

Assessment of High Risk of Obstructive Sleep Apnea in second trimester pregnant women by using Berlin Questionnaire

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Abstract

Objective: This study aims to estimate the proportion of pregnant women in their second trimester who were at high risk of Obstructive sleep apnea which was assessed by Berlin Questionnaire.

Material and method: 1600 second trimester pregnant women in the Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur were screened with Berlin Questionnaire. All pregnant women attending the antenatal clinic having singleton pregnancies in their second trimester were included in the study.

Results: 190(11.87%) pregnant women were found to have high risk of obstructive sleep apnea. Among these 150 pregnant women were studied for their age, gestational age, socioeconomic status, detailed obstetric

and menstrual history. 41.33% were in the age group of 26-30 years, 52% were multigravida, 61.33% belonged to urban area, 71.33% belonged to lower socioeconomic status, 68% were Hindu. 12% had history of previous abortion, 54.66% had anemia, 46.66% had normal pre-pregnancy Body Mass Index.

Conclusion: Although, several risk factors has been recognized which cause preeclampsia and eclampsia, obstructive sleep apnea has been recently identified to be a novel risk factor. Identification of women having obstructive sleep apnea can help us in screening the women who are at risk of developing preeclampsia and eclampsia and thereby help us in providing them with better antenatal care.

Keywords: Obstructive sleep apnea, Berlin Questionnaire, pregnancy

(word count of the main text 2744)

Synopsis: Identification of women having obstructive sleep apnea can help us in screening the women who are at risk of developing preeclampsia and eclampsia.

Introduction

Obstructive sleep apnea is the most common form of sleep disordered breathing in general population as well as in pregnant women. This is characterized by repeated episodes of obstruction in the upper airway that results in brief periods of breathing cessation (apnea) or a decrease in tidal volume (hypopnea) [1]. It is due to periodic partial or complete collapse of the upper airways during sleep. These episodes, thus result into intermittent hypoxia which seem to trigger sympathetic activation and enhance inflammatory and oxidative responses that can lead to endothelial damage and metabolic derangements [2]. Furthermore, obstructive sleep apnea during pregnancy causes a significant increase in the chest load when they begin inhalation. This can decrease the cardiac output by 33% on an average and further cause a reduction in the placental blood supply [3]. The muscle tone decreases throughout body during normal sleep and relaxation of the upper airway dilator muscles results in relative narrowing of air passage. The normal persons will not develop any significant symptoms due to this physiological phenomenon. In patients with sleep disorder the upper airway narrowing result in marked air flow turbulence with repetitive partial or complete obstruction of the pharynx during sleep. Similarly, pregnancy is also associated with changes that promote obstructive sleep apnea such as increased body weight and upper airway edema. Frequent snoring, a cardinal symptom of obstructive sleep apnea, is endorsed by 15-25% of pregnant women. Health outcomes linked to obstructive sleep apnea in the non-pregnant population

such as hypertension and insulin-resistant diabetes have correlates in pregnancy also (preeclampsia, gestational diabetes). Sleep deprivation as in obstructive sleep apnea has been linked to a decrease in uteroplacental perfusion. The repeated episodes of placental hypoxia and reperfusion results in exaggerated endothelial cell activation with an enhanced inflammatory and oxidative stress response causing higher concentration of inflammatory cytokines and chemokines, such as tumor necrosis factor-alpha, interleukin-8 and interleukin-6, endothelial damage, and metabolic derangements which contributes to systemic maternal disease in form of preeclampsia [2,4,5].

Symptoms of Obstructive Sleep Apnea include snoring, excessive daytime somnolence and impaired function. Excessive daytime somnolence is the main symptom of Obstructive Sleep Apnea. Snoring is another major symptom of Obstructive sleep apnea. The patient's partner or family members often report snoring, gasping for air while asleep, or witnessed apnea. However, at times the patients may awaken themselves with any of these symptoms. The mechanism of arousal could vary from the noise to vibration or respiratory drive as a result of hypercapnia that is caused by prolonged apnea [6].

Various methods are available which help us in identifying cases of obstructive sleep apnea: Polysomnography, Home Sleep Apnea, Berlin Questionnaire, Epworth Questionnaire and STOP Bang Questionnaire. Among these, Polysomnography is a conclusive and gold standard test but because of its limited availability, time consuming and expensive procedure it is not widely used. Thus, there is a growing interest in developing screening tools for obstructive sleep apnea. Home Sleep Apnea test is an at-home version of polysomnography. Among the questionnaires,

studies have shown increased sensitivity of Berlin Questionnaire as compared to other questionnaires [7]. It has been found that even with Berlin Questionnaire the findings were similar to those using standard tests (polysomnography) or portable home monitoring systems [1].

Berlin Questionnaire is a simple and useful tool for screening Obstructive Sleep Apnea risk in the general population including pregnant women. The Berlin Questionnaire was developed in 1996, consisting of three categories designed to elicit information regarding snoring (category 1), daytime somnolence (category 2) and the presence of obesity and/or hypertension (category 3).

- In category 1, high risk for Obstructive sleep apnea is defined as persistent symptoms (more than three to four times per week) in two or more questions about their snoring.
- In category 2, high risk for Obstructive sleep apnea is defined as persistent (more than three to four times per week) wake time sleepiness, drowsy driving or both.
- In category 3, high risk for obstructive sleep apnea is defined as the history of high blood pressure and/or the Body Mass Index of greater than 30 kg/m². Because we excluded all the participants with known chronic hypertension at the time of screening, a positive response in the category 3 was based on the presence of the body mass index criteria.

Consideration for high risk for Obstructive sleep apnea (high risk group) required the presence of at least two symptoms categories, otherwise it would be considered as low risk for obstructive sleep apnea (low risk group)[1].

Berlin Questionnaire is a useful and practical method of screening for Obstructive sleep apnea and can easily be

incorporated into routine antenatal care. Studies have demonstrated that Berlin Questionnaire has different predictive values, depending on the trimester of pregnancy when it is administered. The Berlin Questionnaire appears to be most advantageous during the second trimester of pregnancy. During the first trimester, the amount of sleep increases, coinciding with the subjective worsening of the sleep quality. General sleep disturbances and fatigue are more common with advancing gestation, particularly during third trimester, whereas during second trimester, normal characteristics of sleep, such as sleep duration or sleep quality prevail [1].

Material and Method

A prospective hospital based observational study was conducted in the Department of Obstetrics and Gynaecology, SMS Medical College and Associated group of hospitals, Jaipur between April 2019 and September 2020. Pregnant women attending antenatal clinic at the Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur were included in the study after taking written and informed consent and applying Berlin Questionnaire. The patients were then divided into two groups. The high-risk obstructive sleep apnea group included subjects having at least two symptom categories positive in Berlin Questionnaire and the low-risk obstructive sleep apnea group which included subjects with one or less than one symptom category positive in Berlin Questionnaire.

1600 second trimester pregnant women at SMS Medical College, Jaipur were screened with Berlin Questionnaire. Among the high-risk obstructive sleep apnea cases 150 of them were assessed for their demographic characteristics. Eligible participants were pregnant women who were in their second trimester having singleton pregnancies and

women giving written and informed consent. Pregnant women who had chronic renal disease, chronic hypertension, past history of disorder of pregnancy and Body Mass Index > 40kg/m² were excluded. The data was recorded in a pre-structured proforma. Statistical analysis was done from the data. Continuous data were summarized in the form of mean and standard deviation (SD). Difference in means of the two groups were analysed using unpaired student's t test. Counted data were expressed in form of proportions and chi square test was used for their analysis. The level of confidence was kept 95% for all the statistical analysis. P value <0.05% was taken as statistically significant. MedCalc statistical software version 16.4 was used for all statistical calculations.

Results

In this study, among 1600 pregnant women, 190 (11.87%) women met the criteria for high-risk obstructive sleep apnea and were classified as high-risk group while the others i.e., 1410 (88.13%) were classified as low risk group. Hence, the proportion of pregnant women with high risk of obstructive sleep apnea among 1600 pregnant women was 11.87% (Table 1)

Table 1: Proportion of pregnant women with high and low risk of obstructive sleep apnea

High risk Obstructive sleep apnea		Low risk Obstructive sleep apnea		Total
No.	%	No.	%	
190	11.87	1410	88.13	1600

150 pregnant women among 190 of those who had high risk of obstructive sleep apnea were assessed for demographic characteristics (Table 2). In this study, the most common age group for women in high-risk obstructive sleep apnea was 26-30 years i.e., 41.33%. A significant association (p-value < 0.05) was found

between obstructive sleep apnea and 26-30 years age group. 52% were multigravida and 48% were primigravida, but the findings were not statistically significant (p-value=0.245). A large number of pregnant women having high risk of obstructive sleep apnea i.e., 61.33% belonged to urban area and 38.66% belonged to rural area. However, the findings were not statistically significant (p-value=0.182). Majority of high risk for obstructive sleep apnea cases belonged to lower socioeconomic status i.e., 71.33% and 19.33% belonged to middle socioeconomic status. Only 9.33% belonged to upper socioeconomic status. The results were not statistically significant (p-value = 0.232). A large number of pregnant women were Hindu i.e., 68% and 32% were Muslim (p-value=0.186). 88% had no history of abortion while 14.66% had history of at least one abortion or even more (p-value=0.610). 45.33% of pregnant women were not anemic, 33.33% had mild anemia, 21.33% had moderate anemia and none of the women had severe anemia (p-value=0.086). High risk of obstructive sleep apnea was seen in 46.66% with normal pre-pregnancy body mass index, 32% in those who were overweight, 14.66% were obese and around 6.66% in underweight women. A statistically significant association was found between obstructive sleep apnea and pre-pregnancy body mass index(p-value<0.05).

Table 2: Demographic characteristics of pregnant women with high risk of obstructive sleep apnea

Demographic Characteristics	No.	%	
Age (in years)			Chi-square value=14.38 p-value=0.006(significant) degree of freedom=4
≤20	6	4	
21-25	59	39.33	
26-30	62	41.33	
31-35	16	10.67	
>35	7	4.67	

Gravida			Chi-square value=1.351
Primigravida	72	48	p-value=0.245
Multigravida	78	52	degree of freedom=1
Residence			Chi-square value=1.781
Rural	58	38.66	p-value=0.182
Urban	92	61.33	degree of freedom=1
Socioeconomic status	107	71.33	Chi-square value=2.94
Lower	29	19.33	p-value=0.232
Middle	14	9.33	degree of freedom=1
Upper			
Religion			Chi-square value=1.751
Hindu	102	68	p-value=0.186
Muslim	48	32	degree of freedom=1
No. of previous abortions	132	88	Chi-square value=0.260
0	18	12	p-value=0.610
≥1			degree of freedom=1
Anemia			Chi-square value=4.89
Non-anemic	68	45.33	p-value=0.086
Mild anemia	50	33.33	degree of freedom=2
Moderate anemia	32	21.33	
Severe anemia	Nil	Nil	
Pre-pregnancy Body Mass Index(kg/m ²)	10	6.66	Chi-square value=58.221
Underweight (<18.5)	70	46.66	p-value<0.00001(significant)
Normal (18.5-24.9)	48	32	degree of freedom=1
Overweight (25-29.9)	22	14.66	
Obesity (>30)			

Discussion

A random selection of the pregnant women in their second trimester showed that 11.87% among 1600 pregnant women had high risk for obstructive sleep apnea. Similarly, in a study by Ellen M. Lockhart et al.

(2015) [8], it was found that 88% of the patients were obstructive sleep apnea negative and 12% were obstructive sleep apnea positive. According to the study of Antony et al. (2014) [9] among predominantly Hispanic pregnant women, it was found that 15.5% of subjects at any gestational age were screened as high risk for obstructive sleep apnea on Berlin Questionnaire.

In the present study, significant association of obstructive sleep apnea was found in the pregnant women belonging to 26-30 years of age in comparison to those pregnant women who were younger than 25 years and who were older than 30 years of age as 41.33% of pregnant women with high risk of obstructive sleep apnea were between 26-30 years of age. There is an increased chance of obstructive sleep apnea if pregnant women belonged to this age group. Similarly, Judette Louis et al. (2012) [10] in their study found out that obstructive sleep apnea group had older patients. In the general population, older age is a well identified risk factor for obstructive sleep apnea. Similar might also hold true for pregnant women. Ghada Bourjeily et al. (2017) [11] in their study found a significant association between older age group pregnant women and the risk for obstructive sleep apnea. The mean age of the 4746 sampled women in a study conducted by Yi-Hua Chen et al. (2012) [12] was 30.3 ± 4.4 years. The average age of cohort in a study by Ellen M. Lockhart et al. (2015) [8] was 28 years.

In the present study, majority of pregnant women in high-risk obstructive sleep apnea group were multiparous (52%) but the findings were not significant. As it may seem from the present study, parity doesn't influence the occurrence of obstructive sleep apnea in pregnant women. Ellen M. Lockhart et al. (2015) [8] found in their study that 76% of women were multiparous. However, in a study conducted by Visa Siri Tantra Kul et al. (2015)

[13], 51% of pregnant women were nulliparous or primigravida. Yi-Hua Chen et al. (2012) [12], found that those who were primipara reportedly had high risk of obstructive sleep apnea.

In a study by Judette M. Louis et al. (2014) [14] it was found that women in whom obstructive sleep apnea had been diagnosed were more likely in the lowest quartile of household income. In this study also, majority of pregnant women with high risk of obstructive sleep apnea belonged to lower socioeconomic status i.e., 71.33%.

In the present study, we found that no significant association was found between anemia and obstructive sleep apnea. Supporting these results is a study conducted by Yi-Hua Chen et al. (2012) [12]. In contrast to these results, Ghada Bourjeily et al. (2017) [11] in their study found that anemia was significantly more common in women with obstructive sleep apnea.

78.66% of pregnant women who had high risk of obstructive sleep apnea either had normal weight or were significantly overweight. The results were statistically significant suggesting that increased body mass index is associated with increased risk of obstructive sleep apnea. Many studies have been conducted over the past years which supports this outcome. Judette Loius et al. (2012) [10] found that women who had obstructive sleep apnea also had higher body mass index. Manju Aggarwal et al. (2008) [15] in their study concluded that the incidence of snoring increased significantly from 16.7% to 100% in pregnant women as body mass index increased from less than 25 to greater than 40. Ellen M. Lockhart et al. (2015) [8] also found that obstructive sleep apnea-positive patients had greater body mass index both before pregnancy and as measured at the time of sleep study.

Conclusion

Obstructive sleep apnea has been recognized as a novel risk factor in causing preeclampsia and eclampsia. Identification of women at risk of developing obstructive sleep apnea by Berlin Questionnaire can be used as a screening tool in identifying these women and providing them with better antenatal care.

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