Positional and non-positional OSAS: differences in VOTE classification

Original Article

Authors

João Barbosa
Hospital Beatriz Ângelo, Loures, Portugal

Bárbara Roque
Hospital Beatriz Ângelo, Loures, Portugal

João Fernandes
Hospital Beatriz Ângelo, Loures, Portugal

Constança Oom
Hospital Beatriz Ângelo, Loures, Portugal

Inês Delgado
Hospital Beatriz Ângelo, Loures, Portugal

Daniela Serras
Hospital Beatriz Ângelo, Loures, Portugal

Alberto Santos
Hospital Beatriz Ângelo, Loures, Portugal

Carlos Macor
Hospital Beatriz Ângelo, Loures, Portugal

Correspondence:
João Barbosa
jms.barbosa97@gmail.com

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Abstract

Objective: To assess changes in the upper airway in patients with Positional Obstructive Sleep Apnea (SAOS-P) and Non-Positional Obstructive Sleep Apnea (SAOS-NP).
Study Design: Retrospective Study.
Materials and Methods: Evaluation of DISE in patients followed in the Snoring Consultation, undergoing the procedure between 2022 and 2024, using the VOTE classification. SAOS-P was defined as a ≥ 50% reduction in the apnea-hypopnea index (IAH) when shifting from the dorsal to the lateral position.
Results: 48 patients were included, 37,5% of who had SAOS-P. Patients with SAOS-P were tendentionally younger (p=0,188), had a lower IAH (p=0,028), and spent less time in the dorsal position (p<0,001). Improvement in lateral oropharyngeal wall collapse was more pronounced in SAOS-P patients when shifting to the lateral position (p=0,189).
Conclusions: SAOS-P patients are younger with milder SAOS. The lateral oropharyngeal wall play an important role in positional dependency.

Keywords: obstructive sleep apnea syndrome; positional; DISE; VOTE.

Introduction

Obstructive Sleep Apnea (OSA) is characterized by recurrent episodes of complete (apnea) or partial (hypopnea) collapse of the upper airway during sleep, leading to oxygen desaturation and sleep fragmentation.[1]

Upper airway collapsibility is accentuated in the supine position due to gravitational effects and changes in the airway conformation.[2] In this position, some patients experience a higher frequency of apneas and hypopneas and this condition is classified in the subgroup of Positional Obstructive Sleep Apnea (POSA). Clinically, POSA is defined as a ≥ 50% reduction in the apnea-hypopnea index (AHI) when shifting from the supine to the lateral position.[3]

The prevalence of POSA in patients with OSA ranges between 53–70%. The affected individuals are typically younger, have a lower AHI, smaller neck circumference, lower body mass index (BMI), reduced prevalence of hypertension, and lower risk scores on the Berlin questionnaire and the Snoring, Tiredness, Observed apnea, high blood Pressure, Body mass index, Age, Neck circumference, and Gender (STOP-BANG) evaluation.[4–7]

Current treatment options for OSA include continuous positive airway pressure (CPAP), mandibular advancement devices , and surgical interventions. CPAP remains the gold standard; however, surgical treatment may be considered as the first-line therapy in patients with poor adherence to ventilatory therapy.[8]

Studies have shown that treatment outcomes may differ between patients with POSA and Non-positional Obstructive Sleep Apnea (NPOSA).[9,10]

Despite the high prevalence of POSA, the anatomical differences between patients with POSA and NPOSA are not yet fully understood. Drug-induced sleep endoscopy (DISE) is a diagnostic tool that enables the assessment of the upper airway in patients with OSA under conditions that mimic natural sleep, allowing classification of airway collapse by site, pattern, and degree.[11]

Accordingly, this study aimed to compare DISE findings between patients with and without POSA, using the velopharynx, oropharynx, tongue base, and epiglottis (VOTE) classification. We further sought to evaluate how these differences may influence treatment selection, in addition to identifying potential predictive factors that can distinguish POSA from NPOSA.

Materials and methods

Study design and population

This retrospective study evaluated patients who were followed up in specialized snoring clinics and underwent DISE between 2022 and 2024. The inclusion criteria were: (1) age ≥ 18 years, (2) AHI ≥ 5, and (3) DISE with VOTE classification recorded in both the supine and lateral positions. Patients were classified as having POSA when they had an AHI ≥ 5 and the AHI in the supine position was at least twice as high as that in the lateral position, according to the criteria established by Cartwright.[3] Demographic and sleep study parameters were analyzed for all patients, including age, sex, BMI, percentage of sleep time spent snoring, percentage of sleep time in the supine position, and percentage of total sleep time with oxygen saturation < 90% (T90).

Sleep study

The diagnosis of OSA was confirmed by overnight polysomnography.

DISE and VOTE classification

DISE was performed in the operating room under standard monitoring with electrocardiography and pulse oximetry in a dark and quiet environment. Sedation depth was monitored using the bispectral index (BIS), and airway assessment was conducted when BIS values were between 50 and 70. Sleep induction was achieved with target-controlled infusion of propofol. DISE findings were assessed using the VOTE classification, which characterizes both the degree and pattern of upper airway collapse at each airway level. Obstruction severity was graded as 0 (no obstruction, < 50%), 1 (partial obstruction, 50–75%), or 2 (complete obstruction, > 75%). Collapse patterns were categorized into three types: anteroposterior, lateral, or concentric, although not all patterns apply to every anatomical level.

Statistical analysis

Statistical analysis was conducted using the R software (R Foundation for Statistical Computing). Parametric tests were used to compare clinical variables between groups. Specifically, Student's t-test was used to evaluate differences in the VOTE classification, age, BMI, AHI, percentage of sleep time spent snoring, percentage of sleep time in the supine position, and T90 between patients

with POSA and NPOSA. A p-value ≤ 0.05 was considered statistically significant.

Results

In total, 48 patients met the inclusion criteria and were included the study. The mean patient age was 51.7 years (± 11.2), and 77.1% of the patients were men. The mean BMI and AHI were 28.6 (± 3.7) and 21.9 (± 17.7), respectively. Among the 48 patients diagnosed with OSA, 18 (37.5%) were classified as having POSA (Figure 1). The mean age was 48.9 years (± 8.86) for patients with POSA and 53.4 years (± 12.28) for patients with NPOSA. Although there was a slight tendency for patients with POSA to be younger, this trend was not statistically significant (p = 0.188). The mean AHI in patients with POSA and NPOSA was 15.11 (± 6.52) and 26.02 (± 21.04), respectively. A statistically significant difference was observed between the two groups, with patients with NPOSA having a higher AHI than patients with POSA (p = 0.028). Regarding BMI, patients with POSA and NPOSA had a mean BMI of 28.58 kg/m^2 (± 4.36) and 28.55 kg/m^2 (± 3.29), respectively. On evaluating the potential association between BMI and OSA, no statistically significant difference was observed between the two groups (p = 0.980). The mean T90 was 2.34% (± 4.17) in patients with POSA and 6.58% (± 14.76) in patients with NPOSA, with no statistically significant difference between the two groups (p = 0.149). Regarding the percentage of sleep time spent snoring, the mean duration was 27.01% (± 26.73) and 21.23% (± 17.61) in patients with POSA and NPOSA, respectively. Although patients with POSA had a longer snoring time, this difference is not statistically significant (p = 0.421). In terms of the time spent in the supine position, individuals with POSA and NPOSA spent 21.66% (±6.58) and 38.81% (±19) of the time in the supine position, respectively. These results demonstrate that patients with POSA spent a significantly smaller proportion of the sleep time in the supine position compared to those with NPOSA (p < 0.001). These results are summarized in Table 1.

The collapse of the upper airway in both the supine and lateral positions was assessed using the VOTE classification (Tables 2 and

Figure 1
Prevalence of Positional Obstructive Sleep Apnea (POSA) in patients with Obstructive Sleep Apnea (OSA)

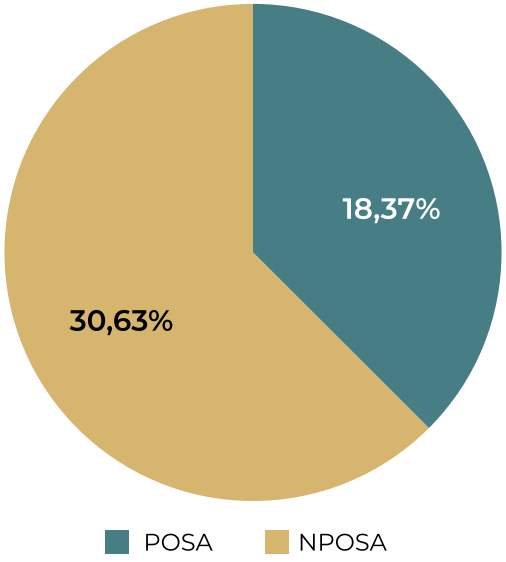


Table 1
Demographic and sleep study parameters in patients with POSA and NPOSA

	POSA	NPOSA	p-value
Age (years)	48,9 ± 8,86	53,4 ± 12,28	0,188
AHI	15,11 ± 6,52	26,02 ± 21,04	0,028
BMI (kg/m2)	28,58 ± 4,36	28,55 ± 3,29	0,980
T90 (%)	2,34 ± 4,17	6,58 ± 14,76	0,149
Time snoring (%)	27,01 ± 26,73	21,23 ± 17,61	0,421
Time in supine position (%)	21,66 ± 6,58	38,81 ± 19	<0,001

POSA, Positional Obstructive Sleep Apnea; NPOSA, Non-positional Obstructive Sleep Apnea; AHI, apnea-hypopnea index; BMI, body mass index; T90, total sleep time with oxygen saturation < 90%.

Table 2
Mean collapse scores at different airway levels according to the VOTE classification in patients with POSA and NPOSA in the supine position

	POSA	NPOSA	p-value
Velopharynx	1,61	1,63	0,914
Oropharynx	1,06	0,83	0,383
Tongue base	0,67	0,77	0,689
Epiglottis	0,44	0,47	0,917

Table 3
Mean collapse scores at different airway levels according to the VOTE classification in patients with POSA and NPOSA in the lateral position

	POSA	NPOSA	p-value
Velopharynx	1,11	1,13	0,930
Oropharynx	0,89	0,9	0,963
Tongue base	0,28	0,27	0,935
Epiglottis	0,17	0,1	0,571

Table 4
Changes in the VOTE scores when shifting from the supine to the lateral position in patients with POSA and NPOSA

	POSA	NPOSA	p-value
Velopharynx	0,5	0,5	1
Oropharynx	0,17	-0,07	0,189
Tongue base	0,39	0,5	0,561
Epiglottis	0,27	0,37	0,589

3). No statistically significant differences in the collapse were observed at various airway levels between the two groups, either in the supine or lateral positions ($p > 0.05$).

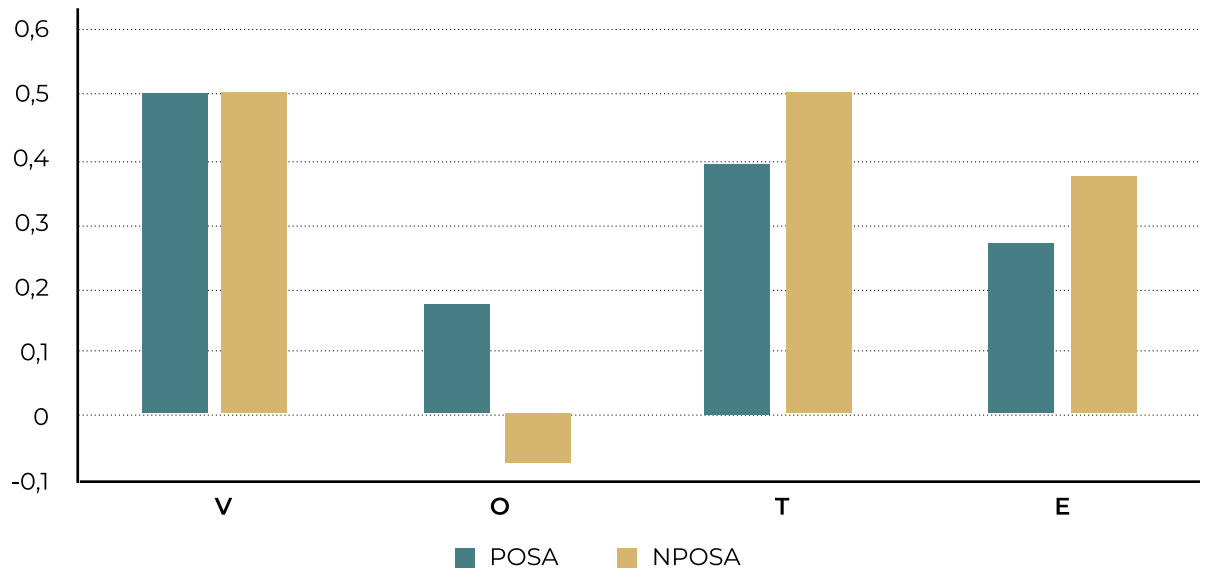
The comparison between patients with POSA and NPOSA showed no statistically significant differences in the degree of collapse improvement at any airway level when shifting from the supine to the lateral position ($p > 0.05$) (Table 4 and Figure 2). However, at the oropharyngeal level, a higher difference in the degree of collapse was observed, which although not statistically significant, indicates a higher rate of improvement in patients with POSA ($p = 0.189$).

Discussion

In our study, the prevalence of POSA in individuals with OSA was 37.5%, which is lower than the 53–70% reported in previous studies.[4,5] This discrepancy may be attributable to differences in the study population, among other factors. Our sample only included patients who underwent DISE, and who had either not adapted to CPAP therapy or were considered suitable surgical candidates, thereby excluding a substantial proportion of individuals with OSA, which may have influenced the results of this study.

Regarding BMI and age, we found no

Figure 2
Comparison of VOTE score changes when shifting from the supine to the lateral position in patients with POSA and NPOSA



statistically significant correlations with POSA, although there was a tendency for POSA to occur in younger individuals. This is consistent with the findings in the literature, where lower BMI and younger age were often associated with POSA in patients with OSA.[4-6, 12] One possible explanation for the influence of age on the pathophysiology of POSA is that structural changes in the pharynx, such as increased fat deposition and elongation of the soft palate, may contribute to the occurrence of apnea in the lateral sleeping position.[15] Another consideration is that older individuals may exhibit fewer postural changes during sleep.[14] Consistent with the results of previous studies, our findings revealed that patients with POSA tend to have a lower AHI compared to patients with NPOSA.[4-6,15] Although not yet confirmed, POSA has been hypothesized to represent an earlier stage of OSA that may progress to NPOSA with increasing age and body weight.[5] Only one previous study has reported differences in T90 between patients with POSA and NPOSA, showing higher T90 values in NPOSA.[4] In our study, although patients with POSA had lower T90 values than those with NPOSA, this difference did not reach statistical significance.

Four studies that evaluated the effect of body position on the snoring duration in patients with OSA found no significant differences between the supine and lateral positions. Our results are similar to these findings, confirming that the snoring duration did not significantly differ between patients with POSA and those with NPOSA.[16,17]

In terms of the time spent in the supine position, we found that patients with POSA spent significantly less time in this position than patients with NPOSA. This finding contrasts with those of previous studies that suggested that a longer sleep time in the supine position increases the likelihood of POSA.[4,12] Our results may reflect a potential protective mechanism in which individuals with POSA naturally spend less time in the supine position to reduce the frequency of apnea and hypopnea.

In our study, no statistically significant differences were observed in the degree of upper airway collapse between patients with POSA and those with NPOSA. However, on comparing the two groups, the greatest improvement in collapse when shifting from the supine to the lateral position was noted at the level of the lateral walls of the oropharynx. Although not statistically significant, this finding aligns with those of prior studies indicating that POSA is largely determined by the collapsibility of the lateral wall of the oropharynx, a characteristic more frequently observed in NPOSA.[15, 18, 19] Gravity affects the collapse of the velopharynx, tongue base, and epiglottis, leading to reduced collapse when patients move from the supine to the lateral position. In contrast, the lateral wall of the oropharynx is less influenced by gravity, resulting in minimal positional change in collapse. Therefore, patients with NPOSA, who have a higher prevalence of lateral oropharyngeal wall collapse, experience a smaller reduction in the AHI when shifting positions.[15] Additionally, Schwartz et al. correlated lateral oropharyngeal wall collapse with the OSA severity, providing further explanation for the higher AHI observed in patients with NPOSA.[20]

According to the literature, the observed differences in airway collapse between POSA and NPOSA, particularly at the level of the lateral oropharyngeal wall, have potential therapeutic implications. In NPOSA, where lateral wall collapse persists even in the lateral position, CPAP therapy is more likely to be effective and adherence is generally higher.[4] This is because CPAP predominantly improves lateral oropharyngeal wall collapse rather than anteroposterior collapse, enhancing patient adherence in NPOSA.[21,22] Moreover, higher BMI has been associated with greater lateral wall collapse, suggesting that weight loss may reduce the collapse severity and lower the AHI, particularly in the lateral position.[23]

Patients with POSA tend to achieve better outcomes with surgical treatment such as repositioning pharyngoplasty compared to

those with NPOSA,[10] whereas severe lateral oropharyngeal wall collapse is more common in patients with NPOSA and associated with higher surgical failure rates.[24] Positional therapy also appears to be particularly beneficial for patients with POSA. Srijithesh et al. compared positional therapy with CPAP in patients with POSA and found no significant differences in the Epworth Sleepiness Scale (ESS) scores between the two groups, although CPAP resulted in a greater reduction in the AHI. Compared with the no-treatment control group, positional therapy significantly reduced both the AHI and ESS scores.[25]

Overall, the literature suggests that weight loss and CPAP are more effective in patients with NPOSA, whereas surgical interventions and positional therapy are more beneficial in those with POSA.[10,21,22,24,25]

Our study has some limitations. The small sample size (48 patients) may have reduced the statistical power and increased the risk of bias. Furthermore, sleep studies were conducted over a single night, which may not fully capture each patient's typical sleep patterns. The VOTE classification involves some subjective assessment, potentially introducing interpretive bias. Finally, performing DISE under propofol sedation may not fully replicate natural sleep conditions, representing another limitation.

Conclusion

Despite these limitations, our findings contribute to a better understanding of the clinical characteristics of patients with POSA, who tend to be younger and have milder OSA compared with patients with NPOSA. The collapse of the lateral oropharyngeal wall plays a key role in positional dependence, emphasizing the need for individualized therapeutic approaches. Positional therapy and surgical interventions are most effective in patients with POSA, whereas patients with NPOSA benefit more from CPAP therapy and weight reduction strategies. Therefore, distinguishing between POSA and NPOSA is critical for optimizing treatment and implementing personalized management strategies, although further research is needed to elucidate the mechanisms underlying positional dependence in OSA.

Conflict of Interests

The authors declare that they have no conflict of interest regarding this article.

Data Confidentiality

The authors declare that they followed the protocols of their work in publishing patient data.

Human and animal protection

The authors declare that the procedures followed are in accordance with the regulations established by the directors of the Commission for Clinical Research and Ethics and in accordance with the Declaration of Helsinki of the World Medical Association.

Privacy policy, informed consent and Ethics committee authorization

The authors declare that they have obtained signed consent from the participants and that they have local ethical approval to carry out this work.

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Scientific data availability

There are no publicly available datasets related to this work.

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