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## Prevalence And Predictors of Obstructive Sleep Apnoea in Elective Surgical Patients: A Multicentre Study in Northwest Nigeria

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### Abstract

**Background:** High-risk Obstructive sleep apnoea (OSA) is linked with hypertension, diabetes and obesity with associated sleep disturbances, and respiratory complications. It is an independent risk factor for perioperative complications such as anoxic brain injury, death, upper airway complications, difficulty in airway management, respiratory arrest and unanticipated intensive care unit (ICU) admission. Despite these, the prevalence of OSA among surgical patients presenting for anaesthesia is poorly documented, and it is largely undiagnosed in northwest Nigeria due to the paucity of relevant studies.

**Aim:** To determine the prevalence and predictors of obstructive sleep apnoea among surgical patients presenting for anaesthesia in northwest Nigeria.

**Methodology:** The study was a multicentre, cross-sectional study involving seven tertiary hospitals in northwestern Nigeria. We included patients aged 18 years and above undergoing elective surgery under general anaesthesia. Data were collected using a form capturing baseline characteristics and the NoSAS score. The primary outcome measure was the prevalence of OSA. After data analysis, baseline sample characteristics were summarised using frequencies and percentages. Multivariate logistic regression was used to identify predictors of high OSA risk.

**Results:** The sample consisted of 180 patients. Among these, 34 (18.9%) patients and 36 (20.0%) had medium and high risk of OSA, respectively. Increasing age, abnormal BMI (overweight/obesity), and hypertension were independent predictors of OSA risk after a multivariate logistic regression analysis.

**Conclusion:** The risk of OSA among surgical patients undergoing elective surgery is high. Thus, protocols are needed to identify and optimise these patients for safe anaesthesia and surgery.

**Keywords:** High-risk OSA, perioperative medicine, Sleep breathing disorder, prevalence of OSA, predictors of OSA

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### Introduction

Obstructive sleep apnoea (OSA) is the most prevalent sleep-related breathing disorder, characterised by recurrent episodes of complete (apnoea) or partial (hypopnoea) upper airway obstruction.<sup>1</sup> In hospital-based studies, mainly from southern Nigeria, the reported prevalence of the condition ranges from 13.8% to 40%.<sup>2-5</sup> The condition arises from collapse of the pharyngeal airway, leading to disrupted sleep architecture, hypoxaemia, and hypercapnia.<sup>1</sup> Individuals at high risk for OSA frequently exhibit comorbidities such as hypertension, diabetes, and obesity, together with associated sleep disturbances and respiratory complications.<sup>6-8</sup> OSA itself is an independent risk factor for perioperative adverse events, including anoxic brain injury, upper airway management challenges, respiratory arrest, unplanned ICU admission, and increased mortality.<sup>8,9</sup> Despite its common occurrence in the general population, OSA remains largely undiagnosed among surgical patients presenting for anaesthesia in northwest Nigeria, owing to a scarcity of local data. The present study, therefore, aimed to determine the prevalence of OSA and identify its predictors in this patient group.

### Materials and Methods

This prospective, multicentre, cross-sectional study was carried out in seven tertiary hospitals across northwest Nigeria. Ethical approval was obtained from each participating institution. We enrolled all consenting adults ( $\geq 18$  years) classified as ASA I or II who were scheduled for elective surgery under general anaesthesia. Patients were excluded if they were nonverbal, had cognitive impairments, could not comprehend written or verbal information, were critically ill, or declined consent. Screening was performed during routine preoperative assessment and anaesthesia preparation at each centre, in accordance with their departmental protocols. The study period spanned four months (January–April 2023), including the time required to secure ethical clearance.

### Sampling Method

All eligible patients presenting for elective surgery were enrolled consecutively, provided they met the inclusion criteria.

### Data Collection

At each hospital, patients who could read and write completed the study questionnaire during their preoperative visit. Each site appointed at least two trained assistants (volunteer nurses) to guide patients through the questionnaires and study forms during routine preoperative assessments. A site manager at every centre supervised these assistants to ensure strict adherence to the questionnaire protocol, perform quality checks, and prevent duplicate entries. Postoperative adverse events were documented by a trained assistant within 24 hours of anaesthesia. All collected data were forwarded to the principal investigator and analysed in collaboration with a statistician, using an appropriate statistical software package. Upon completion of the study, participants received feedback on the prevalence of obstructive sleep apnoea and the factors associated with increased perioperative risk.

### Study Instrument

Data were collected using a questionnaire that recorded participants' baseline characteristics and their NoSAS score (Neck circumference, Obesity, Snoring, Age, Sex). NoSAS risk categories were defined as follows: scores of 0–7 indicate low risk, 8–11 moderate risk, and 12–17 high risk of OSA (see Table 1).

### Outcome Measures

The primary outcome was the prevalence of OSA. Secondary outcomes included predictors of OSA—such as hypertension, body mass index (BMI), and other relevant factors.

### Data Analysis

Sample Size determination:  $n = \frac{Z^2pq}{d^2}$ ,  $n$  = sample size,  $Z$  (Z-score) = 1.96,  $p$  = prevalence in previous studies (24%),  $q = p - 1$ ,  $d = 0.5$

$n = \frac{1.96^2 \times 0.24(1-0.24)}{0.05^2} = 280.28$ . Assuming a 90% response rate, the expected sample size is  $(\frac{280.28}{0.9}) = 311$ . The study originally aimed to enrol 311 participants, but only 180 were included owing to time limitations and fewer-than-anticipated eligible patients at certain centres. All analyses were performed in SPSS version 23. Baseline characteristics were summarised as frequencies and percentages, and multivariate logistic regression was used to identify factors independently associated with OSA risk. To address missing data, we first examined the extent and pattern of missingness. We then performed multiple imputation, generating 10 datasets that included all variables of interest. Finally, sensitivity analyses comparing the imputed and original datasets revealed no significant differences.

### Ethical Considerations

The hospital's Ethics Committee granted ethical approval for this study. Before enrolment, each patient received a detailed explanation of the study's objectives and procedures, supported by a consent form available in both English and Hausa formats. Participants who

declined or later withdrew were assured of uninterrupted standard care. All data were treated as strictly confidential; the research team covered any additional costs arising from study participation. The principal investigator oversaw secure, anonymised storage of the data on a password-protected hard drive.

### Results

A total of 180 patients were enrolled in the study. They had an average age of  $40.3 \pm 15.2$  years, and most were female (Table 2). The majority were also classified as overweight or obese (Table 2), and their full clinical profiles appear in Table 3. In addition, Table 3 describes respondents who have difficulty initiating sleep. More patients were scheduled under the general surgery and obstetrics & gynaecology services (Table 4). Among them, 34 individuals (18.9%) were at moderate risk and 36 (20.0%) at high risk for OSA (Table 5). On multivariate analysis, male sex, older age, elevated BMI (overweight/obesity), and a history of hypertension emerged as independent predictors of OSA risk (Table 6).

**Table I.** Detailed description of NoSAS score showing the various parameters and allocated points

Parameter	Points
Neck circumference > 40cm	4
BMI 25-<30 kg/m <sup>3</sup>	3
BMI ≥ 30 kg/ m <sup>3</sup>	5
Snoring (self-reported or observed)	2
Age > 55 years	4
Male gender	2

**Table II.** Biodata of Respondents showing Age, gender and Body Mass Index (BMI) distribution

Variable	Frequency (N)	Percentage (%)	Mean (SD)
Age			40.30 (15.22)
Gender			
Female	105	58.3	
Male	75	41.7	
BMI			
Normal	24	13.3	
Overweight	71	39.4	
Obese	85	47.2	

**Table III.** Clinical Characteristics of Respondents showing a history of hypertension and other comorbidities

Parameter	Frequency (N)	Percentage (%)
History of Hypertension		
Yes	10	5.6
No	170	94.4
Comorbidities		
Asthma	4	2.2
Sickle cell anaemia	6	3.3
Hypertension	32	17.8
Nil	130	72.2
HTN/DM	2	1.1
Obesity	4	2.2
Old age	2	1.1
History of Respiratory Infection		
Yes	74	41.1
No	106	58.9
Allergy		
Yes	20	11.1
No	160	88.9

**Table IV.** Proportion of Patients Booked by the various Surgical Specialities during the Study Period

Surgical speciality	Frequency (N)	Percentage (%)
ENT	8	4.4
General surgery	65	36.1
Maxillofacial	4	2.2
Neurosurgery	6	3.3
Obstetrics and Gynaecology	52	28.9
Orthopaedics	12	6.7
Paediatric surgery	2	1.1
Plastic surgery	11	6.1
Urology	20	11.1

**Table V.** The Table shows the Prevalence of Low-, Medium- or High-risk Obstructive Sleep Apnoea among the Study Participants

	Frequency (N)	Percentage (%)
Low risk of OSA	110	61.1
Medium risk of OSA	34	18.9
High risk of OSA	36	20.0

**Table VI.** Predictors of Obstructive Sleep Apnoea using Multiple Logistic Regression Analysis

Factors	AOR (95% CI)	p-value
Gender		
Female	1	
Male	1.43 (1.22, 3.28)	0.394
Age (years)	1.13 (1.00, 1.16)	0.015 <sup>1</sup>
Body Mass Index (BMI)		
Normal	1	
Overweight	1.02 (0.82, 1.40)	0.001 <sup>1</sup>
Obesity	1.27 (1.11, 2.86)	0.030 <sup>1</sup>
History of Cardiac Disease		
Nil	1	
Hypertension	1.10 (0.79, 1.90)	<0.001 <sup>1</sup>

<sup>1</sup>level of significance is less than 0.05. AOR = adjusted odds ratio, CI = confidence interval.



## Discussion

Obstructive sleep apnoea increases morbidity and mortality in surgical patients, underscoring the importance of identification and treatment. Our study revealed that high- or medium-risk obstructive sleep apnoea (OSA) is common in our study environment, with incidences of 20% and 18.9%, respectively. In addition, the majority of the participants were female and either overweight or obese.

The prevalence of patients with high-risk OSA in our study was higher than that reported by Nwosu et al.<sup>2</sup>, who found a modest prevalence of 13.8%. Unlike the study by Nwosu et al., which was conducted in Southeast Nigeria, our study was multicentre and involved participants from Northwestern Nigeria. In contrast, their study population involved only participants diagnosed with hypertension, which might have limited the outcome as a result of differences in the target population. In this study, we used the NoSAS score to screen patients for OSA, rather than the STOP-BANG score used in the study by Akanbi and his colleagues<sup>10</sup>, which may explain the differences in findings between the two studies. Notably, the study by Akanbi et al. found a lower prevalence of high-risk OSA (15.76%) than our findings of 20%. Aside from the use of different scoring parameters in both studies, more respondents participated in Akanbi et al.'s study than in this study. Moreover, their study was community-based, which may have led to a lower prevalence than in our hospital-based study. The high point of their study is the reaffirmation of obesity as an independent factor for OSA in Nigeria. A higher prevalence of 23.7% for high-risk OSA has been reported in surgical patients in a study by Finkel et al.<sup>6</sup>, though the population studied was hospital-based and the sample was larger. Moreover, Finkel and colleagues applied the STOP-BANG score, whereas we used the NoSAS score. Differences in the populations studied may explain the variation in reported OSA prevalence.

Although some studies have shown the diagnostic ability of the NoSAS score to be comparable to that of the STOP-BANG score<sup>11-13</sup>, other studies have reported differences<sup>14</sup>. The actual comparison between NoSAS and STOP-BANG scores was not done in this study;

notwithstanding, our individual experiences favour the use of NoSAS for routine clinical practice in a resource-limited setting. In general, OSA questionnaires have high sensitivity. However, when used alone, they tend to have poor specificity for detecting moderate-to-severe high-risk OSA, resulting in high referral rates to specialist clinics<sup>16</sup>. Screening for daytime somnolence using the Epworth Sleepiness Scale (ESS) or polysomnography may improve the diagnostic accuracy of these scoring systems<sup>15,16</sup>.

The association of high-risk OSA with hypertension, diabetes, obesity, sleep disturbances, the elderly, and respiratory complications is well known.<sup>6-8</sup> In our study, we noticed a strong relationship between OSA and increasing age, hypertension, and obesity or overweight. The strongest relationship was observed with hypertension, a finding similar to that reported by Nwosu et al.<sup>2,3</sup>. In contrast, the study by Umor and his colleagues revealed a strong relationship between diabetes and OSA, perhaps because they studied only patients diagnosed with diabetes<sup>17</sup>. Overweight and obesity have been cited as strong risk factors for high-risk OSA among Nigerians<sup>10</sup>; however, our study revealed that being overweight (BMI > 30kg/m<sup>2</sup>) may have a stronger relationship with medium or high risk OSA compared to actual obesity.

## Conclusion

The prevalence of OSA risk among elective surgical patients is high, necessitating protocols to identify and optimise these patients for safe anaesthesia and surgery. Limitations include the smaller-than-planned sample size, which may limit generalizability, and reliance on the NoSAS score without polysomnography confirmation. Future studies should validate these findings in a larger cohort with diagnostic testing. Protocols should be initiated to include routine NoSAS screening and referral for polysomnography in moderate- to high-risk patients.

**Conflict of Interest:** There is no conflict of interest

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