Chronic heart failure: management of chronic heart failure in adults in primary and secondary care

A clinical guideline for the NHS in England and Wales

APPENDIX J: EVIDENCE TABLES

Section 7.5: Oxygen therapy and Continuous Positive Airways Pressure Treatment (CPAP)

Domiciliary oxygen therapy

Non-experimental studies

Paper	Wedzicha, J. A. 1999, *Domiciliary oxygen therapy services: clinical guidelines and advice for prescribers. Summary of a report of the Royal College of Physicians*..
Description	Working party report / guidelines
N=	
Intervention	
Outcomes	
Results	• Patients with severe HF may develop arterial hypoxaemia through inequalities in ventilation perfusion and by disturbances in nocturnal ventilation and respiratory drive. • There are few controlled trials of oxygen therapy in HF and no randomised trials • Randomised trials are required in long-term oxygen therapy for patients with HF, with outcome measures including sleep quality and QOL. • Patients with HF can be prescribed long-term oxygen therapy if they have daytime hypoxaemia with PaO_2 on air of less than 7.3 kPa or nocturnal hypoxaemia with SaO_2 below 90% for at least 30% of the night. • Assessment for long-term oxygen therapy requires consideration of a confident clear diagnosis of the disorder requiring intervention, optimum medical management of that condition, and arterial blood gas tensions need to be measured.
Comments	A report to review the current arrangements for the provision of domiciliary oxygen therapy To provide guidelines for whom and in what circumstances home oxygen should be prescribed An electronic database from the Cochrane Airways group was used to identify relevant data with a search made in 1996, and 7 relevant journal were hand searched from 1986 to 1997 Levels of evidence were assessed using US agency for Health Care Policy and Research criteria, and recommendations graded A to C accordingly Members of the working party prepared a first draft which was discussed at a meeting and a final report produced and peer reviewed.
Reference	200

Continuous Positive Airways Pressure (CPAP) therapy

Experimental Studies

Paper	Andreas, S., Clemens, C., Sandholzer, H., Figulla, H. R., & Kreuzer, H. 1996, "Improvement of exercise capacity with treatment of Cheyne-Stokes respiration in patients with congestive heart failure", *Journal of the American College of Cardiology*, vol. 27, pp. 1486-1490.
Description	Randomised controlled trial
N=	n=27, in cross over design only n=22 completed and reported Age =59years, LV ejection fraction =17%, FEV_1 =81% predicted, NYHA class II =14%, Class III =86% Germany
Intervention	An intervention of nasal nocturnal oxygen administered by nasal prongs with a flow rate of 4 litres/min versus same flow of room air for seven nights
Outcomes	Many outcomes evaluated including sleep parameters by polysomnography, exercise capacity in peak oxygen consumption, and functional status, cognitive scores and QOL endpoints at end of 7 day intervention
Results	• Nocturnal oxygen significantly reduced CSR by about 50%, with duration of 10 mins compared to 33mins on air ($p<0.005$) • There was also a significant improvement in sleep quality with fewer arousals an hour, 15 when on oxygen compared to 20 on air ($p=0.025$) • Oxygen also produced a significant improvement of peak oxygen consumption on exercise with 960ml/min the mean value compared t0 835 ml/min on air ($p=0.010$) • Awakenings as estimated by the sleep questionnaire were not significantly altered with oxygen therapy. • Similarly there was no improvement in daytime sleepiness, functional status, or mood scores with oxygen over air. • Cognitive function appeared to have been improved with time taken to complete a trial making test with oxygen as opposed to air with significant differences of ($P<0.020$ and $p=0.027$) for two separate tests.
Comments	Very small sample size High drop out Short term study Peak oxygen consumption is a strong predictor of mortality in patients with heart failure and it can be speculated that long-term nocturnal therapy improves survival. The results are only applicable to HF patients with Cheyne-Stokes respiration, and no sleep apnoea, or obstructive lung disease. Only those adhering to protocol were included in the analysis Lack of washout period may have led to cross over of benefit of oxygen therapy
Reference	199

Paper	Davies, R. J., Harrington, K. J., Ormerod, O. J., & Stradling, J. R. 1993, "Nasal continuous positive airway pressure in chronic heart failure with sleep-disordered breathing", *American Review of Respiratory Disease*, vol. 147, pp. 630-634.
Description	Randomised controlled study
N=	n=8 in cross-over design Age =not stated, Sex =not stated, LV ejection fraction =15 – 28%, Post MI =62.5%, Ischaemic heart disease =12.5% , Hypertension =12.5%, Aortic reflux, prosthetic valve =12.5% UK
Intervention	An intervention of NCPAP at 7.5cm H_2O versus a placebo of 1.5cm H_2O for 2 weeks duration
Outcomes	Many outcomes are measured including sleep disorders, symptoms of breathlessness, tiredness, chest pain, and activity. Also maximum exercise duration time, and ventricular function were evaluated, all at completion of each cross-over period
Results	• There were no overall changes in any of the stated outcomes; the primary endpoints showed no statistical differences between the groups in exercise capacity, arterial oxygen dip, symptom scores, and NCPAP compliance.
Comments	No significant effect recorded in any outcome studies Potential detrimental effect on 2 subjects who withdrew A different NCPAP level may have proved more effective NCPAP may worsen HF by decreasing sodium and water excretion, as higher airways pressure decreases atrial natriuretic peptide release. Patients were told that 2 pressures would be used and one, both or neither may be beneficial, and outcomes assessed by laboratory process or by physicians blind to allocation. Sleep parameters were measured by full polysomnography, exercise tolerance by a standard bicycle ergometry protocol,, and cardiac function measured by ventriculography or echocardiography and symptoms reviewed using a Likert scale
Reference	202

Paper	Granton, J. T., Naughton, M. T., Benard, D. C., Liu, P. P., Goldstein, R. S., & Bradley, T. D. 1996, "CPAP improves inspiratory muscle strength in patients with heart failure and central sleep apnea", *American Journal of Respiratory & Critical Care Medicine*, vol. 153, pp. 277-282.
Description	Randomised controlled trial
N=	n=17, NCPAP =9, conventional care =8 Age =58yrs, Male =100%, LV ejection fraction =22%, NYHA class II-III =100% Canada
Intervention	NCPAP titrated up to 12.5 cm $H_2O$for at least 6 hours each night for 3 months was compared to conventional care
Outcomes	A range of outcomes are recorded, including maximal inspiratory and expiratory pressures, cardiac function by LV ejection fraction, functional status by NYHA class and QOL by fatigue and dyspnoea scores, no details of side effects given
Results	• Patients receiving NCPAP showed a significant improvement in MIP of 11.4 cm H_2O with a slight decline amongst control patients -4.0 cm H_2O. ($p<0.02$) • There were no significant improvements in maximal expiratory pressure with NCPAP • With an improvement of 8.6% in LV ejection fraction from baseline on NCPAP compared with a decline of 1.1% in control patients a significant effect was found at 3 months ($p<0.02$) • There were also significant improvements in NYHA class ($p<0.02$) and also dyspnoea and fatigue score ($p<0.01$ and $p<0.005$ respectively)
Comments	Length of intervention = 3 months Outcome assessors were blinded No blinding for patients effort in evaluation of MIP, and self evaluation of fatigue and dyspnoea A small study Dyspnoea in HF is multifactorial and probably involves both the cardiovascular and respiratory systems Magnitude of effect recorded suggests that the changes in outcomes are due to the influence of the intervention under investigation No details of validation or reproducibility for the chronic heart failure questionnaire employed
Reference	201

Paper	Sin, D. D., Logan, A. G., Fitzgerald, F. S., Liu, P. P., & Bradley, T. D. 2000, "Effects of continuous positive airway pressure on cardiovascular outcomes in heart failure patients with and without Cheyne-Stokes respiration", *Circulation*, vol. 102, pp. 61-66.
Description	Randomised controlled trial
N=	n=66, CPAP=31, control =35, (n=29 with CSR, 37 without CSR) Age=59yrs, Male =88%, Ischaemic origin of HF =62%, LV ejection fraction =22% Canada
Intervention	An intervention of CPAP at 12.5 cm H_2O for at least 6 hours a night, for 3 months, then continued un monitored use is compared to a control of conventional therapy
Outcomes	The primary endpoints are changes in LV ejection fraction from baseline to 3 months, and transplant free survival to a median 2.2 years.
Results	• For patients with CSR there was a significant increase in LVEF compared with control subjects (p=0.019). In patients without CSR neither CPAP treated or control patients experienced any significant improvement in LVEF • For the cohort as a whole there were mortality or transplant events in 49% of the control group and 29% of the CPAP group RRR 50% (95% CI –14% to 78%) (p=0.101). • For the patients with CSR there were mortality or transplant events in 56% of the control group and 33% of the CPAP group RRR 56% (95% CI –4% to 89%) (p=0.059).an almost significant effect • For the non CSR patients RRR 37% (95% CI 19% to 109%) (p=0.449). • No adverse effects of CPAP were reported
Comments	Patients with CSR had a 2.5 fold greater adjusted risk for mortality or transplant Some patients may have discontinued CPAP post 3 months and some control patients started on this treatment, A suitable placebo for CPAP is difficult. Home setting of trial more closely relates to clinical practice than a traditional trial. 2 of the 31 (6%) patients randomised to CPAP were unable to tolerate the therapy due to discomfort, no patient was lost to follow up Referring cardiologists were free to adjust medications at their discretion during the course of the trial
Reference	203