Sleep Quality Assessment in Ambulatory Surgery Patients

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Abstract

Aim: Evaluate the postoperative quality of sleep in patients submitted to ambulatory surgery and additionally compare who spent the first night at the hospital and those who returned home.

Material and Methods: 80 patients submitted to ambulatory surgery answered and delivered a questionnaire with sleep and recovery evaluation surveys. After the patient completed the questionnaire, more general information about the patient was analysed, as well as if the patient spent the first night at the hospital. The questionnaire consists in an evaluation of sleep and surgery recovery through Quality of Recovery (QoR-15), Visual Analogue Scale – Sleep (VAS-S), Sleep Diary and Patient-Reported Outcome Measures for Sleep Disturbance and Sleep-Related Impairments (PROMIS™). The evaluation refers to seven days before and seven days after surgery.

Results: Comparisons between group "Home" (n=62) and group "Hospital" (n=18) have shown no differences in QoR-15, VAS-S, and PROMIS™. Patients Sleep Diary did not show differences between groups in almost every variable except "Hospital" group patients presented more day napping time the day after surgery (p=0.049). Both groups showed a significant decrease in sleep quality, in 7-day evaluation ("Home": p<0.000; "Hospital": p=0.005).

Conclusion: Our results suggest that sleeping one night at the hospital after ambulatory surgery does not affect significantly the quality of sleep a week after surgery. The procedure per se means a significantly lost quality of sleep during the first week after surgery in both groups (there are no differences between groups). Patient recovery assessment showed more "Hospital" group patients had "poor recovery" at 24 hours, but this is not a significant difference.

Keywords: Sleep; Quality of Sleep; Ambulatory Surgery; Ambulatory Anaesthesia.

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Introduction

Sleep is a complex and dynamic physiological state fundamental to physical (circadian cycle) and mental health [1–3]. Patients undergoing major or minor surgical interventions undergo several physical and psychological changes [4–6]. Postoperative poor sleep quality or "disrupted sleep" is an under-investigated physiological change associated with immune system dysfunction, proinflammatory state, impaired resistance to infection, as well as alterations in nitrogen balance and wound healing [3,7–10], poor sleep quality is also associated with increased in socioeconomic costs due to more extended absences from work and greater use of health care [11]. Multiple investigations have recognised sleep disturbances after minimally invasive surgery, ambulatory surgery and elective surgery [12–15]. These papers agree that sleep alterations are mainly changes in sleep pattern/cycles in the first postoperative days. The changes in sleep cycles are sleep fragmentation, reduced total sleep time and loss of time spend in slow wave sleep (SWS) and rapid eye movement (REM) sleep [12–16]. Suppressed REM sleep is compensated with rebound REM sleep in following nights which is correlated with apnoea, ventricular tachycardia, severe bradycardia [17]. Rebound REM sleep is linked with a threefold increase in hypoxic episodes, obstructive sleep apnoea syndrome, stroke, myocardial infarction, mental status impairment, hemodynamic instability and wound breakdown [17].

Today, Ambulatory Surgery (AS) includes surgical procedures of almost every surgical speciality and in Portugal, patient's hospital stay is limited to a maximum of 24 hours. Therefore some patients may need to sleep one night in a hospital setting [18]. In Braga's Hospital, sleepover was introduced in 2008 to support inclusion of more surgeries (mainly in the evening period), more complex procedures and patients with longer vigilance aiming to reduce the surgical waiting list [19]. Although AS was introduced in Portugal only 20 years ago, in 2006, it was already responsible for 27.1% of all programmed surgical procedures rising to 63.7% in 2016. This fact demonstrates its growing evolution and significant contribution to Portuguese National Health System (data collected by the Annual Report on Access to the National Health System of 2017). Among its numerous advantages, we find lower morbidity, lower mortality and greater patient comfort and satisfaction. Nevertheless, it is not free of complications [5].

Sleep quality is one of the postoperative complications that has been less studied [3,17]. Sleep quality impairment may affect patient's recovery and well-being after surgery, so it should be routinely evaluated [8–10,12,14–16]. Certain postoperative symptoms and signs are already analysed and treated before discharge like pain, nausea, hemodynamic stability, bleeding and dizziness [4,6,13,14,16,20]. Pain and nausea are the most common side effects in the postoperative recovery period [4,6,20].

Currently evaluation of sleep quality is neglected. Hospitalised patients often complain of sleeping difficulty in a hospital setting. This may seem related to endogenous and exogenous factors[9,15,21] including: hospital noise, unfamiliar environment, invasiveness of the procedure, worries about safety, hunger and other symptoms like pain.

With the purpose to get the optimal recovery conditions, quality of sleep should also be an outcome measure and an important variable in patients' recovery. Postoperative sleep disturbances represent a relevant research field, as they may have a significant negative impact on postoperative outcome [14,22].

The primary goal of this study was to evaluate and compare the postoperative quality of sleep in patients submitted to ambulatory surgery who spent a night in hospital and compare it those who returned home on the same day. We wanted to analyse if sleeping one night at the hospital has a significant impact on patients sleep quality and, in the global recovery (physical and psychological) from ambulatory surgical procedures.

Materials and Methods

This prospective, observational and descriptive study with investigator blinded groups included all adults [18-70 years old) submitted to ambulatory surgery at Hospital de Braga, independently of surgery speciality. Patients were asked to fill questionnaires for self-evaluation of sleep (before and after surgery) and quality of recovery after surgery. In sleep and sleep quality assessment, it is possible to use different methods: quantitative parameters such as the number of hours of sleep, sleep latency and number of awakenings, and qualitative parameters like the patient perception of sleep quality [1,9,10,17].

Firstly, due to the subjectivity of self-evaluation questionnaires, to ensure a better quality of data, patients were submitted do a Mini-Mental State Examination (MMSE). Every patient with low score level was excluded (cut-off values appropriated to country language and education level [23,24]. Patients were excluded following the criteria: unable to sign informed consent, motor dependency, cognitive dysfunction or MMSE < 24 (depends on graduation level), age under 18 or older than 70 years old, subjects unable to speak and write Portuguese or incapable of filling questionnaires without help, and if a life threatening complication emerged. Patients on psychiatric medication were excluded if they started a new medication for sleep disturbance recently (<1 month), to avoid potential bias. If surgery was cancelled or transferred to conventional surgery, the patient was excluded. Patients who delivered the questionnaire incomplete tests or non-appropriate answers was considered as invalid.

The questionnaire is divided into five parts: before surgery (T0), 24 hours (T1), 48 hours(T2), 72 hours (T3) and seven days after surgery (T4). Patients were asked to complete each part at the end of the day. After taking informed consent patients immediately filled the first part of the questionnaire (T0), referring to sleep quality for the previous seven days and the night before surgery and baseline overall state for quality of recovery. It took about 10-15 minutes to complete. T1, T2, T3 and T4 questions were self-filled at home. Every question answered at home was also answered at the hospital in T0 (to avoid patients doubts). The patient was requested not to fill the corresponding questionnaire part if he/she forgets to answer in the matching moment/day.

From patients who gave informed consent, demographic and clinical data was analysed. The investigator was blinded as to if the patient did or didn't sleep the first night at the hospital, this was only evaluated later.

Measures

Questionnaire tools

Mini-Mental State Examination: Mini-Mental State Examination (MMS) is a widely used mental state evaluation by many investigators to have a quantitative assessment of cognitive performance. The MMS includes eleven questions and requires only 5-10 min to fill. It has reliability and validity to detect patients with cognitive impairment as well as diseases which cause cognitive and mental impairment [23]. Guerreiro et al. made Portuguese validation and adaptation, more recently, in 2009, Santana revalidated and defined new cut-off scores for different education levels [24].

Quality of Recovery 15: Quality of Recovery 40 (QoR-40) is one of the most applied postoperative recovery questionnaires, and a Quality of Recovery 15 (QoR-15) version was developed, tested and approved. The short version consists of 15 questions and performs well in all dimensions, taking only 2.5 minutes to complete. When compared to QoR-40, QoR-15 provides an equally extensive but less time-consuming evaluation. The QoR-15 questionnaire consists in 15 questions that assess the quality reported by the patient of the postoperative recovery using an 11-point numerical rating scale that ranges from a minimum score of 0 (poor recovery) to a maximum score of 150 (excellent recovery) [25,26].

This questionnaire was to be filled at three different times: in the preoperative period (T0) 24 hours (T1) and 48h postoperatively (T2). It is usually filled out at 0 and 24 hours. In this case, it was also be applied at 48 hours since there are references that in the first 24 hours the QoR results would not correspond to reality. Some patients due to stress and anxiety associated with surgery may have skewed results. Patients with a QoR-15 score lower than total patients QoR-15 (T0) average minus one standard deviation (measurement before surgery) are defined as "poor recovery quality" [26].

Sleep Diary and Visual Analogue Scale – Sleep: One way to evaluate sleep quality is by using scales and complement it with a sleep diary. These instruments are simple, easy to use and could be used by the general practitioner because they allow a good sampling of accurate and repeated measurements of sleep quality with reliability. We chose a protocol of self-evaluation of sleep quality, used in Gögenur et al. (2009) [27]. Sleep quality assessment was made by a questionnaire using both VAS-S and sleep diary for four days (4 measurements). Visual Analogue Scale – Sleep (VAS-S) was applied by asking patients to report how they slept the previous night using a 100 mm visual analogue scale (0 mm is the best conceivable sleep, and 100 mm is the worst conceivable sleep). The visual analogue scales were tested and approved for Portuguese [28].

The sleep diary (SD) was also recorded by patients (at what time they went to bed, when they tried to sleep, how many minutes it took to fall asleep, duration of night-time awakenings, duration of awake time during nighttime and the time they left bed). The time and duration of naps during the day were also counted [27,29].

Patient-Reported Outcomes Measurement Information System - Sleep Disturbance Short Form 8a: The Patient-Reported Outcomes Measurement Information System (PROMIS™) Sleep Disturbance questionnaires allow the patient to self-assess various sleep characteristics such as their quality, depth, and well-being. These questionnaires allow us to carry out an overall evaluation that also includes difficulties in falling asleep, maintaining sleep and perceptions related to adequate and quality sleep. The objective of this questionnaire is to obtain a 7-day evaluation of the sleep quality of the patient in a standardised and quantifiable way. This investigation will be applied before surgery (T0) to obtain the patient's baseline sleep quality and seven days after surgery (T4) to find out if we find differences. All questions from the PROMIS™ sleep disturbances database have already been translated to the Portuguese language [30,31].

The results of the questionnaires were collected in 2 ways: telephone contact (after 7-10 days of surgery) or by mail. All shipping methods had no cost to the patient and identity was kept anonymous.

Ethics

This project was approved by the Ethics Commission of Life and Health Sciences Research Institute and Ethics Committee of Braga's Hospital. Informed and written consent, describing all the procedures and goals of this research protocol, was obtained before any data collection. Moreover, all subjects were informed they could withdraw from participating at any moment during the study.

Analytic and Statistical Analyses

Patients' data was registered in Microsoft Excel 2018, and the statistical analyses were performed with SPSS software (version 25.0, SPSS Inc., Chicago, IL, USA). All variables were tested for normality variables through the Kolmogorov-Smirnov test ($p > 0.05$), asymmetry and kurtosis (George & Mallery, 2010) and the histograms were also verified. Binomial variables evaluation was done using the Chi-squared test, but if more than 20% of expected counts were verified, Fisher's exact test was applied. For quality of sleep scores and objective sleep parameters comparison in distinct groups, the Independent T-test for normally distributed variables and Mann-Whitney U for variables non-normally distributed was performed. Some variables were compared between different evaluations inside the same group using a paired t-test or Wilcoxon test for normally non-normally distributed variables, respectively. Bonferroni correction was made for multiple comparisons. As for effect size evaluation, Cohen's D or R-value was calculated for parametric and non-parametric analysis, accordingly. Results are expressed as mean ± standard deviation (SD) or as median ± interquartile range (IQR) if normality is not assumed. A p-value <0.05 was accepted as statistically significant.

Results

Demographic Data

Figure 1 shows a representative diagram of patients participating in the study.

From July to September 2018, 152 patients were assessed to participate in the study, but not all were admitted as Figure 1 shows. In total, 33 patients were excluded, 36 did not deliver the answers and 3 delivered invalid questionnaires (total drop out of 72 patients).

In the end, 80 patients met all the necessary criteria, and their demographic characteristics are presented in Table 1. Patients were divided in "Home" (patients who spent the first night at home, n=69) and "Hospital" (patients who spent the first night at the hospital, n=19).

Sample analysis and differences between groups variables were verified. Differences between groups were detected in cardiovascular comorbidity (Fisher's exact test: p=.04, $\Phi c = 0.311$) and corticoid use in surgery (Fisher's exact test: p=.034, $\Phi c=0.237$).

Measures Results

In order to evaluate the quantitative parameters of patients sleep patients were asked to make a sleep diary for four days (one day before and three after surgery) (Table 2). Intergroup analysis was performed, and almost no differences were found. Differences were only verified in T1, 24 hours after surgery, in which "Hospital" group spent significantly more time napping (n= 17, U=371; p=.049; r=-.22; n=77) than "Home" group.

VAS-S assessment was made with intragroup and intergroup comparisons. VAS-S has shown no differences between groups (Table 3). However, the intragroup evaluation in Table 4 shows a significantly different score every consecutive night in both groups (T0-T1, T1-T2, T2-T3, p<.05). The first night after surgery (T1) was significantly worse than preceding night (T0) for both groups (Home: n=54, Z=-4.108, p<.000, r= -.56; Hospital: n=17, Z=-2.488, p=.013, r= -.60). Comparing first and second night after surgery (T1-T2), the first was also worse for both groups (Home: n=48, Z=-2.945, p= .024, r=-.43; Hospital: n=16, Z=-2.257, p=.024, r=-.56). The third night (T2-T3) show statistical improvement of subjective sleep quality in both groups (Home: n=45, Z=-2.622, p=.028, r=-.39 ; Hospital: n=14 Z=-2.197, p=.028, r=-.59). The preoperative night (T0)

Figure 1 Representative diagram of patients participating in the study (CONSORT DIAGRAM 2010)(32).

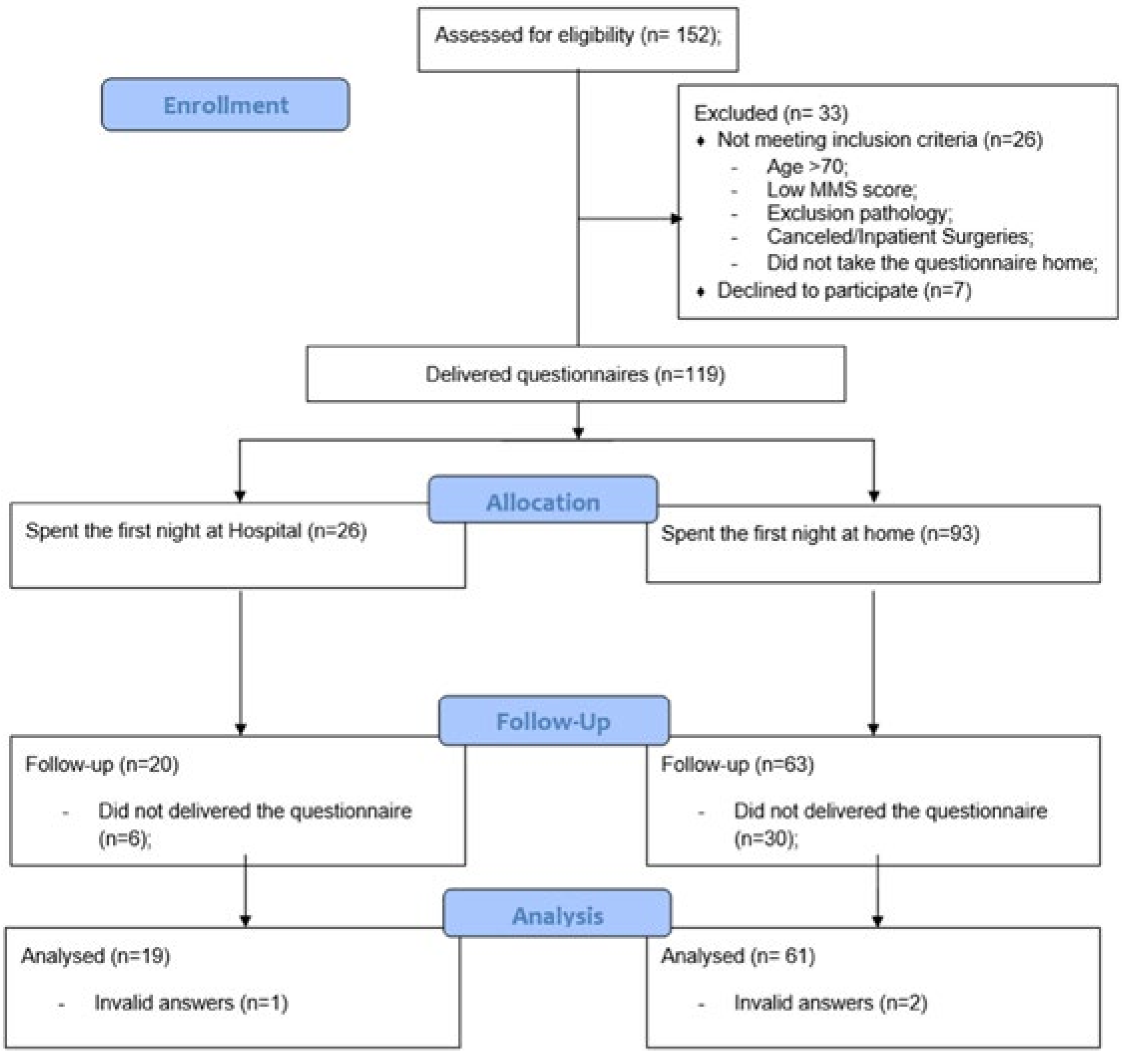

Table 1 Patient Characteristics.

	Home (n=62)	Hospital (n=18)	Statistical test
Gender (M/F)	21/41	4/14	X2(1) =0.881, p=.348, Φ= 0.105
Age (mean ± SD)	45.5 ± 13,3	39.2 ± 12.2	t(78) = 1.801. p=.076, d= 0.493
IMC (mean ± SD)	25.4 ± 4.4 (n=44)	24.7 ± 3.2 (n=14)	t(55)=0.538, p = .593, d=0.183
Surgery Speciality (n - %)			
- ORL	6 – 9.7%	5 – 27.8%	
- General Surgery	9 – 14.5%	5 – 27.8%	
- Vascular Surgery	9 – 14.5%	5– 27.8%	
- Gynaecology	14 – 22,6%	2 – 11.1%	p =.131, Φc = 0.389
- Ophthalmology	4 – 6,5%	0 – 0%	
- Orthopaedics	14 – 23%	1 – 5.6%	
- Plastic Surgery	3 – 4.8%	0 – 0%	
- Urology	3 – 4.8%	0 – 0%	
ASA (n-%)			
- 1	26 – 41.9%	6 – 33.3%	
- 2	34 – 54.8 %	12 – 57.5%	p=.832, Φc = 0.555
- 3	2 – 3.2%	0 – 0%	
Comorbidities (n - %)			
- Cardiovascular*	20 – 32.3%	0 – 0%	p=.04, Φc = 0.311*
- Venous Insufficiency	6 – 9.7%	0 – 0%	p=.328, Φc = 0.153
- Respiratory	1 – 1.6%	2– 11.1%	p=.125, Φc = 0.209
- Alcohol/Smoking addiction	6 – 9.7%	1 – 5.6%	p=1.000, Φc = 0.061
- Multiple involvement diseases	6 – 9.7%	2 – 11.1%	p=1.000, Φc = 0.020
- Overweight	20 – 32.3%	7 – 38.9%	p=.600, Φc = 0.059
- Endocrine	5 – 8.1%	2 – 11.1%	p=.652, Φc = 0.045
- Dyslipidaemia	11 – 17.7%	3 – 16.7%	p=1.000, Φc = 0.012
- Urology	6 – 9.7%	0 – 0%	p=.328, Φc = 0.153
- Gastrointestinal	3 – 4.8%	0 – 0%	p=1.000, Φc = 0.106
- Musculoskeletal	3– 4.8%	1– 5.6%	p=1.000, Φc = 0.014
- Neurologic	5 – 8.1%	1– 5.6%	p=1.000, Φc = 0.040
- Psychiatric	11 – 17.7%	2 – 11.1%	p=.722, Φc = 0.075
Regular user of sleep drugs (n - %)	10 – 16.1%	4 – 22.2%	p =.506, Φc = 0.067
Surgery background (No/Yes)	31/31	13/5	X2 (1) = 2.783, p=.095, Φ=0.187
Anaesthesia (n - %)			
- General, Balanced	52– 83.9%	16 – 88.9%	
- General, Intravenous	4– 6.5%	1– 5.6%	p=.175, Φc =0.286
- Regional	0 – 0%	1– 5.6%	
- Sedation	6 – 9.7%	0– 0%	

Table continures

Surgery drugs (n - %)			
Corticoid*	49 – 79%	18 – 100%	p=.034, Φc=0.237*
NSAID	55 – 88.7%	18 –100%	p=.340, Φc=0.167
Antiemetic prophylaxis	45 – 72.6%	14 – 77.8%	p=.768, Φc=0.049
Antibiotic prophylaxis	20 – 32.3%	4 – 22.2%	$X^2(1)$ = 0.669, p=.413, Φ=-0.091
Benzodiazepine	26 – 41.9%	4 – 22.2%	$X^2(1)$ = 2.313, p=.128, Φ= -0.170
Opioid	25 – 40.3%	7 – 38.9%	$X^2(1)$ = 0.012, p=.913, Φ= -0.012
Surgery duration (median ± IQR)	49.5 ± 26.0	54.5 ± 30.4	U= 501.5, p=.520, r=-0.073
Hospitalization duration (mean ± SD) *	230 ± 94	1003 ± 147	t(78)=-26.765, p<.000*, d=6.27
Opioid used during recovery period	5 – 8.1%	1 – 5.6%	p = 1.000, Φc = 0.040
Incident during surgery	3 – 4,8%	0 – 0%	p = 1.000, Φc = 0.106
Complication during recovery	5 – 8.1%	1 – 5.6%	p = 1.000, Φc = 0.420

n = sample size; SD = standard deviation; % - percentage; IQR – interquartile range Chi-squared, Mann-Whitney and T-Test were performed. *Significantly differences between groups were verified.

Table 2 Sleep Diary (SD) results.

	Preoperative - T0		First Night - T1		Second Night - T2		Third Night -T3	
	Home (n=62)	Hospital (n=18)	Home (n=59)	Hospital (n=17)	Home (n=56)	Hospital (n=17)	Home (n=53)	Hospital (n=18)
Sleep latency – minutes	16 (15)	15 (29)	15 (20)	21 (14)	10 (20)	22 (20)	15 (20)	18 (21)
Total sleep duration – minutes	402 (85)	443 (73)	442 (121)	480 (110)	447 (117)	463 (88)	467 (120)	464 (94)
No. night awakenings	1.0 (3.0)	0.5 (2.0)	2.8 (2.4)	3.0 (2.5)	2.0 (2.0)	2.0 (2.1)	1.0 (3.0)	2.0 (2.0)
Night awakenings – minutes	5 (15)	0.5(5)	10 (25)	14 (18)	10 (15)	18 (21)	10 (30)	10 (10)
No. daytime naps	0 (0)	0 (0)	0.0 (1.0)	1.0 (2.0)	0.0 (1.0)	0.0 (2.0)	0.0 (1.0)	0.0 (1.0)
Daytime nap duration - Minutes	0 (0)	0 (0)	0 (60)	30 (120)*	0.0 (60)	0.0 (120)	0.0 (30)	0.0 (33)

Values are given as median (IQR) or mean (SD) depending if Normal Distribution is verified. Mann-Whitney test was performed. *Significant differences are indicated for intergroup comparisons.

Table 3 Sleep Diary (SD) results.

	Preoperative - T0		First Night - T1		Second Night - T2		Third Night -T3	
	Home (n=61)	Hospital (n=18)	Home (n=54)	Hospital (n=17)	Home (n=49)	Hospital (n=16)	Home (n=49)	Hospital (n=14)
VAS -S median (IQR)	4.0 (3.0)	4.0 (3.0)	5.5 (6.0)	6.0 (4)	4.0 (4.0)	3.5 (4.0)	2.0 (4.0)	2.0 (3.0)
Intergroup evaluation	U= 535.0 p= 0.866 r = -.02		U= 422.5 p=0.62 r=-.06		U=358.0 p=0.596 r=-.07		U=297.0 p=0.434 r=-.10	

n – number; IQR – interquartile range; r – effect size. Mann-Whitney test was performed.

Table 4 Visual Analogue Scale – Sleep (VAS-S) Intragroup comparison results.

	T0 – T1		T1– T2		T2 – T3	
	Home (n=54)	Hospital (n=17)	Home (n=48)	Hospital (n=16)	Home (n=45)	Hospital (n=14)
Intragroup evaluation	Z=-4.108[b] p<.000† r = -.56	Z=-2.488 b p=.013† r = -.60	Z=-2.945[c] p= .024† r =-.43	Z=-2.257[c] p =.024† r =-.56	Z=-2.622[c] p=.028† r =-.39	Z=-2.197[c] p=.028† r =-.59

n – number; IQR – interquartile range; b –value decreased; c – value increased. Wilcoxon test was performed. † - Significant differences are indicated for intragroup comparisons.

compared to the second (T2) and third night (T3) show no statistical difference between them (T0-T2, T0-T3). Finally, the third night had statistically better sleep quality then first night (T1-T3) (Home: n=47, Z=-3.964, p< .000, r=-.58; Hospital: n=17, Z=-2.534, p=.011, r=-.68).

QOR-15 is used to analyse a patient's recovery. Just as mentioned earlier, the cut-off value for "poor recovery" was obtained through calculation of average minus one standard deviation of total patients in baseline score, T0, which the cut-off result was 122. Lower scores mean worst overall recovery. No differences between groups were observed in T1 and T2 (Table 5).

Twenty-four hours after surgery (T1), an analysis between who did or didn't spend the night at the hospital showed more of patients classified as "poor recovery": Home (n=61) 65.6% and Hospital (n=18) 77.7%. However, this difference wasn't statistically significant ($X^2(1)$ =0.957, p=.328, Φ =0.11). At forty-eight hours of recovery (T2), "Home" (n=59) and "Hospital" (n=18) groups showed: 45.7% vs 44.4%, also no statistical difference was found ($X^2(1)$ =0.010, p=.922, Φ =0.11).

To better understand the different scores obtained in each day, we explored each question score to see if Hospital sleepover would affect recovery aspects (Table 6). (Near here)Separate questions of QoR-15, have significant differences in T1 and T2. Patients who slept at hospital demonstrate significantly worst score for "Been able to enjoy food" at T1 (n=79 ,U=346, p=.009, r=-.30) and T2 (n=77, U=297.5, p=.001, r=-.38) and "Able to communicate with family or friends" (n=79, U=298.5, p<.001, r=--.42) at T1.

PROMIS™ was the second measure we used to evaluate patient sleep quality. The baseline is T0 (evaluating seven days before surgery) and postoperative week T4. No differences between Home and Hospital group were found in the quality of sleep assessment in the week before surgery and after surgery (Table 7). (Near here)Nevertheless, an intragroup analysis shows significant differences in both groups between total PROMIS™ score in both groups at T0 (Home score: M=45.0, SD=6.23; Hospital group score: M=41.5, SD=7.91) to T4 (Home score: M=49.3, SD=9.13; Hospital group score: M=46.1, SD=7.02). This finding means that in both groups, the quality of sleep for seven days after surgery was worse than preceding week (Home: n=62, z=-3.51, p<.001, r=-.45; Hospital: n=18, z=-2.81, p=.005, r=-.66).

Discussion

Results discussion

Sleep deprivation has a potentially deleterious effect on postoperative recovery (8). When a patient undergoes surgery, it is crucial that the patient has optimal recovery conditions. Bad sleep quality affects healing (2,3), and also, Yilmaz et al. showed that sleep quality plays a crucial role in patients' satisfaction (21). If the patient is satisfied, recovery becomes easier with better cooperation, among other advantages (21). In this small study, self-reported questionnaires have shown that patients have sleep quality impairment, and so we can assume that in this area, there is space for recovery improvement, even for patients that sleep the first night home.

The primary goal was to compare sleep quality and recovery of patients who spent the night at the hospital in the first night and those who slept at home. We conclude that, in this sample, no significant differences were detected in patients who did or didn't stay the first night at the hospital. Though, a more detailed investigation showed small differences between the group's results and sleep. Sleeping the first night at the hospital proved to increase nap duration in the next day after surgery although similar sleeping times were observed in both groups, which can be an indirect sign that sleep was not as good/refreshing as the patients who slept at home. VAS-S could not confirm this assumption in T1, as both groups scored lower sleep quality but not statistically different between them. The first night was the worse in the postoperative but was independent of patients sleep location suggesting sleep quality is not as good as usual, at least for patient's self-evaluation perception. Due to insufficient data initially, we intended to analyse certain recovery variables like pain, and another patient conditions could influence patient sleep and are typically registered by nurses, yet most of the times patient data did not have any information regarding these variables and so, it was not possible to do it.

As for the recovery quality assessment, overall QoR-15 score shown no significant difference between groups in the 48 hours evaluated. There were no statistical differences, even though a superior percentage of "poor recovery patients" was present in "Hospital" patients at T1 (24 hours after surgery): Home with 65.6% and Hospital group with 77.8%. This difference between groups suggests bigger and balanced samples with the same size would give more information and confirm/dismiss some apparent differences. A deeper analysis of QoR-15 proved that two aspects for the quality of recovery were significantly worst in patients who spent the first night at the hospital: being able to taste the food and being able to speak with familiars and friends. The first difference can be explained because patients have the first meals after surgery at the hospital. Several aspects like the hospital environment can cause anxiety, nausea and problems with appetite, and additionally, hospital food has traditionally an image problem (33). Just like sleep, nutritional status is essential for recovery; this is proving to be another important aspect of studying. The problem with not "being able to speak with familiars and friends" as much as patients would like can be linked to hospital visit restrictions. By the Braga's Hospital rules, patients

Table 5 Visual Analogue Scale – Sleep (VAS-S) Intragroup comparison results.

	Preoperative - T0			First Night - T1		Second Night - T2	
	Home (n=62)	Hospital (n=18)	Total (n=80)	Home (n=61)	Hospital (n=18)	Home (n=59)	Hospital (n=18)
Average (SD)	134 (13.9)	130 (12.3)	133 (10.9)	113 (17.6)	103 (20.8)	119 (22.1)	112 (25.8)
% Patients with poor recovery				65.6%	77.8%	45.7%	44.4%
	Z = -1.21 p= .23 r = -.14			Z = -1.57 p= .117 r=-.18		Z = -0.90 p= .367 r=-.10	

n -number; SD - standard deviation; % - percentage; The cut-off value for "poor recovery failure" is this sample is <122.
Independent T-test was made to analyse differences between groups.

Table 6 Quality of Recovery 15 questions results.

	Preoperative - T0		First Night - T1		Second Night - T2	
Question (0-lowest/worst; 10-highest/best)	Home (n=62)	Hospital (n=18)	Home (n=61)	Hospital (n=18)	Home (n=59)	Hospital (n=18)
1 - Able to breathe easily	10 (0.0)	10 (2.0)	10 (2.0)	9.0 (3.0)	10 (0.0)	10 (3.0)
2 - Been able to enjoy food	10 (0.0)	10 (1.5)	10 (2.0)*	7.5 (6.0)*	10 (1.0)*	8.0 (9.0)*
3 - Feeling rested	8.5 (3.3)	7.0 (5.3)	8.0 (5.0)	7.5 (3.0)	8.0 (4.0)	8.0 (4.0)
4 - Have had a good sleep	9.0 (3.0)	7.0 (4.3)	6.0 (5.0)	5.5 (5.0)	7.0 (5.0)	7.5 (6.0)
5 - Able to look after personal toilet and hygiene unaided	10 (0.0)	10 (0.0)	10 (2.0)	9.0 (4.0)	10 (2.0)	10 (1.0)
6 - Able to communicate with family or friends	10 (0.0)	10 (0.0)	10 (0.0)*	8.5 (3.0)*	10 (0.0)	10 (1.0)
7 - Getting support from hospital doctors and nurses	10 (0.0)	10 (0.0)	10 (1.0)	10 (0.0)	10 (2.0)	10 (1.0)
8 - Able to return to work or usual home activities	10 (0.0)	10 (0.0)	3.0 (5.0)	2.0 (5.0)	5.0 (6.0)	4.5 (6.0)
9- Felling comfortable and in control	10 (2.0)	10 (2.0)	8.0 (5.0)	5.0 (6.0)	8.0 (5.0)	9.0 (5.0)
10 - Having a feeling of general well-being	10 (2.0)	9.5 (2.3)	8.0 (6.0)	5.0 (4.0)	8.0 (5.0)	7.5 (5.0)
11 - Moderate pain	10 (0.0)	10 (2.0)	5.0 (6.0)	5.0 (6.0)	8.0 (6.0)	5.0 (6.0)
12 - Severe pain	10 (0.0)	10 (0.0)	10 (4.0)	10 (2.0)	10 (2.0)	10 (2.0)
13 - Nausea or vomiting	10 (0.0)	10 (0.0)	10 (0.0)	10 (2.0)	10 (0.0)	10 (3.0)
14 - Feeling worried or anxious	5.0 (5.0)	3.5(4.5)	8.0 (6.0)	7.5 (6.0)	9.0 (4.0)	8.5 (6.0)
15 - Feeling sad or depressed	10 (5.0)	10 (2.8)	10 (4.0)	10 (6.0)	10 (3.0)	10 (6.0)

n- number; Value (median; IQR). Mann-Whitney test was performed. * Significant differences are indicated for intergroup comparisons.

Table 7 Patient-Reported Outcomes Measurement Information System (PROMIS™) Sleep Disturbance 8a Short form.

	Preoperative Week - T0		Postoperative week – T4	
Question (0-lowest/worst; 10-highest/best)	Home (n=62)	Hospital (n=18)	Home (n=62)	Hospital (n=18)
1. My sleep quality was	2.5 (1.0)	2.0 (1.0)	3.0 (1.0)	2.0 (1.0)
2. My sleep was refreshing	2.0 (1.0)	2.5 (1.0)	3.0 (2.0)	3.0 (1.0)
3. I had a problem with my sleep	2.0 (2.0)	1.0 (1.0)	2.0 (2.0)	2.0 (2.0)
4. I had difficulty falling asleep	1.5 (1.0)	1.0 (0.0)	2.0 (2.0)	2.0 (2.0)
5. My sleep was restless	1.0 (2.0)	1.0 (2.0)	2.0 (2.0)	1.5 (2.0)
6. I tried hard to get to sleep	1.0 (1.0)	1.0 (0.0)	2.0 (2.0)	1.0 (2.0)
7. I worried about not being able to fall asleep	1.0 (2.0)	1.0 (0.0)	1.5 (2.0)	1.0 (1.0)
8. I was satisfied with my sleep	3.0 (1.0)	2.0 (2.0)	3.0 (2.0)	2.5 (1.0)
Total (mean ± SD) T-Score	45.0 ± 6.23	41.5 ± 7.91	49.3 ± 9.13†	46.1 ± 7.02†

N – number; SD – Standard deviation; † - Significant differences are indicated for intragroup comparisons.

who spend the night at the hospital can have only one family member for one hour at his bedside. The ambulatory surgery concept implies less than twenty-four hours of hospitalisation, and hospital rules defined exclusively 1-hour visit. This visit duration seems not to be satisfactory to patients.

PROMIS™ Sleep Disturbance Short Form 8a was the core tool used to evaluate sleep quality. As referred before, no differences between groups were found — however, both groups showed statistical differences, by the quality of sleep decreasing significantly in the week after surgery. An analysis of each question/parameter evaluated in PROMIS™ also shown no differences between groups. We conclude that a negative impact of hospital sleepover was not verified. The already described sleep impairment in the postoperative period by several studies (12,13,17,21,22) was confirmed in both groups patients, and no particular difference was noticed even evaluating each question of PROMIS™.

Although results between groups globally show little differences, the fact is that small differences were found between groups. We know groups were not perfectly matched because they display different sample sizes and statistical differences in two variables (corticoid use during surgery and cardiovascular comorbidity) and we recognise that as a study limitation.

This study showed that we can introduce policies that are aimed to improve patient's quality of recovery and satisfaction after AS. Group differences in Sleep Diary were not prominent, but patients must be informed that they will be more sleepy in the day after the surgery, and through the results in Qor-15, patients can be better instructed to why they cannot be more time with family or friends during a hospital stay.

Studies analysing the effects of sleeping just one night at the hospital were not found so we could not compare with other results. However, the effect of surgery and anaesthesia in sleep pattern was already studied (12–14,16,21,22,33). All of them demonstrated sleep problems/decrease sleep quality after surgery, and some of them demonstrated hospitalised patients sleep had worse sleep quality mainly due to several environmental factors and endogenous factors as pain, and most studies had more extended hospital stays. An overall sleep quality decrease was also found in our study, which agrees with other studies.

Nevertheless, our results show there is no significant adverse impact in patients sleep if they spend the first night at the hospital. This result may not be verified in other hospitals because the surgical unit in which study was developed could have a better environment for resting or/and one night was not enough to make much difference in the postoperative week sleep quality. More studies in different environments can be made.

It is important to find why patients have this sleep quality decrease and what causes may be responsible for this and if they are preventable. Kain and Caldwell-Andrews already demonstrated postoperative sleep disturbances are not directly proportional to pain as and can be more likely linked do psychological aspects like anxiety (13). Opioid use and personality traits were already investigated (13,22) and were not a part of this investigation.

Adverse effects in sleep pattern in elderly patients with multiple comorbidities may be much more significant. As we already been investigated, postoperative delirium in elderly patients could be a consequence of the postoperative sleep disturbances (22).

Limitations

This comparison, hospital vs home first-night sleepover was not found in other investigations. However, these results have some limitations that must be mentioned. Mainly, the sample size and groups. Like many other similar studies, a larger sample of participants would make the analysis more precise, and groups should be more balanced to avoid type II errors (24). The group's number is unbalanced, and it is a consequence of investigator blind method, and there are more patients not sleeping at the hospital (hospital always should favour non-sleepover of patients (18)), so this effect/bias was inevitable in this methodology. Although sample analysis shows almost no differences between them in demographic data, ideally both groups have the same number and no differences in all variables.

A prospective, randomised, blinded study would help to avoid these limitations. Besides, self-reported questionnaires always associated with response bias and are more limited than objective measurement. We must recognise self-report questionnaires are not the most objective tools for a precise sleep evaluation (34). The most complete and objective evaluations of sleep include polysomnography (Gold Standard), electroencephalographic spectral analysis and actigraphy (1). However, these methods of evaluation require a better logistic capacity as well as more patient availability because of their duration. They are more expensive and demand more complex application and evaluation (4). On the other hand, interviews, sleep diaries and standardised validated tools filled out by the patient himself (self-report) or by an evaluator also provide useful and informative data (15). Quality of sleep is also a subjective perception of how the person perceived sleep, and according to Rosenberg, it is possible to evaluate the subjective sleep quality by merely asking the patient how he perceived his sleep (22). Additionally, we cannot guarantee that patients filled the questionnaires at the correct time, except for T0 and T4, which can be a substantial flaw. Still, patients were asked not to fill in out of time.

Finally, this study's purpose was to have a general perception of sleep, independently of the surgery or medical area, and although group analysis showed no significant difference between groups, patients were submitted to different surgical procedures. Ideally, the same number of patients from each speciality should be analysed, and the effect of different surgeries (e.g. septoplasty can cause more sleeping disturbance than hernioplasty due to anatomic surgery location).

Future considerations

Once again, significant quality of sleep decrease was proved after surgery, even in the ambulatory setting and the physiologically (better recovery) and psychologically (more satisfaction) advantages of good sleep after surgery are undebatable. For the future, we suggest investigating if specific measures (non-pharmacological or/and pharmacological) like decreasing anxiety levels or sleep inductors (i.e. zolpidem) can be useful for improving patients postoperative sleep and efficacy has overall benefits. there should be a report about sleeping problems going unnoticed by nurses and are not recorded (6), it would be interesting to test the use of VAS-S routinely.

Conclusions

Sleeping one night at the hospital after ambulatory surgery does not affect significantly the quality of sleep in this population. Both groups (sleeping at hospital and home) had significant sleep quality impairment during the first week after surgery. Sleeping the first night at the hospital does not worsen sleep quality after ambulatory surgical procedures. As for the quality of recovery, both groups had the lowest score 24h after surgery (T1). A higher percentage of patients with poor recovery was found in the "Hospital" group but turned out to be not a statistically significant difference. Although the hospital sleepover is not affecting the patient's recovery negatively, it can still improve to make patients sleeping and recovery conditions better.

We suggest that there should be a regular assessment of sleep quality in ambulatory surgery centres, as early identification and treatment of this disturbance can improve overall patient healing and satisfaction.

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