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Every Cloud Has a Silver Lining – Treatment of Complicated Breathing Patterns during Sleep

Commentary on Javaheri et al. The performance of two automatic servo-ventilation devices in the treatment of central sleep apnea. SLEEP 2011;34:1693-1698.

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How do we approach patients suffering from sleep apnea that is more complicated than obstructive sleep apnea (OSA)? What is the optimal treatment for patients with central breathing disturbances during sleep?

In this issue of *SLEEP*, Javaheri and coworkers present the results of a short-term, multicenter, controlled study investigating the efficacy of two Automatic Servo-Ventilation (ASV) devices in patients with central sleep apnea (CSA).[1] The conventional BiPAP autoSV device utilised a fixed EPAP, flow targeted IPAP, and an automatic backup rate. The BiPAP autoSV Advanced device differs by providing an automatic EPAP and enhanced automatic backup rate.

The conventional BiPAP autoSV device has been shown to suppress central respiratory disturbances during sleep and increase oxygen supply more effectively than CPAP. Furthermore, evidence suggests it may improve cardiac performance and normalize the sleep profile.[2-9] Additionally, some studies have suggested that compliance might be higher when using ASV in some patient groups when compared to CPAP.[10,11]

Most of these trials focused on patients with pure or predominant central sleep apnea (CSA) and Cheyne-Stokes respiration (CSR). In clinical practice, however, many patients present with more complicated breathing patterns, including the coexistence of OSA and CSA/CSR, the poorly understood phenomenon of central disturbances emerging under CPAP use, and the combination of obstruction of the upper airway and insufficiency in generating minute ventilation (as in obesity-hypoventilation, chronic obstructive pulmonary disease and neuromuscular disorders). Accordingly, algorithms that vary pressure support to overcome periods of hypoventilation using an automatic titration of the expiratory pressure to adapt to the level of upper airway obstruction alongside a dynamic IPAP might be useful.[1,6,7]

Javaheri et al.[1] present the first data comparing the conventional BiPAP autoSV and BiPAP autoSV Advanced devices. The main findings of this study were:

1. The data support previous findings that CPAP reduces the total AHI in patients with central sleep apnea by approximately 50%.
2. Both the conventional BiPAP autoSV and new BiPAP autoSV Advanced devices are equally effective in the resolution of obstructive events compared to CPAP, the gold standard treatment for obstructive sleep apnea.
3. Both the conventional BiPAP autoSV and new BiPAP autoSV Advanced devices are superior to CPAP in the suppression of hypopneas and central and mixed apneas.
4. The BiPAP autoSV Advanced device confers an additional improvement in central disturbances compared to conventional BiPAP autoSV (see fig 2 in Javaheri [1]).
5. Both the conventional BiPAP autoSV and new BiPAP autoSV Advanced devices improve delta sleep more effectively than CPAP.
6. The BiPAP autoSV Advanced device marginally reduced the overall mean pressure while delivering a higher range of treatment pressures during both inspiration and expiration.

What is the reason for the further improvement of central disturbances under BiPAP autoSV Advanced treatment compared to conventional BiPAP autoSV? Based on the data presented by Javaheri et al., it can be speculated that the enhanced backup rate might be more relevant than the automatic EPAP, as the difference between conventional BiPAP autoSV and BiPAP autoSV advanced is more impressive with respect to breathing rate than pressure delivery. The clinical relevance of the greater variability of the applied pressure should also not be underestimated. It has previously been discussed that the automatic adaptation of treatment pressures may improve patients' adherence. However, neither automatic CPAP nor pressure relief have generally improved the adherence of the patients**.** Nevertheless, individual patients may profit from a better adaptation to their requirement in terms of subjective quality of treatment. Thus, these technical advances have broadened the spectrum of our therapeutical options and enable us to more precisely individualize treatment. Other important advantages of the BiPAP autoSV Advanced device have been mentioned in the paper by Javaheri et al. Lower applied pressures may help to avoid CSA emerging under positive pressure and may also reduce the burden on the heart.

From my point of view, an even more important advantage may arise in patients with more complicated breathing disturbances, such as those with combinations of upper airway obstruction or central apneas and hypoventilation. A reduction of the expiratory pressure might allow for better expiration in

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COPD and thus reduce dynamic hyperinflation, or might allow for higher pressure support in obesity hypoventilation and neuromuscular disorders. Although these groups have not been studied here, the findings highlight areas for future research and potential technical enhancement of the devices and algorithms.

Some limitations should be discussed. This short-term trial does not allow for final recommendations on the optimal therapeutical approach for patients with complicated breathing disturbances. It does, however, confirm previous findings about the efficacy of Automatic Servo-Ventilation (ASV) devices. All studies investigating this technology have proved a sufficient improvement of respiratory disturbances and superiority over CPAP. These consistent findings have not been achieved with any other treatment option in this patient group, including oxygen. What we do not know, is whether these results translate into a better long-term outcome with regards to overall survival, exercise performance, or quality of life.

The short duration of the trial by Javaheri et al. may be responsible for the variance in treatment response under the two ASV modes. Despite the overall efficacy, there were some individuals under conventional BiPAP autoSV ASV and one under BiPAP autoSV Advanced whose AHI was not reduced below 15/h. It has been shown that a minority of CPAP non-responders improved under ongoing CPAP treatment.[12] This might also be the case in those with insufficient ASV response. One aspect mentioned by the authors seems to be more relevant: although the BiPAP autoSV Advanced device allows for automatic titration of expiratory pressure and pressure support, precise settings of the pre-defined pressure range and close supervision of the patient during the initiation night remains the duty of the sleep specialist. The advantage of auto-adjusting devices, especially in patients with complicated breathing patterns, is not a cost-reduction by saving labor but a more precise adaptation of the pressures according to their sophisticated algorithms. Despite their advantages, these technical solutions remain prone to problems of patient or interface, such as leakage.

The paper by Javaheri et al. adds another piece to the mosaic of the optimal treatment of the growing group of patients with complicated breathing patterns. Nevertheless, the clinical efficacy raises important pathophysiological questions about the influence of pressure support on the heart and ventilation-perfusion mismatch, the relevance of different parameters (breathing effort vs. oxygen saturation), and the long-term influence on chemosensitivity. Clarity here may allow us to establish a broadly accepted treatment algorithm.

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