



Research Article

Prevalence of Obstructive Sleep Apnea Risk for Brazilian Civil Aircraft Pilots

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Abstract

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Background and purpose: In the context of air transport activity in Brazil there is no preventive regulation of Obstructive Sleep Apnea Syndrome (OSAS). The aim is to identify Brazilian Civilian Pilots (BCP) with the possibility of having OSAS through responses to different questionnaires, validated and used worldwide as indicators of this disease, and propose the inclusion of these screening tools during the annual medical examination of health .

Method: After signing the Informed Consent, 262 BCP were interviewed. The interviews included the Epworth Sleepiness Scale (ESS), the Berlin Questionnaire (BQ) and the STOP-BANG questionnaire (SBQ). Pilots that exceeded daily working hours or did not comply with the rest time required by law, pilots of international flights and users of sleep-inducing drugs were excluded from the study.

Results: Positive results for OSAS were found in 16% of the cases according to the BQ, 37.4% according to the SBQ, and 11.45% were considered at risk in both questionnaires. A weak correlation was found between the answers to the questionnaires and the ESS. weak to moderate agreement was observed between the SBQ and the BQ to suggest the presence of OSAS (Weighted Kappa = 0.263, 95%CI 0.153 – 0.373) and also the odds ratio of 5.58 (95%CI 2.698 – 11.573).

Discussion: We can infer that there is a risk of OSAS in the population studied and we suggest the application of these questionnaires as screening tools to indicate the completion of Polysomnography by the health regulatory agencies and flight licensing in order to increase safety.

Introduction

In recent years, some international flight safety regulating agencies included in the health care of civilian pilots, the screening of predictive factors for Obstructive Sleep Apnea Syndrome (OSAS) [1-4], but in Brazil this is only applied for other types of professionals [5]. Furthermore, this recommendation is not found within the scope of Brazil's aviation medicine, neither is there the use of screening tests for this purpose in the periodic health examinations of Brazilian Civil Pilots (BCP). In like manner, the Brazilian Air Force has no legislation carrying the purpose of early identification of OSAS until now. The objective of this research was to identify BCP with the possibility of having OSAS [1,6,7] through responses to different questionnaires, validated in Brazil [8-10] and used worldwide as indicators of this condition. The methods used were the Berlin questionnaire (BQ) [19:26], STOP-BANG questionnaire (SBQ) [6,9,11] and the Epworth Sleepiness Scale (ESS) [1,8,12]. The results and the occurrence of concordance will serve as means of screening to indicate the polysomnography (PSG) in this group, and also to propose the implementation of this screening model in the routine of the annual health check performed by the health control agencies and flight licensing, in order to increase safety. This study was focused on considering the possibility that OSAS may be underdiagnosed for BCP, impairing their level of attention and consequently the safety of air activity.

Methods

A cross-sectional study was performed analyzing 262 male professionals that pilot commercial passenger aircrafts as a remunerated activity, called BCP, who signed the informed consent after voluntarily accepting the invitation to participate in the months of January and February 2015 and preserving its confidentiality. This project was submitted to the Research Ethics Committee of the Casa Gerontológica de Aeronáutica Brigadeiro Eduardo Gomes, and approved under number 811.345, on 09/16/2014. Pilots that exceeded daily working hours or did not comply, in the last month, with the rest time required by law, were excluded from the study, as well as pilots using drugs that influence sleep. International flight pilots were also excluded due to the risk of jetlag. The individuals analyzed responded to the ESS, and to the BQ and SBQ. They were measured with specific devices and within the international standards, blood pressure (mmHg), cervical circumference (CC) in centimeters (cm); weight in kilograms and height in meters, these, to calculate the body mass index (BMI) in kg/m² and to classify according to the World Health Organization (WHO). The data were analyzed using the

program MedCalc®. [13] Nonparametric tests were opted for, because they are not only more conservative, but also do without the prior knowledge of the variables' behavior. The concordance between the results obtained in the two questionnaires was taken by the Weighted Kappa test and the "odds ratio" (OR). The level of significance was 5% ($\alpha = 0.05$) in a two-tailed test. The figures were presented in the respective range with 95% confidence (95%)

Results

The central and dispersion measurements of the continuous variables can be observed in Table 1, where it is noted that not all have a normal distribution. The frequency distribution of the quantitative variables used by the SBQ in the sample is described in Table 2. In the sample studied, 81 individuals were over 50 years old, corresponding to 30.9%. The CC was over 40cm in 155 individuals, corresponding to 59.2% of the cases. Besides the factor that all individuals were men, these two items were the most frequent in this sample. With respect to the BMI, it was found that 51 individuals were overweight (over 25 kg/m²), 51 were classified as moderately obese (above 30 kg/m² and indicated in the BQ), but only 3 individuals were classified as severely obese (above 35 kg/m² and indicated in the SBQ). When comparing the risk of OSAS presented by the BQ and SBQ, the first demonstrated that 42 individuals had high risk of suffering from OSAS (16.03% - 95%CI: 11.55% - 21.67%), while in the latter, 98 subjects (37.4% - 95%CI: 30.37% - 45.58%) presented this risk, which is over double the positive frequency presented by the BQ (Table 3). Only 30 individuals (11.45% of the sample - 95%CI: 7.73% to 16.35%) showed high risk of having OSAS in both questionnaires, while 152 individuals (58% of the sample - 95%CI: 49.16% to 68.01%) were negative for OSAS in both questionnaires. A weak to moderate concurrence between the SBQ and BQ questionnaires was found to suggest the presence of OSAS (WeightedKappa = 0.263, 95%CI 0.153 - 0.373). Through this same table, it can be affirmed that the chance of having high risk of OSAS according to one of the questionnaires, increases the chance of having high risk according to the other in 5.58 ((95%CI 2.698 - 11.573) (Table 3)). The presence of EDS found through the ESS scale was approximately 15% of the sample cases (95%CI 10.5% - 20.3%). Of these, 10 individuals presented high risk of having OSAS according to the BQ. However, 32 cases out of the 42 which presented high risk of having OSAS according to the BQ, did not report sleepiness. In regard to the SBQ, only 20 were at risk of having OSAS. However, 78 cases among the 98 positive for risk of having OSAS according to the SBQ, did not report sleepiness.

	Median	Minimum	Maximum	25-75 Percentile	* Distr-. Normal	* Distr-. Normal
AGE	43	19	72	32.0 53.0	<0.0001	<0.0001
BMI	26.7	17.93	37.56	24.8 to 29.1	0.3475	0.3475
Cervical circumference	41	34	48	39.0 to 42.0	0.0013	0.0013
Abdominal circumference	97	70	131	90.0 to 104.0	0.7161	0.7161
Systolic BP	120	100	150	120-130	<0.0001	<0.0001
Diastolic BP	80	60	100	70-80	< 0.0001	< 0.0001

Table 1: Descriptive measures and dispersion of the variables in the characterization of the sample.

	Absolute Freq	Relative Freq	95% CI
	(N)	(%)	(%)
S (snoring)	25	9.5	6.17 to 14.09
T (tiredness)	32	12.2	8.35 to 17.24
O (observed apnea)	16	6.1	3.49 to 9.92
P (high blood pressure)	36	13.8	9.62 to 19.02
B (body mass index)	3	1.1	0.24 to 3.35
A (age)	81	30.9	24.55 to 38.43
N (neck circumference)	155	59.2	50.21 to 69.24
G (gender)	262	100	88, 26-100

Freq - frequency; N - number; % - Percentage; 95% - confidence interval

Table 2: Absolute and relative frequency of SBQ items in the sample.

Risk by SBQ		
Risk by BQ	Absent	Present
Absent	152	68 220 (84%)
Present	12	30 42(16%)
Total	164 (62.6%)	98 (37.4%)

BQ - Berlin questionnaire; SBQ - STOP-BANG questionnaire

Table 3: 2x2 contingency table of frequency distribution of responses to the BQ and SBQ.

Discussion

It is important to highlight that research of this nature, using the methodology employed, and especially, the population studied, is unprecedented. There are few studies relating OSAS and air activity, especially for pilots, moreover, there were no publications related to the subject found during the literature review. One of the peculiarities observed in our research was the question of evaluating only male individuals. This fact has repercussions in the SBQ, as being male already features a point in this questionnaire, but it does not interfere with the established objectives, and reflects the reality of the population studied. According to some authors [14] the frequency and severity of OSAS is higher in the male population, and factors such as CC, age and BMI contribute differently between genders. An increased prevalence of OSAS is found to be related to age increase [9], but in the present study there was the predominance of younger subjects (median age of 43 years). According to the SBQ, ages > 50 years is one of the positive criteria for existing OSAS and was only observed in 30.9% of cases (95%CI 24.55 - 38.43). Despite that the ESS only helps in identifying patients

with OSAS when associated with other clinical parameters [15], it was opted for to be studied separately, because the EDS is an important condition to be considered in this group of individuals. A prevalence of EDS according to the ESS, which was 15% of the sample (95% CI 10.5% - 20.3%), is noteworthy since it is a group of individuals that follow strict rules to control tiredness, fatigue or drowsiness, elements that compromise flight security. This value was similar to that observed in another study [16] that applied this same instrument. It is also worth noting that despite the prevalence of EDS increasing with the severity of OSAS, less than 50% of patients with moderate to severe OSAS have ESS>10 [17]. In studies that value risk factors for suspicion of OSAS diagnosis [6,14,18], it was noted that many of these variables are included in the questionnaires used in this research. The main symptoms of adults with OSAS are snoring, feeling of nocturnal suffocation, EDS, sexual impotence and reportings of apneas observed by colleagues [19]. It was also observed that the combination of age>50 years, neck circumference>40cm and ESS>10 increases the diagnostic certainty of OSAS in 15% to 80% [20]. However, in the present study, only four individuals presented all these associated criteria.

Among the questionnaires utilized in this study, there are also different discriminatory values such as the BMI in the BQ, which was considered positive when greater than 30 kg/m², while in the SBQ, positivity only occurs when the BMI is greater than 35 kg/m². Considering the cutoff value of the BMI in the BQ, 51 obese individuals were found. It is worth mentioning that in the population studied there were few obese individuals with a BMI \geq 35 kg/m², as the Brazilian Civil Aviation Regulation number 67 [21], a BMI \geq 40 kg/m² prevents the license release for aircraft piloting in routine situations; especially subjects with prior cardiovascular disease, in which case the BMI should be a maximum of 29.9 kg/m² [21]. Therefore, further studies are needed to fully understand and standardize these discriminatory values, especially in this population. Patients with hypertension are more likely to have OSAS, therefore they should always be investigated to rule out the disease [22]. In this study, the BP was valued in both questionnaires, the BQ and SBQ. However, it did not show significant impact in this sample. The most prominent individual finding on physical examination of patients with snoring or even OSAS is the measure of neck circumference [20]. When considered in isolation to evaluate the risk of OSAS and, considering the cutoff of 40 cm, has a sensitivity of 60.6% (95% CI 54.6 - 66.6%) and specificity of 93.4% (95%CI 86.3% - 100%), providing RV+ = 10.00 (95% CI 4.53 - 22.07), increasing the diagnostic probability from 15% to 64% [23]. In the sample studied, this was a very present condition, with an absolute frequency of cervical circumference greater than 40cm present in 155 individuals (59.2% of the sample - 95% CI 50.21 - 69.24). Although there were few obese individuals, the CC was

increased in almost 60% of the individuals. Through the findings of this research and as a subject of discussion, it is understood that the BQ and SBQ confirm that there is a strong possibility of OSAS in the analyzed BCP. The positivity of the SBQ was noted to be superior to that obtained by the BQ in this study. Almost 40% of cases analyzed by the SBQ should undergo PSG because they were classified as high risk for OSAS by this method. This characterizes the SBQ as possibly more inclusive than the BQ for screening for OSAS in the group studied. It is possible to infer that the questionnaires can exclude the need for performing a PSG in more than half of the cases analyzed in this study, since 152 individuals (58% of the sample - 95%CI 49.16% - 68.01%) were negative for OSAS in both questionnaires. Despite the BQ having been developed for the screening of OSAS in primary health care [10,24,25], and the SBQ to evaluate the risk of OSAS in surgical patients [11], the latter is becoming increasingly important in many populations [9] due to its simplicity and its extensive approach in relation to the questioned variables [26]. It even became utilized as a means of screening for airpilots [27]. Furthermore, there are yet to be studies, on the population in question, to compare definitively the comparative performance of these criteria. When analyzing the correlation between the results of the questionnaires, it was observed to be weak, despite using similar variables. Therefore, it was necessary to apply both in our population to indicate, or not, the need to perform PSG. However, we can infer that if positivity occurs in both, there is a greater probability of OSAS incidence. In this study, this indication occurred in only 30 individuals (11.45% of the sample – CI 95% 7.73% - 16.35%).

The major limitation of this study was the inability to perform PSG on all the subjects, since this test is not a determination of the Brazilian Aeronautics Law. This makes it impossible to say which is the most accurate questionnaire. It is worth noting that some international regulatory bodies for flight safety [1-4] recommend that, when fitting the OSAS risk criteria, the pilots of the countries in question should have a PSG and medical follow-up. This fact reveals a worldwide trend of concern over the impact of OSAS on civil aviation safety. Therefore, this study concludes that this step should also be taken in Brazilian Air Force Medicine, in the sense of performing PSG on at least a selected group of individuals with present and identified risk factors through the application of these questionnaires, in conformity with the international trend and as shown by the results of this research. This statement takes into account the possibility of OSAS occurrence for BCP and consequent EDS, which reduces the flight safety, and because there is no national preventive regulation. The high prevalence of suspected OSAS in this sample suggests that the incorporation of this screening in the periodic health exams, in addition to increasing flight safety, will contribute to enhancing the health of pilots and their life quality.

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