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A PIOLOT STUDY TO FIND THE CORRELATION BETWEEN SLEEP BODY POSTURE AND SEVERITY OF APNOEA IN PATIENTS OF OBSTRUCTIVE SLEEP APNOEA SYNDROME (OSAS) UNDERGOING POLYSOMNOGRAPHY IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Sleep is major biological function essential for life. Sleep apnoea refers to breathing abnormality that ouurs during sleep. Obstructive sleep apnoea (OSA) is common serious disorder of breathing disorder. The aim is to find the corelation between sleep body posture and severity of apnoea in patient of Obstructive sleep apnoea syndrome.

Materials and Methods: This was observational study involving 30 adults patients (> 18 years) who underwent polysomnography study at tertiary care hospital in between July 2017 to Dec.2018. PSG reports were used for study purpose. The subjects with apnoea hypopnoea index >= 5 were included in our study. sleep body posture and severity of apnoea in patients of Obstructive Sleep Apnoea Syndrome statically corelated.

Results: Supine sleeping position was associated with significantly more apnoeas than the lateral positions. 29 cases had more severe apnoea in supine position which was a significant finding. Severe AHI category proportion in Supine position was significantly higher compared to Lateral position. In supine position, the frequencies of mild, moderate and severe category were 11, 9 and 10 respectively whereas in Lateral category these frequencies are 16, 11, 3. With the change in position from supine to lateral, there was a significant decrease in AHI

Conclusion: The present pilot observational study was conducted on 30 subjects of age group of < 18 years coming for PSG to a tertiary care hospital. The PSG reports were used for collecting demographic and sleep data including the apnoea scoring. The subjects with Apnoea Hypopnoea Index >=5 (that is, Obstructive Sleep Apnoea Syndrome patients) coming under our inclusion criteria participated in our study. The overall AHI was used to classify them as mild OSAS, moderate or severe OSAS.

Keywords: Polysomnography (PSG), Apnea hypopnoea index (AHI), Central positive airway pressure (CPPA). Obstructive Sleep Apnoea Syndrome (OSAS).

INTRODUCTION

Sleep is a major biological function essential for life, an average individual spends one third of their life sleeping. Insufficient or poor quality sleep has been linked to neurocognitive impairments,[1-5] chronic diseases,[6-8] and increased mortality.[9,10]

Sleep apnoea refers to breathing abnormalities that occur during sleep and comprises mainly of Obstructive Sleep Apnoea (OSA), central sleep apnoea and mixed sleep apnoea. OSA is due to intermittent cessation of breathing due to upper

airway obstruction while central apnoea is due to CNS disorders, ie, there is failure of the brain to signal breathing.OSA is marked by repetitive upper airway obstructions leading to intermittent hypoxia and sleep fragmentation. However, the consequences of OSAS are many and result from disturbed sleep, intermittent hypoxia, hypercapnia, intrathoracic pressure fluctuations, and increased sympathetic nervous activity in OSAS. People with OSAS experience day-time fatigue, sleepiness, lack of concentration, cognitive dysfunction and impaired quality of life (QOL). This decline in daytime functioning can lead to higher rates of motor vehicle accidents.[11]

The 'gold standard' in diagnosing obstructive sleep apnoea is overnight polysomnography,[12] in a laboratory with the primary measurement of apnoea–hypopnoea index (number of apnoeas plus hypopnoeas per h of sleep). Latest AASM clinical practice guidelines recommend that polysomnography, rather than home sleep apnoea testing, be used for the diagnosis of OSA in patients with significant cardiorespiratory disease, potential respiratory muscle weakness due to neuromuscular condition, awake hypoventilation or suspicion of sleep related hypoventilation, chronic opioid medication use, history of stroke or severe insomnia.[13] If OSAS remains untreated, patients are at higher risk of developing cardio-vascular diseases.[14]

With regards to the disease management, Continuous positive airway pressure (CPAP) is the treatment of choice.[15] Bi-level positive airway pressure is used for patients who are intolerant to continuous positive airway pressure. Although CPAP has proven efficacy in treating OSA, adherence with CPAP therapy is often less than optimal. Reasons for avoidance or discontinuation of CPAP are many and vary from higher cost, to discomfort, to leakage from the nasal mask.[16] Other treatment measures include oral appliances, maxilla facial and uvulopalatopharngeal surgeries, conservative measures like weight loss and sleeping in lateral position. Though development of positional devices is also evolving, some such positional devices being used now include full-length pillows, lumbar or abdominal binders, semi-rigid backpacks, a tennis ball attached to the back, and electrical sensors with alarms that indicate change in position.

Novel treatment alternatives like electrical stimulation of hypoglossal nerve,[17] nEPAP,[18] (nasal expiratory PAP), oral negative pressure systems,[19] are also under research and development.[20] Oral appliances were successful in CPAP uncomfortable patients as observed by Jayan et al.[21] Children with OSA responded better to appropriate surgery after careful selection of patients.[22] Some of the known conservative measures are avoidance of depressants, alcohol and weight loss. However, there is a need to explore conservative measures as CPAP has low adherence discussed earlier. Avoidance of supine posture can also be of help, in some patients it may be the only treatment needed.[23,24]

Coming to the Indian scenario, few investigators have studied the prevalence of OSA among certain Indian populations based on age and gender, studies on correlating sleep position and OSA in India is sparse. Therefore our study aims at understanding the association of body posture, OSAS severity in our study population which may help in identifying patients better suited for conservative positional therapy instead of the more expensive option of CPAP. Any understanding of association between sleep position may help in evaluation and management of OSA. This is therefore the rationale behind our study.

MATERIALS AND METHODS

Study Design: This was a pilot observational study involving patients who underwent sleep study in the Polysomnography Lab of Chest Medicine Department of a tertiary care centre between July 2017 and Dec 2018 (18 months).

Observational model was a retro and prospective chart review where PSG reports of these subjects were studied. The retrospective arm spanned from July 2017 to Sep 2018 (14 months) and prospective arm spanned from Sep - Dec 2018 (4 months).

Study Population: All adult patients (>18 years) who underwent overnight sleep study in Sleep Study Lab / Polysomnography room between July 2017 and Dec 2018 falling under the inclusion criteria. PSG reports were used for study purpose.

Sampling technique and sample size: Completed enumeration method of sampling was done. That is, all subjects falling under the inclusion criteria were studied.

A sample size of 30 was selected by using this sampling method.

Ethical Considerations: Approval to conduct the study was obtained from the Institutional Review Board (IRB) of the Tertiary Referral Centre where data was collected. The study was a retro and prospective chart review. The retrospective arm was from July 2017 to Sept 2018 (14 months) for which waiver of consent was sought from IEC and the prospective arm was from September to December 2018 (4 months) for which consent was taken from the participants. The participants in the prospective arm (Sep - Dec 2018) were informed about the study process, objectives and usefulness of its outcome and also assured that their confidentiality and anonymity would be maintained. They were informed that they could withdraw at any time, without repercussions; and were given an opportunity to ask questions. Those who consented to participate in the study were asked to sign a consent form which was made available in English, Hindi and the regional language spoken in the area commonly - Marathi.

Selection of study participants -

Inclusion criteria

1. Sleep studies with recording time of minimum 5.5 hrs, sleeping time of minimum 2 hrs were included.
2. Patient should have spent sufficient period of sleeping time in both supine and lateral positions i.e., 5% of total sleep time in both supine and lateral positions.
3. AHI (Apnoea Hypopnoea Index) >= 5 and CAI (Central Apnoea Index) <5 i.e. , only patients with Obstructive Sleep Apnoea were included and Central Apnoea cases were excluded.

Note: Central Sleep apnoea (CSA) is known to occur in patients with primary cardiac and central nervous system dysfunction. A central apnoea index of greater than 5 is required for the diagnosis of CSA.

Exclusion criteria

1. Patient who had spent < 5% of total sleep time in either supine or lateral positions, were excluded.
2. Split night studies were excluded. These are studies where first part of sleep study consists of standard polysomnography (PSG) for the diagnosis of Obstructive sleep apnoea syndrome, while the second part is used to establish a suitable level of continuous positive airway pressure for optimal management of the airway obstruction.

Materials Used: Polysomnography (PSG) reports/ Sleep study reports from July 2017 to December 2018 were used to collect study data.

Philips Respironics Polysomnography machine was in use in the Polysomnography room/Sleep Lab of the tertiary care centre.

It documented activity from electroencephalographic (EEG) - C3-A1, C4-A2,O1-A2, O2-A1 leads, left and right electro-oculogram (EOG), chin and leg electromyogram (EMG), electrocardiogram (ECG), thoracoabdominal respiratory effort and air flow at the nose and mouth. The chest and abdominal wall movements were recorded by thoracoabdominal belts (RIP- Respiratory Inductive Plethysmography), the sensors in these belts also recorded the body position. The oxygen saturation was measured by continuous pulse oximetry and the snoring microphone recorded the snoring.

A sleep study report typically contains sections with patient information - their sleep-related symptoms, co-morbidities, demographic data as well as physiological data from EEG,ECG, EOG, EMG, Air flow, Spo2, Respiratory Inductive Plethysmography (RIP) thoracoabdominal belts . The distribution of different stages of sleep called sleep architecture and sleep staging is done along with apnoea scoring and documentation of any abnormal record. Based on the various parameters recorded, automatic sleep and apnoea scoring is done by computerised algorithms; it is then reviewed, corrected and signed off by a Respiratory Physician.

Study Procedure: Since it was a Retro and Prospective chart review, Polysomnography (PSG) reports between July 2017 and December 2018 were studied and data was collected in Case Record forms for subjects which came under our inclusion criteria.

Waiver of consent was sought from the IEC for the retrospective arm of the study (July 17 – Sep 18) while subjects in the prospective arm posted for PSG (Sep- Dec 2018), were explained about the study and written and oral consent was taken from subjects. Usual test instructions like all other patients coming for PSG were given to study subjects too – Subject reported 1 hr before the usual sleeping time, he/she avoided strenuous activities on the day of the test. Naps, caffeine, alcohol, and stimulants were also avoided including medications for narcolepsy (chest physician's advice followed).

Usual medications like antihypertensives etc were to be taken. Technician noted down the medication taken in last 24 hours as a routine protocol. Subject was instructed to have a headwash and remove nail paint for PSG; this is needed for proper placement of EEG electrodes and oximetry probe.

All the subjects underwent overnight supervised Level I Polysomnography (PSG) using Philips Respironics equipment. The standard PSG recording consisted of frontal, central and occipital electroencephalograms (EEGs) channels- C3-A1, C4-A2,O1-A2, O2-A1 two electrooculograms (right and left electro oculogram respectively (ROG) and LOG), submentalis and tibialis anterior electromyography (EMG), electrocardiogram (ECG), and respiratory channels consisting of nasal and oral airflow sensor (thermistor), 6chest and abdominal movements recorded by inductance plethysmography ,pulse oximeter for oxygen saturation, snore microphone. Rib cage belt was placed on the xiphoid process and the abdominal belt was placed near the umbilicus, these belts recorded the respiratory movement as well as body position. The piezoelectric sensors in the belts encode the angle of the body into a continuous voltage and transducers convert it into a digital code. Thus, they sense the body position which is one of the important parameter in our study. The PSG electrodes were applied on the subject by sleep technician in the Sleep Lab. Automated scoring of sleep stages and respiratory events was done by the computerized system and review, modification and finalization by respiratory physicians as per 2007 AASM guidelines. The tracing was scored using 30 second epochs.

Demographic data- Age, Gender, Weight, height, BMI, Neck circumference was also collected.

However, the name, address, Adhar no, any unique identifier in the PSG report was erased from PSG report while taking prints and subject identity was not revealed during entire data collection process.

History of vascular diseases - Stroke, Coronary artery disease, Hypertension, Diabetes, Hypothyroidism, ENT problems like –Tonsillar Hypertrophy etc was noted as these are often associated with OSAS. H/O Substance abuse, drugs, sleep quality, snoring was also collected.

PSG variables such as Total sleep time, percentage sleep time in different positions- Supine, Left lateral and Right lateral; AHI (Apnoea- Hypopnoea index), CAI (Central Apnoea index), Supine AHI and Right

and left lateral AHI and sleep durations in all these three positions were collected.

Operational Definitions: "Obstructive sleep apnoea" was defined as the cessation of airflow for a duration of 10 s or more with continuing respiratory effort as evidenced by thoracic and abdominal excursions and "hypopnea" was defined as reduction in respiratory effort by 30% lasting for 10 s or more, associated with a decline in oxygen saturation by 4%. Number of apnoeas/hypopneas per hour of sleep was scored (apnoea hypopnea index or AHI) to calculate the severity of OSA, which was classified into -

1. Mild (AHI 5–15/h) 2. Moderate (15-30/h) 3. Severe (>30/h).

Supine and Lateral Apnoea Hypopnea Index (AHI) was noted for all OSAS subjects falling under the inclusion criteria. Supine AHI/ Lateral AHI ratio was calculated for all study subjects as we defined positional apnoea as Supine AHI/ Lateral AHI >= 2

Statistical methods: Wilcoxon Signed Ranks test was applied to find correlation between sleep body posture and the severity of apnoea /AHI. As the AHI score is ordinal in nature and the observations were made in the same individual therefore this test was applied. P value< 0.05 difference was considered significant and P value>0.05 difference was considered insignificant.

Supine AHI Category and Lateral AHI Category Crosstabulation was done and analysed using McNemar-Bowker Test. The change in AHI from severe to moderate and from moderate to mild category was noted with change in position from Supine to Lateral.

As our sample size was small, that is 30 Polysomnographies were there to be analysed, the AHI categories of moderate and severe were clubbed together to get modified categoriesc for better statistical analysis and comparisions.

RESULTS

Total 41 polysomnographies were done during the study period of 18 months (July 2017 and Dec 2018), of these 11 were excluded.

In 1 study, the age of subject was >18 years. 7 subjects were excluded as they underwent split night studies (Treatment intervention - BIPAP was used and respiratory pressure titrations done) and 1 subject was excluded as he spent < 5% of total sleep time in either supine and lateral positions. Apnoea Hypopnoea Index was < 5 in 2 subjects who were also excluded as they did not qualify as OSAS.

Therefore 30 subjects were included in the study. The observations are depicted as tables mainly and box plot.

The statistical analysis was done using SPSS software ver. 26, professional biostatistician's help was also sought.

Mean age of subjects was 53 +/- 14 years. Our study population was predominantly male, that is, out of 30, 20 were male and 10 were female subjects. Mean Age for Males was 55+/- 12 years and Females was 48 +/- 16 years.

Table 1: Table showing frequency of different categories of Obstructive Sleep Apnoea Syndrome

		Type of OSAS		
		Frequency	**Percent**	**Cumulative Percent**
Valid	Mild	15	50.0	50.0
	Moderate	9	30.0	80.0
	Severe	6	20.0	100.0
	Total	30	100.0	

It shows that 15 subjects had mild OSAS with AHI from 5-15.
9 subjects had moderate OSAS with AHI from 15-30.
6 subjects had severe OSAS with AHI >30.

Table 2: Table showing frequency of Supine AHI categorised as mild, moderate and severe

		Supine AHI Category		
		Frequency	**Percent**	**Cumulative Percent**
Valid	Mild	11	36.7	36.7
	Moderate	9	30.0	66.7
	Severe	10	33.3	100.0
	Total	30	100.0	

Table 3: Table showing frequency of Lateral AHI categorised as mild, moderate and severe

		Lateral AHI Category		
		Frequency	**Percent**	**Cumulative Percent**
Valid	Mild	16	53.3	53.3
	Moderate	11	36.7	90.0
	Severe	3	10.0	100.0
	Total	30	100.0	

Table 4: Table showing presence or absence of Positional Obstructive Sleep Apnoea (POSA) [Supine AHI/ Lateral AHI>= 2]

		Positional Apnoea		
		Frequency	**Percent**	**Cumulative Percent**
Valid	Absent	21	70.0	70.0
	Present	9	30.0	100.0
	Total	30	100.0	

Positional Apnoea is defined as OSA that improves on changing position of the person while sleeping. In positional obstructive sleep apnoea (POSA), there is a reduction of at least 50% in the apnoea hypopnoea index (AHI) from the supine to a lateral position.

Table 5: Wilcoxon Signed Ranks Test

	Ranks				
		N	**Mean Rank**	**Sum of Ranks**	**Test Statistics**
Lateral AHI - Supine AHI	Negative Ranks	29a	15.72	456.00	Z value =-4.597
	Positive Ranks	1b	9.00	9.00	P value = 0.000
	Ties	0c			
	Total	30			

a. Lateral AHI < Supine AHI
b. Lateral AHI > Supine AHI
c. Lateral AHI = Supine AHI

P value< 0.05 difference is significant
P value>0.05 difference is insignificant

Wilcoxon Signed Ranks test was applied to find correlation between Sleep body posture and severity of apnoea /AHI AHI score is ordinal in nature and the observations were made in the same individual therefore this test was applied.In 29 cases Lateral AHI was found to be less than Supine AHI and in 1 case it was vice versa. The p value of 0.000 was indicative of significant difference between the two.

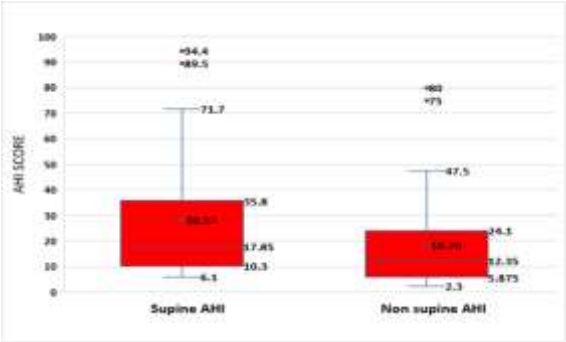

Figure 1: BOX PLOT comparing Median AHI Score between Supine and Lateral sleep position.

Table 6: Supine AHI Category and Lateral AHI Category Crosstabulation

Supine AHI Cat * Lateral AHI Cat Crosstabulation						
Supine AHI Cat		**Lateral AHI Cat**			**Total**	**Test Statistics**
		Mild	**Moderate**	**Severe**		
Mild	Count	11	0	0	11	McNemar-Bowker Test = 12.00
	% within Supine AHI Cat	100.0%	0.0%	0.0%	100.0%	
	% within Lateral AHI Cat	68.8%	0.0%	0.0%	36.7%	DF= 2
Moderate	Count	5	4	0	9	
	% within Supine AHI Cat	55.6%	44.4%	0.0%	100.0%	P value = 0.002
	% within Lateral AHI Cat	31.3%	36.4%	0.0%	30.0%	
Severe	Count	0	7	3	10	Severe AHI category proportion in Supine position is significantly higher compared to Lateral position
	% within Supine AHI Cat	0.0%	70.0%	30.0%	100.0%	
	% within Lateral AHI Cat	0.0%	63.6%	100.0%	33.3%	
Total	Count	16	11	3	30	
	% within Supine AHI Cat	53.3%	36.7%	10.0%	100.0%	
	% within Non supine AHI Cat	100.0%	100.0%	100.0%	100.0%	

McNemar-Bowker Test was applied to obtain the above cross tabulation.In supine position, the frequencies of mild, moderate and severe category were 11, 9 and 10 respectively whereas in Lateral category these frequencies are 16, 11, 3. Out of 11 mild AHI category in supine position, no change was observed in Lateral position.Out of 9 moderate AHI category in supine position, 5 moved to mild category and 4 remained in moderate category.Out of 10 severe AHI category subjects in supine position, 7 moved to moderate category and 3 remained in severe category which suggests significant improvement in the AHI category in lateral position compared to supine position.

DISCUSSION

Obstructive Sleep Apnoea Syndrome is a common disorder found in people with obesity and chronic diseases like hypothyroidism, diabetes, and cardiovascular disorders. Male gender, obesity, heredity, rising age and certain craniofacial features are risk factors for OSAS.OSAS is marked by repetitive upper airway obstruction leading to intermittent hypoxia and sleep fragmentation.

Patients of OSAS experience fatigue, day time sleepiness, unrefreshing sleep, insomnia and lack of concentration. The patients may awaken with gasping, choking or breath holding. The patient's bed partner may report loud snoring or breathing interruptions or both. There is good evidence that OSAS is an independent risk factor for cardiovascular disorders like ischaemic heart disease, arrhythmias, systemic hypertension, congestive heart failure, sudden cardiac death and cerebrovascular diseases.The 'gold standard' in diagnosing obstructive sleep apnoea is overnight polysomnography 12 in a laboratory with the primary measurement of apnoea–hypopnoea index (number of apnoeas plus hypopnoeas per h of sleep). Use of CPAP device during sleep remains the mainstay of treatment; though, the cost and associated claustrophobic discomfort remain impediments in adherence to CPAP therapy.

Other measures like uvulopalatopharyngeal surgeries and conservative treatment like weight loss and sleeping in lateral position may be also useful in certain group of people. Many innovations like nEPAP 18 (nasal expiratory PAP), oral negative pressure systems are under research and remain an evolving challenge.

Though many treatment options are available and still evolving, usefulness of simple conservative measures like tying a tennis ball at the back (TBT-Tennis ball therapy) to maintain lateral position cannot be underrated. This positional therapy is most commonly used in our Indian setup, as buying a CPAP device is economically not feasible for many patients. Therefore, studying the effect of sleep position and severity of apnoea in our Indian scenario would be useful. So, this was the basic aim of our study, to find if there is any correlation between the body position and severity of OSAS. The purpose was to use the sleep data available in PSG reports in our institute to have some understanding about candidates best suited for simple conservative measures like sleeping in lateral position.

Many studies done worldwide have suggested that the supine sleeping position was associated with significantly more apnoeas than the non-supine positions,[23,27] but fewer studies have been conducted in our country on patients with OSAS, which is a prevalent and under diagnosed disorder in Indian population.[28,29] We included adults (> 18 years) with OSAS falling under the inclusion criteria which were undergoing only a simple sleep study/ Polysomnography (no CPAP Titration study/ split night study) in our lab. We did not use data from split night studies as we wanted to study the effect of position on baseline Supine and Lateral AHI and not an altered Apnoea Hypopnoea Index (AHI) after managing the airflow obstruction with CPAP device usage.

A study by Mador et al has reported that positional sleep apnoea cannot usually be assessed during split night study 25 which supports our inclusion criteria. Kavey et al and Cartwright et al found that the supine sleeping position was associated with significantly more apnoeas than the non-supine positions.[21,26] In 2013, a meta-analysis by Menon A and Kumar M documented that numbers of obstructive respiratory events during sleep were reported to be fewer with the lateral or non-supine position than the supine position in patients with OSA in most studies they analysed. According to this study, there was an improvement in AHI in lateral position due to increased activity of pharyngeal dilator muscles.

Our findings matched the findings of these studies. In 29 out of 30 reports we studied, Lateral AHI was found to be less than Supine AHI and in 1 case it was vice versa (p value = 0.000, indicates highly significant difference). In 29 out of 30 reports we studied, Lateral AHI was found to be less than Supine AHI and in 1 case it was vice versa (p value = 0.000, indicates highly significant difference). [Table 5].

Also, the number of patients with severe AHI category (AHI > 30) was significantly higher in supine position as compared to Lateral position [Table 2]. In supine position, the frequencies of mild, moderate and severe category were 11, 9 and 10 respectively whereas in lateral category these frequencies are 16, 11, and 3.

We also observed significant improvement in the AHI category in lateral position was observed compared to supine position. Out of 9 moderate AHI category in supine position, 5 moved to mild category and 4 remained in moderate category when the position was changed to lateral. Out of 10 severe AHI category subjects in supine position, 7 moved to moderate category and 3 remained in severe category. This suggests significant improvement in the AHI category in lateral position compared to supine position which is in coherence to aforementioned international studies [Table 6].

Below are the reasons for increased severity of OSAS in supine position –

- When lying in the supine position, the bulk of the soft tissue structures such as the tongue and soft palate lie anterior to the velopharyngeal airway. Therefore, in this position, gravitational pull favours posterior collapse of the bulky soft tissue structures. The combined effects of gravity, posture, and upper airway anatomy was considered in the "bony enclosure" model described by Isono et al,[30] which suggested that non-uniform distribution of soft tissue around the pharyngeal airway may result in increase in the extraluminal forces acting on the airway leading to obstruction. The bony enclosure model focused on anatomical balance between size of maxilla, mandible, tongue and soft tissues around the pharynx.
- Also there is a decrease in Functional Residual Capacity in supine position as the abdominal contents are pushed up, this adds to decreased ventilation in supine position in OSAS.
- The folding characteristics of the lateral pharyngeal airway may also be responsible in

determining collapse in the supine sleeping position. The airway adopts a laterally oriented ellipsoid shape with the patient in supine position,[31] and collapse is most likely to begin at the lateral walls before progressing to medial structures.[32,33]

There are studies that have used both physical,[34] and mathematical,[35] models of human airway, which indicate that the folding geometry of the lateral airway is critically important in determining collapsibility of the airway. In the lateral position the overall shape of the velopharynx becomes more circular and there is a relative relieve of obstruction.

CONCLUSION

The present pilot observational study was conducted on 30 subjects of age group of < 18 years coming for PSG to a tertiary care hospital. The PSG reports were used for collecting demographic and sleep data including the apnoea scoring. The subjects with Apnoea Hypopnoea Index >=5 (that is, Obstructive Sleep Apnoea Syndrome patients) coming under our inclusion criteria participated in our study. The overall AHI was used to classify them as mild OSAS, moderate or severe OSAS. Supine and Lateral AHI of all subjects was noted, correlated and analysed to check if the severity of apnoea (AHI) was more in supine or lateral position. It was also analysed if severe apnoea incidence was more in supine position.

We derived the below conclusions from our study:

1. Supine sleeping position was associated with significantly more apnoeas than the lateral positions. (AHI was more in supine position). 29 cases had more severe apnoea in supine position which was a significant finding. Out of these 29, 9 had positional apnoea. We defined positional Apnoea as Supine AHI/ Lateral AHI ratio of > =2.
2. Severe AHI category proportion in Supine position was significantly higher compared to Lateral position. In supine position, the frequencies of mild, moderate and severe category were 11, 9 and 10 respectively whereas in Lateral category these frequencies are 16,11,3.
3. With the change in position from supine to lateral, there was a significant decrease in AHI

REFERENCES

1. Hart RP, Buchsbaum DG, Wade JB, Hamer RM, Kwentus JA. Effect of sleep deprivation on first-year residents' response times, memory, and mood. J Med Educ.1987;62:940-942.
2. Horne JA, Anderson NR, Wilkinson RT. Effects of sleep deprivation on signal detection measures of vigilance: implications for sleep function. Sleep. 1983;6:347-358.
3. Nykamp K, Rosenthal L, Folkerts M, Roehrs T, Guido P, Roth T. The effects of REM sleep deprivation on the level of sleepiness/alertness. Sleep. 1998;21:609-614.
4. Ferrara M, De Gennaro L, Casagrande M, Bertini M. Selective slow-wave sleep deprivation and time-of-night effects on cognitive performance upon awakening.Psychophysiology. 2000;37:440-446.
5. Fallone G, Acebo C, Arnedt JT, Seifer R, Carskadon MA. Effects of acute sleep restriction on behavior, sustained attention, and response inhibition in children.Percept Mot Skills. 2001;93:213-229.
6. Weissman MM, Greenwald S, Nino-Murcia G, Dement WC. The morbidity of insomnia uncomplicated by psychiatric disorders. Gen Hosp Psychiatry. 1997;19:245-250.
7. Leproult R, Copinschi G, Buxton O, Van Cauter E. Sleep loss results in an elevation of cortisol levels the next evening. Sleep. 1997;20:865-870.
8. Scheen AJ, Byrne MM, Plat L, Leproult R, Van Cauter E. Relationships between sleep quality and glucose regulation in normal humans. Am J Physiol. 1996;271(pt 1):E261-E270.
9. Wingard DL, Berkman LF. Mortality risk associated with sleeping patterns among adults. Sleep. 1983;6:102-107.
10. Lavie P, Herer P, Peled R, et al. Mortality in sleep apnoea patients: a multivariate analysis of risk factors. Sleep. 1995;18:149-157.
11. Jackson ML, Howard ME, Barnes M Cognition and daytime functioning in sleep-related breathing disorders. Prog Brain Res; 2011; 190:53-68, 21531244
12. Epstein LJ, Kristo D, Strollo PJet al.Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnoea in adults. J Clin Sleep Med; 2009;53:263276, 19960649.
13. Kapur VK, Auckley DH, Chowdhuri S, Kuhlmann DC, Mehra R, Ramar K, Harrod CG. Clinical practice guideline for diagnostic testing for adult obstructive sleep apnoea: an American Academy of Sleep Medicine clinical practice guideline. J Clin Sleep Med. 2017;13(3):479–504.
14. Mark E. Dyken,Virend K. Somers,Thoru Yamada,Zong-Ying Ren,M. Bridget Zimmerman. Investigating the Relationship Between Stroke and Obstructive Sleep Apnoea. J American Heart Association 1996; 27:401–407.
15. Suri JC, Sen MK, Ojha UC. Acceptance and Compliance issues of nasal CPAP amongst Indian patients of obstructive sleep apnoea.Indian J Sleep Med 2006; 1.4: 197-203.
16. Dedhia, R.C., Rosen, C.A. and Soose, R.J. (2014), What is the role of the larynx in adult obstructive sleep apnoea?. The Laryngoscope, 124: 1029-1034.
17. Kezirian EJ, Goding GS Jr, Malhotra A, et al. Hypoglossal nerve stimulation improves obstructive sleep apnoea: 12-month outcomes. J Sleep Res. 2014;23(1):77-83
18. Freedman N. (2014) Improvements in current treatments and emerging therapies for adult obstructive sleep apnoea. F1000Prime Rep 6: 36–45.
19. Pavwoski P, Shelgikar AV. Treatment options for obstructive sleep apnoea. Neurol Clin Pract. 2017;7(1):77-85.
20. Jayan B, Prasad BNBM, Rajput AK, Bhattacharrya R, Dhiman RK, Thampi
21. PS.Management of Obstructive Sleep Apnoea with Oral Appliances: Our Experience. Indian J Sleep Med 2006; 1.4: 204-7.
22. Gupta N, Suri JC, Venkatachalam VP, Sen MK. Evaluation of Polysomnographic Patterns with Reference to Various Treatment Modalities in the Management of Patients with Upper Airway Obstruction. Indian J Sleep Med 2006; 1.2: 97-100
23. N. B. Kavey, A. Blitzer, S. Gidro-Frank, and K. Korstanje, "Sleeping position and sleep apnoea syndrome," American Journal of Otolaryngology, vol. 6, no. 5, pp. 373–377, 1985.
24. Jordan AS, McSharry DG, Malhotra A. Adult obstructive sleep apnoea. Lancet. 2014;383(9918):736-747.
25. M. J. Mador, T. J. Kufel, U. J. Magalang, S. K. Rajesh, V. Watwe, and B. J. B. Grant, "Prevalence of positional sleep apnoea in patients undergoing polysomnography," Chest, vol. 128, no. 4, pp. 2130–2137, 2005.
26. R. D. Cartwright, "Effect of sleep position on sleep apnoea severity," Sleep, vol. 7, no. 2, pp. 110–114, 1984.
27. Menon A, Kumar M. Influence of body position on severity of obstructive sleep apnoea: a systematic review. ISRN Otolaryngol. 2013;2013:670381. Published 2013 Oct 8.
28. A. Benjafield , N. Ayas et al Estimation of the global prevalence and burden of obstructive sleep apnoea: a literature-based analysis . Lancet. August 2019, 687-698.

29. Ahirwar R, Mondal PR. Prevalence of obesity in India: A systematic review. Diabetes Metab Syndr. 2019;13(1):318-321.
30. Isono S, Tanaka A, Nishino T. Lateral position decreases collapsibility of the passive pharynx in patients with obstructive sleep apnoea. Anesthesiology. 2002;97:780–5.
31. Walsh JH, Leigh MS, Paduch A, et al. Effect of body posture on pharyngeal shape and size in adults with and without obstructive sleep apnoea. Sleep. 2008;31:1543–9.
32. Kuna ST, Bedi DG, Ryckman C. Effect of nasal airway positive pressure on upper airway size and configuration. Am Rev Respir Dis. 1988;138:969–75
33. Amatoury J, Kairaitis K, Wheatley JR, Bilston LE, Amis TC. Onset of airflow limitation in a collapsible tube model: impact of surrounding pressure, longitudinal strain, and wall folding geometry. J Appl Physiol. 2010;109:1467–75
34. Lucey AD, King AJ, Tetlow GA, et al. Measurement, reconstruction, and flow-field computation of the human pharynx with application to sleep apnoea. IEEE Trans Biomed Eng. 2010;57:2535–48.
35. Ulukavak Ciftci T, Kokturk O, Bukan N, Bilgihan A. Leptin and ghrelin levels in patients with obstructive sleep apnoea syndrome. Respiration. 2005;72(4):395–401.