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ORIGINAL ARTICLE

Role of STOP-BANG Questionnaire in Predicting Obstructive Sleep Apnea Among Adult Patients in Chest Department of Zagazig University Hospital

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Abstract

Background : Because of the relatively increased prevalence of unrecognized and undiagnosed Obstructive Sleep Apnea (OSA) cases, there is a strong need to develop an accepted screening tool for OSA in the population. *This study aimed at* assessing the predictive probabilities of STOP-BANG Questionnaire (SBQ) for OSA.

Methods: A cross-sectional study included 216 patients presenting to the outpatient clinic of Chest Department, Zagazig University Hospital suspected to have OSA**.** They were studied through: history taking, clinical examination, chest radiography, routine laboratory tests, arterial blood gases. All patients in the study completed SBQ and Epworth Sleepiness Scale (ESS) prior doing Polysomnography (PSG) which the gold standard for the diagnosis of OSA. The sensitivity, specificity, positive and negative predictive values of SBQ and ESS were calculated.

Results: Of 216 screened patients; OSA patients in this study represents 90.7% of the studied cases diagnosed by PSG in which (12% mild, 19.4% moderate and 59.23% severe).89.8% of studied cases were high risk for OSA by SBQ while 65.7% were at high risk for OSA by ESS. SBQ had sensitivity of 95.3% and specificity 58.7% in diagnosis of moderate to severe OSA but 97.7% sensitivity and 63.6% specificity in diagnosis of severe OSA. ESS had sensitivity of 60.6% and specificity 73.9% in diagnosis of moderate to severe OSA but 50.8% sensitivity and 77.3% specificity in diagnosis of severe OSA.

Conclusions: SBQ has an excellent sensitivity and can predict moderate and severe OSA patients. The superiority of SBQ was obvious when compared with ESS.

Keywords : Obstructive sleep apnea ; Polysomnography; STOP-BANG questionnaire; Epworth Sleepiness Scale**;** screening

Introduction :

Obstructive Sleep Apnea (OSA) is a state in which discontinuous occlusion of the airway at sleep leads to fragmentation of sleep and recurrent desaturations **[1]**

OSA is accompained with considerable morbidity, involving too much sleepiness during daytime, snoring loudly at sleep, hypertension, and disturbed life quality**[2] .**Also studies have revealed that OSA is accompained with an elevated traffic accidents and cardiac diseases risk **[3]**.

Usually primary care providers determine either patients are directed to OSA evaluation or not. Because of financial causes, this decision has to be done rapidly and accurately at short patient visits **[4]**.

In time of cost inclusion, it was not practical to refer anyone for PSG, and if cost was not a

matter, long waiting durations at sleep laboratory was another matter. Patients have to be screened before referring for a PSG, however it was proved unexpectedly that it was not easy to precisely predict the presence of OSA or it's absence depending on clinical examination [**5]**
The STOP-BANG questionnaire was primarily made as a quick tool for screening OSA as part of evaluation of patients referred for surgery preoperativly **[6]**.
STOP questionnaire contains 4 yes/no questions on snoring, tiredness, apnea observed, and blood pressure. The STOP-BANG questionnaire includes the STOP questions and gives points for every yes answer on the following : Body Mass Index (BMI) more than 35 kg/m^2,age more than 50 years, neck circumference more than 40 cm ,and male gender **[7]**.

METHODS

Study Design: Cross sectional study.

Patients: This study was carried out in Chest Department of Zagazig University Hospital from June 2016 to June 2017 on 216 adult patients suspected to have OSA, of both sexes with an age range from 18 – 80 years old in which 196 patients were having OSA by PSG while 20 patients were having other diagnosis by PSG. Two patients were excluded from the study.

Inclusion Criteria:

Those patients were selected from the attendants of the outpatient clinic of Chest Department, Zagazig University Hospital suspected to have OSA within the predetermined age range.

Exclusion Criteria:

Patients who did not complete their questionnaires or those who did not undergo PSG or not complete their PSG were excluded from the study.

METHODS:All patients were subjected to the following:

History taking, Clinical examination ,Chest Radiography, laboratory Investigations including **:** Complete Blood Count (CBC), liver function tests, kidney function tests, random blood sugar, thyroid function tests, lipid profile, Arterial Blood Gases (ABG).All patients in the study completed SBQ and ESS prior doing PSG. Consent was taken from all patients participated in the study. The study was approved by zagazig faculty of medicine of IRB approval Number (#2895-5-6-2016). *The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.*

The STOP-BANG Questionnaire consists of two parts [7]: (1) STOP Questionnaire including 4 yes/no questions evaluating snoring, tiredness during daytime, breathing stop observed by another individual during sleep and having or being treated for high blood pressure.(2) BANG including the following items: measuring body mass index (BMI), age, neck circumference, and gender. BMI more than 35 kg\m^2, age more than 50 years, neck circumference more than 40 cm and gender of male refer to positive scores. Patients with answering "yes" to three or more of eight items of the STOP-BANG Questionnaire was identified to be high risk of OSA.

Epworth Sleepiness Scale (ESS) is a questionnaire that asks subjects to rate how likely they would have dozed (fallen asleep) in 8 specific situations or activities that are commonly met in daily life. The chance of dozing is rated on a scale of 0–3 (0= would never doze, 1 =slight chance of dozing, 2 =moderate chance of dozing, and 3 = high chance of dozing). The total ESS score is the sum of 8-items scores and can range between 0 and 24. The higher the score, the higher the person's level of daytime sleepiness as follows: normal, 0–10; and excessive daytime sleepiness, 11–24. Thus, the ESS final score was categorized into <11 (low risk for sleepiness) and ≥11 (high risk for sleepiness) **[8]**.

Polysomnography:

Afull-night polysomnographic sleep study was done using (SOMNOscreen™ plus which is manufactured in Germany) to all patients. It included electroencephalography (EEG), electrooculography (EOG), electrocardiography (ECG), submental and anterior tibial Electromyography (EMG), respiratory effort (abdominal and thoracic effort), nasal pressure sensor, oronasal thermister and pulse oximetry for oxygen saturation.The PSG monitors many body functions including brain (EEG), eye movements (EOG), muscle activity (EMG) and heart rhythm (ECG) during sleep **[9]**.
Total obstructive Apnea/hypopnea index (AHI) was calculated as the number of obstructive apneas and hypopneas per hour of total sleep time (TST). The threshold for diagnosis of OSA was set at an AHI ≥5 and the severity of OSA was defined by cut-off levels of AHI; ≥5–<15 episodes per hour of TST for mild, ≥15–<30 episodes per hour of TST for moderate and ≥30 episodes per hour of TST for severe OSA**[10]**

Statistical Analysis

The Collected data were coded, entered , presented , and analyzed by computer using a data base software program , Statistical Package for Social Science (SPSS) version 20 **(IBM Corporation, Armonk, NY, USA).**For quantitative variables mean, standard deviation (SD) and median were computed. Qualitative data were represented as frequencies and percents. Independent t- test (t) was used for detection of differences between different quantitative variables .Chi square (x2) or Fisher's exact tests were used to detect relation between different qualitative variables. Validity of the screening test is measured by sensitivity , specificity , positive and negative predictive values. P- value is considered significant when it is equal or less than 0.05.

Results :

A total of 216 patients were enrolled in the study. **Table(1)** show that the age of the studied cases ranged from 23 to 76 years with mean **50.35± 11.23**years. Regarding sex more than half of them were male (57.4%). More than half of the studied cases were suffering from hypertension (HPT) (55%) .Also this table shows that by PSG 90.7% of the studied cases had OSA (12% mild, 19.4% moderate and 59.23% sever). SBQ results showed that 89.8% was high risk for OSA while ESS founded that 65.7% was at high risk as seen in **Figures(1)**

Table(2) and figure(2) show that there was a statistically significant agreement between PSG and SBQ in diagnosis of OSA as SBQ had sensitivity of (94.9%), specificity (60%) and Positive Predictive Value (PPV) (95.9%) and Negative Predictive Value (NPV) (54.5%) in diagnosis of OSA. Also they show that there was non significant agreement between PSG and ESS in diagnosis of OSA. ESS had sensitivity of (69.4%), specificity (70%),PPV(95.8%) and NPV(18.9%) in diagnosis of OSA.

Table(3) and figure(3) shows that there was a statistically significant agreement between PSG and SBQ in diagnosis of moderate to severe OSA. SBQ had sensitivity of (95.3%), specificity (58.7%), PPV (89.5%) and NPV (77.1%) in diagnosis of moderate to severe OSA. Also they show that there was a non significant agreement between PSG and ESS in diagnosis of moderate to severe OSA. ESS had sensitivity of (60.6%), specificity (73.9%), PPV (89.6%) and NPV(33.7%**)** in diagnosis of moderate to severe OSA.

Table(4) and Figure(3) show that there was a statistically significant agreement between PSG and SBQ in diagnosis of severe OSA. SBQ had sensitivity of (97.7%), specificity (63.6%), PPV (79.6%) and NPV (94.9%) in diagnosis of severe OSA. Also they show that there was a non significant agreement between PSG and ESS in diagnosis of severe OSA. ESS had sensitivity of (50.8%), specificity (77.3%), PPV(76.5%) and NPV(51.9%) in diagnosis of severe OSA.

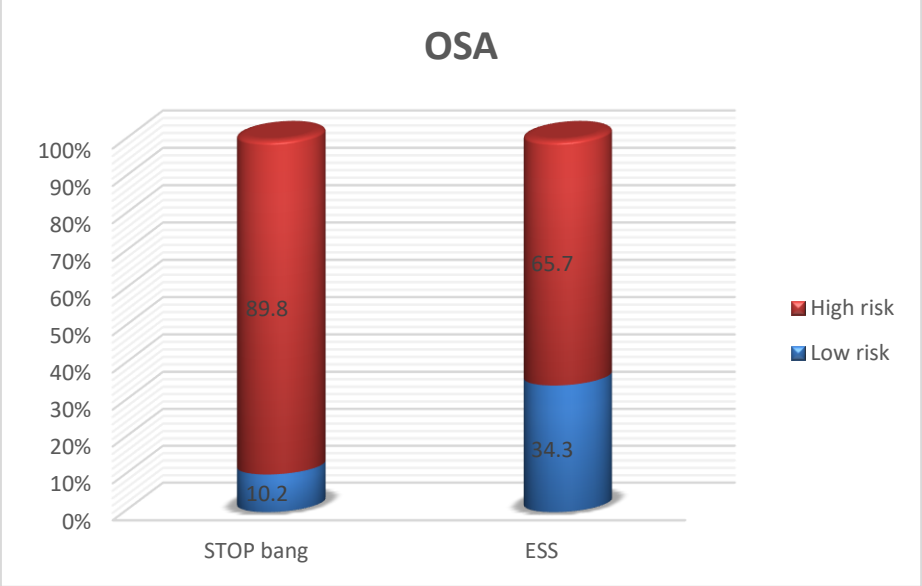
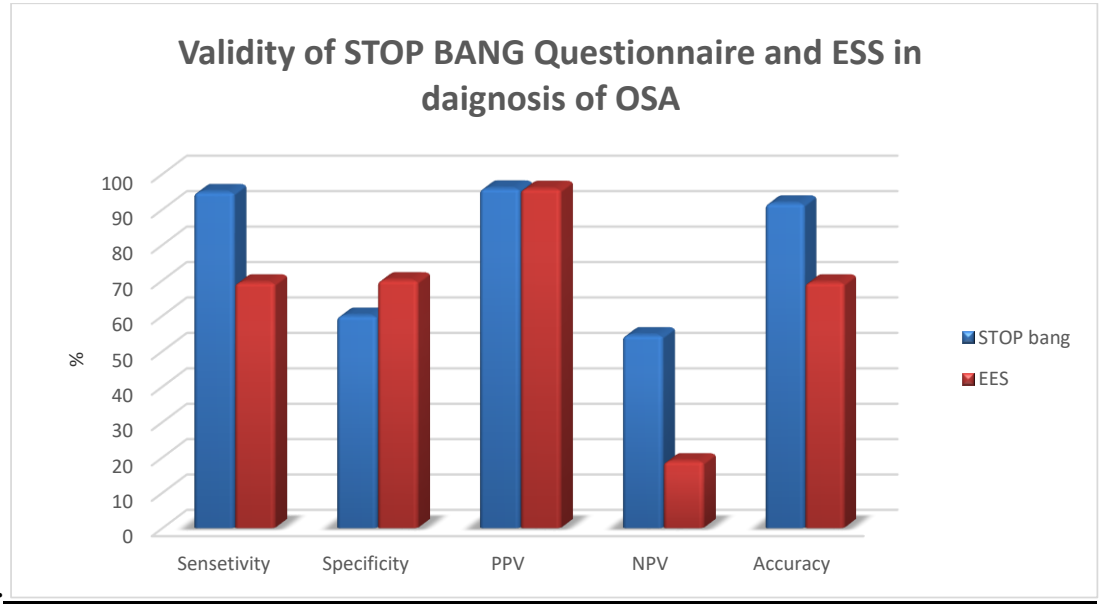


Figure (1): Sleep apnea risk according STOP BANG Questionnaire & EES among the studied



cases.

Figure (2): Validity of STOP BANG Questionnaire & ESS in diagnosis of OSA among the studied cases

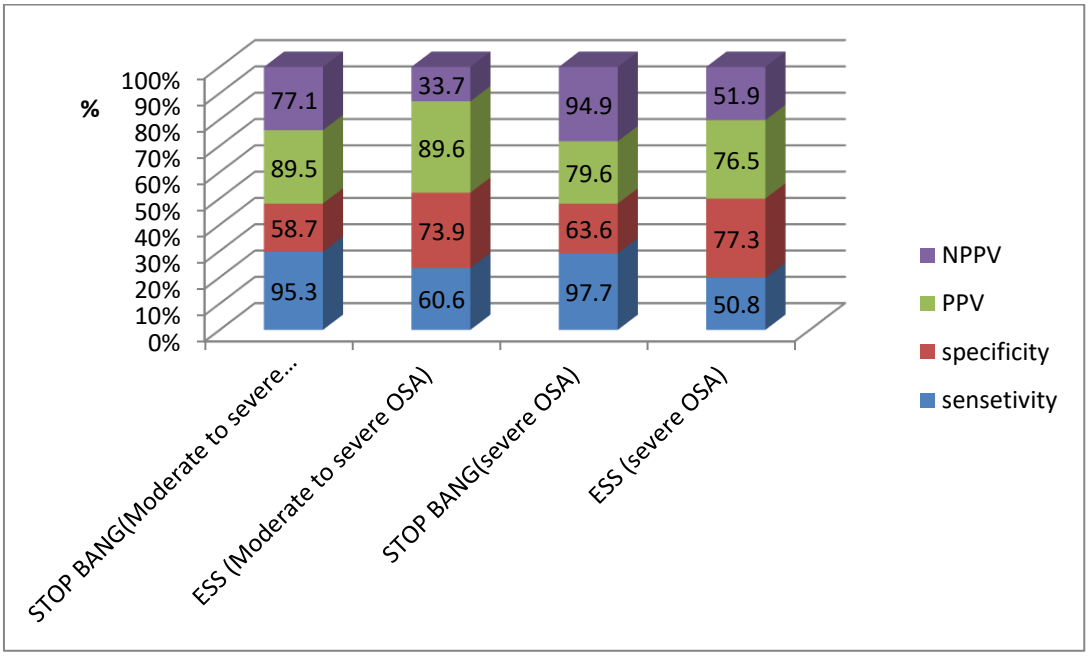


Figure (3): Validity of STOP BANG Questionnaire & ESS in diagnosis of moderate to severe OSA and severe OSA among the **studied cases**

Table (1): Demographic Characteristics and comorbidities of the studied cases

Variable		(n=216)	
Age: (years)	Mean ± SD Range	50.35± 11.23 23 - 76	
		No	**%**
Sex:	Male Female	124 92	57.4 42.6

co morbidities	D.M.	44	20.3
	HPT	119	55
	C.V.D.	72	33.3
	Hypothyroidism	19	8.7
	Hyperlipidemia	68	31.4
	COPD	4	1.8
PSG:	Negative test Mild Moderate Sever	20 26 42 128	9.3 12 19.4 59.3
STOP BANG:	Low risk High risk	22 194	10.2 89.8
ESS:	Low risk High risk	74 142	34.3 65.7

SD: Standard Deviation, **D.M.:** Diabetes Mellitus, **HPT:** Hypertension, **C.V.D.:** Cardiovascular Diseases (other than HPT), **COPD:** Chronic Obstructive Pulmonary Disease

Table (2): Validity of STOP BANG Questionnaire and ESS in diagnosis of OSA among the studied cases

variable	STOP BANG	ESS
Sensitivity (%)	94.9%	69.4%
Specificity (%)	60%	70%
PPV (%)	95.9%	95.8%
NPV (%)	54.5%	18.9%

PPV : Positive Predictive Value, **NPV:** Negative Predictive Value

Table (3): Validity of STOP BANG Questionnaire and ESS in diagnosis of moderate to severe OSA among the studied cases

variable	STOP BANG	ESS
Sensitivity (%)	97.7%	50.8%
Specificity (%)	63.6%	77.3%
PPV (%)	79.6%	76.5%
NPV (%)	94.9%	51.9%

PPV : Positive Predictive Value, **NPV**: Negative Predictive Value

Table (4): Validity of STOP BANG Questionnaire and ESS in diagnosis of severe OSA among the studied case

variable	STOP BANG	ESS
Sensitivity (%)	**95.3%**	**60.6%**
Specificity (%)	**58.7%**	**73.9%**
PPV (%)	**89.5%**	**89.6%**
NPV (%)	**77.1%**	**33.7%**

PPV : Positive Predictive Value, **NPV:** Negative Predictive Value

DISCUSSION :

The prevalence of obstructive sleep apnea (OSA) was reported in 37% of men and in 50% of women **[11].**

OSA is a treatable disease. However, overnight polysomnography (PSG), which is the gold standard for the diagnosis of OSA, is not an easy diagnostic method to reach **[12].**

Polysomnography is not available in many centers and the appointment times are long because it is a time consuming process. Similar to many diseases, questionnaires have been developed for prediction of OSA based on clinical and laboratory findings. In these questionnaires, sleep quality, symptoms of sleep disturbance, risk factors of sleep disturbance and possible complications related to sleep problems are questioned **[13]**.

The objectives of this study were to assess patients who had been suspected to have OSA regarding snoring, tiredness, observed apnea, blood pressure, BMI, age, neck circumference and gender and this was done by using SBQ.

Also patients were assessed by Epworth Sleepiness Scale (ESS) which is a self administrated questionnaire that asks subjects to rate how likely they would have dozed (fallen asleep) in 8 specific situations or activities that are commonly met in daily life and lastly PSG was done to all participants in the study.

In this study **Table (1)** shows that the age of the studied cases ranged from 23 to 76 years with mean **50.35± 11.23** years and these finding are in agreement with **Luo et al. [14].**where the age of their studied population ranged from 20 to 78 years old and **El-Sayed [15]** in which mean age was 50.38 (±11.29 SD) years with a range of 24– 85 years, but in disagreement with **Silva et al.[4]** where mean age was 62.4 (± 10.3 SD) years as patients included in their study were over 40 years of age.

Regarding sex more than half of the studied cases were male (57.4%) and these finding is in agreement with **Silva et al. [4]** in which 51.5% of their studied cases were males but in disagreement with **Luo et al.[14]** where (88.6%) of their studied cases were males.

Also there is disagreement with **El-Sayed [15]** in which the studied cases were (85.5%) males and (14.5%) were females as the participants in their studies were large number of males than our study that suggests that male gender influences the occurrence of OSA.

More than half of our studied cases were suffering from hypertension (55%) and this finding is in agreement with **Mokhlesi et al [16]** in which most of cases in their study suffer from hypertension (17.58%).

Also our findings are in agreement with **Lacedonia et al.[17]** in which most cases in their study suffered from hypertension (59.5%).

By PSG 90.7% of the studied cases had OSA (12% mild, 19.4% moderate and 59.23% sever) and these findings are in agreement with **Sadeghniiat-Haghighi et al. [18]** where mild OSA 20.7%,moderate OSA 18.9%, severe OSA 33.3%.

SBQ results showed that 89.8% of our studied patients were at high risk for OSA and 10.2% were at low risk for OSA as seen in **figure(1)** and these findings are in agreement with **El-Sayed [15]** where 95.5% of their studied cases were at high risk for OSA by SBQ but in disagreement with **Silva et al.[4]** in which only 72.4 % of their studied cases were at high risk for OSA as their study has limitations in which analyses by SBQ and ESS are limited to screening for moderate-to-severe or severe OSA patients according to PSG.

In this study, ESS showed that 65.7% of the studied population were at high risk for OSA. These findings are in agreement with **El-Sayed[15]** where 68.3% of her studied cases

were at high risk for OSA but in disagreement with **Silva et al.[4]**in which 28 % of their studied cases were at high risk for OSA.

Table (2) and Figure (2) show that there was a statistically significant agreement between PSG and SBQ in diagnosis of OSA as SBQ had sensitivity of (94.9%), specificity (60%) and Positive Predictive Value (PPV) (95.9%) and Negative Predictive Value (NPV) (54.5%) in diagnosis of OSA.

Our results are in agreement with **El-Sayed[15]** where SBQ had sensitivity of (97.55 %), specificity (26.32%) and PPV (93.43%) and NPV (50%) in diagnosis of OSA in that study.

Also our findings are in agreement with **Vulli [19]** as SBQ had sensitivity of (96.66%), specificity (40%) and PPV (90.62%) and NPV (66.66%) in diagnosis of OSA. While our findings are in disagreement with **Amra et al.[20]**where SBQ had sensitivity of (81.46%), specificity (82.35%) and PPV (99%) and NPV (16.47%) in diagnosis of OSA. This difference with our study may be attributed to that their patients should complete 3 questionnaires (Berlin,SBQ,ESS) before doing PSG and because of the effect of time on accuracy of answers bias should be considered in scores of the questionnaires. Also their sample size was 400 patients without comorbidities.

Our results are in disagreement with **Chung et al. [21]** as SBQ had sensitivity of (83.8%), specificity (39.4%) and PPV (73.8 %) and NPV (54.5%) in diagnosis of OSA. The cause of disagreement with **Chung et al.[21]**may be attributed to that their study was conducted in the preoperative clinics of Toronto Western Hospital and Mount Sinai Hospital, Toronto, Canada on surgical patients aged 18 years or older while our study was carried on patients suspected to have OSA aged from 18 to 80 years old .

Also **Table(2) and Figure(2)**show that there was non significant agreement between PSG and ESS in diagnosis of OSA. ESS had sensitivity of (69.4%), specificity (70%),PPV(95.8%) and NPV(18.9%) in diagnosis of OSA.

Our findings are in agreement with **El-Sayed [15]** as regard sensitivity(72.55%), specificity (75%),PPV (96.73%) and NPV (21.13%) of ESS in diagnosis of OSA.

Also, our findings are in agreement with **Amra et al [20]**as regard specificity (76.47%),PPV (98.26%) while in disagreement as regard sensitivity (59%) and NPV (7.64%) of ESS in diagnosis of OSA.

Our results are in agreement with **Vulli.[19]**in which sensitivity (73.33%), specificity (60%),PPV(91.66%) and NPV(27.27%) of ESS in diagnosis of OSA.

Table(3) and Figure(3) show that there was a statistically significant agreement between PSG and SBQ in diagnosis of moderate to severe OSA. SBQ had sensitivity of (95.3%), specificity (58.7%), PPV (89.5%)and NPV (77.1%) in diagnosis of moderate to severe OSA.

There is agreement of our results with **El-Sayed [15]** as regard sensitivity (97.74 %) and PPV (86.93%) while disagreement as regard specificity (3.7%) and NPV (20%).

Our findings are in agreement with **Vulli [19]** as SBQ had sensitivity of (100%), specificity (57%), PPV (90.32%) and NPV (100%) in diagnosis of moderate to severe OSA.

Also this table and figure show that there was a non significant agreement between PSG and ESS in diagnosis of moderate to severe OSA. ESS had sensitivity of (60.6%), specificity (73.9%), PPV(89.6%) and NPV(33.7%)in diagnosis of moderate to severe OSA.

Our findings are in agreement with **El-Sayed [15]**in which ESS had sensitivity of (75.71%), specificity (48.15%), PPV(90.54%) and NPV(23.23%) in diagnosis of moderate to severe OSA.

Our findings are in disagreement with **Silva et al.[4]** as regard sensitivity of (39%) and in agreement with that study as regard specificity (71.4%) of ESS in diagnosis of moderate to severe OSA.

Also, our findings are in agreement with **Vulli.[19]** as regard PPV(87.5%) and NPV(36.36%) but in disagreement with that study as regard sensitivity (45.04%) and specificity (57.14%) of ESS in diagnosis of moderate to severe OSA.

Our findings are in agreement with **Luo et al.[14]**as regard sensitivity (58.2%) and specificity (50.0%) of ESS in diagnosis of moderate to severe OSA.

Table(4) and Figure(3) show that there was a statistically significant agreement between PSG and SBQ in diagnosis of severe OSA. SBQ had sensitivity of (97.7%), specificity (63.6%), PPV (79.6%) and NPV (94.9%) in diagnosis of severe OSA.

Our findings are in agreement with **El-Sayed [15]** as regard sensitivity (98.65%) and PPV (73.37%) while in disagreement as regard specificity (5.36%) and NPV (60%).

Our findings are in disagreement with **Silva et al.[4]** as regard sensitivity of (70.4%) but in agreement with the same study as regard specificity (59.5%).

Also our findings are in agreement with **Vulli [19]** as regard sensitivity of (100%) and NPV (60%) but in disagreement with the same study as regard specificity (18.18%) and PPV (41.93%).

Also this table and figure show that there was a non significant agreement between PSG and ESS in diagnosis of severe OSA. ESS had sensitivity of (50.8%), specificity (77.3%), PPV(76.5%) and NPV(51.9%) in diagnosis of severe OSA.

Our findings are in disagreement with **El-Sayed [15]**as regard sensitivity (79.73%)and specificity (46.43%) but in agreement as regard PPV(79.73%) and NPV(46.43%) of ESS in diagnosis of severe OSA.

Also, Our findings are in agreement with **Silva et al.[4]** as regard sensitivity of (46.1%) and specificity (70.4%) of ESS in diagnosis of severe OSA. However, our findings are in disagreement with **Luo et al[14]** as regard sensitivity (81%)and specificity (63.3%) and in disagreement with **Vulli. [**19]as regard sensitivity (76.92%) and specificity (36.36%) PPV(41.67%) and NPV(72.73%) of ESS in diagnosis of severe OSA.

In conclusion, the SBQ is an easy-to-use questionnaire which could be considered as a valid tool for OSA screening in sleep clinic population. SBQ has an excellent sensitivity and can predict moderate and severe OSA patients.

Although, our study was performed among patients at high risk for OSA, the superiority of SBQ was obvious when compared with ESS.

Conflict of interest: none

Financial disclosure: none

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