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Association of Body Position With Severity of Apneic Events in Patients With Severe Nonpositional Obstructive Sleep Apnea*

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Study objective: **To compare the severity of sleep apneic events occurring in the supine posture vs the severity of sleep apneic events occurring in the lateral posture in patients with severe obstructive sleep apnea (OSA).**

Design: **A retrospective analysis of apneic event variables in a group of 30 OSA patients who underwent a complete polysomnographic evaluation in our sleep disorders unit.**

Patients: **Thirty patients with severe OSA (respiratory disturbance index [RDI] = 70.1 ± 18.2) who were nonpositional patients (NPP), *ie*, in whom the ratio of the supine RDI to the lateral RDI is < 2 (supine RDI = 85.7 ± 11.7, lateral RDI = 64.8 ± 17.3), and who had ≥ 30 apneic events in the lateral position and 30 apneic events in the supine position during sleep stage 2 were included in the study.**

Measurements: **For the 30 apneic events in each body position, the following variables were evaluated: apnea duration (ApDur), minimum desaturation (MinDes), Δ desaturation (Δ-Des), duration of arousal (DurArous), maximum snoring loudness (MaxSL), and Δ heart rate (Δ-HR). In addition, three other variables assessed as a ratio of ApDur (Rate-D = Δ-Des/ApDur, R-HR = Δ-HR/ApDur, and R-Arous = DurArous/ApDur) were also calculated.**

Results: **For all variables evaluated, apneic events occurring in the supine posture were significantly more severe than those apneic events occurring in the lateral posture during sleep stage 2. ApDur of both body postures correlated significantly with DurArous, Δ-HR, and MaxSL, but not with Δ-Des and MinDes. ApDur correlated linearly with DurArous for both postures. The slopes of the two regression lines were similar (p = 0.578) but the regression line intercept for the supine apneas was significantly higher than that of lateral apneas (p < 0.0001). In addition, the average number of supine apneic events that did not end with an arousal was smaller than the average number of lateral apneic events not ending with an arousal (4.4 ± 6.0 vs 10.5 ± 6.7, respectively; p < 0.0001). Also, only 4 of 900 (0.44%) apneic events analyzed in the lateral posture ended with an awakening (> 15 s), whereas in the supine posture, there were 37 (4.1%) such events (p < 0.001).**

Conclusions: **These results show that even in patients with severe OSA who have a high number of apneic events in the supine and lateral posture, the apneic events occurring in the supine position are more severe than those occurring while sleeping in the lateral position. Thus, it is not only the number of apneic events that worsen in the supine sleep position but, probably no less important, the nature of the apneic events themselves.**

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Key words: apnea severity; body posture; obstructive sleep apnea; polysomnography; sleep position; sleep-related breathing disorders

Abbreviations: ApDur = apnea duration; Δ-Des = Δ desaturation; DurArous = duration of arousal; Δ-HR = Δ heart rate; MaxSL = maximum snoring loudness; MinDes = minimum desaturation; nCPAP = nasal continuous positive airway pressure; NPP = nonpositional patients; NREM = non–rapid eye movement sleep; OSA = obstructive sleep apnea; PP = positional patients; PSG = polysomnography; RDI = respiratory disturbance index; REM = rapid eye movement sleep; SaO_2 = arterial oxyhemoglobin saturation; UA = upper airway

Obstructive sleep apnea (OSA) patients can be divided into positional patients (PP), *ie*, those patients who have a supine respiratory disturbance index (RDI) that is at least two times higher than their lateral RDI, and nonpositional patients (NPP), *ie*, those patients in whom the supine RDI is less

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than two times higher than the lateral RDI. We previously[1] showed that 55.9% of 574 consecutive OSA patients diagnosed in our sleep disorders unit were found to be PP. These patients had fewer and less severe breathing abnormalities than the NPP group. Consequently, their nocturnal sleep quality was better preserved and, according to multiple sleep latency test data, they were less sleepy during daytime hours. These results showed that because PP have at least the lateral postures (right and left sides) in which breathing abnormalities are few and sometimes totally absent, they enjoy a better sleep quality and function better during daytime hours. Positional therapy, the avoidance of the supine posture during sleep, is therefore a form of therapy appropriate mainly for PP, and it has been shown that this form of therapy produces a significant improvement in the severity indexes (for review, see Oksenberg and Silverberg[2]).

The detrimental effect of the supine posture on sleep breathing disorders has been recognized since the earliest studies on this topic.[3] Most of the publications relating to the effect of body posture on sleep apnea have shown that sleeping in the supine posture produces an augmentation of the severity of sleep apnea.[4–6] In most of these studies, the severity of OSA was usually defined by the apnea index, the apnea + hypopnea index, or the RDI. All these indexes refer only to the number of breathing abnormalities per sleep hour. This is certainly an important expression of severity, but it is not the only one.

Another way of assessing severity would be to determine whether the apnea or hypopnea events themselves are more severe when they occur in the supine posture compared with the lateral one. However, the effect of body position on the severity of these breathing events has not been sufficiently investigated. Because patients with mild-moderate OSA have breathing abnormalities mainly in the supine position and only a few such abnormalities in the lateral position,[1] they are not an adequate group for this investigation. However, patients with severe OSA who are mainly NPP, by having a large number of breathing abnormalities in both the supine and the lateral position, are the optimal patients in whom to investigate this issue.

The aim of this study is to compare the severity of sleep apneic events occurring in the supine position with the severity of apneic events occurring in the lateral position in NPP with severe OSA.

Materials and Methods

Patients

The polysomnograms of NPP with severe OSA who underwent a complete polysomnography (PSG) evaluation in our sleep disorders unit were reviewed. To find 30 polysomnograms without major artifacts and with ≥ 30 apnea episodes in the lateral position and 30 apnea episodes in the supine position during sleep stage 2, we had to review PSG records of 92 consecutive OSA NPP diagnosed in our sleep disorders unit. The 30 apneic events in each position included samples of 10 consecutive apneic events in the initial, middle, and final third of the total sleep period. Polysomnograms of patients with congestive heart failure or COPD were excluded from the study.

The 30 OSA NPP (26 men and 4 women) had an average age of 57.6 ± 11.7 years, the average body mass index was 32.3 ± 4.3 kg/m^2, and the average RDI was 70.1 ± 18.2 events/h of sleep. The mean supine RDI was 85.7 ± 11.7 events/h of sleep, and the mean lateral RDI was 64.8 ± 17.3 events/h of sleep.

PSG Evaluations

The patients arrived at the sleep unit around 8 PM, and the PSG recordings usually began between 10 PM and midnight.

The PSG recordings were performed using Nihon Koden polygraphs (models 4321 and 4414; Nihon Koden; Tokyo, Japan), and included the following variables: electro-oculogram (2 to 4 channels); EEG (4 to 6 channels); electromyogram of submental muscles (1 to 2 channels); ECG (1 channel); electromyogram of the anterior tibialis muscle of both legs (2 channels); and airflow (with a nasal or oral thermistor). Chest and abdominal efforts (2 channels) were recorded using inductive plethysmography (Respitrace; Ambulatory Monitoring Inc; Ardsley, NY; or Resp-Ez breathing belts; SLP; Tel Aviv, Israel); arterial oxyhemoglobin saturation (SaO_2; 1 channel), by pulse oximetry (Ohmeda 37000e; Ohmeda; Boulder, CO) with a finger probe; and snoring sounds (1 channel), by a microphone located above the patient's head at a distance of 1 m and connected to a sound level meter (model 2700; Quest Electronics; Oconomowoc, WI). The output from the sound level meter was also recorded in parallel on a calibrated (40 to 80 dB) chart recorder at a paper speed of 10 cm/h. The recordings were conducted at a paper speed of 10 mm/s, and sleep stages were scored according to the standard criteria of Rechtschaffen and Kales.[7] The PSG technician, who monitored the patient's behavior through a closed-circuit 21-inch TV monitor, marked the changes in body position in two places simultaneously, on the polygraph and on the chart recorder that registered the output of the pulse oximeter data. The PSG technician was responsible for the monitoring of one or two sleeping patients. The two TV monitors were placed side by side to allow easy visualization of all patients' body movements. Because our unit is especially interested in the effect of body position on sleep-related breathing disturbances, our PSG technicians are encouraged to pay special attention to this issue. OSA was defined as an episode of a complete breathing cessation of ≥ 10 s with continuing inspiratory effort. Arousals were scored according to accepted definitions.[8]

Evaluation of Apnea Severity

Six variables related to each apneic event were evaluated in the polysomnograms of the 30 OSA NPP. For each patient, 30 apneic events in the supine posture and 30 apneic events in the lateral posture occurring in sleep stage 2 throughout the night were visually analyzed by one of us (I.K.) for the following variables: apnea duration (ApDur), minimum desaturation (MinDes), Δ desaturation (Δ-Des, defined as the difference between minimum and maximum SaO_2), the duration of arousals (DurArous), maximum snoring loudness (MaxSL), and Δ heart rate (Δ-HR, defined as the difference between the heart rate 3 s before and 3 s after the end of the apneic event). In addition, three other variables, calculated as a ratio of ApDur (Rate-D = Δ-Des/ApDur, R-HR = Δ-HR/ApDur, and R-Arous = DurArous/ApDur), were also assessed.

The selection procedure of the apneic events was not random, but they were selected in a consecutive manner throughout the polysomnogram. For each third of the record, we first identified a continuous period of sleep stage 2 with apnea episodes. Then, the body posture was identified, and a cluster of 10 consecutive apnea episodes (without artifacts) was selected from the beginning of that sleep stage 2 period. Then, a period of sleep stage 2 in the other posture was identified, and 10 consecutive apnea episodes were selected from the beginning of that period. The same selection procedure was used for the second and last third of the PSG record.

Statistical Analysis

For all statistical analyses performed in this study, each subject contributed one data point (the mean of 30 measurements) for each apnea variable in both sleep postures. The comparison of all measures of apnea severity between the sleep postures was performed using a two-tailed paired Student's *t* test. For the correlation between apnea duration and the other apnea variables, the Pearson correlation coefficient was calculated. A linear regression analysis by the least-squares technique was performed to determine the relationship between ApDur and DurArous for each body posture. The F test for parallelism was used to compare the slopes statistically, and the F test for common intercept was used to compare the intercepts statistically.[9] Except for the linear regression comparison, data analysis was performed using the Sigma Stat statistical package (Jandel Scientific; San Rafael, CA) and SAS software package (Version 6.12; SAS Institute; Cary, NC). The values are expressed as means ± SD. A p value < 0.05 was taken as significant.

Results

Table 1 summarizes the comparison of severity variables for apneic events occurring in the supine posture vs apneic events occurring in the lateral posture. For each of the variables evaluated (unadjusted and adjusted for ApDur), apneic events occurring in the supine posture were found to be significantly more severe than apneic events occurring in the lateral posture during sleep stage 2.

Table 2 showed the Pearson correlation coefficients between ApDur and the other measures of apnea severity. ApDur of both body postures correlated significantly with DurArous, Δ-HR, and MaxSL but not with Δ-Des and MinDes. As can be seen, a strong correlation was found between ApDur and DurArous.

In addition, a significant linear regression was found between ApDur and DurArous for both the supine apneas ($F_{1,28} = 23.03$; $p < 0.0001$) and lateral apneas ($F_{1,28} = 13.8$; $p < 0.0009$). The comparison of these two linear regression lines revealed no significant differences for the slopes (supine slope = 0.178 ± 0.04 vs lateral slope = 0.145 ± 0.04; $F_{1,56} = 0.313$; p = 0.578). However, the intercept values for these two linear regression lines were statistically different (supine = 3.71 ± 1.02 vs lateral = 1.64 ± 0.90; $F_{1,57} = 70.98$; $p < 0.0001$; Fig 1).

We also found that, on average, only 4.4 ± 6.0 apneic episodes occurring in the supine posture did not end with an arousal in comparison with 10.5 ± 6.7 apneic episodes in the lateral posture ($p < 0.0001$). Thus, of the 30 apneic events occurring in the supine posture, on average, 25.6 (85.3%) ended with an arousal, whereas for the lateral posture, 19.5 (65.0%) ended with an arousal ($p < 0.0001$). Also, in the lateral posture only 4 apneic episodes (of 900 [0.44%]) ended with an awakening (arousal > 15 s) compared with 37 (4.1%) of such events in the supine posture.

Discussion

The results of this study demonstrate that in patients with severe OSA, who have a large number of apneic events in both the supine and the lateral posture, the apneic events occurring in the supine posture are more severe than the apneic events occurring in the lateral posture. The difference in the degree of severity between apneic events in both postures was consistent for all apnea variables analyzed. These data of 30 NPP with severe OSA relate to apneic events occurring during sleep stage 2 across the night and are the outcome of the analysis of 30 apneic events in each posture per patient.

Few data on the effect of supine posture on the

Table 1—*Apnea Severity Measures in Supine and Lateral Sleep*

	Unadjusted						Adjusted*		
Position	ApDur	MinDes, %	Δ-Des, %	DurArou	MaxSL, dB	Δ-HR, beats/min	Rate-D	R-HR	R-Arous
Supine	26.6 ± 7.3	82.0 ± 6.9	12.6 ± 5.2	8.2 ± 2.0	64.1 ± 9.7	9.1 ± 3.9	0.49 ± 0.2	0.35 ± 0.14	0.32 ± 0.08
Lateral	22.8 ± 4.9	86.2 ± 5.5	8.3 ± 3.9	4.9 ± 1.2	60.9 ± 7.1	6.8 ± 3.4	0.37 ± 0.2	0.30 ± 0.14	0.22 ± 0.05
t†	5.94	6.48	6.84	9.13	2.52	7.62	4.64	3.63	6.51
p	0.0001	0.0001	0.0001	0.0001	0.0173	0.0001	0.001	0.001	0.0001

*Adjusted for apnea duration (calculated as a ratio of ApDur). The values are means ± SD.
†The degree of freedom for all comparisons was 29.

Table 2—*Pearson Correlation Coefficients Between Supine Apnea Duration (S-ApDur), Lateral Apnea Duration (L-ApDur), and Total Apnea Duration (T-ApDur) and Other Apnea Variables*

Variable	S-ApDur		L-ApDur		T-ApDur	
	r	p	r	p	r	p
MinDes	−0.139	0.461	−0.162	0.392	−0.140	0.46
Δ-Des	0.254	0.175	0.229	0.222	0.241	0.20
MaxSL	0.516	0.003	0.380	0.038	0.483	0.007
Δ-HR	0.368	0.045	0.393	0.031	0.396	0.03
DurArous	0.534	0.002	0.574	0.0009	0.690	0.0001

severity of sleep-related breathing events have been published. As far back as 1978, Harper and Sauerland,[10] while studying the role of the tongue in sleep apnea, described a 52-year-old obese OSA patient in whom the supine posture produced longer and more severe apneas. Others[11,12] have reported similar cases. However, George et al,[13] who analyzed 11 polysomnograms from seven very obese OSA patients, found that apnea duration was longer in rapid eye movement (REM) sleep than in non-REM (NREM) sleep regardless of body position.

What could be the mechanism for the increased apnea severity in the supine position compared with those apneic events occurring in the lateral position?

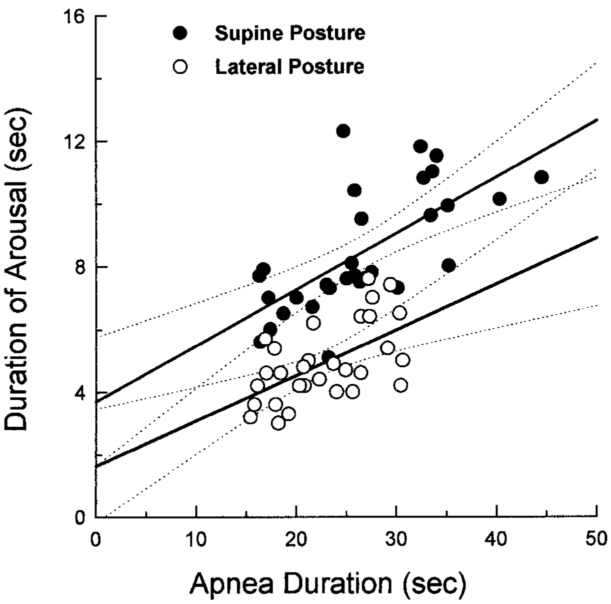

FIGURE 1. The relationship between ApDur and DurArous for OSA events occurring in the supine and lateral position of 30 NPP with severe OSA. Each point represents the average of 30 measurements for each patient in each body posture. The regression lines (solid lines) and the 95% confidence intervals (dotted lines) were fitted by the least-squares technique (supine posture: $r = 0.67$, $F_{1,28} = 23.03$, $p < 0.0001$; lateral posture: $r = 0.58$, $F_{1,28} = 13.8$, $p < 0.0009$). The slopes (supine $= 0.18 \pm 0.04$; lateral $= 0.15 \pm 0.04$) were not significantly different ($F_{1,56} = 0.313$; $p = 0.578$), but the intercept for supine apneas (3.71 ± 1.02) was significantly higher than that of lateral apneas (1.64 ± 0.90; $F_{1,56} = 70.98$; $p < 0.0001$).

The physiologic mechanism responsible for this effect is most probably related to the effect of gravity on the upper airway (UA). It is known that in the supine posture, the gravitational forces increase the tendency of the tongue and soft palate to fall back into the throat, causing a smaller caliber of the UA. Thus, in this sleep position, the likelihood for the airway to obstruct is higher, which would lead to the occurrence of a large number of breathing abnormalities.[1]

In this study, by demonstrating that supine apneas are more severe than apneas occurring in the lateral position, we suggest that in the supine position, the UA is more difficult to reopen because gravitational forces add a further burden to the obstruction. Consequently, in the supine posture, the UA muscles require a greater activation or a longer time for reopening the UA obstruction than would be needed in the lateral posture. The process of reopening the UA in the supine posture is associated with a gradual increase in respiratory effort (reflecting the increased UA resistance) up to the point at which the UA reopens. This increased respiratory effort activates the UA mechanoreceptors, which, by sending the information to the CNS, trigger the arousal response that ends the obstructive event. This reopening moment for supine apneas is characterized by a longer arousal response, which is accompanied by an overall larger sympathetic activation, leading to a greater cardiorespiratory response than is observed in lateral apneas.

The findings described in Table 1 (for adjusted variables) are of interest, showing that even when the effect of ApDur is neutralized, apneic events occurring in the supine position still show characteristics of greater severity than those occurring in the lateral position. To our knowledge, the mechanisms by which apneas occurring in the supine posture are significantly more severe than those occurring in the lateral posture independent of the duration have not yet been investigated. However, as discussed earlier, it is probably the augmented respiratory effort of supine apneas that may explain these results, although other mechanisms may be also possible.

The results in the present study relating to the duration of the arousals are different from those reported by other researchers.[14] We found that the DurArous after apneic events occurring in the supine position was longer compared with DurArous occurring from apneic events in the lateral posture and that these results were confirmed even after adjusting these data for ApDur (Table 1). Moreover, ApDur has a stronger correlation with DurArous in both body positions than with any other variable investigated (Table 2). Also, this relationship was found to be linear for both postures. No difference in the slopes of the linear regression lines for the supine and lateral positions was found, meaning that for both postures, as the apneas increase in duration, the arousal response that follows it increases, too, at the same rate. The data, seen in Figure 1 by showing differences in the intercepts of the two linear regression lines, suggest that it is the body sleep position that in most cases will determine the DurArous after an apnea. Apneic events occurring in the supine posture will consistently produce longer arousal even for the same ApDur as in the lateral posture.

However, Stradling et al[14]recently reported that, contrary to what they originally expected, no significant differences were seen between the average DurArous in supine vs lateral decubitus apneas. The reason for these different results is not entirely clear. We both studied patients with severe OSA. Nevertheless, some methodological differences exist in the two studies. First, we analyzed apneic events visually and only in sleep stage 2 at the beginning, middle, and end of the sleep period, whereas they used both a sophisticated neural network technique[15] as well as a visual analysis and chose apneic events during 1 h of NREM sleep. Second, the sampling size was different, both for the number of patients and for the number of apneic events analyzed. We evaluated polysomnograms of 30 OSA NPP and analyzed 30 apneic events in each posture, whereas they[14] studied 12 OSA patients and analyzed an average of 18 apneic events in each position. Even though these methodological differences may partially explain the different results, it is not entirely clear what the major reason for this discrepancy is. This controversy strengthens the case for performing more investigations on this topic.

Our finding of a nonsignificant correlation between ApDur with Δ-Des and MinDes is not totally surprising. Series et al[16] observed that the postapneic fall of Sa_{O_2} is influenced by the apnea type (greater in obstructive than in central) and by the sleep stage (greater in REM than in NREM sleep), independent of the ApDur. In an earlier study, Bradley et al,[17] by studying the physiologic determinants of nocturnal arterial oxygenation in OSA patients, found that three variables (awake supine arterial P_{O_2}, expiratory reserve volume, and percentage of sleep time spent in apnea) correlated strongly with the mean nocturnal Sa_{O_2} and accounted for 73% of its variability. Moreover, it should also be remembered that other factors, such as alveolar volume at the beginning of the apnea, metabolic rate, ventilation-perfusion ratio, anemia or blood volume, and cardiac output, are also related to the degree of oxygen desaturation during an apnea.[18]

Study Limitations

Some possible methodological limitations of this investigation should be addressed. Because body posture changes were marked into the PSG record, the selection of the supine and lateral apneic events analyzed was not performed blindly; this could introduce some degree of bias. However, the measurements of the apneic event variables were highly objective, and the apneic events were selected in consecutive manner; thus, it is unlikely that a major bias would be present in this analysis.

Several studies have reported a lengthening of apneic events across the night,[19–21] and for the present analysis, this factor was not taken in consideration. Nevertheless, it is possible that the degree of lengthening of apneic events is different in the supine posture compared with the lateral posture as the night goes on. If supine apneic events were indeed more detrimental than those occurring in the lateral posture, it would be expected that the degree of lengthening across the night of supine apneas would be more pronounced than for lateral apneas.

We did not analyze hypopneas, and although we think that it would have been interesting to do so, the difficulties that currently exist with the definition of hypopnea[22] make the interpretation of these data more difficult to replicate and compare. In addition, we analyzed apneic events only in stage 2 of NREM sleep because this sleep stage is the most dominant sleep stage during sleep; this allows us to assess a relatively large amount of apneic events in both body positions across the night. However, it could be possible that different results would have been obtained if the comparison of apneic event characteristics for both supine and lateral positions had been made from apneic events occurring during REM sleep.

Another issue that should be mentioned relates to the definition of NPP. We used the most accepted definition of NPP, *ie*, OSA patients who have less than two times more breathing abnormalities in the supine than in the lateral position. It is clear that by using this definition, our patients still have a large number of apneic events in the supine posture. By using a different NPP definition (for example, patients who have a similar (± 10%) RDI in the supine and lateral posture), one may argue that we might have reached a different conclusion. Nevertheless, our NPP population includes a wide range of supine RDI to lateral RDI ratios (1.1 to 1.9) and still shows these major differences in the nature of apneic events between both postures. Because the comparison will still be between the characteristics of supine apneic events vs lateral apneic events, it seems unlikely that OSA patients with ratios lower than these would produce different results on apnea characteristics than the ones obtained in this study. Obviously, all the above-mentioned issues would be worthwhile assessing in future investigations.

Clinical Implications

The results of this study suggest that, similar to OSA PP who have breathing abnormalities mainly in the supine posture, the supine posture during sleep should also be avoided in OSA NPP. It is likely that some of these NPP probably avoid the supine posture spontaneously during sleep, as in this posture they frequently complain about breathing difficulties even while lying in bed still awake, and, consequently, they try to avoid this sleep posture. However, although most of them probably begin the night in the lateral posture, it is very difficult to control the body posture all night long. Thus, at least part of the night, they most likely sleep in the supine posture as well.

Certainly, positional therapy, *ie*, the avoidance of the supine position during sleep, is not a radical solution for these NPP with severe OSA, because they continue to have many breathing abnormalities while sleeping in the lateral posture. Nevertheless, in spite of the fact that, at present, there is no question that nasal continuous positive airway pressure (nCPAP) is the best solution for these patients, not all of them accept this form of therapy, and many do not comply well with it.[23] In addition, some of these patients elect as first choice of treatment to lose weight. Although this form of therapy has been demonstrated to produce good results in some patients, unfortunately, compliance with it is very poor.[24] However, if patients were willing to lose weight before they try nCPAP, it would be difficult for a clinician to refuse their wishes. Indeed, we found that weight loss was associated with a greater fall in the number of breathing abnormalities in the lateral position than in the supine position and, in some cases, an NPP became a PP.[1] Thus, for those OSA NPP who are trying to lose weight, or those who failed with or refuse nCPAP treatment, or those who are waiting for a surgical procedure, avoiding the supine posture during sleep may confer important although limited benefits.

Recently, Chervin and Aldrich,[25] in > 1,000 patients referred to a clinical sleep laboratory because of suspected sleep-disordered breathing, investigated the relationship between apnea and hypopnea characteristics and daytime sleepiness. They found that excessive daytime sleepiness was better explained by the rate of apneic events in the supine position as compared with that in other positions, by the rate of apneas compared with that of hypopneas, and by the rate of obstructive rather than that of central or mixed apneas. If supine OSAs explain better the excessive daytime sleepiness of OSA patients, it suggests that the sleep fragmentation produced by these apneic events can perhaps be among the most important detrimental components of OSA. Their results also suggest that the supine OSA arousal index is perhaps the most crucial arousal index that could explain daytime sleepiness in OSA patients. The logical next step after these interesting results would be to find out whether these supine OSA events can better explain the cardiovascular consequences observed in OSA patients. For example, does the supine apnea index or supine apnea plus hypopnea index correlate better with hypertension than the total apnea index or apnea plus hypopnea index?

We previously[26] showed that avoiding the supine posture during sleep for a 1-month period lowers the 24-h awake and sleeping BP in hypertensive and normotensive OSA PP. In the light of the above data, it is also possible that by avoiding the supine posture, OSA NPP will also lower their BP. This investigation is now being performed in our sleep unit.

The results of the present study support the above notion that supine sleep apneic events are more detrimental than those events in the lateral posture. These data are also consistent with our recent findings[27] on the effect of body position on optimal nCPAP, showing that irrespective of REM vs NREM sleep, RDI, body mass index, and age, the supine posture increases the optimal nCPAP by > 2.0 cm H_2O. This increase in optimal nCPAP in the supine position infers a UA that is more difficult to reopen, therefore producing more severe apneic events, as has been demonstrated in the present study.

In summary, we have shown that in NPP with severe OSA, the apneic events occurring in the supine position during sleep stage 2 are significantly more severe than those apneic events occurring in the lateral posture in the same sleep stage. Thus, it is not only the number of apneic events that worsens in the supine sleep position but, probably no less important, the nature of the apneic events themselves.

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