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Sleep pattern changes in patients with lung cancer

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***Abstract*---**The impact of Lung cancer on sleep patterns and sleep related breathing disorders had different variability. Aim of the work: to evaluate sleep architectures, and sleep related breathing disorders in patients with lung cancer and their outcomes. Patients and methods: 26 patients with non-small cell lung cancer assisted according to TNM classification .Chemotherapy, radiotherapy, targeted therapy and surgical treatment were scheduled. Epworth sleepiness score (ESS), overnight full polysomnography, and overall survival (OAS) were calculated. Results: The percent of the studied patients who aged above 60 was 53.8% and 76.9% of them were male. 38.5%,23.1%,38.5% of the studied patients were stage III, II, and IV respectively.84.6%, 34.6%, 19.2%, and 7.7% of the studied patients were on chemotherapy, targeted therapy, radiotherapy and surgical treatment respectively ..Sleep latency was 52.535± 60.077 min; sleep efficiency was 45.9% ±18.5%; Wakefulness after sleep onset /minute (WASO) was 107.06± 0.61.94. Total Apnea-Hypopnea Index/hour

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(AHI) was 27.61± 27.45, Desaturation Index/hour (DI) was 23.44± 23.075. 34.7%, 39.1% and 26%were mild, moderate and sever obstructive sleep apnea syndrome (OSAS) respectively. 80.8% had sleep maintenance insomnia. Overall survival was 18.38±11.426, there was a positive correlation between overall survival (OAS) and sleep efficiency (r = 0.435, P = 0.026), and negative correlation between OAS and total AHI, ESS and snoring episodes (r = 0.622, P = 0.001), (r = 0.411, P = 0.037), (r = 0.637, P = 0.001) respectively. Conclusion: Patients with lung cancer had insomnia and OSAS. Tumor staging impacted OSA severity and outcomes.

***Keywords*---**lung cancer, PSG, OSA, OAS.

Introduction

Lung cancer is the third most common cancer diagnosed among men and women (after prostate cancer and breast cancer). The quantity and quality of sleep comprise an important factor that affects the life quality of both healthy and sick individuals. Cancer patients suffer from higher rates of sleep disturbances than both the general and the psychiatric population [1].Insomnia symptoms, excessive daytime sleepiness, and restlessness leg syndrome were found to be the most prevalent complaints,while they present with reduced sleep duration and efficiency, increased daytime napping, and difficulty in maintaining both sleep and wakefulness[2].

Their etiology is most likely multifactorial, with disease- and treatment-related factors interacting with various demographic, lifestyle, and psychological factors and resulting in altered sleep regulation processes, blunted circadian rhythms, and maladaptive behaviors perpetuating the problem[3].Lung cancer patients are a unique cancer population, often having advanced stage disease and high symptom and comorbidity burden. In previous studies ,prevalence of poor sleep quality was consistently over 50% of participants, underlining the challenge faced by the health care practitioners in diagnosis, severity assessment, and treatment of these disorders in this highly at-risk population.

Independent associations with fatigue and poor functional status have also been identified [4]. Psychological factors, especially anxiety and depression, have emerged as important contributors of poor sleep quality in cancer patients, both in treatment and palliative settings. Few studies have explored the same association exclusively in lung cancer patients, yielding mostly inconsistent results, the main reason being not considering the confounding effects of environmental and disease-related factors that influence sleep quality in those populations [5].

Aim of the work

To evaluate sleep pattern changes in patients with lung cancer.

Patients & Methods

Study Design: it was a Prospective cohort study.

Study population: this study had carried out in collaboration between Sleep Unit Chest Department Faculty of Medicine Menoufia University and Clinical Oncology and Nuclear Medicine Department Faculty of Medicine Menoufia University. 26 patients were diagnosed with non small cell lung cancer with different pathological subtypes and stages according to TNM classification according to American Joint Committee of caner (AJCC) 8th edition [(6)]. During the period from (April 2019 to April 2021). after having informed patient's consent and approval of medical ethics committee of Menoufia University Hospital (112020 CHES28).

Inclusion criteria: The patients were fulfilled the following enrollment criteria:

1. histopathological diagnosis of non-small cell lung cancer and all histopathological subtypes(adeno carcinoma, large cell and squamous cell carcinoma).
2. Patients diagnosed with bronchogenic carcinoma with different stages according to TNM classification according to American Joint Committee of caner (AJCC) 8th edition [(6)].
3. Performance status (0-2) according to the Eastern Cooperative Oncology Group (ECOG) [(7)].

Exclusion criteria:

1. M obesity
2. Known to be sleep breathing disorders before diagnosis bronchogenic carcinoma.
3. Any other pulmonary disorders.

Methods

All selected cases underwent the following:

1. detailed history taking:

Personal history: included patient`s name, age, gender, residence, occupation, marital status and special habits.

Previous medical history, full pathological, treatment and survival data-assessment of neck circumfence, BMI and performance status [(7)]. Overall survival calculated from date of diagnosis up to date of death or date of last contact.

2. Clinical examination

3. Investigations:

1- Routine laboratory examination in the form of:(CBC – Liver function tests – kidney function tests –Random blood sugar)
2- PET C.T or C.T chest, abdomen and pelvis with contrast, bone scan, brain MRI with contrast for staging.
3- Epworth Sleepiness Score (ESS)·

- (ESS) is a simple self-administered questionnaire for daytime sleepiness scored by asking the patient about the chance that he or she fall asleep in the following situations:

Sitting and reading ,watching TV, sitting inactive in public places e.g. theater or meeting, as apassenger in acar for an hour without abreak , Lying down to rest in the afternoon if circumstances permit, Sitting and taking to someone, sitting quietly after lunch without alcohol, In acar while stopping for few minutes in atraffic. The item score is estimated by 4 points ordinal scale (0-3) for each situation according to the following:
-Would never fall asleep (0).
-Slight chance to fall asleep (1).
-Moderate chance to fall asleep (2).
-Hight chance to fall asleep (3).

The final ESS for the patient is calculated as the sum of the eight items score and can range from 0-24.
5-Polysomnography was done in Sleep Laboratory Unit Menoufia University Hospital using (Philips Alice6 Base Station LDS) made in USA.

The system records the following parameters:
1-Sleep stages by EEG, EOG and EMG. EEG was used to monitor sleep stages and identify sleep latency and arousal .EOG was used to monitor both horizontal and vertical eye movements to document the onset of REM and slow rolling movements accompany the onset of sleep.
EMG records atonia during REM or lack of atonia in REM related parasomnia.
2- ECG.
3- Oxygen saturation: this recorded by pulse oximeter which is connected to the patient's index finger . It is logged every second. Oxygen saturation is recorded as maximum and minimum oxygen saturation.
4- Snoring; was detected using an inbuilt microphone. Snoring index is averaged and logged every second, from 1 to 5 units scale (one unit =75decibell) .Value of 0 or less corresponds to silent breathing .Value of 1 and 2 corresponds to average snoring .Value of 3 or more corresponds to extremely loud snoring .Snoring index was recorded using the patient curve to estimate the percent of time over which the patient had snored more than 3 unit.1-3 units and less than 1 unit .
5-Flattening index: it is ameasure of inspiratory air flow limitation and it is ameasure of upper airway obstruction .It is dervied from inspired airflow changes thourgh the breathing cycle. Typical un obstructed breath will have an index above 0.15 units, limited breath will have an index less than 0.15 units. Flattening index was recorded using the patient curve to estimate the percent of time in which the patient had flattening index less than 0.15 units.
6-Nasal ventilation: Averaged and logged every second in the diagnostic mode. Variation in nostril size, nasal cannula dimension and position in the nostril can affect nasal ventilation reading. Nasal Ventilation was recorded using the patient curve to estimate the percent of time in which the patient had nasal ventilation more than 10 L/min, 5-10 L/min, and less than 5L/min.
7-Body position: *Body position indicator was fixed to the front of the patient abdomen. It recorded the percent of time of the study spent in each of the four body position (back, front, left or right).*
8-Respiratory effort:
Using thoracic and abdominal belts, the respiratory effort chart displays the amplitude of respiratory effort averaged over one second. This was done using

respiratory band connected to band amplifier. The presence of respiratory effort during periods of apnea is astrong indication of obstructive apnea, While if respiratory effort traces Zero during period of apnea it suggests central apnea.

9-Apnea index: Number of apneas per hours of study time. Apnea is defined as acessation of airflow for more than 10 seconds with apnea index more than 15 events / hour.

10-Hypopnea index: Number of hypopneas per hour of study time. Hypopnea is defined as limitation of airflow below 50% with O2 desaturation > 40%.

11-Apnea /hypopnea index.

(Number of apneas + number of hypopneas) /Hours of study time.

Results

Table 1 Socio-demographic data, comorbidities, and anthropometric measurements of the studied lung cancer patients

Parameter	Number 26	Percent 100.0
Age/ years old		
• Mean ±SD	63.76±6.778	
• Min.-Max.	54-75	
Age categories		
• More than 60 years old	14	53.8
• Less than 60 years old	12	46.2
Gender		
• Male	20	76.9
• Female	6	23.1
Body mass index kg/m^2		
• Mean ±SD	27.315±4.232	
• Min.-Max.	20.3-33.6	
Neck circumference/ cm		
• Mean ±SD	38.96±3.104	
• Min.-Max.	35-45	
Smoking		
• Non smoker	3	11.5
• Smoker	12	46.2
• Ex-smoker	11	42.3
Performance status		
• Ps0	5	19.2
• Ps1	9	34.6
• Ps2	12	46.2
Comorbidities		
• No comorbidities	18	69.2
• Hypertension	4	15.4
• Ischemic heart disease	1	3.8
• Benign prostatic hyperplasia	1	3.8
• Diabetes mellitus	2	2

Table 2: Clinical parameters in lung cancer patients ----and lung cancer outcomes

Parameter				Number 26	Percent 100.0
Type of malignancy Non-small cell lung cancer	Adenocarcinoma	Squamous cell carcinoma	Large cell carcinoma	26	100.0
	16	7	3		
Stage group • II • III • IV				6 10 10	23.1 38.5 38.5
ALK mutation • Negative • Positive				24 2	92.3 7.7
EGFR • Negative • Positive				19 7	73 26.9
Treatment					
Surgery • No • Yes				24 2	92.3 7.7
Chemotherapy • No • Yes				4 22	15.4 84.6
Radiotherapy • No • Yes				21 5	80.8 19.2
Targeted therapy • No • Gefitinib • Crizotinib				17 7 2	65.4 26.9 7.7
Over all survival (OAS) • Mean ±SD • Min.-Max.				18.38±11.426 5.0-48.0	

Table 3: Epworth sleepiness score of the studied lung cancer patients

Parameter	Number 26	Percent 100.0
Epworth sleepiness score • Normal sleep • Average day time sleep • Excessive situational sleepy • Excessive sleepy	4 4 11 7	15.4 15.4 42.3 26.9

Table 4: Polysomnography parameters (Sleep architecture, Respiratory data, arousal, snoring, limb movement, oxygen saturation, and cardiac data) of the studied lung cancer patients

Parameter	Number 26	Percent 100.0
Sleep onset /minute • Mean ±SD • Min.-Max.	52.535± 60.077 9- 310.7	
Sleep efficiency % • Mean ±SD • Min.-Max.	45.9% ±18.5% 17% - 77%	
Wakefulness after sleep onset /minute • Mean ±SD • Min.-Max.	107.06± 0.61.94 2.6- 223.7	
Total Apnea-Hypopnea Index/hour (OSA) • Mean ±SD • Min.-Max.	27.61± 27.45 1-100	
Oxygen saturation during sleep% • Mean ±SD • Min.-Max.	90.69%± 48.89% 81%- 96%	
Arousal Index/ hour • Mean ±SD • Min.-Max.	27.25± 14.72 6.7-59.0	
Snoring Episodes • Mean ±SD • Min.-Max.	27.25± 46.05 0.0-139.0	
Main Heart Rate during sleep/beat per minute • Mean ±SD • Min.-Max.	80.51± 18.54 56.1-140.0	
Desaturation Index/hour • Mean ±SD • Min.-Max.	23.44± 23.075 0.5- 99.6	
PLMS/ hour (periodic limb movements) • Mean ±SD • Min.-Max.	54..71± 69.503 1.5-279.1	

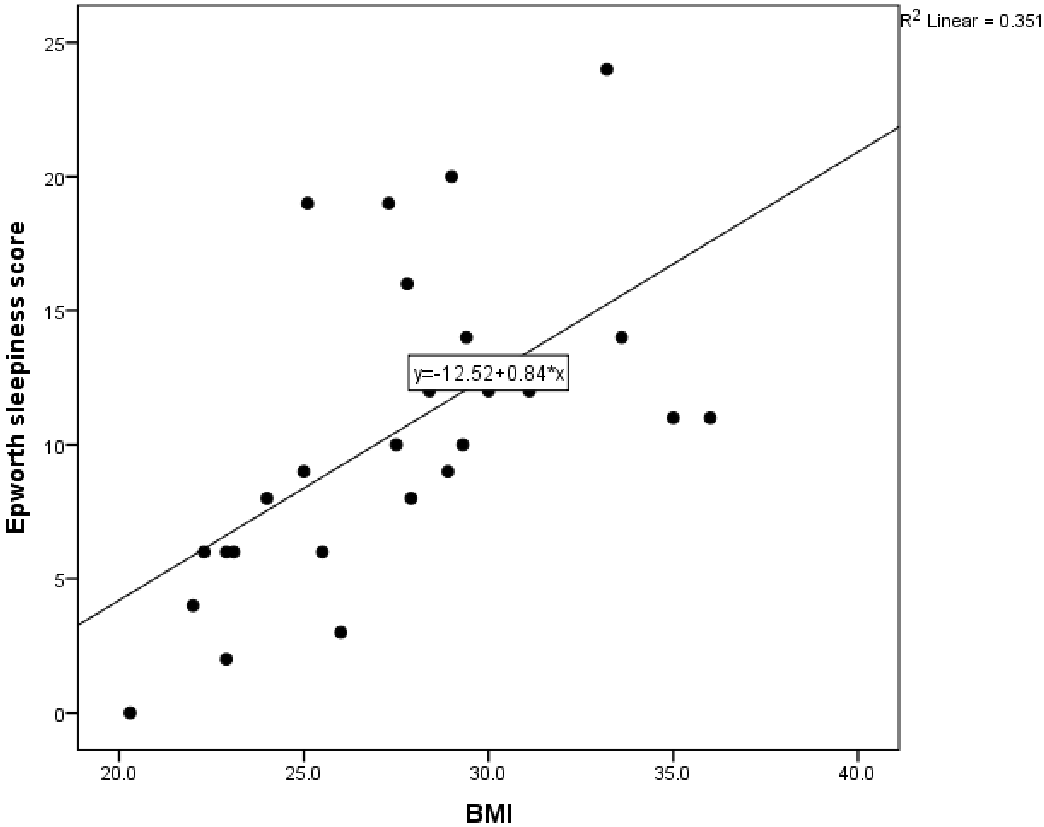
Table 5: Sleep staging according to the American Academy of Sleep Medicine (AASM)

Parameter	Number 26	Percent 100.0
N1% • Mean ±SD • Min.-Max.	20.1± 16.79 10-80	

N2% • Mean ±SD • Min.-Max.	49.0± 13.69 20-70
N3% • Mean ±SD • Min.-Max.	19.4± 13.26 0.0-50.0
R% • Mean ±SD • Min.-Max.	11.3± 81.6 0.0-30.0

Table 6: The predictors of the Epworth score among the studied patients

Parameter	Epworth <10		Epworth >10		Total		P value
	No 8	% 30.8	No 18	% 69.2	No 26	% 100.0	
Gender							
Male	6	30.0	14	70.0	20	76.9	0.622*
Female	2	33.3	4	66.7	6	23.1	
Age categories							
Age< 60 years old	2	14.3	12	85.7	14	53.8	0.061*
Age >60 years old	6	50.0	6	50.0	12	46.2	
BMI							
BMI <25kg/m^2	6	75.0	2	25.0	8	30.8	0.003*
BMI>25 kg/m^2	2	11.1	16	88.9	18	69.2	
Smoking							
Non smoker	2	66.7	1	33.3	3	11.5	0.213
Smoker	2	16.7	10	83.3	12	46.2	
Ex-smoker	4	4	7	63.6	11	42.3	
Performance status							
Ps0	5	100.	0	0.0	5	19.2	<0.001
Ps1	3	33.3	6	66.7	9	34.6	
Ps2	0	0.0	12	100.0	12	46.2	
Comorbidities							
No comorbidities	6	33.3	12	66.7	18	69.2	0.852
Hypertension	1	25.0	3	75.0	4	15.4	
Ischemic heart disease	0	0.0	1	100.0	1	3.8	
Benign prostatic hyperplasia	0	0.0	1	100.0	1	3.8	
Diabetes mellitus	1	50.0	1	50.0	2	7.7	



The figure 1 showed that there was significant positive correlation between body mass index and the Epworth sleepiness score; r 0.592, p value 0.001.

Table 7: Comparison of sleep patterns between chemotherapy- and non-chemotherapy-using patients

Parameter	No chemotherapy		Patents on chemotherapy		Total		P Value
	No 4	% 15.4	No 22	% 84.6	No 26	% 100.0	
Apnea hypopnea index/ hour(OSA) < 5 5-15 16-30 >30	 1 2 1 0	 25.0 50.0 25.0 0.0	 2 6 8 6	 9 27.3 36.3 27.3	 3 8 9 6	 11.5 30.8 34.6 23.1	 χ2 3.723 0.293
Epworth sleepiness score <10 >10	 4 0	 100.0 0.0	 4 18	 18.2 81.8	 8 18	 30.8 69.2	 0.005**
Sleep onset /minute • Mean ±SD.	24.73±18.558		56.16±62.8		52.535± 60.077		0.312*
Sleep efficiency % • Mean ±SD	62.23± 0.404		43.77±1.86		45.9% ±18.5%		0.095*
Snoring Episodes • Mean ±SD	7.0±2.64		47.96±10.002		27.25± 46.05		0.442*
PLMS/ hour (periodic limb movements) • Mean ±SD	59.83±74.87		53.339±71.37		54..71± 69.503		0.880*

*Mann-Whitney test, **Fischer exact, OSA obstructive sleep apnea

Table 8: Comparison of sleep patterns between different disease stages of the studied patients

Parameter	Stage II		Stage III		Stage IV		P Value
	No 6	% 23.1	No 10	% 38.5	No 10	% 38.5	
Apnea hypopnea index/ hour (OSA) < 5 5-15 16-30 >30	 2 4 0 0	 33.3 66.7 0.0 0.0	 1 4 4 1	 10 40 40 10	 0 0 5 5	 0.0 0.0 50 50	 0.006
Epworth sleepiness score <10 >10	 5 1	 83.3 16.7	 3 7	 16.7 70	 0 10	 0.0 100.0	 0.006
Sleep onset /minute • Mean ±SD.	22.7±13.49		61.48±69.22		63.4±24.61		0.046*
Sleep efficiency % • Mean ±SD	53.28±16.1		46.06±18.42		22.0±1.41		0.083*
Snoring Episodes							

• Mean ±SD	6.16±6.96	32.778±43.53	122.5±14.84	0.027*
PLMS/ hour (periodic limb movements) • Mean ±SD	62.017±107.67	55.23±60.35	19.95±28.213	0.552*

*Kruskal Wallis test, OSA obstructive sleep apnea

Table 9: Correlation between OAS and Sleep pattern of the studied patients

Spearman correlation	OAS	
	R	P-value
Sleep onset /minute	-0.102	0.619
Sleep efficiency %	0.435	0.026*
Wakefulness after sleep onset /minute	-0.108	0.598
Total Apnea-Hypopnea Index/hour	- 0.622	0.001*
Epworth score	-0.411	0.037*
Oxygen saturation during sleep%	-0.137	0.503
Arousal Index/ hour	0.150	0.466
Snoring Episodes	- 0.637	0.001*
Main Heart Rate during sleep/beat per minute	0.328	0.102
Desaturation Index/hour	-0.233	0.252
PLMS/ hour (periodic limb movements)	0.156	0.466
Sleep staging		
N1%	-0.169	0.408
N2%	0.039	0.850
N3%	0.198	0.332
R%	-0.095	0.643

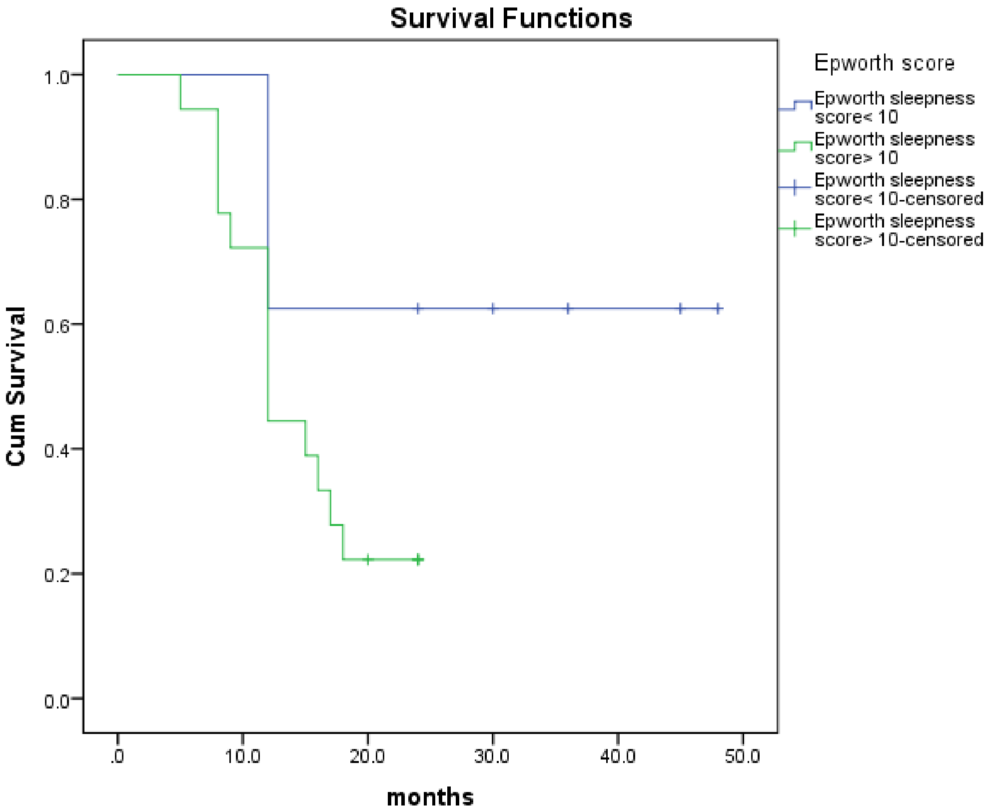


Figure 2: Survival plots in relation to Epworth sleepiness score in the studied patients

The cumulative survival plot shows that the overall survival appears to be lower in the patients with Epworth sleepiness score more than 10 compared to others with Epworth sleepiness score less than 10.

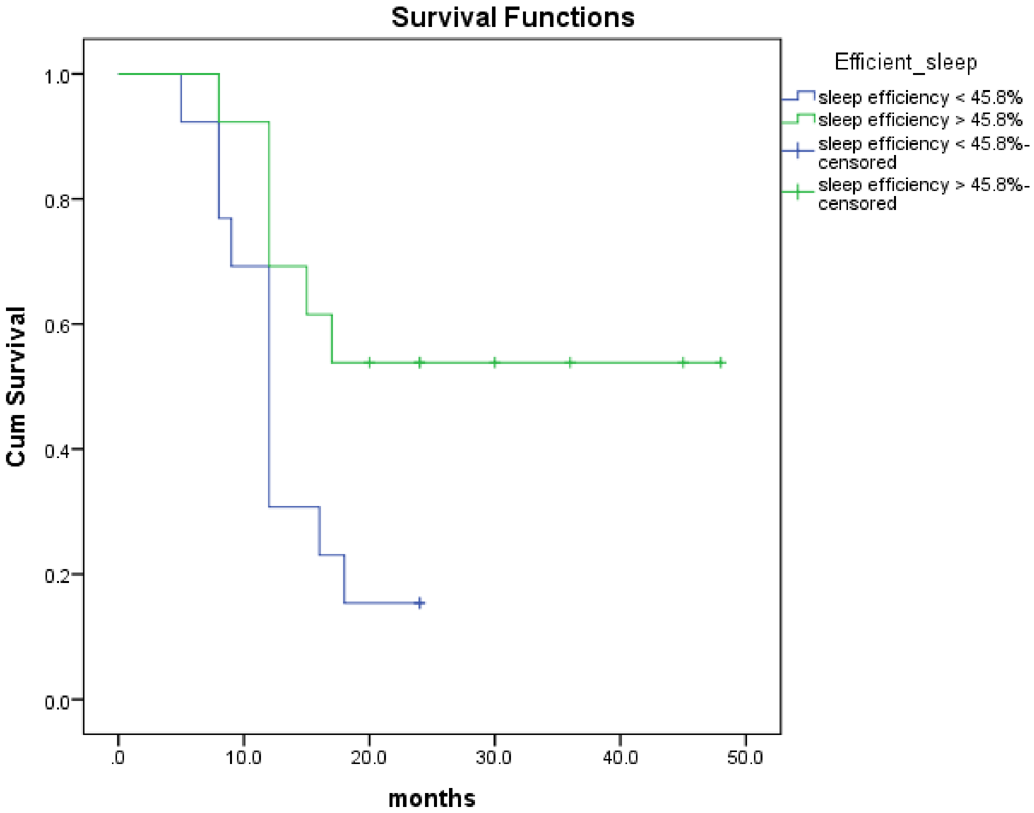


Figure 3: Survival plots in relation to sleep efficiency, % in the studied patients.

The cumulative survival plot shows that the overall survival appears to be lower in the patients with sleep efficiency less than 45.8% compared to others with sleep efficiency more than 45.8%.

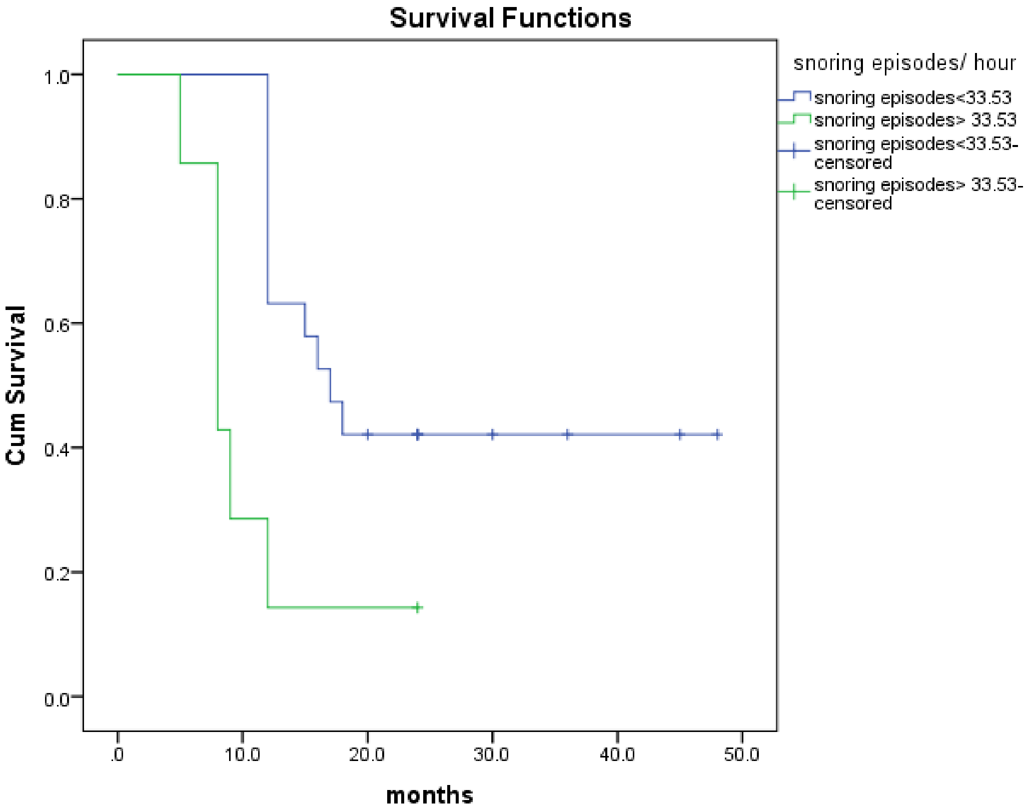


Figure 4: Survival plots in relation to snoring episodes / hour in the studied patients.

The cumulative survival plot shows that the overall survival appears to be lower in the patients with snoring episodes more than 33.53/ hour compared to others with snoring episodes less than 33.53/ hour.

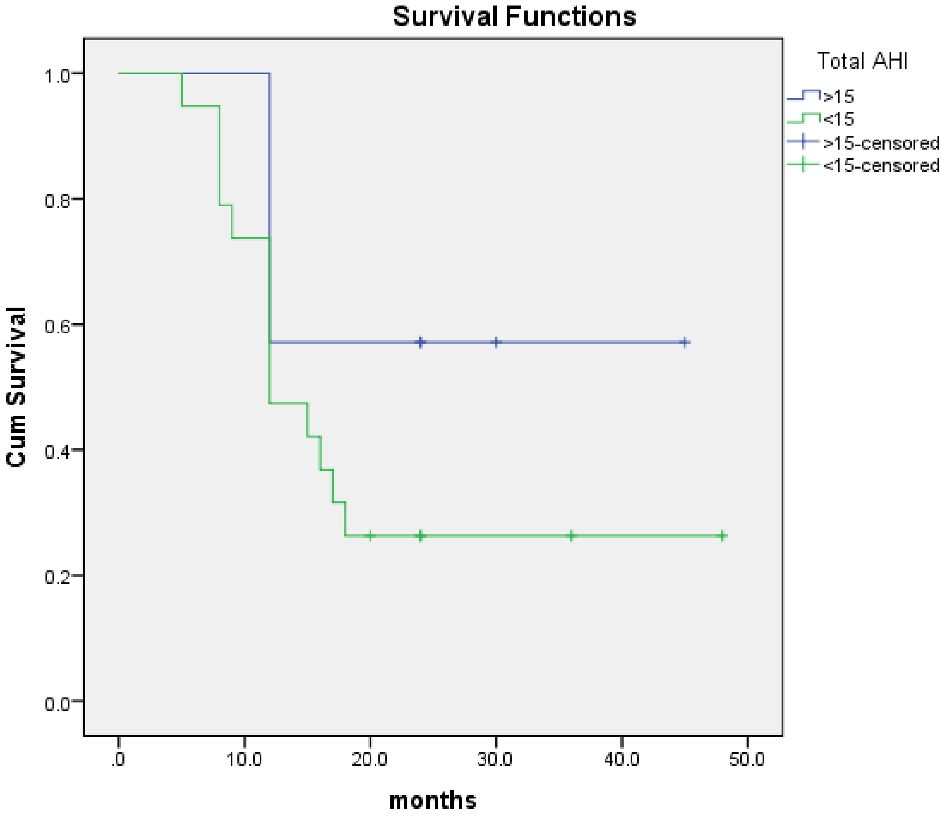


Figure 5: survival plots in relation to total apnea hypopnea index in the studied patients

The cumulative survival plot shows that the overall survival appears to be lower in the patients with total apnea hypopnea index more than 15/hour compared to others with total AHI less than 15/hour.

Discussion

Lung cancer is one of the most frequently diagnosed cancers in the world. The relationship between OSAS and lung cancer has been gained attention in a cohort study, but the authors were unable to find an association between OSAS and lung cancer incidence. Additionally, currently available evidence that assesses the association between OSAS and lung cancer mortality or outcomes is lacking.

As regarding table 1 (demographic data of the studied patients) we found that the mean age of the studied patients was 63.76±6.778; The percent of the studied patients who aged above 60 years old was 53.8% and 76.9% of them were male, the mean body mass index was 27.315±4.232 while, the mean of neck circumference was 38.96±3.104 while 11.5% of them were nonsmoker and 46.2% were smoker. 46.1% of them were (PS 2). 69.2% of the studied patients were with no comorbidities and 15.4% were hypertensive; 3.8% were with ischemic heart disease. Lung cancer, as with many diseases, is generally more common in older people, Data show that more men than women develop lung cancer.

These results were in agreement with Also, Bhaisare et al. (2022) who aimed to investigate the existence and pattern of Sleep-Disordered Breathing in patients diagnosed with lung cancer. The study included 26 (87%) men and four (13%) women, and the median age of the study population was 55 years (IQR: 12 years). Patients had a mean BMI of 19.4 ± 3.9 kg/m2. Twenty-five patients (84%) had a BMI of 19.4 ± 3.9 kg/m2] [8].

- As regarding table (2) that discussed (Clinical parameters in lung cancer patients) all the studied patients were non-small cell lung cancer (61.5% were adenocarcinoma,26.9% were squamous cell carcinoma,11.5% were large cell carcinoma).92.3% were negative ALK mutation; 73% of them were negative for EGFR. Regarding staging 38.5% of the studied patients were stage III, 38.5% were stage IV. In regard to treatment options; 7.7% of the studied patients undergone surgery; 84.6% of them received chemotherapy; 19.2% of them had radiotherapy; 26.9% were on Gefitinib targeted therapy and 7.7% were on Crizotinib targeted therapy. The mean of OAS (overall survival) was 18.38±11.426. Non-small cell lung cancer is the most common type of lung cancer. It grows and spreads more slowly than small cell lung cancer.

Bhaisare et al. (2022) reported that the most common form of lung cancer was adenocarcinoma (n=17, 56.7%), followed by squamous cell carcinoma (n=12, 40%) and small cell lung cancer (n=1, 3.3%) [8].

As regarding table (3) that discussed (Epworth sleepiness score of the studied lung cancer patients) 26.9% of the studied patients were excessive sleepy and 15.4% of them were normal. Cancer as well as cancer treatments and associated symptoms result in sleep disturbances. Prolonged awakenings during the night were attributed to pain, anxiety, medications and depression. Sleep disruption can lead to impairment of daily functioning as excessive situational sleepy and deterioration of quality of life.

Paul Zarogoulidis et al (2012) who aimed to investigate Subjective sleep quality in lung cancer patients before and after chemotherapy demonstrated that The main finding of his study is that the sleep quality of newly diagnosed lung cancer patients is poor, excessive daytime sleepiness, and impaired quality of life[9].

As regarding table (4) and (5) discussed Polysomnography parameters: the mean of sleep onset/ minute was 52.535± 60.077; the mean of Sleep efficiency % was 45.9% ±18.5%; the mean of Wakefulness after sleep onset /minute was 107.06± 0.61.94; the mean of Total Apnea-Hypopnea Index/hour was 27.61± 27.45; the mean of Oxygen saturation during sleep% was 90.69%± 48.89%; Arousal Index/ hour was 27.25± 14.72; Snoring Episodes was 27.25± 46.05; Main Heart Rate during sleep/beat per minute was 80.51± 18.54; Desaturation Index/hour was 23.44± 23.075 and PLMS/ hour (periodic limb movements) was 54..71± 69.503. .

Furthermore, the mean of N2% was the highest among sleep staging according to the American Academy of Sleep Medicine (AASM) [10].

We were in agreement with Dreher et al. (2018) who aimed to investigate the prevalence of Sleep-disordered breathing in patients with newly-diagnosed lung cancer. The study enrolled 100 patients. The mean ESS score was 6.3 ± 3.5; mean PSQI score was 7.0 ± 3.2 also median (IQR) Arousal Index/ hour was 4.9 [2.0, 10.4]; ODI/h was 5.3 [3.0, 10.1]; Mean SpO2, % 91.3 ± 2.4; Lowest SpO2, % 78.2 ± 8.2; Time with SpO2 < 90%, min 34.5 [9.8, 78.0]; Heart rate, beats/min 72.7 ± 11.8; Respiration rate, breaths/min 17.7 ± 4.9; Snoring, /h 66.6 [22.7, 130.3][11].

As regarding table (6) that discussed (The predictors of the Epworth score among the studied patients) there was significant positive correlation between body mass index and the Epworth sleepiness score as 88.9 % of the patients with BMI above 25kg/m2 were with Epworth score above 10. But there were insignificant difference between the gender, age categories, smoking status, comorbidities and the Epworth score above or below 10; (p value; 0.622, 0.061, 0.213 and 0.852 respectively). Obese patients with elevated BMI levels is traditionally associated with Obstructive sleep apnea which result in sleep impairment and affect daily functioning.

Liu et al. (2019) also conducted a study to investigate the possible relationship between lung cancer and nocturnal intermittent hypoxia, apnea and daytime sleepiness, especially the possible relationship between the occurrence and progression of lung cancer and obstructive sleep apnea syndrome (OSAS). They reported that there was significant difference in body mass index (BMI), ESS, AHI, T90% (min), between lung cancer group and control group (P<0.05) [12].

As regarding table (7) that discussed (Comparison of sleep patterns between chemotherapy- and non-chemotherapy-using patients) ESS >10 mean excessive day time sleepiness was significant in patients receiving chemotherapy (p value 0.005) increase sleep latency, more sleep inefficiency in patients on chemotherapy however there was insignificant statistical result p value 0.312, 0.095. Receiving chemotherapy can disrupt sleep due to therapy side effects, including pain, nausea, shortness of breath and anxiety, have higher fatigue levels that impair their sleep and health-related quality of life.

Momayyezi et al. (2021) reported that patients who were treated with chemotherapy were associated with significantly worse overall sleep quality, sleep latency, daytime dysfunction, sleep efficiency, sleep duration and subjective sleep quality[13].

On the other hand, Dean et al. (2015) reported that there was insignificant difference between chemotherapy- and non-chemotherapy-using patients and Apnea Epworth sleepiness score. The percentage of patients with ESS scores of greater than 10 was 21% at baseline, 33% at pre-second chemotherapy, and 35% at pre-third chemotherapy. Group means for ESS did not significantly change over time[14].

As regarding table (8) that discussed comparison of sleep patterns between different disease stages of the studied patients .There were significant differences between staging of the studied patients and Apnea hypopnea index/ hour(p value 0.006), Epworth score (p value 0.006), Sleep onset /minute (p value 0.061)and snoring episodes (p value 0.027). 50% of patients on stage IV were with moderate OSA and 50% were with sever OSA and all patients on stage IV above 10 Epworth sleepiness score. The mean of Sleep onset /minute (63.4±24.61) and snoring episodes in patients with stage IV (122.5±14.84) were the highest among the studied patients. While there were insignificant differences between different staging of the studied patients and Sleep efficiency % (p value 0.083), and PLMS/ hour (periodic limb movements) (p value 0.552). In this study the concurrence of lung cancer and obstructive sleep apnea syndrome (OSAS) was noted in 23 from 26 (88.5%) patients.

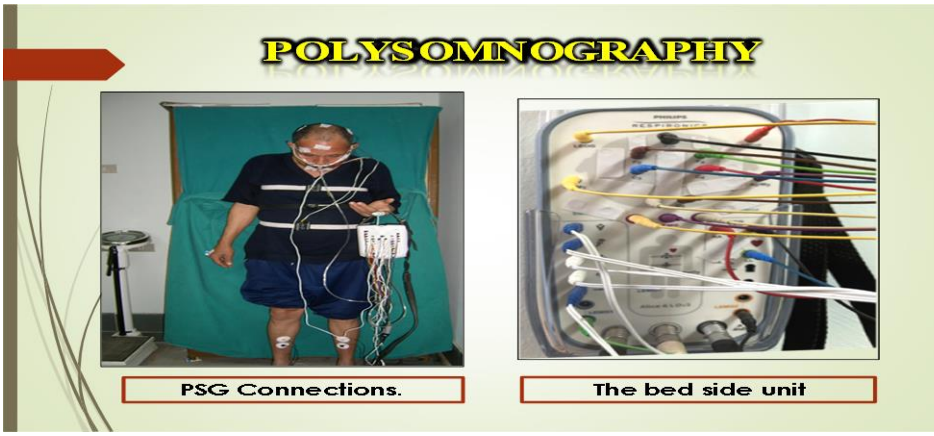
Li et al. (2017) demonstrated that tumor size and tumor staging were found to be adherent to Obstructive sleep apnea syndrome (OSAS) severity category after stratification based on severity of OSAS (measured by AHI). Of the 18 lung cancer patients with severe OSAS, 11/18 (61%) had bigger tumor size, 16/18(88.9%) were in the stage of III/IV. Of the 11 lung cancer patients with moderate OSAS, 5/11(45%) had bigger tumor size, 7/11(64%) were in the stage of III/IV. Of the 14 lung cancer patients with mild OSAS, 1/14 (7%) had bigger tumor size, 2/14(14%) were in the stage of III/IV[15].

When lung cancer tumors grow, breathing can become more difficult. This is sometimes caused by inflammation (localized irritation or swelling). Tumors can also press against airways, giving the air less space to move and making it difficult to breathe. Obstructive sleep apnea is a condition in which airflow is blocked during sleep, which happens as the muscles relax and loosen while sleeping.

As regarding table (9) and the figures (2,3,4,5) discussed Correlation between overall survival (OAS) and Sleep pattern of the studied patients. There were significant correlation between OAS and sleep efficiency (P = 0.001), total apnea-hypopnea index/hour (r -0.622, P= 0.001) and snoring episodes (r -0.637, P= 0.001) and ESS (p value <0.001). as the mean of OAS was 22.44±11.51 in patients with Epworth score above 10 which was higher than that of patients' Epworth score < 10

While there were insignificant correlation between OAS and sleep onset /minute, wakefulness after sleep onset /minute, oxygen saturation during sleep%, arousal Index/ hour, main heart rate during sleep/beat per minute, desaturation Index/hour, PLMS/ hour (periodic limb movements) and sleep staging.

However, Li et al. (2017) reported that there is a significant difference in survival rates across all lung cancer stages in patients with mild, moderate, and severe Obstructive sleep apnea(OSA) (p=0.0061). Also, patients with lung cancer who combined with severe or moderate OSAS had a lower overall survival relative to patients with mild OSAS, suggesting that OSAS severity was a risk factor to shorter overall survival in patients with lung cancer [15].

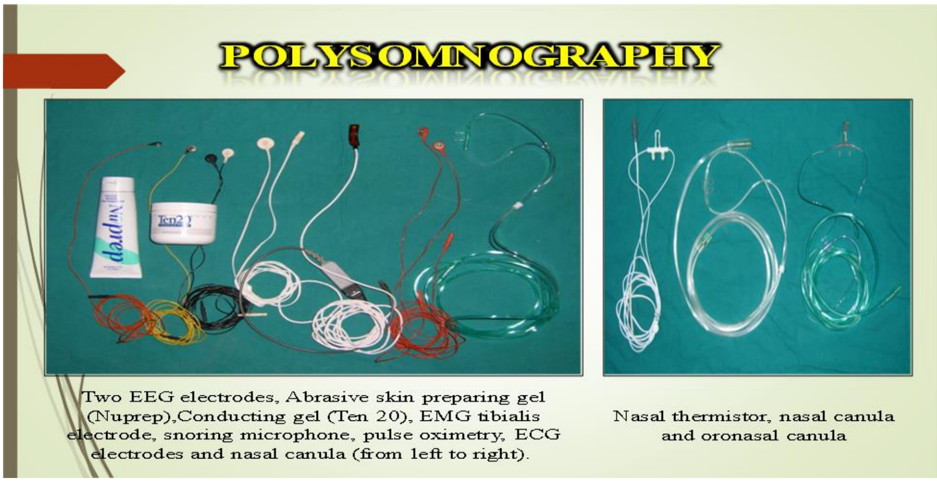


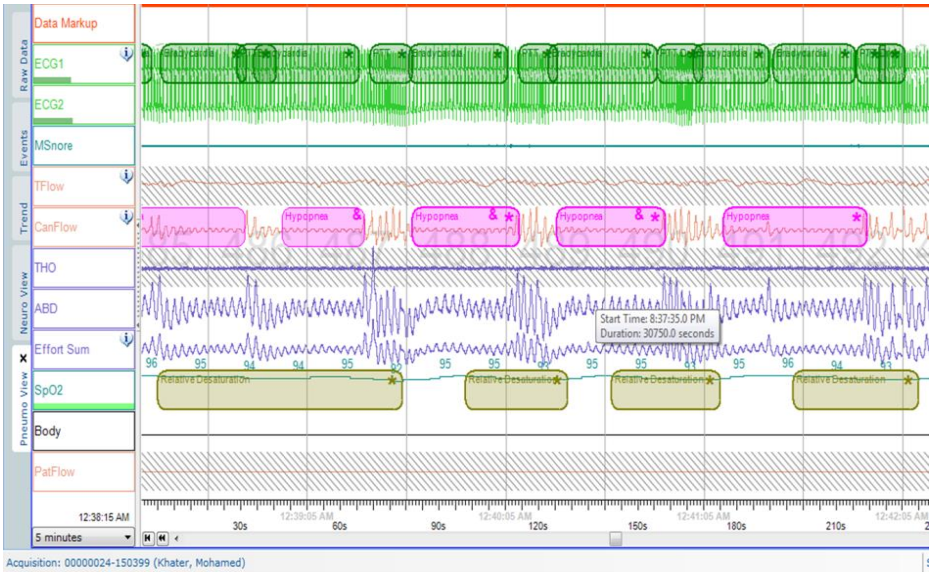
This is consistent with the follow-up results of cancer patients with OSAS in Dreher et al. (2018) cohort, suggesting that there is higher mortality and shorter median survival time in lung cancer patients with OSAS than in those without OSAS. It also indicates that concurrent OSAS may be a promoter of lung cancer occurrence and progression[11].

Other study showed the relation between lung cancer and OSA Wenjun Wang et al (2021) constructed a unique model for predicting the prognosis of lung cancer patients on the basis of four genes common to OSA and lung cancer. These genes may also serve as candidate genes to improve our knowledge about the underlying mechanism of OSA that leads to an increased risk of lung cancer at the genetic level. Genes associated with OSA and lung cancer were screened by weighted gene co-expression network analysis (WGCNA). The four genes are modulator of apoptosis 1 (MOAP1), chromobox 7 (CBX7), platelet-derived growth factor subunit B (PDGFB), and mitogen-activated protein kinase 3 (MAP2K3) were identified as key genes by univariate and then multivariate Cox regression analyses.

Conclusion

Patients with lung cancer had insomnia and OSAS. Tumor staging impacted OSA severity and outcomes.





Procedure

Polysomnography was conducted on the night .The following parameters were monitored: frontal, central and occipital EEG, electrooculogram (EOG), submentalis EMG, nasal and oral airflow, anterior tibialis EMG, body position and electrocardiogram. Additionally, thoracic and abdominal movements were recorded by inductance plethysmography. Oxygen saturation (SpO2) was monitored using a pulse oximeter.

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