Editorial

Telemedicine for enhancing positive airway pressure compliance in obstructive sleep apnea: Are we on cloud nine yet?

Obstructive sleep apnea (OSA) is a common sleep disorder that is associated with significant morbidity and mortality. Positive airway pressure (PAP) therapy delivered via a mask interface is the first-line therapy for OSA. PAP therapy has been shown to improve daytime sleepiness, cognitive functions, quality of life and systemic blood pressure among patients with OSA.[1] It can also reduce the risk of road traffic accidents for these individuals.[2] However, major drawbacks of PAP device therapy include the need for daily device usage and low treatment compliance.

Most studies and professional bodies have defined compliance with PAP therapy as usage for at least 4 h on at least 70% of nights. This is generally calculated over 7 to 90 days of therapy. This threshold is somewhat arbitrary and has been adopted based on findings that the improvement of subjective sleepiness, as measured by the Epworth Sleepiness Scale (ESS), plateaus beyond 4 h of nightly usage.[3] Additionally, in a meta-analysis of randomized trials, the subgroup of patients with usage greater than 4 h per night had a 36% lower risk of major adverse cardiovascular events.[4] However, objective measures of sleepiness (assessed by the multiple sleep latency test) and functional outcomes in OSA may incrementally improve up to 6 h and 7.5 h of PAP usage, respectively.[3] Hence, most experts suggest that PAP therapy should be used throughout the night, and the 4 h usage definition is the bare minimum acceptable usage. Even with this definition, Weaver *et al*.[5] have noted that between 46 and 83% of patients are not compliant with PAP therapy.

The PAP compliance among OSA patients can be assessed subjectively by patient recall or objectively from the device downloads. However, patients tend to overestimate their PAP usage. For instance, Rauscher *et al*.[6] found that the self-reported mean nightly usage of PAP among 63 OSA patients was 6.1 h, whereas the mean usage according to device data for these patients was only 4.9 h. Hence, device downloads are invaluable in assessing PAP compliance. Additionally, they may provide information on the reasons for non-compliance, for example residual obstructive events or mask leaks. In older machines, this data had to be manually downloaded using secure digital (SD) cards. However, newer machines can transmit their data wirelessly to a cloud database which can be remotely accessed by the healthcare provider. This has awakened the possibility of using telehealth for providing sleep medicine services to patients. The COVID-19 pandemic further provided an impetus to the growth of telemedicine.

In this context, we were enthused to read the article by Haldar *et al*. in this issue of Lung India.[7] They have presented their experience of the usage of cloud-based technologies to observe the patterns of positive airway pressure (PAP) therapy usage among patients with obstructive sleep apnea (OSA) treated at a single centre in India. The data were collected in a cross-sectional manner from patients with a duration of PAP usage varying between 7 and 390 days. Despite being a retrospective analysis, this is commendable for being one of the first reports of telemonitoring in the context of OSA from India.

The authors reported that the overall compliance with PAP in their population was 66%.[1] Although this level of PAP compliance is equivalent to that found in Indian and international studies,[5,8,9] an important caveat applies. The authors did not report on the initial acceptance of PAP therapy. Rather, the study has only included patients who have purchased a PAP machine with cloud-based monitoring capability from a high-end manufacturer. On the contrary, previous Indian studies have found that between one-fourth and two-thirds of patients with OSA who were prescribed PAP do not purchase the machine or initiate therapy.[8-10] This is primarily due to financial constraints as PAP devices are not reimbursed by insurance in India. Further many Indian patients presumably purchase cheaper devices without cloud-based technology. In fact, in previous Indian reports, among those OSA patients who do purchase the PAP device, compliance may range between 70 and 80%.[8,9]

Interestingly, the present study reported that the proportion of compliant patients was higher after 60 days of therapy.[7] This is in contrast to existing literature which suggests that patients decide about long-term PAP usage within the first week of therapy.[10] Haldar *et al*. suggested that the use of telephonic and web-based interventions by their sleep clinic helped patients to accept the PAP device after initial hesitant usage. Although these are encouraging findings, the retrospective design, variable durations of follow-up of individual patients, and the lack of a control group in the present study limit our confidence in the same.[7] We need prospective controlled trials of telemedicine-based interventions for increasing PAP compliance in the Indian setting to conclusively support this hypothesis.

While there is no doubt that early in-person follow-up and troubleshooting in the first two weeks of treatment may improve PAP compliance in OSA,[12] international studies which have employed telemedicine have yielded conflicting findings.[13,14] Hwang *et al*.[15] have reported that the use of telemonitoring of PAP compliance combined with automated feedback messaging may improve compliance over 90 days of therapy. In contrast, Turino *et al*.[14] found no difference between standard management or telemonitoring in PAP compliance, and patients who received telemonitoring had a lower level of satisfaction.

The present study also explored the efficacy of treatment in compliant and non-compliant patients.[7] Three-fourths of compliant patients and 35% of non-compliant patients achieved a residual AHI of less than five events per hour. This is in agreement with the findings of Ye *et al*.[16] that a higher residual AHI in the first week of PAP usage may predict future non-compliance. The strategy adopted by Haldar *et al*. of cloud-based pressure adjustments to PAP devices in case of residual events is an attractive intervention that deserves further study. This may be useful for patients who are prescribed auto-PAP therapy, for whom an open pressure window of 4 to 20 cmH_2O without proper titration is not an ideal strategy.

Despite the limitations, the authors must be congratulated for addressing a relevant research question. Although PAP therapy is the first-line treatment for OSA, its benefit is limited by the lack of compliance in a sizable proportion of patients. Furthermore, the use of telemedicine and cloud-based technologies is an exciting addition to the armamentarium of the sleep physician. The present study emphasizes that further exploration into non-compliance to PAP therapy in India and its predictors is warranted. There is also a need for prospective studies of cloud-based interventions to improve PAP compliance in India. Such in-depth analyses would be invaluable to understanding and improving PAP compliance among Indian patients.

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