

CPAP therapy: outcomes and patient use

Neil J Douglas, Heather M Engleman

Continuous positive airway pressure (CPAP) therapy is the treatment of choice for most patients with the sleep apnoea/hypopnoea syndrome. CPAP therapy is mainly used to improve daytime function but increasingly some centres are using CPAP to attempt to decrease cardiovascular risk. CPAP can be one of the most effective forms of therapy in modern medicine. However, not all patients find this therapy ideal and many do not use it as much as physicians would wish. This paper reviews the potential outcomes from CPAP therapy, the data on patient use of CPAP therapy, the factors which limit CPAP use, and whether CPAP use can be improved.

Outcome measures

The sleep apnoea/hypopnoea syndrome (SAHS) may be treated in order to improve patient survival, decrease hypertension and vascular risk factors, or to decrease symptoms and improve daytime function. The evidence that CPAP therapy improves survival is limited to one small study which was non-randomised and in which only 54% of the patients were followed up.¹ Although these data suggest improved survival on CPAP, the study does not meet the levels of rigour required for present day evidence based medicine. There are no studies as yet addressing the issue of whether CPAP therapy prevents myocardial infarctions or cerebrovascular disease, and there is conflicting evidence about whether CPAP therapy does^{2,3} or does not⁴⁻⁶ reduce arterial blood pressure. Most of these studies suffer from either lack of a control limb,²⁻⁵ small numbers,²⁻⁶ or lack of evidence of CPAP usage.²⁻⁵ There is thus a need for further well conducted large scale studies to address this issue.

Although the satisfactory clinical response of daytime sleepiness and impaired daytime function to CPAP therapy in patients with SAHS is well known, few controlled studies have addressed this issue. In a randomised placebo controlled trial we have shown that CPAP therapy improves symptoms, objective sleepiness, daytime cognitive function, IQ, driving "simulator" performance, mood, and quality of life.⁷ This study has now been continued and we have shown that, in patients with apnoea/hypopnoea frequencies of >15/h, the extent of the improvement in sleepiness, while statistically highly significant ($p < 0.001$), is somewhat disappointing with the Epworth score decreasing from 10 on placebo to 7 on CPAP and mean sleep latency on an MSLT increasing from 6 min on placebo to 8 min on CPAP therapy. It is noteworthy that there were significant improvements in the Epworth sleepiness scale on placebo compared with the baseline value! In patients with apnoea/hypopnoea frequencies of 5-15/h benefits were still found, although these

were more significant in patients with apnoea/hypopnoea frequencies in the range 10-15/h where significant improvements were obtained in the Epworth sleepiness scale, depression scores, cognitive function, and quality of life.^{8,9}

These results were obtained in carefully controlled clinical trials, but theoretically they may not be applicable to everyday clinical practice. We have therefore recently carried out a survey of benefits and problems with CPAP therapy in which we obtained an 85% response rate from an unselected group of 250 patients on CPAP therapy. These patients reported significant improvements in sleepiness, the distances that they were able to drive, their work performance and concentration ability, their general health, and in the time they were taking off work.¹⁰ There was also a significant decrease in the number of road traffic incidents that they reported per mile driven, although this difference was due to differences in near miss road traffic accidents rather than in actual impact collisions. It must be stressed that in all of these outcome studies the results reported are for all the patients studied, despite what might be considered suboptimal CPAP usage (see below).

CPAP usage

CPAP is an obtrusive form of long term therapy and thus one would expect the individual to titrate their CPAP usage against the benefits that they obtain from the treatment. Reeves-Hoche and colleagues¹¹ were the first to study objective CPAP use by recording the time that the patient's CPAP machine was being used at an effective CPAP pressure. Several groups have now shown that CPAP usage averages 4.7 hours per night with approximately 90% of that time being spent at effective pressure.¹¹⁻¹³ This level of CPAP use should not be regarded as surprising as similar superficially disappointing results are obtained with most forms of chronic therapy. For example, use of inhaled anti-asthma therapy is suboptimal in 43-52% of patients,^{14,15} and the use of oral antihypertensive therapy has been shown to be suboptimal in at least 44% of patients.¹⁶ It is much easier to use an inhaler twice a day or to take the occasional tablet than it is to comply with CPAP therapy all night every night. CPAP usage of about 5.1 hours per night has been found in two cross-sectional studies of CPAP users in clinics.^{17,18} However, it must be appreciated that these figures will inevitably be higher than those obtained in studies of allcomers, as patients who refuse or subsequently stop using CPAP will not be present in the CPAP-using clinic population.

It is important not to view the seemingly poor use of CPAP therapy in isolation, and it must always be stressed that the excellent improvements in outcome measures obtained

Respiratory Medicine
Unit, Department of
Medicine, The
University of
Edinburgh, Royal
Infirmary, Edinburgh
EH3 9YW, UK
N J Douglas
H M Engleman

Correspondence to:
Professor N J Douglas.

in controlled trials⁷⁻⁸ are obtained with an average CPAP usage of 4.7 hours per night or less. Indeed, sleep physicians should be commended for carefully monitoring their CPAP compliance; there are many patients on other forms of therapy in whom compliance is very low, unbeknown to the monitoring physicians.

Factors influencing CPAP usage

Meta-analysis of all of our studies shows that there is a statistically significant relationship between apnoea/hypopnoea frequency and objective CPAP use.⁷⁻⁹ However, this relationship only explains around 4% of the variance in CPAP usage and is therefore not of any clinical significance, even though it may be of statistical significance. Thus, many patients with low apnoea/hypopnoea frequencies comply well with therapy, while others with high apnoea/hypopnoea frequencies may not comply at all. There is a tendency for patients with the greatest impairment of quality of life and greater subjective daytime sleepiness to comply better with therapy, but again these relationships are not tight.

Factors limiting CPAP usage

In our survey of 250 CPAP users¹⁰ we found that many patients reported problems with the treatment. The most common problem rated as severe was nasal stuffiness followed by the sensation of cold air, noise, and mask pressure. CPAP noise and nocturnal awakenings due to CPAP therapy correlated negatively with CPAP use and with benefits from CPAP therapy, indicating that these were the problems that the patients blamed for lack of CPAP use. Care must be taken, however, in interpreting these data as it could be that other factors were waking the patients making them aware of the noise. The noise of the CPAP machine and awakenings throughout the night were negatively correlated with apnoea/hypopnoea frequency, indicating that patients in whom the condition was milder found these to be a bigger problem.

Objective CPAP use does correlate with outcome.⁷⁻⁹ The larger the CPAP use, the greater the decrement in Epworth sleepiness scale, quality of life, energy, and depression.

Can CPAP usage and outcome be improved?

The first study to address this issue was a randomised crossover study of regular telephone advice.¹⁹ This study showed no benefit from regular telephone advice but the design of the study may have contributed to this negative finding. Because it was a crossover study, those patients who received telephone prompts regularly in their first three months went into the second limb of the study, having had the importance of regular use of CPAP therapy reinforced in their mind, and thus they were not a good control group.

We have recently embarked on a randomised parallel group control trial of usual CPAP support against intensive CPAP support.²⁰ Patients in both limbs of the study had apnoea/hypopnoea frequencies of >15/h and two major symptoms of SAHS. They then received full

CPAP education by a doctor and a nurse, including watching an educational video. Following a CPAP mask fitting they then spent at least 30 min during the daytime trying CPAP therapy. Those patients on the usual limb then had a one night CPAP titration study followed by telephone follow up at two and 21 days by the CPAP nurses and clinic visits at one, three and six months. Those on the intensive limb had home CPAP education with their spouse, three nights in the sleep laboratory for CPAP titration, phone calls at two and 21 days, home visits at seven, 14 and 28 days and four months, and clinic visits at one, three and six months. The preliminary results from this study show a significant improvement in CPAP usage with the intensive group using the treatment for a mean (SD) of 6.2 (1.8) hours per night and those receiving the usual CPAP support using it for 4.8 (1.8) hours per night ($p = 0.02$). It remains to be seen whether this difference detected at one month persists thereafter, and also whether this improvement in CPAP use translates into differences in outcome measures.

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