International Journal of Physiotherapy and Research,
Int J Physiother Res 2016, Vol 4(4):1583-88. ISSN 2321-1822
DOI: http://dx.doi.org/10.16965/ijpr.2016.139

Original Research Article

SCREENING FOR OBSTRUCTIVE SLEEP APNOEA USING MODIFIED BERLIN QUESTIONNAIRE, STOP-BANG QUESTIONNAIRE AND ANTHROPOMETRIC MEASUREMENTS IN PATIENTS VISITING VARIOUS OPDs IN A TERTIARY CARE SET-UP

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ABSTRACT

Background and Objective: Obstructive sleep apnoea is characterized by repetitive interruption of ventilation during sleep due to collapse of the pharyngeal airway leading to intermittent hypoxia, sleep fragmentation and is also associated with atherosclerosis, initiation and progression of cardiovascular disease. Obesity has shown to be a major predisposing factor for OSA. Anthropometric measurements have shown to be a risk factor for OSA. Though, sagittal abdominal diameter (SAD) has been proposed as the valid measurement of the visceral fat mass and cardio-metabolic risk. There is dearth in literature suggesting SAD as a risk factor for OSA. Hence, this study was taken up to investigate the same.

Materials and Methods: This pilot study was conducted on 50 subjects including both males and females. Demographic data along with the anthropometric measurements like waist circumference, hip circumference, waist hip ratio, waist-height ratio, thigh circumference and sagittal abdominal diameter were measured after which the subjects were administered with STOP-BANG questionnaire and Modified Berlin questionnaire.

Results: The results have shown to have a positive correlation between sagittal abdominal diameter and STOP-BANG questionnaire(r=0.13) and modified berlin questionnaire(r=0.038). There is weak positive correlation between neck length and STOP-BANG questionnaire(r=0.038) and modified berlin questionnaire(r=0.002).

Conclusion: This pilot study suggests that sagittal abdominal diameter and neck length may also be considered as a novel risk factor for diagnosis of obstructive sleep apnea (OSA) in larger population.

KEY WORDS: Obstructive Sleep Apnoea, Waist-Height Ratio, Neck Length, Sagittal Abdominal Diameter, STOP-BANG Questionnaire, Modified Berlin Questionnaire.

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Quick Response code	International Journal of Physiotherapy and Research ISSN 2321- 1822 www.ijmhr.org/ijpr.html	
DOI: 10.16965/ijpr.2016.139	Received: 27-05-2016 Peer Review: 28-05-2016 Revised: None	Accepted: 14-06-2016 Published (O): 11-08-2016 Published (P): 11-08-2016

INTRODUCTION

Obstructive sleep apnoea (OSA) is a condition that is characterized by repetitive interruption of ventilation during sleep due to collapse of the pharyngeal airway [1]. Obstructive sleep apnoea (OSA) further leads to intermittent hypoxia, and sleep fragmentation. In addition, it also leads to increased hormonal fluctuations leading to an increased risk of hypertension, insulin resistance, heart attack, stroke and metabolic syndrome [2]. Sleep-disordered breathing (SDB) has been strongly associated with insulin resistance and glucose intolerance, and is frequently found in people with type 2 diabetes. SDB not only causes poor sleep quality and daytime sleepiness, but has clinical consequences, including hypertension and increased risk of cardiovascular disease [3]. Studies indicate that obstructive sleep apnea is also associated with atherosclerosis and initiation and progression of cardiovascular disease [4,5].

Obstructive Sleep Apnoea Syndrome (OSAS) has shown to have a causative role in hypertension [6,7]. OSAS was listed as one among the identifiable causes of hypertension, and its screening is justified in clinical practice [8]. A number of studies have reported a high prevalence of hypertension in OSA patient populations as well as high levels of OSA in hypertensive cohorts. The etiologic association between OSA and hypertension has been somewhat blurred because of the confounding effect of obesity as well as other comorbidities that characterize both patients with hypertension and patients with OSA. The Sleep Heart Health Study suggested that the presence of OSA is independently associated with an increased risk for hypertension. There appears to be a dose–response relationship that associates increasing sleep apnoea severity with higher blood pressure levels [9]. Wisconsin sleep cohort study has shown an association between sleep disordered breathing and hypertension and found likely to be a risk factor for hypertension and consequent cardiovascular morbidity in general population [10]. There are claims of a very high incidence of OSAS in COPD patients. COPD and OSAS are independent risk factors for cardiovascular events and their coexistence in overlap syndrome probably increases this risk [11].

Obesity predisposes and potentiates OSA. Recent estimates suggest that 60% of the adult population in industrialized countries is overweight (BMI > 25 kg/m^2) and at least 30% is obese (BMI > 30 kg/m^2) [12]. The prevalence of OSA in obese or severely obese patients is nearly twice that of normal-weight adults. Furthermore, patients with mild OSA who gain 10% of their baseline weight are at a six fold-increased risk of progression of OSA, and an equivalent weight loss can result in a more than 20% improvement in OSA severity [13].

Anthropometric Measurements which includes waist-to-height ratio, which is a rapid and effective global indicator for health risks of obesity and is a better obesity index than Body Mass Index, and waist-to-hip ratio for predicting diabetes, hypertension and lipidemia [14]. Sagittal Abdominal Diameter has been proposed as the valid measurement of the visceral fat mass and cardio metabolic risk [15]. Among the other anthropometric measurements, neck circumference has been suggested to be predictive risk factor for obstructive sleep apnoea. An increased neck circumference has shown as a better sign for obstructive sleep apnoea than other clinical indicies and also has shown to be 77% sensitive and 82% specific for Obstructive Sleep apnoea in patients referred to sleep clinic [16,17].

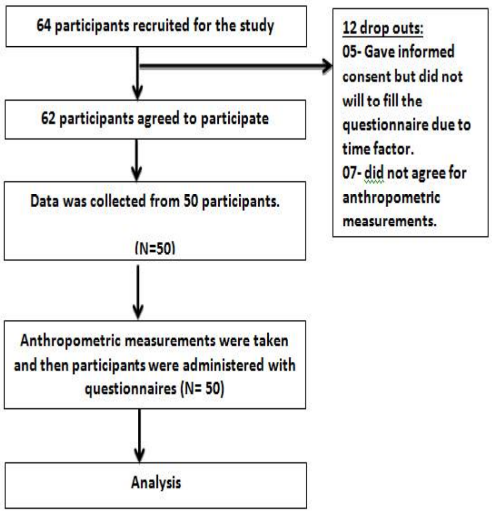
The musculoskeletal disorders like rheumatic disorders, osteoarthritis, fibromyalgia, ankylosing spondylitis also shares a correlation with OSA. In general, there is reduced sleep efficiency accompanied by increased periods of wakefulness during the night [18].

The STOP – BANG questionnaire is a concise and easy to- use screening tool for OSA. It has been developed and validated in surgical patients at preoperative clinics. Combined with body mass index, age, neck size, and gender, it had a high sensitivity, especially for patients with moderate to severe OSA [19]. The Modified Berlin questionnaire is a screening tool used widely used to determine the prevalence of OSA [20]. Early screening and detection of OSA may help in aiding treatment on the future development of vascular disease, renal failure, stroke and heart failure. Since there are studies to suggest various anthropometric measurements as predictors of obesity and other metabolic diseases, however no studies suggest anthrop-ometric measurements except neck circumference as a risk factor for Obstructive

Sleep Apnoea. Hence, this pilot study was conducted to find out if other anthropometric measurements like SAD (sagittal abdominal diameter) could be used as a predictor of risk factor for Obstructive Sleep Apnoea.

MATERIALS AND METHODS

Fig. 1: Study flow chart of the study.



This pilot observational (cross-sectional) study with non-probability sampling method was conducted on adult male and female subjects visiting physiotherapy, respiratory and medicine OPD's and executive health check-up center at tertiary health care center. It was a 3 months study ranging from November2014- January2015.

Inclusion criteria: (1) All adult subjects visiting Physiotherapy, Respiratory and Medicine OPDs and executive health check-up center (2) Educated subjects, who can understand English language and follow Questionnaire were included in the study.

Exclusion criteria: (1) Subjects not able to stand/ non-ambulatory (2) Subjects not willing to participate (3) or patients with psychological illness were excluded from study.

Procedure: Ethical clearance was obtained from Institutional Ethical Committee prior to the commencement of the study. The purpose of the study was explained and a written informed consent was obtained from all the subjects. All subjects were screened based on the inclusion and exclusion criteria prior to their enrolment into the study. A total of 64 subjects were screened for the study out of which 62 subjects agreed to participate and data was collected from 50 subjects. There were 12 dropouts out of which 05 gave the informed consent but did not agree to fill the questionnaire and 07 did not agree for anthropometric measurements. Demographic data of all the subjects was noted along with the physiological parameters like blood pressure, respiratory rate and pulse rate (BP, RR, PR) which was measured using a digital monitor by the therapist (Figure 1).

Anthropometric Profile: Body weight of all subjects was recorded in erect position without shoes and wearing only light indoor clothes, with a bathroom weighing scale. Height was measured to the nearest 1 cm and body mass index (BMI) was calculated as body weight/ height^2 (kg/m^2).

The circumferences (cms) were verified with the aid of non-elastic measuring tape.Waist circumference was measured midway between the lower rib cage margin and the anterior superior iliac spine. The reading was taken at the end of a normal exhalation. Hip circumference was measured at the maximum circumference of the buttocks, the subject standing with feet placed together and waist-hip ratio (WHR) was calculated. A waist-to-hip ratio (WHR) was composed by dividing the waist circumference by the hip circumference. The reading was taken to the nearest millimeter. Neck circumference (NC) was measured at the level of cricothyroid membrane using a non-elastic measuring tape. A height-corrected measure for NC, percentage predicted neck circumference (PPNC) was computed using the formula, PPNC = (1000 x NC)/ (0.55 H+310).[16] Neck length (NL) was measured from occipital tubercle to the vertebra prominens.Thigh circumference was measured, by positioning the tape horizontally at the midpoint between the inguinal fold and the proximal border of the patella, while maintaining a slight flexion of the knee. SAD was measured on subjects in standing or supine position. Two rulers were used to measure abdominal height in which one ruler will be placed on the posterior aspect and other was placed on the highest abdominal height parallel to each other and the distance was measured. Peak expiratory flow rate as a measure of pulmonary function test was also measured using a Wright's Peak flow meter. All subjects were examined on a conventional, clinic examining table. After taking all the anthropometric measurements, then the subjects were administered with STOP-BANG questionnaire and modified berlin questionnaire.

Statistical analysis:

Statistical analysis for the present study was done manually as well as using statistical package of social sciences (SPSS) version 21 so as to verify the results obtained. Nominal data of the patient's including demographic data i.e. age, gender, BMI, height, weight distribution were analyzed using mean and standard deviation and percentage distribution. Correlation co-efficient was used to find the strength of association between numerical variables i.e. anthropo-metric measurements and STOP-BANG questionnaire and Modified Berlin questionnaire.

RESULTS

A total of 50 subjects were included in the studyamong which males were 34(68%) and females 16(32%) with a mean age 47.2±14.6 years (Table 1). This pilot study demonstrated a strong positive correlation between waist-hip ratio and STOP-BANG questionnaire(r=0.0024), neck length and STOP-BANG questionnaire (r=0.038), BMI and modified berlin questionnaire (r=0.037), waist-hip ratio and modified berlin questionnaire (r=0.001), neck length and modified berlin questionnaire(r=0.002), neck circumference and modified berlin questionnaire (r=0.008), sagittal abdominal diameter and modified berlin questionnaire(r=0.038). There was a weak positive correlation between anthropometric measurements like BMI (r=0.13), neck circumference (r=0.13) and sagittal abdominal diameter(r=0.131) with STOP-BANG questio-nnaire (Table 2&3).

Table 1: Demographic data.

Gender		Total
Male	34	50
female	16	
Age		
Mean ± SD	47.2 ± 14.6	

Table 2: Association between anthropometric measurement and STOP-BANG questionnaire.

Variables	BMI	STOP-BANG	Waist Hip Ratio	STOP-BANG	Neck Length	STOP-BANG	Neck Circu mference	STOP-BANG	Saggital Abdominal Diameter	STOP-BANG
Mean±SD	24.91± 3.93	3.08± 1.60	0.88± 0.07	3.08± 1.60	11± 1.16	3.08± 1.60	37.66± 3.99	3.08± 1.60	28± 4	3.08± 1.60
Correlation (r value)	0.13		0.0024		0.038		0.131		0.13	

Table 3: Association between anthropometric measurement and Modified Berlin questionnaire.

Variables	BMI	Modified Berlin Questionnaire	Waist Hip Ratio	Modified Berlin Questionnaire	Neck length	Modified Berlin Questionnaire	Neck circumference	Modified Berlin Questionnaire	Saggital abdominal diameter	Modified Berlin Questionnaire
Mean±SD	24.91± 3.93	0.3± 0.5	0.88± 0.07	0.3± 0.5	11± 1.16	0.3± 0.5	37.66± 3.99	0.3± 0.5	28± 4	0.3± 0.5
Correlation (r value)	0.037		0.001		0.002		0.008		0.038	

DISCUSSION

The present study was conducted to examine the correlation between new anthropometric measurements such as neck length (NL), sagittal abdominal diameter (SAD) and OSA using STOP-BANG and modified Berlin questionnaires as a predictive factor of OSA. Waist circumference was found to be important and one of the modest predictor of coronary risk factor [21]. Adult height is also an important anthropometric measure and can estimate for diabetes and hypertension in a population with low birth weight as short stature is related to low birth weight and undernutrition in early life that predisposes to diabetes and cardiovascular risk. So waist circumference and adult height is an important factor and together in a variable it is taken as waist-to-height ratio (WHtR) which is a better index for metabolic diseases [22,23]. However, in the present study, WHtR is being used as a predictor of OSA. The prevalence of diabetes and hypertension increased significantly with higher quintiles of BMI, WHR and WHtR [14]. Body mass index (BMI) has been widely accepted as a simple and the most practical measure of fatness in clinical and epidemiological surveys, even though it doesn't distinguish fat from lean body mass [24]. A study has shown a correlation between BMI and OSA, as OSA is associated with both Growth hormone excess (GH) and severe GH deficiency but obese adults have markedly suppressed GH secretion. However, the present study has shown to have a strong positive correlation of BMI and OSA when compared modified berlin questionnaire.

Obesity is recognized as an independent factor for the development of the cardiovascular diseases. Obesity implies increased body weight due to the enlargement of the adipose tissue to the extent that impairs health [15]. Abdominal (central) obesity is associated with dyslipidaemia, impaired fasting glucose, insulin resistance and hypertension, which result in increased risk of cardio- and cerebrovascular diseases [25]. Among all the other anthropometric measurements, sagittal abdominal diameter is an important factor in prediction of glucose intolerance and insulin resistance and also correlates with atherogenic lipid profile and inflammatory and prothrombotic markers. In a study it has shown to have a strong correlation between the central (abdominal) type of obesity and the cardiovascular and metabolic diseases and therefore sagittal abdominal diameter is shown to be a valid measurement of the visceral fat mass and cardio metabolic risk level [15]. However, the present study demonstrated that sagittal abdominal diameter (SAD) have shown to have a strong correlation with the modified Berlin questionnaire.

Upper-body fat distribution is related to increased cardio-vascular disease risk and neck skinfold or neck circumference. Free-fatty acid release from upper-body subcutaneous fat was larger than that from lower-body subcutaneous fat. Neck circumference has been suggested to be more predictive of obstructive sleep apnoea (OSA) than general obesity. The study suggests that OSA severity is more significantly correlated with sagittal abdominal diameter (SAD) than neck circumference [25,26]. Similar study was been done and reported that OSA severity is more significantly correlated with fat accumulation of the intra-abdominal region than of the neck region.

Another study, where validation of modified Berlin questionnaire (á= 0.86-0.92) was done to identify patients at risk for obstructive sleep apnoea syndrome. The questionnaire was validated to use in the western population to determine the risk of OSA but with certain modifications it is used in Indian setting and is termed as modified Berlin questionnaire [20]. However, in the present study anthropometric measurements has shown to have a strong correlation with modified Berlin questionnaire. Having a symptom-based questionnaire with good predictive ability will avoid unnecessary sleep studies in the subjects who are not at high risk for having OSA.

CONCLUSION

The present pilot study suggests that sagittal abdominal diameter and neck length has shown a strong positive correlation with modified berlin questionnaire and may also be considered as a novel risk factor along with other gold standard anthropometric measurements like body mass index (BMI), waist-hip ratio (WHR) and neck circumference (NC) for diagnosis of OSA

ACKNOWLEDGEMENTS

The authors would like to thank the tertiary care hospital for giving permission to carry out the study.

Conflicts of interest: None

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How to cite this article:

Renu B. Pattanshetty, Ceona Chopde. SCREENING FOR OBSTRUCTIVE SLEEP APNOEA USING MODIFIED BERLIN QUESTIONNAIRE, STOP-BANG QUESTIONNAIRE AND ANTHRO-POMETRIC MEASUREMENTS IN PATIENTS VISITING VARIOUS OPDs IN A TERTIARY CARE SET- UP. Int J Physiother Res 2016;4(4):1583-1588. **DOI:** 10.16965/ijpr.2016.139