



Pulmonary Comorbidities of HF COPD and Sleep Apnea

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Types of Heart Failure

The pathophysiology underlying HFpEF and HFmrEF is heterogeneous, and they are associated with different phenotypes including:

Cardiovascular diseases (e.g. AF, arterial hypertension, CAD, pulmonary hypertension).

Non-cardiovascular diseases [diabetes, chronic kidney disease (CKD), anaemia, iron deficiency, COPD and obesity].

Types of Heart Failure



Compared with HFrEF patients, hospitalizations and deaths in patients with HFmrEF/HFpEF are more likely to be non-cardiovascular.

Ignored combination



- Prevalence of COPD ranges from 20-32% in CHF
- Risk ratio of developing CHF is 4.5 in COPD
- Tobacco use
- Global epidemics
- Almost half of people aged 65 yrs or more: at least 3 chronic medical conditions

Rutten FH. Am Heart J 2002;143:412-7, O'Connor CM.J Card Fail 2005;11:200-5, Gustafsson F. Eur Heart J 2004;25:129-35

Prevalence of COPD in patients with HF



- COPD strongly predicts hospitalisation rate and duration and non-cardiovascular mortality
- 5-year mortality as high as 69% (58% in patients without COPD)
- Respiratory infections associated with cardiac decompensations in 10-16% admissions

Nieminen MS. Eur Heart J 2006;27:2725-2736

Prevalence of heart failure in COPD patients



- Cigarette smoking is associated with 50% increased risk of HF
- Prevalence of unrecognised HF in COPD patients presenting to the ED with acute dyspnea: 20.9%

McCullough PA. Acad Emerg Med 2003;10:198-204



Clinical Approach

- HF and COPD are common and they commonly co-exist in the same patient
- Diagnosis may be challenging due to similarities in clinical presentation
 - Overlap in signs
 - Overlap in symptoms
 - Overlap in investigations



Diagnostic pitfalls: Radiology

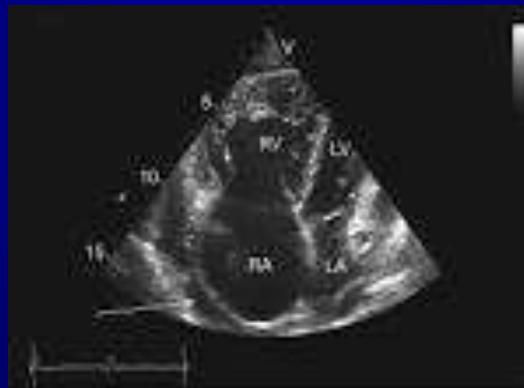


Diagnostic pitfalls: Radiology



- Chest hyperinflation reduces cardiothoracic ratio
- Pulmonary vascular remodelling and radiolucent lung fields mask typical alveolar shadowing in pulmonary oedema
- Asymmetric, regional and reticular patterns of pulmonary oedema
- Vascular bed loss with upper lobe venous diversion mimics HF

Diagnostic pitfalls: echocardiography



Diagnostic pitfalls: echocardiography & CMR



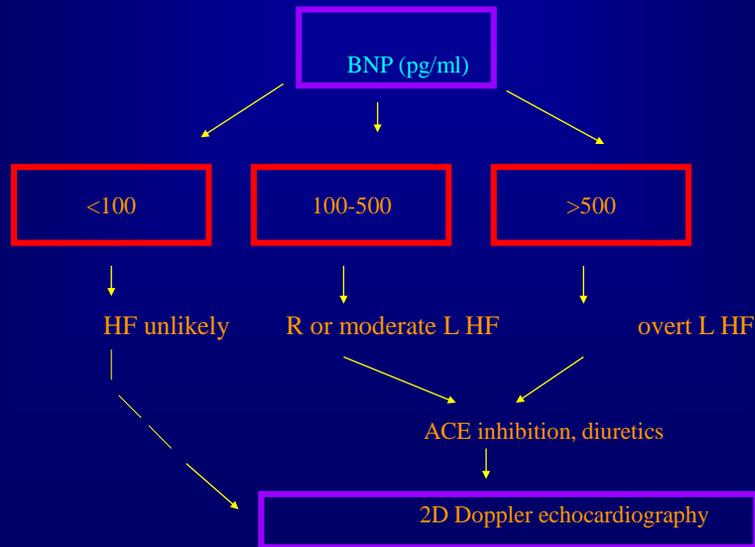
- Inadequate visualisation related to air trapping (10-50%)
- High cost of comprehensive echo-Doppler cardiac examination
- Limited examination?
- Cardiac magnetic resonance imaging

Diagnostic pitfalls: Natriuretic peptides



- Prognostic information
- Monitoring therapy
- Screening for subclinical disease
 - Up to 50% patients with LV dysfunction
- High negative predictive value for ruling out HF

Evaluation of HF during COPD exacerbation

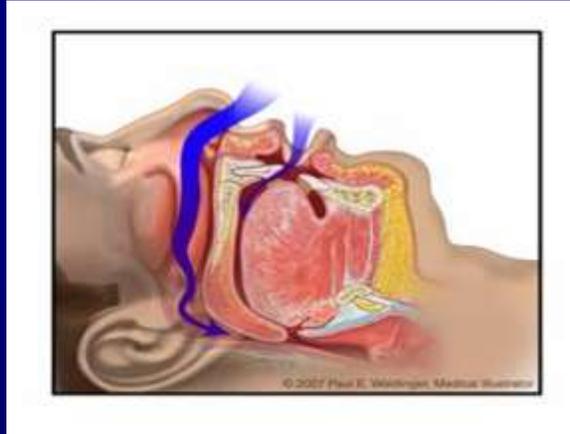


Hints on Treatment



- Beta-blockers are only relatively contraindicated in asthma, but not in COPD, although a more selective β_1 -adrenoceptor antagonist (i.e. bisoprolol, metoprolol succinate, or nebivolol) is preferred.
- Oral corticosteroids can cause sodium and water retention, potentially leading to worsening of HF, but this is not believed to be a problem with inhaled corticosteroids

Sleep Breathing Disorder



Definition



Sleep apneas are divided into:

- Central sleep apnea: neural drive to all respiratory muscles is abolished
- Obstructive sleep apnea: airflow ceases despite continuing respiratory drive because of occlusion of the oropharyngeal airway

Sleep Breathing Disorder



- Obstructive sleep apnea
- Central sleep apnea
- Mixed
- Obesity Hypoventilation syndrome

Pathophysiology



- Tissue laxity and redundant mucosa
- Anatomic abnormalities
- Decreased muscle tone with REM sleep
- Airway collapse

Prevalence of Sleep Disordered Breathing in Cardiovascular Disease



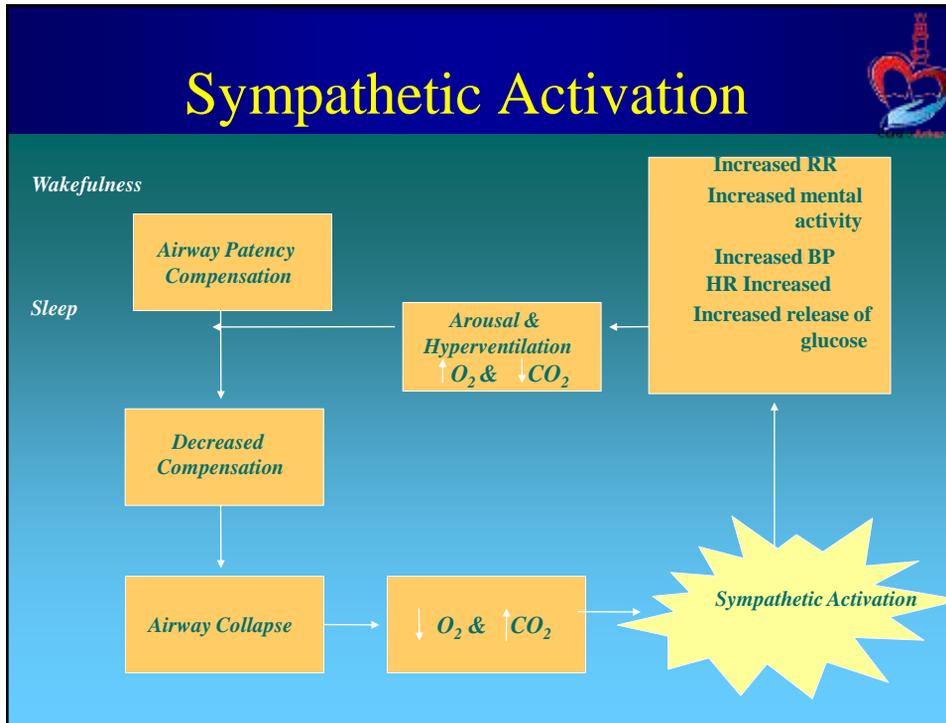
- **30% of cardiac disease patients**
 - *Schafer et al, Cardiology 1999*
- **50% of heart failure patients**
 - *Javaheri, Circulation 1998*
 - 40% pts with systolic HF
 - 50% pts with diastolic HF
- **30% of hypertensive patients**
 - 83% of refractory hypertension
 - *Logan et al, J Hypertension 2001*



SBD Impact on the Cardiovascular System



Both OSA & CSA occur commonly in patients with cardiovascular disease and HF and may contribute to disease progression.



Association Between OSA & Heart Failure

- 37% of 450 HF patients had OSA
 - Also high incidence of Central or Mixed apneas
- Risk factors for OSA in HF included
 - BMI > 35 in males
 - Age > 60 in females

Sin et.al. Am J Respir Crit Care Med 1999; 160: 1101-1106

Pathophysiology - complications



- Desaturation with compensatory polycythemia
- Hypercapnia with pulmonary hypertension
- Systemic hypertension
- Arrhythmias

ACC/AHA HFSA Heart Failure Guidelines



- Recommendation by American College of Cardiology, American Heart Association and the Heart Failure Society of America :
 - Sleep Apnea listed identifiable cause of Heart Failure
 - It is recommended that all newly diagnosed patients be screened for Sleep Apnea
 - Patients refractory to treatment for HF should be screened for Sleep Apnea

Table 2. Evaluation of the Cause of Heart Failure: The History

History to include inquiry regarding:
Hypertension
Diabetes
Dyslipidemia
Valvular heart disease
Coronary or peripheral vascular disease
Myopathy
Rheumatic fever
Mediastinal irradiation
History or symptoms of sleep-disordered breathing
Exposure to cardiotoxic agents
Current and past alcohol consumption
Smoking
Collagen vascular disease
Exposure to sexually transmitted diseases
Thyroid disorder
Pheochromocytoma
Obesity
Family history to include inquiry regarding:
Predisposition to atherosclerotic disease (Hx of MIs, strokes, PAD)
Sudden cardiac death
Myopathy
Conduction system disease (need for pacemaker)
Tachyarrhythmias
Cardiomyopathy (unexplained HF)
Skeletal myopathies

Hunt, et.al. ACC/AHA 2005 Guidelines: Circulation:2005:112

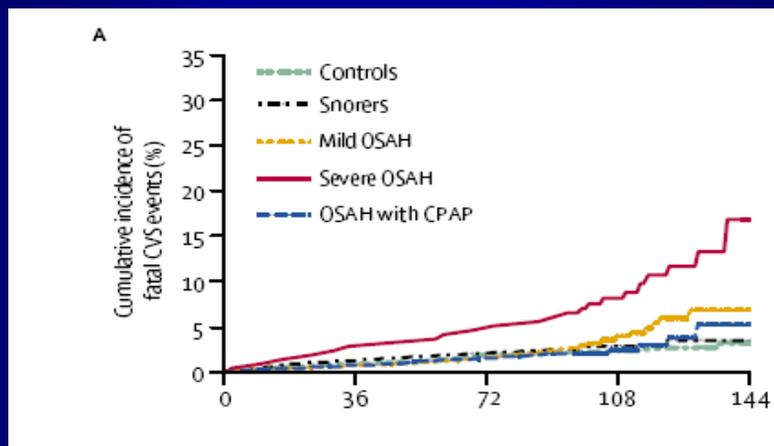
Cardiovascular mortality and morbidity in OSA



- Study of 1651 Men, over 10 years
 - 264 Normal (control group)
 - 377 Snorers (AHI<5)
 - 403 Untreated Mild-Mod OSA (AHI 5 – 30 without EDS)
 - 235 Untreated Severe OSA (AHI > 30 or AHI> 5 with EDS)
 - 372 Severe OSA with CPAP Treatment OSA (AHI > 30, CPAP > 4hrs/day)
- CPAP compliance objectively measured
- Study **Fatal and Non-Fatal Cardiac Events**

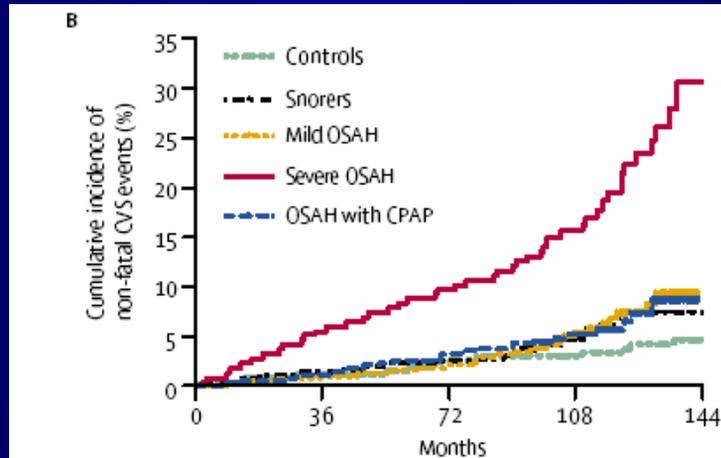
Marin, JM et. al Lancet 2005; 365:1046 - 1053

Fatal CV Events over 10 year period



Marin, JM et. al Lancet 2005; 365:1046 - 1053

Non-Fatal CV Events per group



Marin, JM et. al Lancet 2005: 365:1046 - 1053

Outcome of Study



- Patients with severe OSA that was left untreated had a significant increase in CV events (both fatal or non-fatal events) after 10 years
 - Risk factor: 2.87 higher than norms
- Patients with severe OSA had a significant reduction in CV events when treated with CPAP
 - Patients who used CPAP > 4 hours per night had a drop in CV risk

Marin, JM et. al Lancet 2005: 365:1046 - 1053

Clinical Application



- Reviewing sleep history (including asking a partner) is part of the holistic care of patients with HF .
- CSA and OSA have been shown to be associated with a worse prognosis in HF

In Hospital screening



- Sleep apnea is found in at least 50% of patients with CHF
- Heart Failure nurses should screen for sleep apnea in all CHF patients
- Referral to sleep disorder team
- Outpatient sleep study per MD

Evaluation



- Thyroid function tests
- Arterial blood gas
- Complete blood count
- ECG
- Echocardiography
- Radiological studies

Treatment



- Nocturnal oxygen supplementation, continuous positive airway pressure (CPAP), bi-level positive airway pressure (BiPAP), and adaptive servo-ventilation (ASV) may be considered to treat nocturnal hypoxaemia in OSA.
- An apnoea/hypopnoea index (AHI) of above 30 per hour can be treated using any of CPAP, BiPAP, ASV and nocturnal oxygen supplementation

BiPAP & CPAP



Treatment



- The safety and efficacy of alternative approaches to treating CSA in HFrEF patients, such as implantable phrenic nerve stimulation, are presently undergoing clinical investigation and may require additional long term study.

Conclusions



- COPD is common in HF
 - and independently predicts mortality
- HF is common in COPD
 - and independently predicts mortality
- Cardiovascular risk factors cluster in patients with COPD
- Many symptomatic, diagnostic and therapeutic challenges

Conclusions



- HF and COPD are common and they commonly co-exist in the same patient:
 - The presence of both is associated with worse outcomes
 - Diagnosis may be challenging due to similarities in clinical presentation
 - Diagnostic tools exist which may help to differentiate these disease entities in the dyspneic patient
 - In general, traditional pharmacological and non-pharmacological therapies are well tolerated and may have benefit across both disease states

CPAP in HF



CPAP in HF related CSA has been shown to reduce the frequency of episodes of apnoea and hypopnoea, and improve LVEF and 6 minute walk test distance, but did not improve prognosis or the rate of HF related hospitalizations

