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Obstructive sleep apnea syndrome is associated with maternal complications in pregnant women

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ABSTRACT

Objectives: This study was performed to evaluate the relationship between obstructive sleep apnea syndrome and pregnancy complications.

Material and methods: A total of 500 women (18–45 years) who had delivered (vaginal delivery or caesarean section) between January 2017 and March 2017 in our clinic were included in the study. Patients at high risk for obstructive sleep apnea syndrome were identified using the Stop Bang questionnaire. Based on the results of the questionnaire, pregnancy complications were compared between high-risk pregnant women (Group 1) and low-risk pregnant women (Group 2).

Results: Age, body mass index, smoking rate, and the rate of systemic disease (*e.g.*, diabetes and/or hypertension) were higher in Group 1 than in Group 2 ($p < 0.05$). Rates of preeclampsia, gestational diabetes, preterm labor, premature rupture of the membranes, and cesarean section were significantly higher in Group 1 than in Group 2 ($p < 0.05$).

Conclusions: Obstructive sleep apnea syndrome is associated with a higher rate of maternal complications among pregnant women. Affected patients should be carefully monitored.

Key words: obstructive sleep apnea syndrome; pregnancy; complication

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INTRODUCTION

Sleep is a fundamental daily need, and a lack of sleep could negatively influence quality of life. The need for sleep changes occasionally because of various hormonal, environmental, and psychological changes. Through various physiological and hormonal mechanisms, pregnancy can create substantial changes in respiratory function during sleep. These changes cause large differences in sleep quality and pattern during pregnancy [1]. The frequency of respiratory disorders, from simple snoring to severe obstructive sleep apnea syndrome (OSAS), has been reported to increase in pregnant women [2]. Narrowing of the oropharynx, nasal congestion caused by increased blood flow and estrogen, and hyperventilation are known to increase susceptibility to OSAS during pregnancy [3, 4]. Other contributing factors include progressive weight gain and upward displacement of the diaphragm. OSAS is a respiratory disorder characterized by upper airway obstruction and hypoxemia during sleep; it is experienced by 2% of women in the general population [2]. The rates of premature birth, cesarean section, preeclampsia, low birth weight, and gestational diabetes are higher in pregnant women at high risk for OSAS than in pregnant women without OSAS [5–10]. The aim of this study was to investigate the relationships between pregnancies at high risk of OSAS and pregnancy complications, mode of delivery, and delivery week.

MATERIAL AND METHODS

Study design and population

This study included 500 patients (age range, 18–45 years) who agreed to participate in the study and had delivered (vaginal delivery or caesarean section) between January 2017 and March 2017 at Bursa Training and Research Hospital/University of Health Sciences. The study protocol was approved by the ethics committee of the university (2011-KAEK-25). Informed consent was obtained from all participants. Patients were included if they gave birth in our hospital to a live baby and were not of foreign nationality. Patients were excluded if they were adolescents and/or had delivered at another hospital.

Age, number of pregnancies, body mass index (BMI), chronic disease status, drug use status, smoking status,

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Table 1. Comparisons of demographic characteristics between patients with and without obstructive sleep apnea syndrome (OSAS)

Demographic characteristics	Group 1 (OSAS +) (n = 73)	Group 2 (OSAS -) (n = 427)	p value
Age*	29.7 ± 5.3	27.7 ± 5.7	0.004
Nulliparity**	12 (16.4)	104 (24.4)	0.139
Smoking**	11 (15.1)	32 (7.5)	0.033
BMI*	34.4 ± 5.2	28.1 ± 3.5	< 0.001
Pre-GDM**	8 (11)	7 (7.6)	< 0.001
Chronic HT**	5 (6.8)	3 (0.7)	< 0.001
Hypothyroidism**	4 (5.5)	25 (5.9)	0.899

BMI — body mass index; Pre-GDM — pregestational diabetes mellitus; HT — hypertension; data are shown as mean ± standard deviation* and n (%)**

obstetric history, routine pregnancy test results, delivery mode, gestational week, baby weight, and baby sex were recorded for all 500 patients. The pregnancy complications (*e.g.*, hypertensive diseases of pregnancy, preeclampsia, preterm birth, gestational diabetes, fetal growth restriction, oligohydramnios, and polyhydramnios) and neonatal information (*e.g.*, neonatal weight, sex, low birth weight, and large infant size) were recorded for all participants.

Study procedures

The Turkish version of the Stop Bang questionnaire — the most used questionnaire in obstetrics — was used to evaluate sleep apnea and sleepiness [11]. The Stop Bang questionnaire consists of eight questions and has been used for community screening of OSAS. Patients with two or more positive answers to the first four questions, or three or more positive answers to all eight questions, were considered to be at high risk for OSAS. Based on the questionnaire results, the pregnant women were divided into two groups: high-risk pregnancy (Group 1) and low-risk pregnancy (Group 2). The two groups were compared in terms of demographic characteristics, medical findings, pregnancy complications, and newborn information. The Stop Bang questionnaire was administered to hospitalized patients at 24 hours after birth. The questionnaires were completed in face-to-face interviews. The answers were marked on the questionnaire form. The completed questionnaire forms were collected for statistical analysis.

Statistical analysis

PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The chi-squared test and *t*-test were used for statistical comparisons. Categorical variables are presented as numbers and percentages, while continuous variables are presented as means ± standard deviations. Differences with $p < 0.05$ were considered statistically significant.

RESULTS

The questionnaire was administered to all patients in this study. Seventy-three (14.6%) patients were in Group 1 and 427 patients (85.4%) were in Group 2. The mean age of all patients was 28.0 ± 5.7 years. Mean BMI was 29.0 ± 4.4 kg/m^2 and the nulliparity rate was 23.2% (116 patients). Age, BMI, and the rates of smoking, chronic hypertension, and pregestational diabetes were higher in Group 1 than in Group 2 ($p < 0.05$) (Tab. 1).

The rates of preeclampsia, gestational diabetes, preterm birth, premature preterm birth, premature rupture of the membranes, and macrosomia were higher in Group 1 than in Group 2, whereas fetal growth restriction, oligohydramnios, and intrauterine exitus rates were similar between the groups (Tab. 1). The cesarean section rate was significantly higher in Group 1 than in Group 2 (75.3% vs 43.3%; $p < 0.001$).

DISCUSSION

In our study, 500 women who had given birth were evaluated and 73 women (14.6% of the participants) were at high risk for OSAS. The frequency of OSAS is reportedly 2–26% in the general population worldwide, although it varies among communities [12, 13]. The prevalence of OSAS during pregnancy differs with respect to patient ethnicities and diagnostic tests used, but is reportedly 20–35%, particularly in patients with high-risk pregnancies [14, 15]. In our study, the prevalence of OSAS was less frequent than has been described in the literature. This discrepancy is potentially related to differences in populations and ethnicities; notably, our study included high-risk pregnant women and pregnant women from the entire population. The prevalence of OSAS in pregnant women (low-risk pregnant women) in Turkey is 11.4–12.5% [16, 17].

In our study, BMI was higher in pregnant women with OSAS than in pregnant women without OSAS. Thus, high BMI was closely related to OSAS in pregnant women. It has been reported that excess weight and obesity before and during pregnancy are strongly associated with the development

Table 2. Comparisons of pregnancy-related complications between patients with and without obstructive sleep apnea syndrome (OSAS)

Pregnancy Complications	Group 1 (OSAS +) (n = 73)	Group 2 (OSAS -) (n = 427)	p value
Preeclampsia	13 (17.8)	12 (2.8)	< 0.001
GDM	9 (12.3)	14 (3.3)	< 0.001
Preterm Birth (< 37 weeks)	21 (28.8)	45 (10.5)	< 0.001
Preterm Birth (< 34 weeks)	12 (16.4)	22 (5.2)	< 0.001
Macrosomia	7 (9.6)	6 (1.4)	< 0.001
PROM	6 (8.2)	11 (2.6)	0.014
FGR	6 (8.2)	25 (5.9)	0.439
Oligohydramnios	9 (12.3)	29 (6.8)	0.099
Intrauterine Fetal Death	1 (1.4)	4 (0.9)	0.731

GDM — gestational diabetes mellitus; FGR — fetal growth restriction; PROM — premature rupture of the membranes; data are shown as n (%)

of OSAS during pregnancy. [17, 18]. In addition, while OSAS was 3.69-fold higher in overweight pregnant women (BMI: 25–29.9 kg/m^2) than in normal-weight pregnant women, it was 13.23-fold higher in obese (BMI ≥ 30.0 kg/m^2) pregnant women [18]. In our study, mean BMIs were 34.4 ± 5.2 kg/m^2 in pregnant women with OSAS and 28.1 ± 3.5 kg/m^2 in pregnant women without OSAS.

In our study, the smoking rates were 15.1% in pregnant women with OSAS and 7.5% in pregnant women without OSAS. In a study that evaluated the relationship between OSAS and smoking during pregnancy, smoking caused a 3.39-fold increase in sleep-related problems [19]. OSAS was twice as frequent in pregnant women who smoked.

Untreated OSAS contributes to many systemic diseases, such as systemic hypertension, myocardial infarction, and neuropsychiatric sequelae [20–22]. In our study, the prevalence rates of pregestational diabetes and chronic hypertension were higher in pregnant women with OSAS than in those without OSAS. Hypertension and diabetes are reportedly strongly associated with OSAS in the general population [23–26]. The relationships between OSAS and both hypertension and diabetes may be related the associations of these diseases with obesity, which is associated with OSAS. In particular, hypertension is an independent risk factor in patients with OSAS [23]. Relationships between OSAS and both gestational diabetes and hypertensive diseases of pregnancy have been reported; however, there are insufficient data in the literature regarding the relationship between pregestational diabetes and chronic hypertension.

A relationship has been reported between preeclampsia and OSAS [27]. However, some studies have shown that preeclampsia is not associated with OSAS [8]. In a meta-analysis, Chen et al. [7] found that the relative risk of preeclampsia for OSAS was 1.60 (95% CI, 2.16–11.26). In our study, the rate of preeclampsia was significantly higher in pregnant women with OSAS than in those without OSAS. Furthermore, the frequency of chronic hypertension was approximately two-fold higher in pregnant women with OSAS than in those without OSAS [27]. In our study, the rate of chronic hypertension was higher in pregnant women with OSAS than in those without OSAS.

Gestational diabetes is also strongly associated with OSAS during pregnancy. Gestational diabetes is 6.6-fold more common in pregnant women with OSAS than in those without OSAS [10]. Şahin et al. [17] reported that the risk of OSAS increases by 7.7-fold in pregnant women with gestational diabetes. However, some other studies have shown conflicting results [8, 28]. In our study, the prevalence of gestational diabetes was significantly higher in pregnant women with OSAS than in those without OSAS. Further studies and meta-analyses are needed to clarify this discrepancy.

In our study, both early (< 34 weeks) and late (< 37 weeks) preterm delivery prevalence rates were higher in pregnant women with OSAS than in those without OSAS. The prevalence of preterm birth is generally higher in women with OSAS than in those without OSAS [5, 9, 27]. The most important factor associated with the high preterm birth rate in pregnant women with OSAS is the high prevalence of perinatal complications; moreover, there is a strong relationship between OSAS and iatrogenic preterm birth rates (*e.g.*, preeclampsia and fetal growth restriction) [27]. Our results showed that the preterm birth rate was higher in pregnant women with OSAS; in contrast, spontaneous and indicated preterm delivery rates did not differ from those of pregnant women without OSAS. However, both preeclampsia and early membrane rupture rates were higher in pregnant women with OSAS than in those without. Thus, preterm deliveries were encountered due to spontaneous premature rupture of the membranes, in addition to indicated preterm births.

The limitations of this study were as follows. First, the study assessed OSAS by questionnaire, rather than polysomnography. Second, the study did not involve follow-up re-

garding the neonatal findings and did not include pre-pregnancy weight and BMI data. However, this study had multiple strengths, including the large number of patients and prospective study design. To the best of our knowledge, this is the first study involving screening of the general pregnant population in Turkey for characteristics of OSAS.

CONCLUSIONS

The results showed that complications such as preeclampsia, gestational diabetes, preterm labor, and rupture of the membranes were more common in pregnant women with OSAS than in healthy pregnant women. Appropriate evaluations should be administered to pregnant women with symptoms of OSAS during the antenatal follow-up; pregnant women with OSAS should be closely monitored for possible pregnancy-related complications.

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Disclosure

Authors have no interest to disclose.

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