March 2019

Sleeping pattern before thoracic surgery: A comparison of baseline and night before surgery

Mohammad Hamid
Aga Khan University Karachi, mohammad.hamid@aku.edu

Mohammad Irfan Akhtar
Aga Khan University

Saba Ahmed
Aga Khan University

Heliyon

Received:
13 September 2018
Revised:
19 December 2018
Accepted:
1 March 2019

Cite as: Hamid Mohammad, Akhtar Irfan Mohammad, Ahmed Saba. Sleeping pattern before thoracic surgery: A comparison of baseline and night before surgery. Heliyon 5 (2019) e01318. doi: 10.1016/j.heliyon.2019.e01318

Sleeping pattern before thoracic surgery: A comparison of baseline and night before surgery

Hamid Mohammad*, Akhtar Irfan Mohammad, Ahmed Saba

Anaesthesia Department, Second Floor PW II, Aga Khan University, Stadium Road, Karachi, Pakistan

* Corresponding author.

E-mail address: mohammad.hamid@aku.edu (H. Mohammad).

Abstract

Background: Sleep deprivation is considered a stress factor in the perioperative period. There are several studies on sleep disturbance after surgery but very limited literature available on preoperative sleep patterns, predictors of sleep disturbance and its effect on surgical outcome.

Methodology: Patients scheduled for thoracic surgery were asked to fill out a written Pittsburgh Sleep Quality Index (PSQI) questionnaire. The primary investigator explained this form to all the patients. This was filled out before premedication for subjective assessment of sleeping pattern at two different time point. Only those patients included who spent the previous night at home. Participants were asked to respond to the questions regarding their baseline sleeping pattern and compare it with last night.

Results: Total eighty-three patients with a mean age of 47.83 $\pm$ 17.88 were included in the study. Overall mean PSQI scores were significantly higher (p-value $<$ 0.01) during the night before surgery (6.94 $\pm$ 2.115) when compared with baseline (3.88 $\pm$ 1.877). Sleep latency was also significantly affected when last night-1 (the night before admission) was compared with usual sleep latency. Twenty patients were unable to sleep more than 5 hrs at night before admission which was significant when compared with their last month status (20 vs 3).

https://doi.org/10.1016/j.heliyon.2019.e01318

Logistic regression model demonstrated the age and Timing of surgery as a strong predictors of poor sleep (defined as PSQI $\geq$ 5).

Conclusion: Quality of sleep was profoundly affected at night before thoracic surgery, mainly due to a significant change in sleep latency and sleep duration. Although age and Timing of surgery were strong predictors of poor sleep we were unable to find any association between quality of sleep and type of surgery.

Keyword: Surgery

1. Introduction

Sleep is a naturally recurring state of rest characterized by partial or complete loss of consciousness, reduced metabolism, reduced or absent sensory and voluntary muscle activity and helps to conserve energy. Sleep is influenced by many factors including age, gender, food, physical and psychological health. Sleep disturbance affects the quality of life, health and daytime functions.

Very few studies on preoperative sleep disturbances have mentioned its effect on various postoperative components. Disrupted sleep the night before surgery seems to be more important than other sleep factors in increasing the severity of postoperative pain [1]. It may also affect the quality of life postoperatively. Leung et al. found that those patients who developed delirium postoperatively had more preoperative sleep disturbances even when they slept at home [2].

Sleep deprivation is considered a stress factor [3] in the perioperative period leading to fatigue, physical discomfort and may also contribute to postoperative pain [1]. There are several studies on sleep disturbance after surgery but very limited literature available on preoperative sleep pattern. Sleep disturbance in the preoperative period may be related to anxiety, pain, the magnitude of surgery and other environmental factors which are more common in the in-house patients than those who admitted on the day of surgery [4, 5]. In addition, possible surgery-related factors, which may affect sleep are the type of procedure (VATS vs. thoracotomy) [6], duration of the procedure, the severity of disease (Cancer vs. benign) and associated pain.

Adequate preoperative sleep may help in improving the quality of life and patient's satisfaction at the same time. When evaluating preoperative sleep, it is very important to know the quality of sleep and the baseline sleep pattern of the individual patient. Sleep quality means the degree of excellence in sleep. Sleep quality has several components like sleep initiation, maintenance of sleep, depth of sleep, amount of sleep, dreams, condition after sleep and effect on daily life [7].

There are various subjective and objective methods available for the assessment of Quality of sleep. Polysomnography and actigraphy are commonly used for objective

https://doi.org/10.1016/j.heliyon.2019.e01318

sleep monitoring. While for subjective assessment, a questionnaire is commonly used to assess the sleeping habit of individuals. Pittsburgh Sleep Quality Index (PSQI) uses a questionnaire to answer the important questions like duration of sleep, sleep efficiency and sleep disturbance. PSQI has shown moderate sensitivity to complaints of subjective distress (i.e. surgery, perceived stress) [8]. It has been validated in several populations and languages [9, 10].

The objective of our study was to assess the sleep pattern of thoracic surgery patients, a night before admission and compare it with the patient's baseline sleeping pattern.

2. Methods

This prospective survey was conducted in the surgical wards of Aga Khan University on 83 adult thoracic surgery patients between the ages of 18−65 years. Aga Khan University ethical review committee approval was sought. Consent was taken from all thoracic surgery patients. All patients admitted for elective thoracic surgery were included. Strict exclusion criteria were used which included patients who are in severe pain, patients on daily sleeping pills, psychiatric illness patients, patients with sleep disorders including sleep apnoea, unable to complete questionnaire and patients from outside Karachi.

Patient's demographics were also recorded at the same time which included age, gender, diagnosis, ASA status and type of surgery including video-assisted thoracoscopic surgery (VATS) and thoracotomy. In addition, all participants were asked to fill out a written PSQI questionnaire. This questionnaire was translated in local Urdu language as well. A medical officer explained this form to the patient. This was filled out before premedication to these patients. PSQI was used for assessment of baseline (sleeping pattern in the last month) and then the same questions were asked about the previous night while sleeping at home in a familiar environment.

2.1. Statistical analysis

The sample size was calculated on the basis of the previous study, which revealed a pattern of relatively low nocturnal sleep efficiency (79.3%) before surgery, with a 9% margin of error [11].

All statistical analysis performed using Statistical packages for Social Science version 19 (SPSS Inc., Chicago, IL). The sleeping pattern was assessed by the Pittsburgh Sleep Quality Index (PSQI) questionnaire. It has 7 components and 19 items. Each component is scored separately and weighted equally on a 0−3 scale. Scores range from 0 to 21 but in the present study daytime dysfunctions were excluded and the maximum score which patient can achieve was 18. Components of PSQI

https://doi.org/10.1016/j.heliyon.2019.e01318

including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication and daytime dysfunction were analyzed individually and mean and standard deviation were computed for all component score. The qualitative observation was computed by frequency and percentage and quantitative measurement was estimated by the mean and standard deviation. Normality was checked by the Shapiro Wilks test. Normally distributed data analyzed by t-test and proportion with the chi-square test. $P \leq 0.05$ was considered significant. Appropriate multivariate statistical techniques were depended on the pattern of PSQI score and independent variables.

Multivariate logistic regression was used to see the possible predictors of poor sleep. The variables included age, type of surgery (VATS vs. thoracotomy), the severity of disease (cancer vs. non-cancer) and time (baseline vs. last night). A p value of less than 0.05 was considered as significant.

3. Results

83 patients consented to participate in the study. Initially, 90 patients were approached but seven excluded due to errors in data entry. The average age of the patients was 47.83 ± 17.88, out of which 44 (53%) were males and 39 (47%) females Table 1. Most common surgery was video-assisted thoracoscopic surgery 60 (72.2%) which includes VATS plus decortication and VATS plus biopsy. Thoracotomy was done in 23 (27.7%) patients. 31 (37.3%) patients operated for cancer while resting for non-cancer surgery.

Fifteen (18%) patients had no partner while rest of the patients had a partner either sleeping in adjacent room 10 (14.7%) or in the room on same bed 29 (42.6%) or separate bed 29 (42.6%).

Table 1. Demographic and surgery statistics (n = 83).

Variables	Point estimates
Age (years)	47.83 ± 17.88 [18–87]
Gender	
Male	44 (53%)
Female	39 (47%)
Surgery	
Thoracotomy	11 (13.3%)
VATS	6 (7.2%)
VATS + Thoracotomy	2 (2.4%)
VATS + Decortication	34 (41%)
VATS + Bx	18 (21.7%)
Others	12 (14.5%)

Data are presented as mean ± standard deviation [range] and n (%).

https://doi.org/10.1016/j.heliyon.2019.e01318

When these patients were asked to rate their quality of sleep last night, none of these patient rate it as very good and 23 (27.7%) said that it was very bad. This change was significant when compared with the baseline sleep pattern Table 2.

Overall mean PSQI scores (Fig. 1) were significantly higher (p-value < 0.01) during the night before surgery (6.9 ± 2.1) when compared with baseline (3.8 ± 1.8).

Sleep latency was determined by adding the response of two questions. These questions were, how long has it taken you to fall asleep and cannot get to sleep within 30 minutes. Sleep latency was also significantly affected when last night-1 (the night before admission) was compared with usual sleep latency. Thirty-four (41%) patients require more than 30 minutes at night-1 to fall asleep while on the bed and it was usual for only 11 patients. Twenty patients were unable to sleep more than 5 hrs night before admission which was significant when compared with their last month status (20 vs 3).

Sleep efficiency was determined by dividing the number of hours patient slept by the total hours he/she spent on the bed. Sleep efficiency and sleep disturbance were

Table 2. Assessment of sleep pattern of thoracic surgery patients [n = 83].

Variables	During the past months	Last night before one day of surgery	P-value
Total time in bed (hours)	6:58 ± 1:06	6:47 ± 1:17	0.286*
Total sleep time (hours)	6:41 ± 1:07	6:20 ± 1:18	0.005*
Sleep latency (minutes)	16.7 ± 20.9	27.7 ± 27.6	0.0005*
Subjective sleep quality [C1]			
Very good	13 (15.7%)	0 (0%)	0.0005†
Fairly good	47 (56.6%)	47 (56.6%)	
Fairly bad	18 (21.7%)	13 (15.7%)	
Very bad	5 (6%)	23 (27.7%)	
Sleep latency [C2]			
No	58 (69.9%)	36 (43.4%)	0.0005‡
Yes	25 (30.1%)	47 (56.6%)	
Sleep duration [C3]	[n = 80]	[n = 80]	0.0005‡
>7 hours	15 (18.8%)	6 (7.5%)	
6–7 hours	62 (77.5%)	54 (67.5%)	
≤5 hours	3 (3.8%)	20 (25%)	
Sleep efficiency (%) [C4]	[n = 79]	[n = 79]	0.261‡
>85%	76 (96.2%)	74 (89.2%)	
75–84%	1 (1.3%)	3 (3.6%)	
65–74%	2 (2.5%)	2 (1.2%)	
<65%	0	0	

Results are presented as mean ± SD and n (%) and applied paired test as * Wilcoxon. Signed Ranks Test, † Marginal Homogeneity Test; ‡ McNemar-Bowker Test.
In case of missing information total patients is presented as [parenthesis].
C = Component.

https://doi.org/10.1016/j.heliyon.2019.e01318

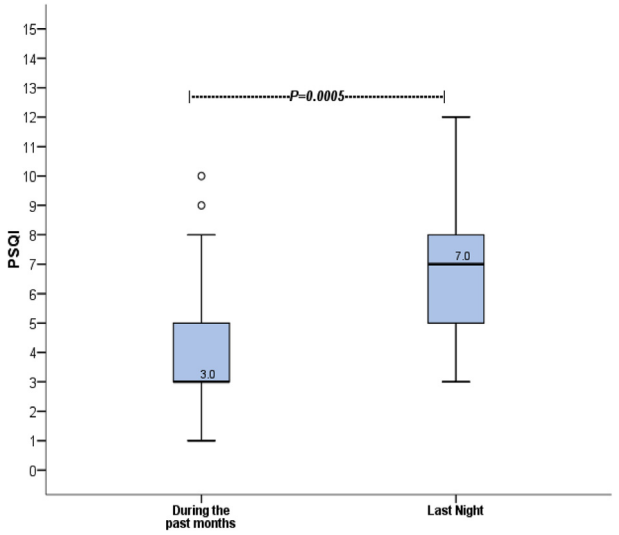

Fig. 1. Comparison of PSQI between during the past month and last night. Note: Component 7 were not included in the comparison of median PSQI score because day time activity was not observed of patients for last night.

comparable in both groups. Mean PSQI of sleep disturbance was 0.88 for night-1 and 1.14 for a baseline. Interrupted sleep at night-1 was seen in 30 (36%) patients and the main reason for interruption was, use of washroom.

Logistic regression model demonstrated the age and timing of surgery as strong predictors of poor sleep (defined as PSQI $\geq$ 5). Gender, type of surgery and severity of disease (cancer vs. non-cancer) had no influence on the quality of sleep Table 3.

4. Discussion

There is a paucity of literature on preoperative sleep pattern in surgical patients. This is the first study evaluating preoperative sleep pattern and quality of sleep in thoracic surgery patients. We used the Pittsburgh sleep quality index (PSQI), which is a self-reported questionnaire, commonly used to assess the quality of sleep and disturbances over a month period. Higher PSQI scores are associated with lower quality of sleep. PSQI of 5 or greater is considered as a poor quality of sleep [12]. We

Table 3. Preditors of poor sleep (PSQI $\geq$ 5) by Logistic regresssion analysis.

Predictors	P-value	OR	95% CI
Age (Years)	0.015	1.03	1.01−1.06
Gender (Male vs. Female)	0.775	1.13	0.49−2.57
Type of surgery (VATS vs. Thoracotomy)	0.896	1.07	0.39−2.88
Nature of disease (Cancer vs. Non Cancer)	0.432	0.681	0.26−1.77
Time of evaluation (Last Night, past months)	0.0005	29.37	11.57−74.5

https://doi.org/10.1016/j.heliyon.2019.e01318

compared last month sleep activity as a baseline with the last night sleep pattern while the patient was still sleeping at home in the same environment. Overall mean PSQI scores were significantly higher at night before surgery when compared with baseline. This study indicates that sleep is profoundly affected at night-1, mainly due to a significant change in sleep latency and sleep duration. Subjective sleep quality was also significantly altered at night-1. Another interesting finding was the lack of association between poor sleep and the type of surgery.

Boaz and colleagues [13] also demonstrated that preoperative sleep is mainly disturbed at night before surgery when compared with the baseline (which was assessed six weeks earlier). Sleep quality scores were also significantly higher at night-1 than baseline in that study. They looked at the preoperative sleep pattern of gynecology patients at six weeks before, 2 days prior and night before surgery at home. Canadian task force classification II-2 was used to evaluate sleep parameters. Patients in that study had difficulty in falling asleep, waking up early and more incidents of nocturnal awakening. The present study also showed greater sleep latency and reduced sleep duration at night before surgery. Approximately 25% of patients slept for less than 5 hrs night before surgery, which was significantly different from the baseline of only 3%. Very few patients (7.5%) were able to sleep more than seven hours at night before surgery. It may be that patients had to wake up early morning to get ready for hospital admission and surgery. Quality of sleep was very poor on direct questioning as well. When asked to rate their quality of sleep 27.7% said that it was very bad last night, which was again quite significant when compared with baseline. Another study on cardiac surgery patients also mentioned high PSQI scores for three consecutive days preoperatively and even higher scores in the postoperative period [14].

Sleep efficiency is probably the best method to evaluate the quality of sleep during last night than over a month period. It is probably less sensitive to measure sleep over a month period. Wright and colleagues also mentioned sleep efficiency to be greater than 85%, which is comparable to the present study. They mainly looked at the association between sleep efficiency night before surgery and postoperative pain control and found that patients with lowest sleep efficiency had 59% higher pain scores than patients in highest sleep efficiency, which remains for a week. Although, last night sleep efficiency was reduced (93.21 ± 6.438) in our study but it did not show any significant change from the baseline efficiency (95.650 ± 5.629). The reason may be that we did not consider awakenings or interrupted sleep at night, which also reduces total night sleep duration. Since this was a subjective survey and patients had difficulty in remembering the total interrupted time. Probably, it's better to keep a sleep diary for the whole month and then complete this questionnaire. Thirty patients in this study had interrupted sleep at night before surgery. Out of which 19 woke up to use the bathroom and rest for other reasons. Probably polysomnographic studies are more useful to look at the total sleep duration. Mean sleep

https://doi.org/10.1016/j.heliyon.2019.e01318

efficiency was higher in this study than the study by Ull M and colleagues [11], where efficiency was 79 ± 11.8 and sleep was more fragmented in their study compared to the normal population. In contrast to our study, this study was done in admitted patients where several factors influence sleep efficiency. Dolan and colleagues found that it is very difficult to sleep in surgical wards due to various reasons including bright light at night, more night time activity by staff, noises by patients and staff and performance of painful procedures like Foley's catheter and intravenous catheter insertion [15]. We avoided this survey on patients who spent the night at the surgical ward so that the true picture of sleep pattern can be seen. Another study showed preoperative efficiency of 82.98 during 72 hrs preoperatively which reduced drastically during the first week of cardiac surgery [14].

Sleep interruptions were also seen in the 1/3 of patients at night-1. Higher awakenings in the preoperative phase is also seen in other studies (Leung) leading to sleep disruptions. As expected the sleep interruptions after sleep were significantly more in the past month than last night as whole month's night activity was compared with only one-night activity and patients may have sleep disturbances due to one cause or other during previous thirty days. This is the reason why more patients woke up in the middle of the night than last night (33 vs 26). Probably it is not suitable to compare sleep disturbance of whole month activity with last night because only one sleep disturbance will be counted as a positive response. In previous studies, baseline sleep pattern was done six weeks [13] earlier while the present survey was completed on the morning of surgery.

Sleep latency at last night was significantly increased in our study. Around 41% of patients had difficulty in falling asleep and it took them more than 30 minutes. This was significantly different from a baseline of 13.3%. Boaz et al. also mentioned increased latency night before when compared with baseline and two days prior to surgery. In contrast to our study, Leung and colleagues mentioned the latency of 6−24 minutes during 6 days (3 days prior and 3 days after surgery) in the perioperative period [2].

Sleep disturbance is not only associated with cardiac diseases but also leads to poor outcome after cardiac surgery [16]. These patients also adopt poorly after surgery leading to deterioration of sleep, had greater symptoms including pain and poor quality of life. Although, Lung cancer patients are already known for sleep disturbances perioperatively present study was unable to show the impact of the type of disease on quality of sleep [17].

Poor sleep may be a marker of anxiety related to surgery and anesthesia outcomes. Anxiety is a common occurrence before surgery due to various reasons including fear of death, pain, financial reasons, disfigurement, and long recovery. Stress and anxiety both can interfere with sleep. Sleep disturbances can also lead to anxiety and depression. Sleep disturbance is extremely common in anxiety disorders like

https://doi.org/10.1016/j.heliyon.2019.e01318

panic disorder. We were unable to find any study, which looked at surgery-related anxiety and its association with sleep disturbances. Some patients may have a primary sleep disorder and preoperative identification of these patients may help in postoperative sleep disturbances.

Sleep disturbance is commonly seen before surgery but there are limited studies on this topic and no guidelines to manage this condition. The present study confirms the presence of poor sleep quality at night before surgery even when the patient is sleeping in a familiar environment. Strategies are required to deal with this anticipated problem by using either sedatives or anti-anxiety medications at night before surgery. Further studies needed to look at the association of poor sleep quality with intraoperative anesthesia requirement and postoperative outcomes like satisfaction and pain control.

Declarations

Author contribution statement

Hamid Mohammad: Conceived and designed the experiments; Wrote the paper.

Ahmed Saba: Analyzed and interpreted the data; Wrote the paper.

Akhtar Irfan: Performed the experiments.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Acknowledgements

We acknowledge the contribution of Mr. Amir Raza, research coordinator Anaesthesiology for assistance in statistical part.

References

[1] C.E. Wright, D.H. Bovbjerg, G.H. Montgomery, C. Weltz, A. Goldfarb, B. Pace, et al., Disrupted sleep the night before breast surgery is associated

https://doi.org/10.1016/j.heliyon.2019.e01318

with increased postoperative pain, J. Pain Symptom Manage. 37 (3) (2009 Mar) 352−362.

[2] J.M. Leung, L.P. Sands, S. Newman, G. Meckler, Y. Xie, C. Gay, et al., Preoperative sleep disruption and postoperative delirium, J. Clin. Sleep Med. 11 (8) (2015 Aug 15) 907−913.

[3] S. Rosenberg-Adamsen, M. Skarbye, G. Wildschiodtz, H. Kehlet, J. Rosenberg, Sleep after laparoscopic cholecystectomy, Br. J. Anaesth. 77 (5) (1996 Nov) 572−575.

[4] I. Maranets, Z.N. Kain, Preoperative anxiety and intraoperative anesthetic requirements, Anesth. Analg. 89 (6) (1999 Dec) 1346−1351.

[5] W. Caumo, A.P. Schmidt, C.N. Schneider, J. Bergmann, C.W. Iwamoto, D. Bandeira, et al., Risk factors for preoperative anxiety in adults, Acta Anaesthesiol. Scand. 45 (3) (2001 Mar) 298−307.

[6] I. Gogenur, S. Rosenberg-Adamsen, C. Kiel, M. Kjaersgaard, H. Kehlet, J. Rosenberg, Laparoscopic cholecystectomy causes less sleep disturbance than open abdominal surgery, Surg. Endosc. 15 (12) (2001 Dec) 1452−1455.

[7] H. Yi, K. Shin, C. Shin, Development of the sleep quality scale, J. Sleep Res. 15 (3) (2006 Sep) 309−316.

[8] J.R. Dietch, D.J. Taylor, K. Sethi, K. Kelly, A.D. Bramoweth, B.M. Roane, Psychometric evaluation of the PSQI in U.S. college students, J. Clin. Sleep Med. 12 (8) (2016 Aug 15) 1121−1129.

[9] S.A. Beaudreau, A.P. Spira, A. Stewart, E.J. Kezirian, L.Y. Lui, K. Ensrud, et al., Validation of the Pittsburgh sleep quality index and the Epworth sleepiness scale in older black and white women, Sleep Med. 13 (1) (2012; Jan) 36−42.

[10] M. Salahuddin, T.T. Maru, A. Kumalo, S.R. Pandi-Perumal, A.S. Bahammam, M.D. Manzar, Validation of the Pittsburgh sleep quality index in community-dwelling Ethiopian adults, Health Qual. Life Outcomes 15 (1) (2017; Mar 27) 58.

[11] U.M. Edell-Gustafsson, J.E. Hetta, C.B. Aren, Sleep and quality of life assessment in patients undergoing coronary artery bypass grafting, J. Adv. Nurs. 29 (5) (1999 May) 1213−1220.

[12] M.A. Grandner, D.F. Kripke, I.Y. Yoon, S.D. Youngstedt, Criterion validity of the Pittsburgh sleep quality index: investigation in a non-clinical sample, Sleep Biol. Rhythms 4 (2) (2006 Jun) 129−139.

 https://doi.org/10.1016/j.heliyon.2019.e01318

[13] B. Sheizaf, B. Almog, K. Salamah, F. Shehata, J. Takefman, T. Tulandi, A pragmatic evaluation of sleep patterns before gynecologic surgery, Gynecol. Surg. (8) (2011) 151−155.

[14] N.S. Redeker, J. Ruggiero, C. Hedges, Patterns and predictors of sleep pattern disturbance after cardiac surgery, Res. Nurs. Health 27 (4) (2004 Aug) 217−224.

[15] R. Dolan, J. Huh, N. Tiwari, T. Sproat, J. Camilleri-Brennan, A prospective analysis of sleep deprivation and disturbance in surgical patients, Ann. Med. Surg. (Lond) 6 (2016) 1−5.

[16] L. Poole, T. Kidd, E. Leigh, A. Ronaldson, M. Jahangiri, A. Steptoe, Preoperative sleep complaints are associated with poor physical recovery in the months following cardiac surgery, Ann. Behav. Med. 47 (3) (2013) 347−357.

[17] I.H. Halle, T.K. Westgaard, A. Wahba, T. Oksholm, T. Rustoen, K.H. Gjeilo, The trajectory of sleep disturbances in patients undergoing lung cancer surgery: a prospective study, Interact. Cardiovasc. Thorac. Surg. 25 (2) (2017 August) 285−291.

https://doi.org/10.1016/j.heliyon.2019.e01318