

## Redefining Success in Airway Surgery for Obstructive Sleep Apnea: A Meta Analysis and Synthesis of the Evidence

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**Study Objectives:** The role of upper airway surgery as a treatment for adult obstructive sleep apnea (OSA) remains controversial, with perspectives on treatment efficacy varying considerably. Though debate may occur in the clinical sphere, it is necessary to appreciate the ever-increasing funding and policy focus on cost effectiveness and “efficacy” in health care.

**Design:** In this review, we examine contemporary evidence that highlights the importance of “highly effective treatment” over “sub-therapeutic treatment” as a necessity to confer improved health outcomes in OSA. We highlight that assumptions of surgical success inherent in most articles fail to assimilate contemporary, clinically significant indicators of success. We performed a literature search and present interpolated meta-analyses data from 18 surgical articles. Statistical meta-analyses highlight how surgical success decreases when new evidence-based criteria of success are applied.

**Measurements and Results:** Specifically, when the traditional definition

is applied (50% reduction in apnea-hypopnea index [AHI] and/or  $\leq 20$ ) the pooled success rate for Phase I procedures is 55% (45% fail). However, at  $\text{AHI} \leq 10$ , success reduces to 31.5% (68.5% fail) and, at  $\text{AHI} \leq 5$ , success is reduced to 13% (87% fail). According to these definitions, Phase II success (fail) rates decrease from 86% (14%) to 45% (55%) and 43% (57%), respectively.

**Conclusions:** The evidence for clinical efficacy must define treatment “success”. We propose all future surgical audits report “objective cure” rates with success based on AHI outcomes of  $\leq 5$  and/or  $\leq 10$ . We hope this paper serves as a catalyst for debate and consensus.

**Keywords:** Surgery, sleep apnea, evidence, treatment effectiveness, health outcomes

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## Pentobarbital Sedation Increases Genioglossus Respiratory Activity in Sleeping Rats

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**Objective:** To determine whether certain sedatives may, by increasing arousal threshold, allow pharyngeal dilator muscle activity to increase more in response to chemical stimuli before arousal occurs.

**Design, Participants and Interventions:** Thirteen chronically instrumented rats were studied during sleep following injections of placebo or sedating doses of pentobarbital (10mg/kg). Intermittently, inspired  $\text{CO}_2$  was increased gradually until arousal occurred.

**Measurements and Results:** Maximum genioglossus activity reached before arousal was higher with pentobarbital than placebo ( $34.5 \pm 24.3$  vs  $3.7 \pm 2.9$  mV;  $P < 0.001$ ) for 2 reasons. First, genioglossus activity was greater during undisturbed sleep before  $\text{CO}_2$  was applied ( $23.3 \pm 15.3$  vs  $2.5 \pm 1.5$  mV,  $P < 0.001$ ). When sleep periods were long, a ramp-like increase in genioglossus activity (GG-Ramp) began and progressed until arousal. GG-Ramps developed with both placebo and pentobarbital but reached higher levels with pentobarbital due to longer sleep periods and faster increase in genioglossus activity during the ramp. GG-Ramps began

when diaphragm activity was lowest and progressed despite unchanged diaphragm activity. Second, as hypothesized, the increase in genioglossus activity with  $\text{CO}_2$  before arousal was greater than with placebo ( $11.2 \pm 2.5$  vs  $1.2 \pm 2.5$  mV;  $P < 0.05$ ) due to increased arousal threshold. In 27 of 126  $\text{CO}_2$  challenges delivered while GG-Ramps were in progress, genioglossus activity paradoxically decreased despite increased diaphragmatic activity. These negative responses occurred randomly in 7 of 13 rats.

**Conclusions:** In rats: 1) Sedatives may allow genioglossus activity to reach higher levels during sleep. 2) A time-dependent increase in genioglossus activity occurs during undisturbed sleep that is unrelated to chemical drive. 3) Transient hypercapnia may elicit inhibition of genioglossus activity under currently unidentified circumstances.

**Keywords:** Obstructive sleep apnea,  $\text{CO}_2$ , arousal, sleep

**Citation:** Younes M, Park E, Horner R. Pentobarbital Sedation Increases Genioglossus Respiratory Activity in Sleeping Rats. *SLEEP* 2007;30(4):478-488

# Practice Parameters for the Use of Actigraphy in the Assessment of Sleep and Sleep Disorders: An Update for 2007

Standards of Practice Committee, American Academy of Sleep Medicine

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**Background:** Actigraphy is increasingly used in sleep research and the clinical care of patients with sleep and circadian rhythm abnormalities. The following practice parameters update the previous practice parameters published in 2003 for the use of actigraphy in the study of sleep and circadian rhythms.

**Methods:** Based upon a systematic grading of evidence, members of the Standards of Practice Committee, including those with expertise in the use of actigraphy, developed these practice parameters as a guide to the appropriate use of actigraphy, both as a diagnostic tool in the evaluation of sleep disorders and as an outcome measure of treatment efficacy in clinical settings with appropriate patient populations.

**Recommendations:** Actigraphy provides an acceptably accurate estimate of sleep patterns in normal, healthy adult populations and inpatients suspected of certain sleep disorders. More specifically, actigraphy is indicated to assist in the evaluation of patients with advanced sleep phase syndrome (ASPS), delayed sleep phase syndrome (DSPS), and shift work disorder. Additionally, there is some evidence to support the use of actigraphy in the evaluation of patients suspected of jet lag disorder and non-24hr sleep/wake syndrome (including that associated with blindness). When polysomnography is not available, actigraphy is indicated to estimate total sleep time in patients with obstructive sleep apnea. In patients

with insomnia and hypersomnia, there is evidence to support the use of actigraphy in the characterization of circadian rhythms and sleep patterns/disturbances. In assessing response to therapy, actigraphy has proven useful as an outcome measure in patients with circadian rhythm disorders and insomnia. In older adults (including older nursing home residents), in whom traditional sleep monitoring can be difficult, actigraphy is indicated for characterizing sleep and circadian patterns and to document treatment responses. Similarly, in normal infants and children, as well as special pediatric populations, actigraphy has proven useful for delineating sleep patterns and documenting treatment responses.

**Conclusions:** Recent research utilizing actigraphy in the assessment and management of sleep disorders has allowed the development of evidence-based recommendations for the use of actigraphy in the clinical setting. Additional research is warranted to further refine and broaden its clinical value.

**Keywords:** Circadian rhythms, actigraphy, advanced sleep phase syndrome, delayed sleep phase syndrome, shift work disorder

**Citation:** Practice Parameters for the Use of Actigraphy in the Assessment of Sleep and Sleep Disorders: An Update for 2007. *SLEEP* 2007;30(4):519-529

## Increased Adherence to CPAP With a Group Cognitive Behavioral Treatment Intervention: A Randomized Trial

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**Study Objective:** To improve adherence to continuous positive airway pressure (CPAP) treatment in participants with obstructive sleep apnea (OSA) using a cognitive behavioral therapy (CBT) intervention.

**Design:** A randomized controlled trial.

**Setting:** A major teaching hospital in Sydney (2005).

**Participants:** One hundred individuals (96 men), ranging in age from 32 to 81 years, diagnosed with OSA.

**Intervention:** Two 1-hour CBT interventions (including a video of real CPAP users) plus treatment as usual (mask fitting and information) or treatment as usual only.

**Measurements and Results:** Hours of CPAP usage was assessed at 7 nights and 28 nights. Adherence was defined as usage at least 4 hours per night. Questionnaires measuring self-efficacy, social support, and expectancy (mediators of adherence) were given after intervention or after usual

treatment. A higher adherence to CPAP therapy was found in the CBT group (2.9 hours difference) relative to treatment as usual ( $P < 0.001$ ) at 28 days. Only 4 participants in the CBT group did not initiate treatments after their titration study, compared with 15 in the treatment as usual group ( $P < 0.02$ ). The CBT group had significantly higher scores for self-efficacy ( $P < 0.001$ ) and social support ( $P < 0.008$ ) but not for expectancy.

**Conclusions:** The CBT intervention resulted in both increased adherence and "uptake" of CPAP and therefore would be expected to reduce the social, economic, and health-related consequences of untreated OSA.

**Keywords:** Obstructive sleep apnea, continuous positive airway pressure, cognitive behavioural therapy, adherence.

**Citation:** Richards D; Bartlett DJ; Wong K et al. Increased adherence to cpap with a group cognitive behavioral treatment intervention: a randomized trial. *SLEEP* 2007;30(5):635-640

# The Cyclic Alternating Pattern Demonstrates Increased Sleep Instability and Correlates With Fatigue and Sleepiness in Adults with Upper Airway Resistance Syndrome

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**Objective:** To clarify the relationship between sleep instability and subjective complaints in patients with upper airway resistance syndrome (UARS).

**Methods:** Thirty subjects (15 women) with UARS and 30 age- and sex-matched controls in a prospective, single-blind, case-control study. Blinded cyclic alternating pattern (CAP) electroencephalogram analysis and scales of fatigue and sleepiness were completed.

**Analysis:** Mann-Whitney U tests for independent, nonparametric variables between groups and  $\chi^2$  tests for nonparametric variables with defined standard values.

**Results:** Patients with UARS had significantly more complaints of fatigue and sleepiness, compared with controls, demonstrated on their Fatigue Severity Scale ( $P < 0.001$ ) and Epworth Sleepiness Scale ( $P < 0.001$ ). By design, the mean apnea-hypopnea index was normal in both groups, whereas the respiratory disturbance index was greater in patients with UARS than in those without ( $14.5 \pm 3.0$  vs  $9 \pm 5.2$ , respectively [ $P < 0.001$ ]). CAP analysis demonstrated abnormal non-rapid eye movement sleep with abnormally increased CAP rate, electroencephalogram arousals, A2 index, and A3 in-

dex. Decreased A1 index in controls was consistent with their more normal progression of sleep. CAP rate correlated with both the Epworth Sleepiness Scale ( $r = 0.38$ ,  $P < 0.01$ ) and the Fatigue Severity Scale ( $r = 0.51$ ,  $P < 0.0001$ ), and there was a positive trend between the Fatigue Severity Scale and phase A2 index ( $r = 0.29$ ,  $P < 0.05$ ).

**Conclusion:** Compared with age- and sex-matched controls, patients with UARS have higher electroencephalogram arousal indexes and important non-rapid eye movement sleep disturbances that correlate with subjective symptoms of sleepiness and fatigue. These disturbances are identifiable with sensitive measures such as CAP analysis but not with traditional diagnostic scoring systems.

**Keywords:** Upper airway resistance syndrome, chronic snoring, cyclic alternating pattern, fatigue, sleepiness, sleep disturbance.

**Citation:** Guilleminault C; Lopes C; Hagen CC et al. The cyclic alternating pattern demonstrates increased sleep instability and correlates with fatigue and sleepiness in adults with upper airway resistance syndrome. *SLEEP* 2007;30(5):641-647

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# Randomized Clinical Effectiveness Trial of Nurse-Administered Small-Group Cognitive Behavior Therapy for Persistent Insomnia in General Practice

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**Study Objectives:** Persistent insomnia, although very common in general practice, often proves problematic to manage. This study investigates the clinical effectiveness and the feasibility of applying cognitive behavior therapy (CBT) methods for insomnia in primary care.

**Design:** Pragmatic randomized controlled trial of CBT versus treatment as usual.

**Setting:** General medical practice.

**Participants:** Two hundred one adults (mean age, 54 years) randomly assigned to receive CBT ( $n = 107$ ; 72 women) or treatment as usual ( $n = 94$ ; 65 women).

**Intervention:** CBT comprised 5 sessions delivered in small groups by primary care nurses. Treatment as usual comprised usual care from general practitioners.

**Measurements and Results:** Assessments were completed at baseline, after treatment, and at 6-month follow-up visits. Sleep outcomes were appraised by sleep diary, actigraphy, and clinical endpoint. CBT was associated with improvements in self-reported sleep latency, wakefulness after sleep onset, and sleep efficiency. Improvements were partly sustained at follow-up. Effect sizes were moderate for the index variable of sleep ef-

iciency. Participants receiving treatment as usual did not improve. Actigraphically estimated sleep improved modestly after CBT, relative to no change in treatment as usual. CBT was also associated with significant positive changes in mental health and energy/vitality. Comorbid physical and mental health difficulties did not impair sleep improvement following CBT.

**Conclusion:** This study suggests that trained and supervised nurses can effectively deliver CBT for insomnia in routine general medical practice. Treatment response to small-group service delivery was encouraging, although effect sizes were smaller than those obtained in efficacy studies. Further research is required to consider the possibility that CBT could become the treatment of first choice for persistent insomnia in primary healthcare.

**Keywords:** Insomnia, sleep, treatment, primary care, psychological intervention

**Citation:** Espie C; MacMahon KMA; Kelly HL et al. Randomized clinical effectiveness trial of nurse-administered small-group cognitive behavior therapy for persistent insomnia in general practice. *SLEEP* 2007;30(5):574-584