Achieving Adherence to Positive Airway Pressure Therapy

Modifying Pressure and the Holy Grail

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Dingo: Where are you going?

Sir Galahad: I seek the Grail! I have seen it, here in this castle!

Dingo: No, oh no! Bad, bad Zoot!

Sir Galahad: What is it?

Dingo: She has been setting a light to our beacon, which, I've just remembered, is Grail shaped. It's not the first time we've had this problem.

Sir Galahad: It's not the real Grail?

Monty Python and the Holy Grail [1]

Adherence to continuous positive airway pressure (CPAP) treatment for obstructive sleep apnea syndrome (OSAS) continues to be a subject of intense interest to practitioners who treat these patients; indeed, the search for techniques that would ensure compliance could be likened to the search for the Holy Grail, a quest spoken of in medieval mythology. Of the many aspects of CPAP treatment that have been implicated as a
cause of reduced adherence, patient complaints about the difficulty of exhaling against pressure are sometimes mentioned, although less often than one might suppose: Only 18% of 204 patients in an often-quoted survey by Engleman et al\[2\] noted it, and it was not even listed as a side effect in several other studies. [3] . [4] . [5] More common are symptoms that are almost certainly closely related to the level of pressure, such as mask leaks, aerophagia, and chest discomfort, and those symptoms that are attributable to the magnitude of airflow necessary to maintain a set pressure, such as nasal congestion, sneezing, and rhinorrhea; oral/nasal desiccation; and blower noise. [2] . [3] . [4] . [5] In addition, problems with mask discomfort and fit often are related to the degree of tightening necessary to prevent leaks, and such complaints are legion among CPAP users (roughly one-half of respondents in most reports [2] . [3] . [6] ), although it is likely that advances in mask design have somewhat mitigated this situation. Finally, a complaint of claustrophobia is frequently heard, and some of these patients may actually be reacting to the difficulty they experience in exhaling against pressure.

There is also a high degree of face validity to the contention that the degree of pressure is a major impediment to CPAP use, since exhaling against pressure is one of the more obvious attributes of this therapeutic approach. Hence, a variety of alternative modalities of pressure delivery have been developed and proposed to enhance compliance in some patients by reducing positive airway pressure under certain conditions: bilevel positive airway pressure (bilevel PAP; pressure is reduced during the entire expiratory phase), auto-titrating CPAP (pressure is varied depending on what is actually required to maintain airway patency), and pressure-relief CPAP. Interestingly, another option that has been proposed involves detecting wakefulness using respiratory pattern analysis and reducing pressure whenever the patient is awake[6]; to my knowledge, no published reports of this technology being incorporated into a CPAP generator have yet appeared. Pressure-relief CPAP involves a brief reduction in pressure at the start of exhalation to ameliorate the sensation of resistance to breathing out, and several vendors offer their own proprietary versions.

Whether these techniques represent a useful advance in improving adherence in the treatment of OSAS or are just a marketing tool remains controversial, although studies of bilevel PAP and auto-titrating CPAP for this purpose have not been particularly promising thus far. [7] It may well be that pressure-related complaints do not occur with great enough frequency to show an overall benefit for a study group of patients who are unselected for this attribute. Indeed, complaints of nasal and pharyngeal symptoms and lack of subjective perceived benefit from treatment represented more common reasons for noncompliance in one case-control study. [8]

The literature thus far does not consistently support the overall usefulness of pressure-relief CPAP. One small, nonrandomized study suggested better treatment adherence with CPAP plus pressure-relief CPAP compared with CPAP alone,[9] whereas a second, larger, randomized trial found no difference in long-term compliance. [10] A third study examining auto-titrating CPAP with and without pressure relief in experienced CPAP users found a subjective preference for the pressure relief mode in this group of patients but only a nonsignificant trend in terms of greater subjective comfort with the pressure relief modality. [11] Other outcome measures showed no significant differences (eg, apnea-hypopnea index, sleep efficiency, mean oxyhemoglobin saturation). Additional crossover and parallel studies published since then, and systematically reviewed 2 years ago in an update of a Cochrane Database article, have collectively failed to demonstrate an adherence advantage for pressure relief technologies. [7]

In a study appearing in this issue of CHEST (see page 1322), Bakker and Marshall\[12\] performed a systematic review and meta-analysis of all of the reports to date that have investigated the usefulness of pressure-relief CPAP for improving adherence to CPAP treatment. They used proven analytic techniques with objectively measured compliance as the primary outcome measure. Additional outcome variables that were analyzed, when available, were Epworth Sleepiness Scale, maintenance of wakefulness test, mean sleep latency, and results of a psychomotor vigilance task. Data from crossover and parallel studies were separately pooled and analyzed. Robust statistical testing was performed, including reasoned choices of random vs fixed effects modeling, use of the Q-statistic to determine heterogeneity and the I^2 statistic to estimate variability due to heterogeneity rather than chance, Forest plots with calculation of the mean and 95% CI of any effect, sensitivity analyses to exclude undue influence on a result from one particular study, and Funnel plot to determine publication bias. Data on a total of 599 subjects were available, although not all subjects were represented in the analyses of each outcome variable. Despite (or perhaps, because of) these meticulous techniques, the authors were unable to demonstrate any significant differences in any of the outcome variables due to the use of pressure relief technology.

This rigorous study, adhering closely to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines, [13] confirms and updates the results of the Cochrane review[7] and adds to the
already substantial literature that has failed to support the ubiquitous deployment of pressure relief technologies in the clinical arena. The fact that some additional cost must necessarily be imposed on the health-care system in order to equip positive airway pressure generators with any of these features makes such analyses particularly relevant in this age of escalating medical expense. Admittedly, outfitting a modern microprocessor-controlled CPAP generator with pressure-relief CPAP probably entails little but a rewriting of a portion of the programming code, and the overall effect of adding this feature likely has had little or no discernible effect on health-care spending. Moreover, dialing in this feature when a patient is having difficulty adhering to CPAP therapy certainly does no harm. However, what would be truly useful is if the manufacturers of these devices would fund more comprehensive studies that might identify which subgroup of patients would actually benefit from pressure-reducing technologies. Such investigations would not only aid in the clinical care of patients with OSAS, but would almost certainly add to our understanding of the science of sleep apnea treatment. Until that time, I fear that the Holy Grail of achieving CPAP adherence will continue to elude us.

REFERENCES: