abnormal or previous MI or murmur present, request
  – Echocardiogram
    community Heart Failure service
direct access

  – BNP venous sample in gold top container for NTpro BNP

- CXR usually unhelpful for early COPD or CCF, but will pick up malignancies and pleural disease
Diagnosis with BNP

Serum natriuretic peptides – – NTpro BNP assay

Normal levels – NTpro BNP
men<70yrs <100 pg/ml,
women<70yrs <150 pg/ml
Over 70yrs <400 pg/ml

GREY AREA  100 – 500 pg/ml difficult to assess the relevance

Raised levels – NTpro BNP 100-2000 pg/ml refer for routine Echo (age appropriate)

High levels – NTpro BNP > 2000 pg/ml refer for urgent Echo

Common levels on admission with acute LVF - 40-80,000 pg/ml

Echo – is still the definitive diagnostic tool for Heart Failure–
If Echo is poor quality use Nuclear Medicine or Magnetic Resonance scan or TOE
BNP — Brain type Natriuretic Peptide

BNP – a protein secreted by the Atria & Ventricles of the Heart

BNP > 500 pg/ml has significant implications - refer to secondary care if appropriate
BNP < 100 pg/ml makes CCF extremely unlikely

BNP can be up with LVH, Tachycardia, Ischaemia, Cor Pulmonale/COPD, PE, eGFR<60 ml/min, Diabetes, Cirrhosis and sepsis.

BNP can be reduced in Obesity, diuretics, ACE inhibs, ARBs, Beta Blockers and Aldosterone antagonists
Heart Failure

Natriuretic Peptides NP – group of 3
Atrial, Brain, Central Nv Sys, types - A,B,C, NP
These are beneficial in Heart Failure
Increase Na+ and water excretion

Neprilysin is a metalloproteinase that metabolises the NPs and Bradykinin
Neprilyin worsens Heart Failure
Neprilysin Inhibitor (LCZ696 – aka Sacubitril)

Nep Inh(NI) increases A,B,C NP – bradykinin and substance P levels, resulting in natriuretic, vasodilatory and anti-proliferative effects
NI – lowers endothelin, vasopressin, sympathetic activity and RAASS
NI+ACEinh results in raised bradykinin levels > facial angioedema
NI+ARB blocks Angitensin II receptors(good vasodilatory effect) with not too much bradykinin
New drug Entresto is a combination of Valsartan(ARB) + Sacubitril
Side effects BP v, K+ ^, cough 10%, dizzyness 10%, renal failure
SoB due to Heart & Lung disease

BNP can help assess patients – with both COPD and LVF to give an indication of which system is predominant.

If COPD pt is SoB - BNP levels are low 100 - 1000

If HF pt is SoB - BNP levels are raised 1000 – 20,000 LVF is not adequately treated.

BNP levels can gauge effectiveness of Rx for Heart Failure (high levels reducing with Rx)
Heart Failure prognosis

[Graph showing annual survival and hospitalizations per year across NYHA class and HF stage.]
Heart Failure NICE 108 Aug 2010

Referral
i, initial diagnosis of heart failure
ii, management of severe – NYHA class IV heart failure, or valve HF, or unable to manage at home
iii, Pregnant women or planning pregnancy
iv, Urgent referral for Pts with suspected CCF and previous MI or Viral illness should have Echo within 2 weeks

Refer to Cardiology those patients in whom prognosis is key, younger patients, the elderly managed in the community
Systolic and Diastolic HF

Heart Failure 2 types:-  i, Weak Heart or ii, Stiff Heart

i, CCF or HF rEF (heart failure reduced ejection fraction)
   Usually due to poor Systolic function of LV (cardiomyopathy) most commonly post MI/Ischaemia, HT, Valvular disease and Viral Myocarditis aka Dilated Cardiomyopathy

ii, DiastolicHF or HF pEF (preserved ejection fraction)
   Less common - Systolic function of LV is good BUT poor LV relaxation in diastole (diastolic dysfunction – usually seen in the elderly and those with longstanding HT with LVH and Diabetes)

Rx is not the same as CCF drugs except – Spironolactone or BFZ/Indapamide
Treatment

Usual Rx for Systolic CCF,
First line: ACE inhib/ARB(Candesartan), BB, Diuretic, Aldosterone antagonist (Spironolactone or Eplerenone) (monitor U+Es)

Second line: CRT pacemaker only if SR+LBBB on ECG and QRS > 150ms.

Third line: Implantable Cardiovertor Defibrillator, ICD increases lifespan in patients particularly with prev MI, BUT in patients with extremely poor LV function provides no benefit. Also consider appropriateness of ICD in the elderly who are in a poor prognostic group due to age.
Heart Failure meds

Diuretics - loop –Furosemide
- Thiazides – BFZ or Indapamide,  (Metolazone – handle with care)
- Anti mineralocorticoids – Spironolactone ( women), Eplerenone(men – MOOBS)

Beta blockers – Bisoprolol, Carvedilol, Nebivolol

ACE – Perindopril, Ramipril

ARBs – Candesartan - only

Entresto use in LVEF of <35%  or NYHA II-IV once pt is stabilised on an ACEinh for 3 weeks, BP>90sys

Hydralazine + Nitrates - rarely
Beta Blockers

Use the 3 licensed BB usually Bisoprolol, others being Carvedilol and Nebivolol

NICE says offer BB to **ALL** adult pts with Heart Failure incl those with
i, peripheral arterial disease
ii, Erectile dysfunction
iii, Diabetes mellitus
iv, COPD
v, Interstitial pulmonary disease / fibrosis
Atrial Flutter
Atrial Flutter
Atrial Fibrillation
The Treatment of all TachyArrhythmias is:-

**Beta Blockers** - NICE guidance

Which Beta Blockers – BISOPROLOL and NEBIVOLOL

Atrial Fibrillation – Beta blockers and rarely-Catheter Ablation
Atrial Flutter – Beta blockers and occasionally-Catheter Ablation
Atrial Tachycardia – Beta blockers and Catheter Ablation
SVT – Catheter Ablation and Beta Blockers
VT and VF – Beta blockers and Implantable Cardiovertor Defibrillators (ICD) and occasionally Amiodarone

**NB** Atrial Fibrillation/Flutter **think** CHADS$_2$VA$_2$Sc and Oral Anti Coagulant
DIGOXIN

- Digoxin **ONLY** to be used in AFib* pts
- Various meta-analyses suggest link with increased mortality (unclear as to cause and effect)
- Only add Digoxin to Betablocker or Amiodarone not to use alone
- **Use smaller doses 62.5 or 125mcg rather than 250 mcg**
  Check serum levels in ‘new’ Digoxin pts
  Serum level >1.2 ng/ml reduce dose or discontinue

*DIG trial shows Digoxin when added to an ACE inhib + diuretic has little/no effect when pt is in Sinus Rhythm but had slight beneficial effect when pt in AFib
Other Rx for HF

In Pts who cannot tolerate ACE inhib or ARBs particularly AfroCaribbeans
Rx Hydralazine + Nitrates oral combination

Only use Amlodipine (Ca2+ blocker) to treat HT in HF pts after all else has failed – otherwise Ca2+ blockers are to be avoided.

Usually no need for Ca2+ blockers, if BP high use Carvedilol
Monitor Systolic HF pts

Monitoring CCF Pts

i, Assess Functional capacity, exercise distance, general well being, fluid=oedema=weight, Pts to weigh themselves 3x week

ii, Heart Rhythm look for AFib for dOAC eg Dabigatran
Control resting Heart Rate to < 70 bpm
If using low dose Digoxin (do levels – if nausea or drug naïve pt.)

iii, U+Es

iv, up titrate Rx at short intervals 1-2 weeks visits no later. Once on stable Rx 6 monthly visits
Rehab and Support

Rehabilitation
Offer a supervised group exercise-based rehab programme eg approach current Cardiac rehab programmes for post MI/CABG/Stent patients

Depression
Depression is common in this group
Consider treatment NICE guide 91 ‘Depression in adults with a chronic physical health problem’

Be aware of pts self medicating eg St John’s wort in pts who may need Warfarin
Prognosis:
Prognosis has been very poor in the past pre- ACE&BB ~50% 1yr mortality after 1st CCF
Prognosis now very much better, but life span reduced depending on state of LV and cause of impairment
Approach prognosis carefully, Mod LV impairment has a mod prognosis BUT Severely impaired LV likely to be <5 years
Terminal Phase of CCF <12 months life expectancy
Features Term Phase :-  NYHA 4 SoB at rest
Age +++
Albumin <25 g/L
Cardiac cachexia
3x admissions to hosp in last 6 months
Needs help with 3 x ADLs daily activities

Death is often sudden
Help for Term Phase:- put Pts on ASTRA end of life care register
Marie Curie and night sitters
Hypertension to Heart Failure

HT can result in Heart Failure via two routes:

1. LVH will eventually become fibroxed poorly functioning LV

2. HT > Endothelial Dysfunction > Atherosclerosis > Myocardial Infarction > Poor LV function
Causes of Hypertension

1. Genetic + Environment = “Essential HT” 93%
   Environment = Wt: low birth wt or high BMI
   salt: too much Na+, too little K+
   alcohol: 21 units per wk OK

   (Obesity > Insulin resistance > HT > lipids > athero)

2. Secondary causes 7%
   Renovascular 5% (Ren Art Sten/ FMD)
   Others 2% Conns, Cushings, CoArct, Phaeo
Causes HT: Renal Artery stenosis
Causes of HT: Fibro-Muscular Dysplasia - FMD
Effects of Hypertension Stroke
Effects of Hypertension
Retinopathy
Hypertension Poor results in Rx

1. BP levels are inadequately known or measured office vs 24Hr vs home

2. Poor patient compliance

3. Monotherapy or inappropriate combinations
Centrally Driven Breathlessness Brain

1. Hyperventilation (acute & chronic) / dysfunctional breathing patterns eg sighing, yawning, deep breaths

- marked respiratory effort on minimal exertion, settles during distraction eg talking to patient while walking or during mental tasks

- Normal examination (upper airways noises – chest clear), normal ECG, no risk factors

- PMH of anxiety
Centrally Driven Breathlessness

Brain

1. Anaemia

2. Thyrotoxiocosis

3. Diabetic ketoacidosis DM type1
Sites of regulation of blood pressure

- Cardiac output
- Peripheral resistance
- Blood volume
- Renal perfusion
- Baroreceptors
- Urinary output
- Renin
- Angiotensin II
- Aldosterone
- Angiotensin II Antagonists
- Beta-blockers
- Ca Channel Blockers
- Ace inhibitors
- Diuretics
- Parasympathetic
- Sympathetic
- Heart rate
- contractility
- Heart rate contractility
- Vasoconstriction
- Sympathetic
- Parasympathetic
It is useful to think of breathlessness under 4 headings

1. The Heart
2. The Lungs
3. The Heart & The Lungs
4. The Brain
Effects of Hypertension
Left Ventricular Hypertrophy
Cardiac silhouette on normal CXR
Normal CXR
Normal CXR
To date the neuro-humeral hypothesis has provided the best explanation of the breakthroughs in the treatment of heart failure.
Angiotensin Converting Enzyme
ACE inhibitors

ACE inhib are 1st line Rx in CHF with diuretics in moderate size doses at least. Intolerance due to cough, rash or angioedema in ~15-20 %

Replace with Angiotensin Receptor Blockers (ARBs, aka AIIRA, ATRB) ?evidence? Clean side effect profile
Anti Aldosterone Rx

RALES trial showed that even modest doses of Spironolactone e.g. 25, 50 mg od had a relative risk reduction of ~30% in mortality in patients with CHF
Sympathetic NS blockers

Beta blockers were first recommended by the Scandinavians in the 70’s for Rx of CHF
Once the USA discovered the benefit of β-blockers in 90’s use became accepted (except in UK Medical Schools!!!)
Doses of β-blockers much lower than usual & need slow titration. Initially symptoms deteriorate but improve in few weeks
Only Bisoprolol and Carvedilol licensed in UK
Major Beta Blocker trials

**US Carvedilol**

![Graph showing survival rates for Carvedilol and Placebo over days of therapy.]

- **P** < 0.001
- Red line: Carvedilol
- Green line: Placebo


**CIBIS II**

![Graph showing survival rates for Bisoprolol and Placebo over time after inclusion.]

- **P** < 0.0001
- Blue line: Bisoprolol
- Green line: Placebo


**MERIT-HF**

![Graph showing cumulative mortality for Placebo and Metoprolol CR/XL over follow-up months.]

- **P** = 0.0062 (adjusted)
- **P** = 0.00009 (nominal)
- Green line: Placebo
- Blue line: Metoprolol CR/XL


**Meta - Analysis**

<table>
<thead>
<tr>
<th>Trial</th>
<th>n</th>
<th>OR (95% CI)</th>
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<tbody>
<tr>
<td>Meta-analysis</td>
<td>3141</td>
<td>0.69 (0.54-0.99)</td>
</tr>
<tr>
<td>Studies including ACCM, CIBIS I, ANZ and US-carvedilol</td>
<td>2647</td>
<td>0.66 (0.54-0.81)</td>
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<tr>
<td>CIBIS II</td>
<td>2647</td>
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<td>MERIT-HF</td>
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Mortality benefit of ACE inhib & Beta blockers in CHF trials
Angiotensin Receptor Blockers

ARBs block Angiotensin receptors but have no effect on Bradykinin pathway and its production of NO (which ACE inhib do)

ELITE-II trial Captopril vs Losartan (Losartan.Mark)
Val-HeFT Valsartan + ACE vs ACE (Mark no diff)
CHARM Candesartan + ACE vs ACE (?)
Hypertension

High BP has long been recognised as the major cause of Stroke and atherosclerosis
Lowering BP reduces the risk of Stroke and to a lesser extent MI
UK Audit:- ¼ of HT pts have Rx BP of <165/95
If new guidelines set target of  Rx BP of<140/80 only 5% of pts will in target  (? renumeration?)
Treatment of Hypertension

ALLHAT  JAMA 18 Dec 2002  (33K patients 1994 - 2002)

Conclusion “thiazide diuretics are superior ( to Amlodipine & Lisinopril) in preventing 1 or more forms of Cardiovascular disease (CHF, MI & stroke) and are less expensive. They should be preferred for first-step antihypertensive therapy.”
Treatment of Hypertension in DM

Thiazide alters glucose levels very slightly
ACE inhibitors
ARBs
Beta blockers mask symptoms of hypoglycaemic episodes - very rarely
Ca2+ channel blockers
Treatment of Hypertension in CAD

Beta blockers
Thiazide
ACE inhibitors or ARBs
Ca2+ channel blockers
Treatment of Hypertension in HF

Thiazide ± Loop diuretics
ACE inhibitors
Beta blockers (Bisoprolol, Carvedilol)
ARBs

NOT: αlpha blockers, or Ca2+ blockers
Treatment of Hypertension - no other risk factors / conditions

Thiazide diuretic
Beta blocker
ACE inhibitor or ARBs ( ? combined)
Ca2+ channel blockers
alpha blockers
CNS receptors - Moxonidine