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Original Article

Application of First Trimester Screening in the Prognostication of Small for Gestational Age

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ABSTRACT

Background: Fetal growth restriction is defined as the failure of the fetus to achieve its full growth potential. The present study aimed to investigate the application of first trimester screening in the prediction of small for gestational age (SGA).

Methods: This cohort study was conducted on the consecutive and unselected women with singleton pregnancies undergoing routine first-trimester examinations in a health center affiliated to Neyshabur University of Medical Sciences in Razavi Khorasan Iran during February 2014-March 2016. Subjects received a first-trimester visit by a physician, which included the entry of basic maternal characteristics, medical history, measurement of maternal weight and height, ultrasound examination for fetal anatomy, and measurement of crown-rump length to assess gestational age.

Results: SGA was significantly correlated with maternal age, parity, and body mass index. Furthermore, a significant association was observed between SGA and smoking habits in the mothers.

Conclusion: According to the results, first trimester screening was a useful method for the prediction of SGA.

Keywords: First pregnancy trimester, Gestational age, Infant, Neonatal, Small for gestational age

Introduction

Fetal growth restriction (FGR) is defined as the failure of the fetus to achieve its full growth potential, which is usually secondary to placental incapability (1). Approximately 40% of non-anomalous, singleton, preterm newborns are small for gestational age (SGA) (2, 3). The SGA neonates that are born alive are at an increased risk of long-term adverse outcomes (4-6). Placental insufficiency is considered to be a major cause to the pathophysiology of the pregnancies leading to SGA (7).

SGA neonates are susceptible to a wide range of complications (7) and mortality (8, 9). SGA could cause basic pathologies, such as the pregnancy complications or maternal morbidities associated with placental dysfunction (10). On the other hand, maternal obesity may be a predisposing factor to various prenatal morbidities, including gestational hypertension, gestational diabetes, cesarean delivery, and preeclampsia (11-13). Consequently, the neonates of obese mothers are at an increased risk of macrosomia, SGA, preterm birth, and cardiovascular diseases in the long run (14-16).

SGA could result from high rates of neonatal morbidity and mortality and other compli-cations, such as type II diabetes mellitus, cardiovascular diseases, and psychological disorders (17-19). Meanwhile, SGA newborns are at an increased risk of perinatal death, neonatal complications, and abnormal neurodevelopment, as well as metabolic syndrome, coronary heart disease, and hypertension during adulthood (18-22).

SGA is diagnosed in the neonates that are born with a smaller size compared to those that are normal for gestational age. This anomaly could primarily caused by placental insufficiency. It is hypothesized that identifying the standard definition of FGR based on prenatal criteria

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might improve the efficiency of first-trimester prognostication of SGA.

With this background in mind, the present study aimed to evaluate the effectiveness of a combined first-trimester screening model, which has been developed by incorporating maternal characteristics and biophysical parameters, in the prediction of placental-related disorders (15, 16).

In Iran, low birth weight is considered to be the major cause of neonatal mortality, as well as several other complications (1). As such, improvement of the neonatal mortality index requires the identification of the influential factors in low birth weight. Another objective of the current research was to investigate the use of first trimester screening for the prediction of SGA (defined postnatally) and compare its efficiency in the prediction of FGR (defined prenatally).

Methods

This cohort study was conducted on 1,050 consecutive and unselected women with singleton pregnancies undergoing routine first-trimester examinations in a health center affiliated to Neyshabur University of Medical Sciences in Razavi Khorasan, Iran during February 2014-March 2016. Subjects received a first-trimester visit by a physician, which included the entry of basic maternal characteristics, medical history, measurement of maternal weight and height, ultrasound examination for fetal anatomy, and measurement of crown-rump length to assess gestational age.

Exclusion criteria of the study were as follows: 1) missing outcome data; 2) presence of major fetal defects or chromosomopathy; 3) miscarriage; 4) fetal mortality before 24 weeks of gestation; 5) termination of pregnancy without medical indications and 6) maternal diabetes. In total, 30 subjects (8.1%) were excluded, and the study was performed on 1,020 participants. SGA was detected in the newborns with the birth/fetal weight of $<10^{th}$ percentile or a birth weight of <2,500 grams (18, 20).

Demographic characteristics of the subjects were recorded in a checklist, including maternal age, parity, weight, height, smoking during pregnancy (a minimum of seven cigarettes per week and average daily of at least one thread), contraceptive method, medical history (e.g., chronic hypertension, diabetes mellitus, renal diseases, autoimmune diseases, congenital or acquired thrombophilic conditions), and obstetric history of the previous pregnancies.

Negative obstetric history was considered as a previous pregnancy with SGA and/or stillbirth. Data on the pregnancy and neonatal outcomes were collected from the hospital records. Blood pressure of the mothers was measured in a seated position after a five-minute rest. In addition, the uterine artery Doppler examination was performed during the first trimester (25). The subjects were followed-up to determine the neonatal weight and examine the association of low birth weight and the aforementioned factors at birth.

Data analysis was performed in SPSS version 19 using the analysis of variance, Bonferroni post-hoc test, Pearson's correlation-coefficient, Chi-square, and multiple regression analysis.

Results

Mean maternal age was 26.3±6.8 years (age range: 18-40 years), and the majority of the subjects had high school diploma. Among 1,050 women, 30 cases were excluded from the study due to maternal diabetes. In terms of parity, 30%, 33%, 15%, and 12% of the subjects had one, two, three, and more than three pregnancies, respectively.

Mean body mass index (BMI) was 28.3±0.75 kg/m^2. With regard to the occupation status, 70%, 20%, and 5% of the women were housewife, employed, and self-employed, respectively. A positive correlation was observed between maternal age and neonatal birth weight (P=0.043). In addition, maternal BMI and SGA were significantly correlated (P=0.031), and the mothers with the BMI of <19.8 kg/m^2 had SGA neonates.

Our findings indicated a significant difference between the mothers with SGA neonates and those with normal neonates in terms of parity (P=0.036) (Table 1). Nonetheless, no significant difference was observed between these groups in terms of the income status and systolic and diastolic blood pressure (P>0.05) (Table 1). Furthermore, there was a positive association between maternal smoking habits and SGA, and the rate of SGA was higher in the mothers using cigarettes compared to non-smoking subjects (P=0.001). However, no significant difference was noted between the two groups in terms of the contraceptive method (P>0.05).

The results of multiple regression analysis revealed that maternal age, BMI, smoking habits, and parity could predict SGA (Table 2). Accordingly, factors such as maternal age, BMI,

Table 1. Comparison of Study Groups in Terms of Investigated Variables

Variables	Normal (n=800)	Small for Gestational Age (n=220)	P-value
	Mean±SD	Mean±SD	
Parity	2.41±0.6	1.61±0.4	0.036
Maternal Age	34.23±6.4 30	26.33±3.32	0.043
Neonatal Weight	92.31±2826.53	2396.35±112.79	0.028
Income Status	32±304.736	53±360.000	0.629
Body Mass Index	0.75±28.27	1.09±26.5	0.031
Maternal Weight	2.48±68.14	69.524±2.02	0.015
Systolic Blood Pressure	12.99±0.50	13.74±0.38	0.590
Diastolic Blood Pressure	8.21±0.27	8.78±0.30	0.916

Table 2. Results of Multiple Regression Analysis for Prediction of Small for Gestational Age

	(Beta)	T	P<		f	df	P<
Parity	0.34	5.3	0.001				
Maternal age	-0.23	4.3	0.001				
Maternal weight	0.43	9.7	0.001	0.20	8.6	256.5	0.05
Cigarette consumption	0.07	0.87	0.70				

and parity could predict 20% of the SGA variance.

Discussion

According to the results of the present study, SGA had a significant correlation with maternal age, parity, and BMI. Additionally, maternal smoking habits were significantly correlated with SGA. The results also demonstrated that maternal age, parity, and BMI could predict 20% of the SGA variance.

In a study in this regard, Hafner claimed that the sonograpbic measurement of the placental volume alone is not an effective technique for predicting SGA infants, and a comprehensive review might be required as well (23). On the other hand, the findings of Yousefi indicated that maternal demographic characteristics, gestation-rank prenatal healthcare, pregnancy weight gain, chronic diseases, gestational infections, and drug consumption are not correlated with neonatal weight, which is inconsistent with the results of the present study (24).

In a study by Ndiaye et al., no significant difference was reported between the SGA group and eutrophic new-born groupin terms of the mean age (P=0.44), gravidity (P=0.7), and parity (P=0.48). However, in the mentioned study, the mothers of the SGA neonates had lower weight compared to those with normal newborns. Meanwhile, mean maternal BMI was found to be within the normal range in both groups. In the mentioned study, neonatal weight was significantly correlated with maternal age and education level. However, the researchers denoted no significant correlation between neonatal weight and maternal occupation/income status (25). These findings are in congruence with the current research; it is also notable that in the present study, no significant correlation was observed between maternal education level and SGA.

In another study by Aldous and Calfio, the findings indicated that the risk of SGA may increase due to higher parity (P=0.04) (26), which is inconsistent with our findings. However, in line with the results of the current research, maternal age was found to affect birth weight in the mentioned study. Therefore, it could be concluded that increased maternal age in the first childbirth is an independent risk factor for low birth weight and preterm birth of white infants in the United States. In the present study, race was not assessed due to the investigated region.

According to the results of the present study, maternal weight gain during pregnancy was correlated with neonatal weight, which is consistent with the findings of Marica et al. (27). In line with the results obtained by Klufio et al. (28), maternal age and smoking habits had significant associations with neonatal weight. In the present study, no significant difference was observed between the two groups in terms of the systolic and diastolic blood pressure, while Marica reported an indirect correlation between neonatal weight and maternal blood pressure (27). This discrepancy could be due to the fact that none of the mothers in our research had hypertension.

Conclusion

According to the results first pregnancy trimester screening was a useful method for the

prediction of SGA.

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Conflicts of interests

There is no conflict of interest.

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