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Obstructive Sleep Apnea Syndrome-Prevalence and Screening in the Pre-admission Clinic

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Abstract

Objective: The aim of this study was to evaluate the suitability of 2 different screening methods for the detection of obstructive sleep apnea syndrome (OSAS) in the preadmission clinic at a university hospital.

Methods: Patients were screened for OSAS using 2 different methods.

Method 1: If they were deemed conspicuous by answering three specific medical history questions (daytime sleepiness, snoring and BMI (body mass index)), the patients hat to fill in the Epworth Sleepiness Scale (ESS).

Method 2: All patients had to fill in the ESS.

An ESS-score of 10 or higher was deemed conspicuous and regarded as a high risk for OSAS.

The length of hospital stay of these patients was compared to a matched non OSAS group.

Results: Of the 4355 (100%) patients evaluated with method 1, 109 (2.5%) had a known OSAS and 631 (14.5%) had to fill in the ESS-Score in consequence of the 3 specific medical history questions. 82 (13% of the 631 patients) of them reached a score ≥ 10, which equals 1.9% of all patients screened with method 1. At least 191 (4.4%) of all patients who were screened with method 1, were declared as conspicuous.

Of the 3415 (100%) patients detected with method 2, 115 patients (3.35%) had a known OSAS. 115 patients (3.35%) achieved an ESS score ≥ 10. Thus 230 patients (6.7%) screened with method 2 were classified as conspicuous.

The deviation of mean hospital stay was significantly higher in the group of conspicuous patients compared to the inconspicuous patients.

Conclusion: At the pre-admission clinic more patients with OSAS or high risk for OSAS were detected using a standardized screening tool (ESS-Questionnaire) compared to specific questions alone.

Due to the increased risk for perioperative complications, the preoperative detection is essential for perioperative management and to initiate further diagnostics and therapy.

Keywords: Obstructive sleep apnea syndrome; Epworth sleepiness scale; Screening; Prevalence; Perioperative risk

Introduction

The prevalence of OSA (Obstructive Sleep Apnea) is about 20% in the middle aged [1]. In 1997 Young et al. showed that the OSA is undiagnosed in about 80% of women and 93% of men [2]. Even today, large parts of the patient's population remain undiagnosed [3].

OSA is defined as apnea or hypopnea as a result of airway obstruction during sleep (apnea/hypopnea per hour of sleep: Apnea-/Hypopnea-index AHI; AHI ≥ 5 is considered as pathologic). If the patient also suffers from a relevant daytime sleepiness, it is called an obstructive sleep apnea syndrome (OSAS). The prevalence of OSAS is approximately 4% [4].

Obstructive sleep apnea is associated with an increased risk for cardiovascular diseases such as arterial hypertension and coronary

heart disease [5-13]. In connection with the nocturnal apnea episodes, cardiac arrhythmias can occur [14,15]. Furthermore OSAS is an independent predictor for the occurrence of cerebral ischemia [16]. Further studies showed that OSAS is an independent factor for progression of diabetes mellitus [17,18]. Subjectively, patients often suffer, alongside excessive daytime sleepiness and headache, from severe depressive symptoms, which can be favourably influenced by effective treatment of OSAS [19].

OSA patients are at increased risk for perioperative complications [20,21]. In a patient cohort of 172 patients Hwang et al. retrospectively illustrated that the patients with OSAS or an ODI 4% > 5 (oxygen desaturation index; number of oxygen desaturation of 4 percent or more per sleeping hour) suffered significantly more from perioperative complications such as bleeding, atelectasis, hypotension, hypoxemia, pulmonary embolism and pneumonia [20]. The postoperative pathophysiological changes and persistent drug effects after general anesthesia have a negative effect on the symptoms of sleep apnea. This can, for example, lead to an increase in postoperative AHI. For selective patient populations such as ENT patients with a need for postoperative nasal packing, this effect is well described in clinical studies [22]. Overall, these patients have an increased risk for hypoxemia [22-24].

Besides patients with a clearly confirmed diagnosis of OSAS (available polysomnography report) in clinical routine patients are also detected, who report themselves of a presence of OSAS without the possibility to examine the details. Some of the details are vague (snoring, breathing pauses, etc.) and an exact diagnosis cannot be made. Furthermore, patients were detected during the screening, in which the presence of OSAS is very likely (anamnesis, Epworth Sleepiness Scale - ESS score). The extent of daytime sleepiness can be evaluated by using the Epworth Sleepiness Scale [25]. Especially at a high AHI, the sensitivity of the ESS Score for detection of OSAS is raised up to 76% [26].

The current gold standard for diagnosis of OSAS is overnight polysomnography. With the underlying number of about 50.000 patients per year in our pre-admission clinic, about 2000 patients (4%) probably suffer from OSAS. To perform preoperative polysomnography in all patients is almost impossible. Except for patients who are at high risk, it often seems easier to treat suspected patients as OSAS patients compared to a preoperative evaluation using a polysomnography for confirmation of diagnosis OSAS.

The aim of our survey was to detect the majority of patients suspected of suffering from OSAS at the pre-admission clinic of a University Hospital over a large period with an appropriate effort in clinical routine, and to draw specific conclusions for our clinical practice from this prevalence. For this purpose, we used two different screening methods and examined their suitability in our clinic routine.

Methods

The collection of data took place in the pre-admission clinic and was performed by the physicians and nurses of the clinic for anesthesiology. The detection was carried out over a period of 24 months. This study was approved by the institutional ethics committee (EA1/213/12).

Method 1

Patients were screened by three specific medical history questions.

Does the patient suffer from a known OSAS?

If the answer was,, no“ three more questions were asked:

Does the patient feel daytime sleepiness (without taking sedatives or working in shifts)?

Does the patient snore?

Does the patient have a Body Mass Index (BMI)> 28kg/m^2?

The BMI was calculated using a table where size and weight were requested by the patient. The BMI cut-off was set over 28 kg/m^2.
If question 2a was answered with yes, or if both questions 2b and 2c were answered with yes, the ESS score was determined.

We used the German version of the Epworth Sleepiness Scale (ESS, Table 1) [3]. If the patient reached 10 or more points, it has been postulated that the patient suffered from relevant daytime sleepiness and OSAS was suspected.

Epworth Sleepiness Scale

Name: _____ Today's date: _____

Your age (Yrs): _____ Your sex (Male = M, Female = F): _____

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the **most appropriate number** for each situation:

0 = would **never** doze
1 = **slight chance** of dozing
2 = **moderate chance** of dozing
3 = **high chance** of dozing

It is important that you answer each question as best you can.

Situation	Chance of Dozing (0-3)
Sitting and reading	
Watching TV	
Sitting, inactive in a public place (e.g. a theatre or a meeting)	
As a passenger in a car for an hour without a break	
Lying down to rest in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after a lunch without alcohol	
In a car, while stopped for a few minutes in the traffic	

THANK YOU FOR YOUR COOPERATION

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Table 1: Epworth-Sleepiness-Scale (ESS)

If the patient had a known OSAS (answered question 1 with yes) or reached an ESS score 10 or higher, he was classified as conspicious in the context of this study.

Method 2

The ESS score was filled in directly. With an ESS-Score of ≥ 10 the patient was classified as conspicious in the context of this study.

Length of Hospital Stay

From the 191 conspicuous patients that were detected with method 1 the hospital stay and the deviation from mean hospital stay was recorded. These data were compared with a matched sample of 200 inconspicuous patients.

Statistical Methods

The description of the data was performed by absolute and relative frequencies of categorical variables, and mostly by mean values and standard deviations for the quantitative variables. The random critical examination of dependencies between categorical variables was performed using chi2-square test.

For the analysis of the results the Mann-Whitney test was used. As level of significance $p<0,05$ was defined [27].

Results

Screening results

The screening path is shown in figure 1.

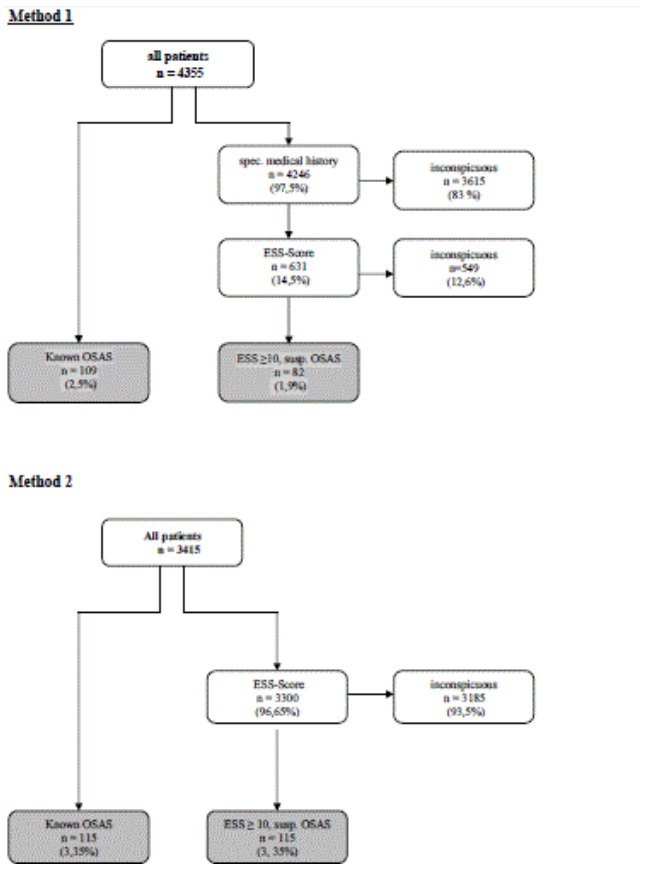

Figure 1: Number and percentage of patients, method 1 and 2, gray box: ESS ≥ 10 + known OSAS = conspicuous patients, white box: ESS <10 and unknown OSAS

Frequency of conspicuous patients based on clinical departments

Exemplarily for our clinic the relative and absolute distribution to the clinical departments of all with method 1 screened patients is shown in Figure 2. Cardiac patients scheduled for cardioversion of atrial fibrillation or AICD implantation suffered from known OSAS or had an ESS score ≥ 10 with a frequency of 10.8%, followed by 8.3% of the ear, nose and throat (ENT) patients.

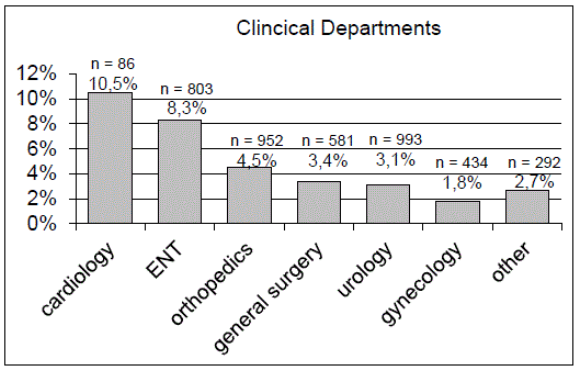

Figure 2: Relative and absolute frequencies of conspicuous patients (OSAS known or ESS score ≥ 10) based on all patients screened, the individual clinical departments in percent; n = number of patients; cardio = cardiology, ENT = ear, nose and throat medicine, ortho = orthopedics, uro = urology, GS = general surgery, gyn =gynecology

Method 1

Within the group of patients who responded to the specific history questions (excluding patients with known OSAS), we found that 320 patients (7.5%) often felt daytime sleepiness, 1391 patients (32.8%) were snorers according to their own anamnestic data and 991 (23.3%) had a BMI> 28. Of the total 4355 patients screened, 631 (14.5%) were conspicuous insofar that they had to fill in the ESS questionnaire, namely 320 patients (50.7%) due to frequent daytime sleepiness and 311 patients because of snoring and a BMI> 28 (49.3%).

Of the 631 patients that had to fill in the ESS-Questionnaire, 82 patients (1.9% of all screened patients) recorded an ESS score of 10 or more points. Together with the patients with a known OSAS (n=109; 2.5%) 4.4% patients were declared conspicuous with method 1.

Method 2

Of the 3415 patients examined by the ESS questionnaire alone, 115 (3.35%) patients had a known OSAS and 115 reached (3.35%) an ESS score of ≥ 10. Thus, 230 of the screened 3415 (6.7%) patients were classified as conspicuous. If we compare the 3.35% of patients with a relevant high ESS Score after the screening with method 2 to the 1.9% that had a ESS-Score ≥ 10 after the screening with method 1 significantly ($p<0.05$) more patients were detected with method 2.

Length of Hospital Stay

The hospital stay of the screened patients using method 1 is shown in Figure 3.

In the group of conspicuous patients the, according to Diagnosis Related Groups, expected mean hospital stay was 8.27 days. The actual length of stay was 8.36 days in this group.
In the group of inconspicuous patients the expected mean hospital stay was 8.5 days. The actual length of stay was 7.8 days ($p<0.05$ vs. conspicuous patients).
The deviation from the mean length of stay is significantly different between the groups.
If the maximum length of stay is exceeded, no differences between the groups were seen.

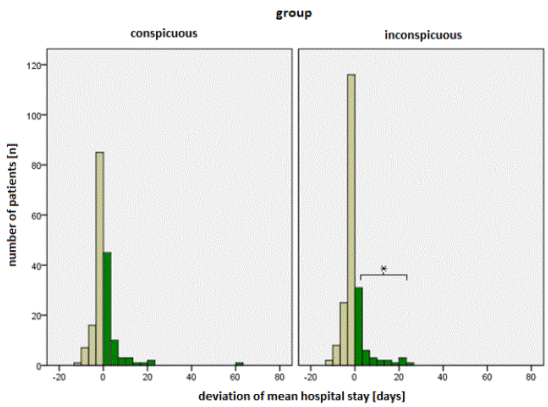

Figure 3: Deviation from mean length of hospital stay, method 1- The number of patients [n] and their deviation from the mean length of hospital stay in days *P --> p<0,05%vs. conspicuous patients

Discussion

Within the evaluated period 191 patients of the 4355 screened with method 1 in our anesthesia pre-admission clinic were declared as conspicuous (known OSAS or ESS ≥ 10). With method 2 we detected 230 as conspicuous from 3415 screened patients.
To verify what influence the specific history questions have on the acquisition of the conspicuous patients, we asked questions about daytime sleepiness, snoring and BMI in method 1. In method 2 in comparison, the ESS questionnaire had to be filled in directly.

Screening method

In addition to the ESS score used in this study, various screening methods for detecting obstructive sleep apnea can be found in literature. An example is the Berlin Questionnaire [28], which determines a score by asking for snoring, daytime sleepiness and hypertension and then divides patients in "high-risk"-patients and "low-risk"-patients. With a "high-risk"-classification an AHI ≥ 5 is likely with a sensitivity of about 86%. Although it seems to be a useful tool, inconsistent findings concerning the diagnostic accuracy of the Berlin Questionnaire exist [29].

Furthermore, the STOP Questionnaire and its extension, the STOP-BANG Questionnaire is commonly used. In the STOP questionnaire 4 questions, addressing snoring, tiredness, observed apnea and hypertension are asked. With 2 or more positive responses the suspicion of OSA is made. The sensitivity for mild, moderate or severe OSA lies at about 65%, 74% and 80% in the STOP-Questionnaire. If yes is answered in 3 or more questions in the STOP-BANG questionnaire, the patient is classified as high-risk for OSA. In the STOP-BANG questionnaire the sensitivity increases up to 100% in severe OSA by adding the parameters age, BMI, gender, and neck circumference [30,31]. In comparison to other methods, the STOP-BANG method seems to have the highest sensitivity [32].

The American Society of Anesthesiologists (ASA) has classified several other factors as indicators for the presence of OSA (e.g. craniofacial abnormalities, nasal obstruction, tonsillar hyperplasia, awakening with choking) [33]. The sensitivity of this method is not significantly different from that of the Berlin Questionnaire [34].
The sensitivity of the Epworth Sleepiness Scale for detection of OSA suspected patients varies in the literature from 66% to over 80%, depending on the severity of sleep apnea [26]. Using the ESS the daytime sleepiness is detected. The additional detection of BMI, neck circumference, age and questions about additional anamnestic information increases the sensitivity. Although the sensitivity of the ESS-Score is lower compared to the STOP-BANG Questionnaire, the work load for the anaesthesiologist in the pre-admission clinic is lower as well.

Frequency of conspicuous patients in different clinical departments

If the relative frequency of conspicuous patients with known OSAS or an ESS score of 10 or more points is related to the different clinical departments (Figure 2), it is striking that about 10% of the cardiac patients are affected, followed by ENT patients (about 8%). The cardiac patient population consists mainly of patients who had to undergo cardioversion for atrial fibrillation or pacemaker or AICD implantation. There is a known association between sleep-disordered breathing with increased AHI and the occurrence of cardiovascular disease. In patients with coronary heart disease, the incidence of OSAS is indicated in up to 35% [35-38]. A relationship between obstructive sleep apnea and the appearance of atrial fibrillation, exists as well [11,36,37].
A similarly high proportion of conspicuous patients is found among the ENT patients. This proportion can be explained by the fact that some of these patients undergo surgery because of known sleep apnea. The contribution of postoperative nasal packing, which leads to the increase of postoperative AHI, plays an important role in this context [22].

The prevalence of OSAS is approximately 4% of the population. The prevalence within the surgical patient population varies according to literature between 6-7% [38] and depends largely on the different fractions of the departments within the hospital. For bariatric patients, the prevalence increases to 60% [39]. Using our method which included patients with known OSAS, we reached a prevalence of 4.4%. However when looking at the distribution of surgical patients, the high proportion of urological patient has to be mentioned (Figure 2). Relatively few urological patients have become conspicuous in the screening process. This could explain the low prevalence in our patients collective as well.

The lower percentage of patients with known OSAS of the patients screened by method 1 compared to method 2 (2.5% vs. 3.35%) is noticeable. The reason for this is unclear. A comparison of the patient population of both screening methods has not been carried out. So for

example a different distribution of patients from the various departments is thinkable.

Method 1

In all patients screened by method 1 we found that 8% of the patients suffered from daytime sleepiness, 33% were snoring according to their anamnestic data and 23% had a BMI>28.

A total of 4355 patients were detected by means of specific medical history, of which 109 patients had a known OSAS (2.5%). 631 patients (14.5%) had to fill out the ESS due to the answers of the 3 medical history questions.

320 patients (50.7%) completed the ESS score due to frequent daytime sleepiness. Of these patients 60 (18.5%) patients ended up with an ESS score ≥ 10.

In 311 patients (49.3%) the ESS score was recorded for snoring and a BMI> 28. Only 22 of these patients (7.2%) reached a relevant high ESS score.

Snoring was, both in the overall screening population, as well as in the patients that were asked to fill in the ESS (n = 631) due to their results in the three medical history questions, the most common symptom. This was followed by a high BMI and daytime sleepiness. The daytime sleepiness occurred in about half (n = 320) of the patients detected as conspicuous after answering the specific history questions with previously unknown OSAS. Of these sleepy patients however, only 18.5% reached an ESS score of 10 or more points, which suggests that the actual relevance of daytime sleepiness cannot be determined with a single question of the main symptom alone and is mostly overestimated by patients.

If one were to assume that patients with relevant daytime sleepiness (ESS ≥ 10) the OSAS diagnosis can be made also, 43% of patients had been diagnosed within the pre-admission clinic.

In summary, out of the total 631 patients who completed the ESS questionnaire, 82 patients reached an ESS score of 10 or more. Thus, only 13% of patients who have become conspicuous by completing the questionnaire 1 and had no known sleep apnea syndrome suffered from a relevant daytime sleepiness. The remaining 87% of patients didn't suffer from relevant sleepiness.

Method 2

An interesting question is whether the screening results change when the Epworth Sleepiness Scale alone is used for screening.

The evaluated questionnaires show that significantly more patients are classified as conspicuous if solely the ESS questionnaire was used (3.35% compared to 1.9% with previous use of specific medical history questions). This means that the single use of the specific medical history questions causes some patients with relevant high ESS score not to fill in the ESS and therefore go undetected.

Comparison of methods

By asking the specific patient history questions, some patients were classified as inconspicuous who would have otherwise shown an increased ESS-Score. If we would utilise method 2 in our patients as standard and all patients in whom an OSAS is not yet known would fill in the ESS Score, 3.48% of the patients (in our case 115 of 3300 patients) would achieve a conspicuous ESS score of ≥ 10. For the 4246 patients screened initially with specific medical history questions (method 1) a number of 147 patients would actually achieve a relevant high ESS score when screened with method 2 (compared to only 82 patients were detected by method 1). Thus possibly 65 patients were not detected with relevant elevated ESS score by this method in the investigation period of 24 months. Assuming that only 66% of these patients achieve a relevant increased AHI according to literature [26] in a following polysomnography, 43 patients would not have been detected with obstructive sleep apnea by screening method 1.

If one uses the ESS questionnaire as the single screening tool, the prevalence, including known OSAS, increases as shown up to 6.7%. Therefore, it appears to be reasonable to use the ESS Score to objectively assess daytime sleepiness with these standardized questions. Because of the little time required for the examiner we decided to establish the ESS score as the standard screening method in our clinic.

We prospectively evaluated consecutive patients using two different screening methods, in each case over a certain time period. A statement about sensitivity and specificity of the both methods in comparison is not possible since we did not perform a polysomnography to confirm the suspected diagnosis OSAS.

Length of Hospital Stay

The maximum length of hospital stay did not differ between the groups. However, there is a significant difference in the deviation from the mean length of hospital stay (Figure 3). This could be explained by the fact that the patients with a diagnosis of OSAS have a prolonged hospital stay due to the increased rate of perioperative complications. Whether a targeted intervention (e.g. postoperative nocturnal oxygen administration, consistent CPAP therapy, intensive postoperative monitoring) in these patients would have an impact on hospital length of stay, should be the subject of further investigations.

More detailed analysis of the influence of OSAS or suspected OSAS on the hospital stay is not possible, since we did not perform a polysomnography to confirm the suspected diagnosis OSAS.

Conclusion

The prevalence of OSAS is currently approximately 4% of the population, and still a major part of these patients are undiagnosed [40]. OSA patients are at increased risk for the occurrence of various perioperative complications [20]. The anaesthesiologist plays a crucial role in the detection not only for the purpose of the perioperative management of these patients but also for the diagnosis itself and the appropriate therapy in the future. A suitable tool for this is a simple screening test such as the Epworth Sleepiness Scale. Screening all patients with ESS in our study we identified more patients at risk for OSAS compared to the screening of the patients by three specific medical history questions. In clinical routine, ESS seems to be more useful if utilized as a generalized screening tool than if it is used only after identifying a subset of patients with clinical questions.

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