Research article

Stop-bang questionnaire as a screening tool for obstructive sleep apnoea in the surgical population: a prospective observational study

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ABSTRACT

Introduction and Aim: Obstructive sleep apnoea (OSA) is a type of sleep-related breathing disorder characterized by repetitive episodes of partial and complete pharyngeal collapse causing a reduction or total cessation of airflow during sleep. Undiagnosed, it increases the intraoperative and postoperative complications. This study aimed to screen patients undergoing surgical procedures for OSA using a validated self-report STOP-Bang questionnaire.

Materials and Methods: This prospective observational study was conducted in a tertiary care hospital between June and November 2021 and included 174 patients posted for elective surgery. A modified STOP-Bang questionnaire was used to evaluate participants for OSA. Documentation also included the difficulty in mask holding, number of attempts at laryngoscopy and intubation, the type and size of the endotracheal tube, and attempts to place a supraglottic airway device.

Results: The prevalence of self-reported OSA was 5.2% (n=9) among the 174 participants included in this study. Among the patients (n=98) who underwent general anaesthesia 32 had difficult airways, among which 20 (62.5%) had a predictor of difficult airway and two had OSA. One among the 2 OSA patients had other predictors of difficult airway. No statistical significance was observed between OSA and the difficult airway (p=0.723). However, a clinically significant association was seen for difficult mask holding for patients with OSA but having no other predictors of difficult airway.

Conclusion: Using the STOP-Bang questionnaire to screen OSA in patients undergoing general anaesthesia or sedation can help the anaesthesiologist manage difficult airways more effectively.

Keywords: OSA; difficult airway; modified STOP Bang questionnaire.

INTRODUCTION

Among several types of sleep-related breathing disorders, the obstructive sleep apnoea (OSA) is increasingly common and characterized as repetitive episodes of partial and complete pharyngeal collapse, causing a reduction or total cessation of airflow during sleep (1). Apnoea is defined as the cessation of airflow for more than 10 seconds (2). Hypopnea is defined as a reduction in airflow for more than 10 seconds duration of more than or equal to 30% with a reduction in oxygen saturation of more than and equal to 4% (1-3). OSA occurs when the throat muscles intermittently relax and block the airway during sleep. OSA has been of special concern to anaesthesiologists as it is associated with increased perioperative morbidity and mortality (4).

Increased postoperative cardiac complications, respiratory failure, emergent re-intubations, and post-operative intensive care unit admissions have shown to be associated with OSA (5,6). OSA is more often seen in clinical practice and if left undiagnosed, anaesthetists may encounter complex challenges like difficult mask ventilation, laryngoscopy, tracheal intubation, airway obstruction, accelerated arterial desaturation, postoperative airway depression, and obstruction, postoperative monitoring and discharge status (2). Hence, it is important for anaesthesiologists to have good knowledge of the clinical presentation and diagnosis of OSA.

Studies have reported an increasing trend of sleep-disordered breathing in the adult population (aged 50-70 years), with prevalence being higher in men as compared to women (7). A large proportion (>80%) of surgical patients remain undiagnosed for OSA (8) which could pose serious challenges during surgical induction and recovery and therefore a proper preoperative screening for OSA is of paramount importance. In recent years, a STOP-Bang questionnaire method which is highly reliable has been widely used in preoperative clinics, sleep clinics and the general population to detect patients at high risk of OSA due to its ease of use, practicality and high sensitivity (9, 12-14).

STOP-Bang Questionnaire is a simple, self-reportable screening tool which includes four subjective (STOP: Snoring, Tiredness, Observed apnoea, and high Blood pressure) and four demographic (BANG: BMI, Age, Neck circumference, Gender) questions which are scored (10,11). Based on the scores the patient is either considered to be at low risk (2 or less) or at high risk (≥5) for having either moderate or severe OSA (14). As undiagnosed OSA has been associated with perioperative risks during induction and recovery of airways, it is important to screen the patients for OSA in the surgical population. Hence, in this study we undertook a preoperative screening for OSA with the STOP-Bang questionnaire in patients undergoing surgery which would not only help in diagnosing OSA but also in minimizing airway complications.

MATERIALS AND METHODS

This prospective observational study was conducted in a tertiary care hospital for the duration of 6 months (June - November 2021). The sample size (n=174) was calculated based on the average prevalence of OSA (13%) in a general population, 5% precision and 95% confidence level using nMaster software version 2.1. All adult patients posted for elective surgery except the paediatric and pregnant patients were included in the study. After obtaining written informed consent, the participants (n=174) underwent evaluation for OSA with the STOP-BANG questionnaire as documented in the proforma (Table 1). STOP-Bang questionnaire has a maximum of eight points, where each factor receives one point. Patients with a STOP-Bang score of <3, were considered as having no OSA while those with scores ≥5 were considered as having OSA. Patients with a STOP-Bang score of 3 and 4 were further classified based on their BMI ≥35 kg/m^2 and gender for the presence or absence of OSA. Overall, higher the STOP-Bang score, greater is the OSA risk. A flowchart showing the STOP-BANG questionnaire scores used in screening patients for OSA is depicted in Fig.1.

Table 1: The STOP-BANG questionnaire

A. STOP (Snoring, Tiredness, Observed apnoea, blood pressure)	**YES = 1**	**NO = 0**
Do you SNORE loudly (louder than talking or loud enough to be heard through closed doors)?		
Do you often feel TIRED, fatigued, or sleepy during daytime?		
Has anyone OBSERVED you to stop breathing during your sleep?		
Do you have or are you being treated for high blood PRESSURE?		
B. BANG (BMI, Age, Neck circumference, Gender)		
BMI more than 35 kg/m^2?		
AGE over 50 years old?		
NECK circumference > 16 inches (40cm)?		
GENDER: Male?		

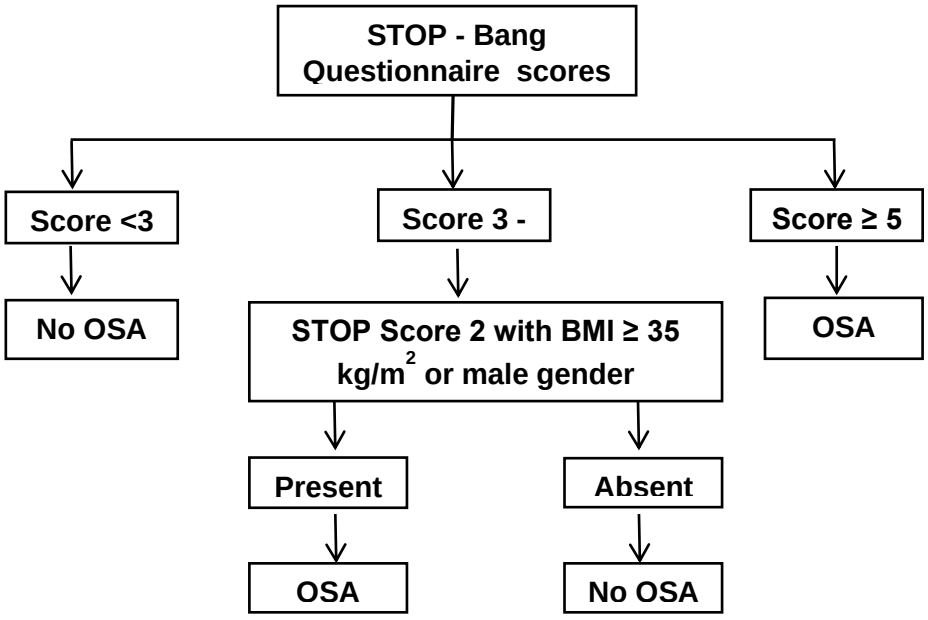

Fig 1: Flowchart showing STOP-Bang questionnaire score to predict OSA

Patients also underwent routine pre-anaesthetic evaluation as per the discretion of the anaesthesiologist. The details of predictors of difficult airway and type of anaesthesia administered and surgical procedure was documented. In patients undergoing general anaesthesia, any difficulty in mask ventilation defined as need for use of two hand techniques/two person techniques and/ or use of airway adjuncts like oral or nasal airway were documented. The attempts at laryngoscopy (i.e., insertion of a laryngoscope into an oral cavity for viewing the glottic aperture), intubation (number of times an endotracheal tube has been passed into the oral cavity before it has been successfully placed through the vocal cords) as well as the supraglottic airway insertions (i.e., the number of times the supraglottic airway device was to be inserted into the oral cavity for successful placement) were documented.

Table 2: Demographic details of participants

Variables	**Category**	**Among total population** (n = 174)	**OSA (n=9)**
Gender	Female	65 (37.3%)	3 (33.33%)
	Male	109 (62.6%)	6 (66.66%)
OSA (based on ASA classification)	1	65 (37.4%)	1 (11.11%)
	2	84 (48.3%)	5 (55.55%)
	3	24 (13.8%)	3 (33.33%)
	4	1 (0.6%)	0
Type of Surgery	ENT	17 (9.8%)	2 (22.22%)
	General Surgery	40 (23%)	3 (33.33%)
	Gastro Surgery	3 (1.7%)	0
	Maxillofacial	4 (2.3%)	0
	Neuro-surgery	8 (4.6%)	0
	OBG	15 (8.6%)	1 (11.11%)
	Onco-surgery	8 (4.6%)	1 (11.11%)
	Orthopedics	47 (27%)	0
	Plastic Surgery	3 (1.7%)	0
	Urology	29 (16.7%)	2 (22.22%)
Age	< 20	3 (1.7)	0
	20 – 40	58 (33.3)	3 (33.33%)
	41 – 60	71 (40.8)	2 (22.22%)
	≥ 61	42 (24.1)	4 (44.44%)
BMI	< 18.5 (Underweight)	17 (9.8)	0
	18.5 – 24.9 (Normal weight)	98 (56.32)	3 (33.33%)
	25 – 29.9 (Pre-obesity)	42 (24.14)	2 (22.22%)
	30 – 34.9 (Obesity class I)	14 (8.04)	2 (22.22%)
	35 – 39.9 (Obesity class II)	2 (1.15)	1 (11.11%)
	≥40 (Obesity class III)	1 (0.57)	1 (11.11%)
Type of Anaesthesia	Ankle Block	1 (0.6)	1 (11.11%)
	Ankle Block + Sedation	1 (0.6)	0
	Epidural + GA	8 (4.6)	0
	Epidural + GA (RSI)	1 (0.6)	0
	Epidural + SA	1 (0.6)	0
	Epidural Anaesthesia	1 (0.6)	0
	GA	81 (46.6)	5 (55.55%)
	GA + Cervical plexus block	1 (0.6)	0
	GA + Epidural	1 (0.6)	0
	GA + Interscalene Block	2 (1.1)	0
	GA + Superficial cervical plexus block	1 (0.6)	0
	GA + Supraclavicular block	2 (1.1)	0
	Lumbar + sciatic block	1 (0.6)	0
	SA	65 (37.4)	3 (33.33%)
	SA + Epidural	1 (0.6)	0
	Sedation (Mask Holding)	1 (0.6)	0
	Supraclavicular block	4 (2.3)	0
	Supraclavicular Block +GA	1 (0.6)	0

ASA: American Society of Anaesthesiologist; GA: General anaesthesia; SA: Spinal anaesthesia

In case the patient underwent direct laryngoscopy and intubation, Cormack Lehane grading was documented. Use of alternative techniques of intubation such as use of FOB, retrograde intubation, and video laryngoscope was noted. In all the instances, the people performing the procedure were either noted trainees (JR1, JR2, JR3) or consultant anaesthesiologist. Difficult airway (i.e., use of two hand techniques/two person techniques, >2 attempts of intubation, >2 attempts of supraglottic airway device insertion, use of FOB, retrograde intubation or video laryngoscope and Cormack Lehane grading ≥3) was documented.

Statistical analysis

Continuous data were expressed in terms of mean ± standard deviation and categorical data as frequency and percentage. Chi-square test was used for statistical analysis.

RESULTS

This study included a total of 174 patients aged between <20 to ≥ 61 years. Table 2 summarizes the demographic details of the participants. The majority of participants in this study (56.32%) were of normal weight (BMI 18-24.9), while 24.14% were pre-obese (BMI 25-29.9), 9.26% obese (BMI >30) belonging to various classes (Table 2) Majority of the participants who underwent surgical procedures were males 109 (62.6%) compared to females (Table 2).

Among the 174 participants who completed the STOP-Bang questionnaire, 65.5% obtained a STOP score of 0, while 28.2%, 4.6% and 1.7% obtained STOP scores of 1, 2 and 3 respectively. Likewise, a Bang score of 0, 1, 2, and 3 was obtained by 17.2%, 44.8%, 29.3% and 8.6% of the participants respectively. A cumulative STOP-BANG score was calculated, based on which the study participants were further distributed as those with STOP-Bang score of 0 (15.5%), score 1 (35.1%), score 2 (24.1%), score 3 (16.1%), score 4 (2.3%), score 5 (6.3%) and score 6 (0.6%) (Table 3).

Among the surgical population (n=174) included in this study, OSA was detected only in 9 (5.2%) of the patients. However, assessment of the population using the STOP-BANG questionnaire predicted a difficult airway in 40.8% of the surgical population (Table 4).

Table 3: STOP-Bang test characteristics and frequency percentage among participants

Question	Response	Frequency (%)
Snore	Yes	14 (8)
	No	160 (92)
Tired	Yes	15 (8.6)
	No	159 (91.4)
Observed Stop Breath	Yes	6 (3.4)
	No	168 (96.6)
Blood Pressure	Yes	39 (22.4)
	No	135 (77.6)
STOP Score	0	114 (65.5)
	1	49 (28.2)
	2	8 (4.6)
	3	3 (1.7)
BMI > 35.5 kg/m^2	Yes	3 (1.7)
	No	171 (98.3)
AGE > 50yrs	Yes	75 (43.1)
	No	99 (56.9)
Neck Circumference > 40cm	Yes	38 (21.8)
	No	136 (78.2)
Gender (male)	Yes	109 (62.6)
	No	65 (37.4)
BANG score	0	30 (17.2)
	1	78 (44.8)
	2	51 (29.3)
	3	15 (8.6)
STOP-BANG score	0	27 (15.5)
	1	61 (35.1)
	2	42 (24.1)
	3	28 (16.1)
	4	11 (6.3)
	5	4 (2.3)
	6	1 (0.6)

n = 174

Table 4: Anticipated difficult airway and encountered difficult airway

Parameter			**Frequency (%)**
OSA (n=174)		Yes	9 (5.2)
		No	165 (94.8)
Predictor of Difficult Airway	In surgical population (n=174)	Yes	71(40.8)
		No	103 (59.2)
	In patients undergoing general anaesthesia (n=98)	Yes	45 (45.9)
		No	53 (54)
Difficult Airway experienced		Yes	32 (32.7)
		No	66 (67.3)

Table 5: Statistical association between OSA and predictor of difficult airway to difficult airway experienced

Parameter		**Difficult Airway experienced**		**Chi-Square value**	**P- value**
		Yes N (%)	No N (%)		
OSA	Yes	2 (6.25)	3 (4.55)	0.125	0.723
	No	30(93.75)	63 (95.4)		
Predictor of difficult airway (n=98)	Yes	20 (62.5)	25 (37.9)		
	No	12 (37.5)	41(62.1)	5.261	0.022**

**Significant value ($p<0.05$)

Further, screening of patients (n=98) within the surgical population who underwent general anaesthesia, 45 (45.9%) were observed to be predictors of difficult airway, among which only 32 (32.7%) patients actually experienced difficult airway, while the remaining did not experience any difficult airway (Table 4). A significant association ($p = 0.022$) was observed between patients diagnosed with difficult airway and those experiencing difficult airway (Table 5).

DISCUSSION

OSA is a chronic disorder that is associated with multiple systemic impairments; due to which these patients may have comorbidities and may pose challenges in the intraoperative and postoperative period. In this study, the majority of patients who underwent the surgical procedure were observed to be aged between 41-60 years, which is consistent with a similar study conducted by Tan *et al*., (3). In surgical patients, ASA physical status classification is used to assess the comorbidities of surgical patients. Along with other factors like type of surgery, frailty, level of deconditioning, it can be helpful in predicting perioperative risks and helps in communicating with the patient during pre-anaesthetic evaluation. Majority (48.3%) of the patients in this study were classified as having Class 2 ASA, which is in agreement with a similar study conducted by Edwin Seet and colleagues (5). In this study, the prevalence of OSA was seen to be higher among elderly patients, which is consistent with previous studies that undertook sleep-disorder studies in the elderly population (15,16).

Approximately 56.32% of the participants in this study had normal weight (BMI = 18.5 to 24.9kg/m^2), and 24.14 % pre-obese (BMI 25 - 29.9kg/m^2) which is similar to Adeline's and colleagues' study (3). As there is a rise in the incidence of pre-obesity and obesity, OSA incidence has also been increasing. In our study, out of 9 (5.2%) participants who had OSA, 5 (55.55%) participants were obese (BMI≥30kg/m^2). Similarly, most other studies show that OSA is strongly associated with obesity and higher BMI must be screened for OSA and disorders that are associated with it (17).

The patients in this study were also classified based on the Mallampati scoring system (data not shown). In this system the oro-pharyngeal opening is used to identify and classify patients with potentially difficult intubation (18). Mallampati classes I and II have been associated with easy while III and IV as difficult intubation. In this study, most of the patients classified as belonging to either Mallampati class I or II showed similar outcome in the STOP-BANG questionnaire screening, indicating both the screening options to be similar in predicting no or mild sleep apnoea.

The STOP-Bang Questionnaire can help identify people who need greater attention during and after surgery, so as to minimize the risks posed by surgery, anaesthetic agents, and medications prescribed after surgery. Generally, the prevalence of OSA ranges

from 3.2% to 24% (19). In accordance with this, our study found the prevalence of OSA to be 5.2% in the surgical population which is similar to that of the general population (1,19).

Results in this study showed an association between gender (22.2% females and 77.7% males) and occurrence of OSA among patients. This is in accordance with earlier reports wherein the prevalence of OSA was reported to be higher in males as compared to females (20,21). STOP-Bang questionnaire can be an important tool to predict OSA in the general population especially so in the male obese population.

Several other studies found that OSA is significantly associated with a difficult airway (22). Hence, ruling out the presence of OSA preoperatively may help us be prepared by having a difficult airway cart and other preferred pharmacological agents ready. Although our study did not show a statistically significant association between OSA and difficult airway, out of 98 patients who underwent general anaesthesia, 5 patients had OSA. Among the 5 patients with OSA, 2 (40%) patients had a difficult airway out of which only 1 patient had other predictors of difficult airway. Similarly, in the other patient with OSA no other predictors of difficult airway were observed, except difficultly in mask holding which is clinically significant. This emphasizes the importance of screening OSA patients preoperatively for preventing and preparing for any airway-related complications, which can be achieved with evaluating the patients posted for surgery with the STOP-Bang questionnaire.

Patients predicted for anticipated difficult airway by means of any assessment criteria may not experience difficult airway in reality (19). Our results are in accordance with this with a significant association observed between patients predicted for difficult airway and those actually experiencing difficult airway. Thus we presume that any of the anticipated difficult airway cases should be managed with utmost care with a difficult airway cart kept ready so as to not encounter a ventilate/can't intubate situation.

CONCLUSION

The study concludes that there is no difference for OSA prevalence among the surgical as well as the general population. Screening OSA in all patients undergoing general anaesthesia or sedation with the STOP-Bang questionnaire would help an anaesthesiologist to be better prepared for managing difficult airways in patients.

CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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