Clinical Medicine 2017 Vol 17, No 6: 499–503 ORIGINAL RESEARCH

Screening for obstructive sleep apnoea using the STOPBANG questionnaire and the Epworth sleepiness score in patients admitted on the unselected acute medical take in a UK hospital

Authors: Barney T J Isaac,[A] Sarah E Clarke,[B] Mohammad Saiful Islam[C] and Johnson T Samuel[D]

ABSTRACT

Obstructive sleep apnoea (OSA), which is often overlooked in patients presenting to primary and secondary care, is an increasingly common comorbidity. The prevalence of OSA has not been studied in the unselected acute medical take. The aim of this study was to screen for the prevalence of undiagnosed OSA using the STOPBANG Questionnaire and the Epworth sleepiness scale (ESS) score in an unselected acute medical take. This was a cross-sectional study in a busy UK general hospital. Patient demographics, comorbidities, ESS and STOPBANG scores on unselected acute medical takes were reviewed and analysed to assess the prevalence of OSA. Of 93 patients screened, more than 50% were obese. The STOPBANG score was ≥3 in 73%. The ESS was significantly increased (≥11) in 20%. On multivariate analysis, ESS continued to remain independently associated with the STOPBANG score with a p-value of 0.04. The routine use of the STOPBANG questionnaire followed by an ESS score in those with a score of ≥3 may focus evaluation for undetected OSA in the acute medical care setting.

KEYWORDS: Acute medicine, obstructive sleep apnoea, screening, sleepiness, STOPBANG

Introduction

Although obstructive sleep apnoea (OSA) and OSA syndrome (where OSA is associated with increased daytime sleepiness) have been recognised for over 40 years, OSA is significantly underdiagnosed and consequently not investigated. In western populations, about 2–4% of middle-aged men and 1–2% of middle-aged women have OSA, but in the majority of these patients, OSA is undetected and is therefore not treated – even when they present to healthcare professionals.[1,2] Over the last two decades, there has been a substantial increase in the prevalence of OSA. A recent study by Peppard *et al*, using data from the Wisconsin Sleep Cohort Study, estimated the prevalence of moderate or severe OSA to be 10–17% in men and 3–9% in women.[3]

OSA is strongly associated with obesity, but it is also increasingly seen in the less obese. Only about 50% of patients diagnosed at a large sleep clinic in Edinburgh in recent years were obese.[4] There are increasing concerns about the health and economic impact of untreated OSA. Increased sleepiness impairs social functioning, work performance and driving ability.[5] The long-term effects on health in those affected can consequently have a significant impact on the health status of the individuals affected and the socio-economic burden in the community.

Several studies have evaluated the associations of OSA with the development of cardiovascular and cerebrovascular disorders, including hypertension, stroke, ischemic heart disease and cardiac failure. OSA has been associated with the 'metabolic syndrome', ie central obesity, glucose intolerance and insulin resistance with significant independent implications on morbidity and mortality. A minority of patients with OSA develop pulmonary hypertension. In addition, neuropsychological manifestations – such as inattention, poor concentration, depression and diminution of sexual function – have been described. Patients with OSA impose a significant burden on healthcare systems before the diagnosis is made, with greater average medical costs before diagnosis. Untreated OSA is estimated to have additional medical costs of up to $3.4 billion per annum in the USA.[6] The cost burden of OSA associated with poor workplace performance and high risk of road traffic accidents has not been fully assessed, but is likely to be significant.

While patients presenting routinely or acutely to healthcare providers are screened for risk factors such as smoking and alcohol consumption, those who may have OSA are not screened. Screening in specialty clinics, such as diabetes and heart failure clinics, have demonstrated a high prevalence of OSA. As most studies of OSA were in the clinically obese,

Authors: [A]specialty doctor, Basildon and Thurrock University Hospital, Basildon, UK; [B]core medical trainee, Basildon and Thurrock University Hospital, Basildon, UK; [C]specialty registrar (ST5), Basildon and Thurrock University Hospital, Basildon, UK; [D]consultant respiratory physician, Basildon and Thurrock University Hospital, Basildon, UK

the recognition of symptoms and signs of OSA in the less obese is negligible as demonstrated by the referral patterns to sleep clinics. There is also a misconception that OSA is predominantly a disorder in male patients; this often results in a gender bias in referral. A recent study in an unselected female population showed a significant prevalence of OSA in patients who did not report symptoms.[7]

We postulated that screening for OSA in patients attending the acute medical unit for a variety of medical conditions might give an idea of the scale of the problem in this unselected population seeking acute medical care. This could lead to early diagnosis and treatment for those affected. In addition, if the prevalence is significant in this cohort, actively looking for symptoms and signs of OSA may need to become part of normal practice in the acute medical setting.

The STOPBANG questionnaire includes loud snoring, tiredness, observed apnoea, high blood pressure (STOP), body mass index (BMI), age, neck circumference and gender (BANG). It is a validated screening tool for identifying OSA in surgical patients.[8] and has shown to have good predictive value for detecting OSA in obese patients.[9] It is a sensitive but not a specific screening tool for OSA. A score of 3 or more has a sensitivity of over 90% for OSA.[9] However, this has not been studied in the acute medical admission setting. The Epworth sleepiness scale (ESS) score is a useful validated tool to assess sleepiness and has been used to initiate treatment for OSA syndrome. Hence, we used these two tools in our study.

Aim

The aim of this study was to screen for the prevalence of an elevated STOPBANG (≥3) and the ESS score (≥11), which predict a high risk for OSA in patients admitted to hospital via the unselected acute medical take.

Methods

Patients admitted to the acute medical unit in a UK general hospital for any medical reason from January to June 2014 were included in the study. This was a cross-sectional study and convenience sampling was adopted to fit with the clinical work of the authors. Assuming a prevalence of 50% with an absolute precision of 10, allowing for an alpha error of 5% and a power of 80%, we calculated a required sample size of 97 patients. The study was approved by our local institutional review board.

Patients attending the acute medical unit at Basildon Hospital are referred either from general practice or the accident and emergency department. Patients aged 30–75 years were prospectively included in the study by convenience sampling. They were excluded if they were previously diagnosed with OSA or obesity hypoventilation syndrome, if there was an obvious cause of hypoventilation such as chest wall deformities or neuromuscular disease, or if they were critically unwell and therefore unable to complete the questionnaire. Information regarding their demographic characteristics and comorbidities were also collected.

After obtaining written informed consent, participants completed a questionnaire. This questionnaire included the parameters of the STOPBANG and the ESS. For those patients who scored 3 or more on the STOPBANG score, their GPs were informed suggesting referral if appropriate. SPSS 16.0 software was used to analyse the data. Descriptive statistics were used for analysing the demographic data. The association between risk variables and STOPBANG were tested using Chi-square test with Yates correction. The variables that had significance of $p<0.25$ at bivariate were considered for multivariate logistic regression analysis (parameters which were part of STOPBANG were not included in this). Results were presented with odds ratio (OR) and 95% confidence interval (CI).

Results

In total, 93 patients were prospectively recruited during the study period. The commonest reason for admission was a respiratory cause (21.5%). 67% of the patients were more than 50 years of age and 57% of the study participants were female. More than 50% of the patients were obese (BMI >30). The commonest comorbidity was hypertension (39%). The demographic data are given in Table 1. The STOPBANG score was ≥3 in 73% of all the patients. More than 60% of all the patients were over 50 years in age. The commonest symptoms were snoring and apneic spells, each occurring in over 60% of patients. The GPs of these patients were informed of the elevated STOPBANG score and, if appropriate, a referral to the sleep clinic was suggested to decide on the need for further evaluation. The ESS score was increased (≥11) in 20% of patients.

The ESS was not associated with any of the baseline demographics or comorbidities (Table 2). However, current smokers had a statistically significant association with the STOPBANG score compared with people who had never smoked (Table 3). In addition, there was a significant associations between ESS and STOPBANG scores ($p=0.02$, Table 3). For a multivariate analysis to estimate the true associations with STOPBANG score, BMI, age, gender and hypertension were not included as they are part of the STOPBANG score. Ex-smokers and smokers were grouped together for the multivariate analysis. Arrhythmias and diabetes were included for the multivariate analysis as they had a p-value of up to 0.25 and were clinically relevant. However, only ESS score was independently associated with the STOPBANG score ($p=0.04$, Table 4).

We also looked at the ability of STOPBANG to reflect a significantly elevated ESS. STOPBANG had a sensitivity of 95%, specificity of 32%, positive predictive value of 27% and a negative predictive value of 96% to reflect an elevated ESS. The positive and negative likelihood ratios were 1.4 and 0.16, respectively. A positive STOPBANG had an odds ratio of 8.6 of predicting an elevated ESS score, but this had a wide confidence interval. The details are tabulated with the Youden index in Table 5.

Discussion

This is the first study to our knowledge attempting to estimate the prevalence of OSA in the acute medical care setting. We used two existing screening questionnaires:

- STOPBANG, which has been validated in OSA
- ESS, the well-established sleepiness score in OSA.

This study was designed to estimate the prevalence of positive STOPBANG and ESS scores to give an indication of the burden of OSA in this population. This could inform

Table 1. Baseline characteristics

Variables	Number (n=93)	Percentage
Age:		
≤50 years	31	33.3
>50 years	62	66.7
Gender:		
Male	40	43.0
Female	53	57.0
Reason for admission:		
Respiratory	20	21.5
Gastrointestinal	14	15
Neurological	12	12.9
Chest pain	12	12.9
Cardiac (cardiac failure, arrhythmias)	9	9.7
Renal	4	4.3
Sepsis	3	3.2
Thrombo-embolic	3	3.2
Orthopedic	3	3.2
Others	13	14
Smoking:		
Never smoked	36	38.7
Ex-smoker	30	32.3
Current smoker	27	29.0
BMI:		
Normal (18.5–24.9)	15	16.1
Overweight (25–29.9)	29	31.2
Obese (≥30)	49	52.7
Comorbidities:		
Hypertension	36	38.7
Arrhythmias	14	15.1
Diabetes	17	18.3
Ischaemic heart disease	7	7.5
Chronic kidney disease	8	8.6
Snoring	60	64.5
Tiredness	20	21
Observed apnoeas	58	62.4
Increased neck circumference	48	51.6
STOPBANG:		
Negative (<3)	25	26.9
Positive (≥3)	68	73.1
ESS score:		
Negative (<11)	74	79.6
Positive (≥11)	19	20.4

BMI = body mass index; ESS = Epworth sleepiness score; STOPBANG = loud snoring, tiredness, observed apnoea, high blood pressure, body mass index, age, neck circumference and gender

Table 2. Association of ESS score with risk variables

Univariate analysis							
Parameters	ESS score						
	Negative (<11)		Positive (≥11)		OR	95% CI	p-value
	n	%	n	%			
Age:							
≤50	23	74.2	8	25.8	1.00		
>50	51	82.3	11	17.7	0.62	0.22–1.75	0.36
BMI:							
<25	12	80.0	3	20.0	1.00		
≥25	62	79.5	16	20.5	1.03	0.26–4.10	0.96
Gender:							
Male	30	75.0	10	25.0	1.63	0.59–4.49	0.34
Female	44	83.0	9	17.0	1.00		
Smoking:							
Never smoked	28	77.8	8	22.2	1.00		
Ex-smoker	22	73.3	8	26.7	2.28	0.54–9.59	0.26
Current smoker	24	88.9	3	11.1	2.90	0.68–12.37	0.15
Hypertension:							
Yes	28	77.8	8	22.2	1.19	0.43–3.33	0.73
No	46	80.7	11	19.3	1.00		
Arrhythmia:							
Yes	12	85.7	2	14.3	0.61	0.12–2.98	0.54
No	62	78.5	17	21.5	1.00		
Diabetes:							
Yes	12	70.6	5	29.4	1.84	0.56–6.09	0.31
No	62	81.6	14	18.4	1.00		
IHD:							
Yes	4	57.1	3	42.9	3.28	0.67–16.13	0.13
No	70	81.4	16	18.6	1.00		
CKD:							
Yes	6	75.0	2	25.0	1.33	0.25–7.20	0.74
No	68	80.0	17	20.0	1.00		

BMI = body mass index; CKD = chronic kidney disease; ESS = Epworth sleepiness score; IHD = ischaemic heart disease

further management and ascertain the need to screen for OSA presenting to acute care.

Interestingly, more than 50% of our patients were clinically obese and this indicates the higher incidence of acute medical problems in the obese. Increased BMI (>25) had a trend towards significant association with the STOPBANG score (p=0.07); however, because it is also part of this score, it was not included for multivariate analysis. Of note, an elevated ESS score (≥11) was equally prevalent in the groups with increased BMI and normal BMI (Table 2). Although our study subjects did not have sleep studies to evaluate this further, it highlights the increasingly recognised prevalence of OSA in the non-obese.

Table 3. Association of STOPBANG with risk variables

Parameters	Univariate analysis: STOPBANG						
	Negative (<3)		Positive (≥3)		OR	95% CI	p-value
	n	%	n	%			
ESS score:							
Negative (<11)	24	32.4	50	67.6	1.00		
Positive (≥11)	1	5.3	18	94.7	8.64	1.09–68.58	0.04
Age:							
≤50	12	38.7	19	61.3	1.00		0.07
>50	13	21.0	49	79.0	2.38	0.92–6.13	
BMI:							
<25	7	46.7	8	53.3	1.00		
≥25	18	23.1	60	76.9	2.92	0.93–9.15	0.07
Gender:							
Female	18	34.0	35	66.0	1.00		
Male	7	17.5	33	82.5	2.42	0.90–6.55	0.08
Smoking:							
Never smoked	8	22.2	28	77.8	1.00		
Ex-smoker	5	16.7	25	83.3	2.80	0.94–8.35	0.06
Current smoker	12	44.4	15	55.6	4.00	1.18–13.60	0.03
Hypertension:							
Yes	7	19.4	29	80.6	1.19	0.71–5.18	0.20
No	18	31.6	39	68.4	1.00		
Arrhythmia:							
Yes	2	14.3	12	85.7	2.46	0.51–11.89	0.25
No	23	29.1	56	70.9	1.00		
Diabetes:							
Yes	2	11.8	15	88.2	3.26	0.69–15.40	0.12
No	23	30.3	53	69.7	1.00		
IHD:							
Yes	0	0.0	7	100.0	–	–	0.10
No	25	29.1	61	70.9			
CKD:							
Yes	0	0.0	8	100.0	–	–	0.07
No	25	29.4	60	70.6			

BMI = body mass index; CKD = chronic kidney disease; IHD = ischaemic heart disease; STOPBANG = loud snoring, tiredness, observed apnoea, high blood pressure, body mass index, age, neck circumference and gender

The other risk variable that was associated with STOPBANG was smoking (p=0.04). However, on multivariate analysis this was no longer significant, indicating that it was not independently associated with STOPBANG. This could be because of confounders or because of an inadequate sample size. Smoking has been known to be a risk factor for OSA. A case-control study in 2001 suggested current smokers have a

Table 4. Multivariate analysis of STOPBANG with risk variables

Parameters	OR	95% CI	p-value
ESS score:			
Negative (<11)	1.00		
Positive (≥11)	8.23	1.03–66.47	0.04
Smoking:			
Never smoked	1.24	0.44–3.49	0.68
Smoker	1.00		
Arrhythmia:			
Yes	2.27	0.44–11.67	0.33
No	1.00		
Diabetes:			
Yes	2.31	0.44–12.03	0.32
No	1.00		

2.8-times adjusted odds of having OSA than former smokers and 2.5-times adjusted odds compared with former smokers and never smokers.[10] A review in 2012 looking at the association between smoking and OSA concluded that smoking may be a risk factor for OSA, but also raised the possibility of OSA being a risk factor for smoking addiction.[11] Although not statistically significant, being over the age of 50 years and male gender had a trend towards association with STOPBANG; however, as these are part of the STOPBANG score, they are not discussed further.

73% of our patients had a positive STOPBANG (≥3) indicating that nearly three-quarters of this population could potentially be screened for OSA. However, only 20% scored ≥11 on the ESS, indicating that only one fifth of patients in the study had excessive daytime somnolence. Only one patient with an elevated ESS score had a negative score using the STOPBANG questionnaire; this suggests that STOPBANG is a good screening test to pick up almost all patients who have excessive daytime somnolence. This is further demonstrated by its high sensitivity (95%) and negative predictive value (96%) in reflecting an elevated ESS score, as shown in Table 5. STOPBANG has been shown to be a better screening score in the sleep clinic compared with ESS, Berlin questionnaire and STOP questionnaire. It had a sensitivity of 94.9%, 96.5%

Table 5. Point estimates and 95% confidence intervals of STOPBANG versus ESS

True prevalence	0.204 (0.128–0.301)
Sensitivity	0.947 (0.74–0.999)
Specificity	0.324 (0.22–0.443)
Positive predictive value	0.265 (0.165–0.386)
Negative predictive value	0.96 (0.796–0.999)
Positive likelihood ratio	1.402 (1.159–1.696)
Negative likelihood ratio	0.162 (0.023–1.125)
Odds ratio	8.64 (1.088–68.584)
Youden index	0.272 (–0.04 to 0.442)

and 97.7% in predicting mild, moderate and severe OSA, respectively.[12] Our study suggests it can be used as a screening tool in the acute medical care setting as well.

Limitations

One limitation of our study was that patients did not have a sleep study to diagnose OSA. This would have been the gold standard to compare the screening questionnaire, giving a better estimate of the prevalence of OSA. However, this was not the aim of the study. As part of good clinical practice, the GPs of all patients who scored 3 or more on the STOPBANG score (73%) were informed, so that they could initiate further referral as appropriate. The second limitation of the study was that patient recruitment during the study period was neither consecutive nor randomly sampled. This could have caused a sampling bias due to convenience sampling. However, as the daily admission lists are relatively similar this may not be a bias.

Conclusions

Almost three-quarters of patients on our unselected acute medical take had a positive STOPBANG score, which had high sensitivity in predicting an elevated ESS score. Further research with sleep studies on those who have a positive STOPBANG score to give an accurate indication of the prevalence of OSA in those presenting to acute medical units is warranted. However, the data suggest it is not unreasonable to proactively look for symptoms of OSA on the acute medical take as there are implications for patients' health and the wider health economy. Should this become part of normal practice in the future, it is likely that STOPBANG could be a good screening tool in this setting. ■

Conflicts of interest

The authors have no conflicts of interest to declare.

Author contributions

All authors were responsible for designing the study, data acquisition and the literature search. BTJI prepared the initial manuscript and all authors were involved in reviewing and editing it.

Acknowledgement

The authors would like to thank Mr Bijesh Yadav, the biostatistician who helped with the statistics in the study.

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Address for correspondence: Dr Barney T J Isaac, Department of Pulmonary Medicine, Christian Medical College, Vellore – 632004, India.
Email: barneyisaac98@gmail.com