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Editorial Open Access

The Effect of Sleep Stage and Position on Postoperative Polysomnography

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Editorial

Polysomnography is the gold standard for the diagnosis of obstructive sleep apnea (OSA), evaluation of its severity, and assessment of treatment response. Sleep apnea syndrome has been defined as an apnea hypopnea index (AHI) greater than 5 with the presence of associated symptoms such as excessive daytime sleepiness. Because the correlation between AHI and morbidity and mortality is well established, it is frequently used as the primary parameter to describe surgical treatment outcomes. However, recent reports suggest that polysomnographic indices such as AHI may be discordant with quality of life measures [1-4].

One potential explanation for this discrepancy is that the overall AHI is frequently reported as the primary or sole postoperative outcome. Without taking into account night to night variability in sleep position and percentages of various sleep stages, including rapid eye movement (REM) sleep, this assessment may lead to an inaccurate reflection of the true effect of surgery.

The “first night effect”, where patients typically sleep less soundly during their first night in a sleep laboratory may contribute to an underestimation of disease severity by reducing the percentage of REM sleep during initial diagnostic testing. It is also well established that OSA itself can alter sleep architecture by significantly decreasing rapid eye movement (REM) sleep. A preoperative AHI may appear spuriously low in a patient with REM predominant OSA if REM duration is significantly reduced [5-10].

Sleep position can also have a significant effect on the severity of disease in a subset of patients with OSA. AHI in the supine sleep position is generally higher than that in lateral or prone sleep due to effect of gravity on the oropharyngeal and hypopharyngeal soft tissues. Oskenberg coined the term “positional sleep apnea” for patients who have a supine AHI at least twice that of their non-supine AHI. Hence, position-dependent patients may have highly variable overall AHIs depending on the proportion of time spent in the supine position on any given night. More than half of patients with OSA have positional obstructive sleep apnea. Patients who have mild to moderate OSA, are non-obese and younger are more likely to have positional OSA. This description entails a large proportion of CPAP intolerant considered to be good surgical candidates [11-14].

Lee et al. published a report investigating the effect of sleep position on surgical outcomes in obstructive sleep apnea. In this retrospective review of 69 consecutive patients who underwent uvulopalatopharyngoplasty, 85% of those who failed to improve had positional sleep apnea. When a position-corrected AHI was calculated in order to eliminate the effect of sleep position, >20% of patients were reclassified to a different severity category (mild, moderate or severe). Although improvement was noted in the postoperative supine AHI compared to the preoperative supine AHI, the overall AHI increased in half of the positional sleep apnea patients due to an increase in proportion of time spent in the supine position.

A sleep stage/position corrected AHI can be utilized to eliminate the confounding effects of varying sleep position and stage during preoperative and postoperative polysomnography. This allows for a more accurate assessment of the effect of surgery [14-18].

Corrected postoperative AHI=([Preoperative %TST in supine REM × postoperative supine REM AHI]+[preoperative %TST in supine non-REM × postoperative supine non-REM AHI]+[preoperative %TST in non-supine REM × postoperative non-supine REM AHI]+[preoperative %TST in non-supine non-REM × postoperative non-supine non-REM AHI])/100. Alternatively, one may individually compare the preoperative *vs.* postoperative supine REM AHI, supine non-REM AHI, non-supine REM AHI and non-supine non-REM AHI.

The following case illustrates the importance of detailed postoperative polysomnography reporting: A 55-year old woman with worsening of excessive daytime sleepiness and morning headaches underwent diagnostic polysomnography (PSG) which revealed an AHI of 11 (markedly worse in REM sleep, AHI=75), an oxygen saturation nadir of 81% and REM sleep limited to 2% of total sleep time (TST). Due to persistent CPAP intolerance, the patient decided to pursue surgical treatment of her sleep apnea and subsequently underwent uvulopalatopharyngoplasty with tonsillectomy. The postoperative PSG demonstrated an apparent worsening of her OSA with an overall AHI of 17. Despite this, the patient reported subjective improvement in her symptoms and sleep quality. Physical examination revealed normal postoperative healing. A detailed review of her postoperative PSG revealed a significant increase in %REM sleep to 21% of TST. The patient slept exclusively in the supine position during both PSGs. A modest postoperative improvement was noted compared to the preoperative REM AHI (51 *vs.* 75) and non-REM AHI (8 *vs.* 10) when assessed separately.

An apparent worsening of OSA severity following surgery should be interpreted carefully by assessing not only the overall AHI but also the sleep architecture and sleep position. To account for night to night variability in both sleep stage and position, a corrected AHI can be calculated to allow for a more accurate assessment of the effect of surgery on the underlying OSA. Although a postoperative increase of supine sleep time and percentage of REM sleep may account for an increase in postoperative AHI, it is unclear if this should be interpreted as the cause of apparent surgical failure or the consequence of surgical treatment itself. Further research is needed to confirm the validity and utility of a sleep stage/position-corrected AHI [19-22].

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