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Association between Prenatal Maternal Tobacco Use and Intrauterine Growth Restriction: A Case-Control Study

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Abstract **Original Research Article**

Introduction: Intrauterine growth restriction (IUGR) refers to the poor growth of a baby while in the mother's womb during pregnancy. More than 9% of women smoke tobacco and one-third of women consume smokeless tobacco in developing countries. The intent of the study was to examine the effect on fetal intrauterine growth retardation using maternal tobacco. ***Methods:*** This convenient case-control study was conducted with 75 cases and 150 suitably matched controls enrolled in the Department of Pediatrics at Sylhet MAG Osmani Medical College Hospital for about 12 months. Ethical considerations were undertaken before the enrollment of patients. Data were analyzed using SPSS software. ***Result:*** ST user mothers of IUGR infants used jarda or gul as smokeless tobacco about 5 times a day and smoker mothers smoked about 5 sticks a day. Maternal tobacco use had a higher (6.9 times) risk of having IUGR babies compared to the non-tobacco user. ***Conclusion:*** This study observed that maternal total tobacco use showed a risk of having IUGR infants more than 6.9 times in contrast to non-tobacco user.

Keywords: IUGR, tobacco, smoker.

INTRODUCTION

Intrauterine growth restriction (IUGR) refers to the poor growth of a baby while in the mother's womb during pregnancy [1]. It results in newborns that have not attained their full growth potential and are already malnourished at birth [2]. Currently, about 12.6 million infants suffer from IUGR based on a recent estimation. Nowadays IUGR is increasing in South Asian regions. More than two-thirds of low birth weight newborn babies have IUGR in developing countries. According to UNICEF, the prevalence of low birth weight in babies in Bangladesh is 36% [3]. There are many factors that are behind fetal growth retardation, such as chronic fetal infection, chromosomal abnormalities, multiple gestations, renal diseases, hypertension, and drugs (tobacco, alcohol, and cannabis) [4]. Commercial tobacco is a leading contributor to health disparities among Indigenous peoples1 in many settler countries [5]. Tobacco is mainly a broad curved leave that is frequently used as a form of cigar or cigarettes, pipes, and hookah. The complex mixture of chemicals in tobacco smoke includes carbon monoxide, nicotine, hydrogen cyanide, nicotine, phenols, and tobacco- specific nitrosamines [6]. Tobacco is the only legal product that kills almost six million people worldwide every year. Maternal tobacco smoking is often associated with a higher risk of IUGR babies, ectopic pregnancy, premature ruptures of membranes, miscarriage, etc [7]. Bangladesh is one of the largest tobacco-consuming countries not only in South Asia but also in the world. It is estimated that more than 58% of males and 29% of females use tobacco in distinct forms [8]. Tobacco is an essential public health concern in Bangladesh, however, only a few studies have been undertaken in Bangladesh based on the antagonistic effects of tobacco on fetuses or newborn babies accordingly. This current study's aim was to determine the effect of fetal intrauterine growth retardation using maternal tobacco.

METHODS

This is a case-control study that was carried out in the Department of Pediatrics at Sylhet MAG Osmani Medical College Hospital for about 12 months. A total of 75 cases and 150 suitably matched controls were included in this study. Ethical considerations were undertaken before the enrollment of patients. Data were analyzed using SPSS software.

Inclusion Criteria

Term neonates weighing not more than 10th percentile for gestational age:

- Infant's age was less than or equal to 24 hours.
- BMI and hemoglobin level of mothers higher than 17 and 10gm/dl accordingly.
- Age between 20-35 years.

Exclusion Criteria

- Premature babies.
- Mothers having hypertension, chronic renal disease, toxemias, chromosome abnormalities, etc.
- Smokers among other family members excluding the mother.

RESULTS

Cases are comparable to controls having a number of variables (age, sex, gestational age) almost similar in both groups; except for tobacco use frequency. The frequency of maternal smokeless tobacco (ST) use was upright in the cases (4.8±1.7 times/day) than in the controls (2.1±0.9 times/day) and the frequency of maternal smoking was higher in the cases (4.7±2.1 times/day) than the controls (1.5±.4 times/day). About 74.6% of mothers of IUGR infants used ST, among them 49.3% were jarda users, 17.3% used sada and 8% gul, and about 14.6% of mothers of IUGR babies were smokers; 4% were cigarette smokers and 10.6% were bidi smoker. [Table-I] The frequency of smokeless tobacco was more than 3-6 times/day in 55.4% of cases, and on average, the frequency of smoking was 4.8±1.7 times/day. [Table II] Frequency of smoking among the majority (45.4%) of the mothers was between 3and 6 cigarettes per day. [Table-III] Effect of smokeless tobacco ingestion is considerably associated with the development of IUGR infants. (71.9% vs 28.5%) and maternal smokeless tobacco use had a higher possibility of having IUGR babies with an odds ratio of 6.4. [Table-IV] Simultaneous use of both smokeless tobacco and smoking is significantly associated with IUGR development in IUGR babies (35.7% vs1.9%) and continuous use of smokeless tobacco and smoking showed a risk of having IUGR infants 28.6 times that of non-tobacco user with odd ratio was 28.6. [Table-V] Maternal total tobacco use is significantly associated with the development of IUGR infants (76% vs 31.3%) and maternal total tobacco use showed a risk of having IUGR infants 6.9 times that of non-tobacco users and the odds ratio was 6.9. [Table-VI]

Table I: Baseline characteristics of the patients. (n=225)

		Cases	**Controls**
1. Total number		75	150
2. Age in hours (±SD)		5.97 (±5.7)	6.28 (±5.9)
3.sex	Male	31 (41.3%)	74 (49.3%)
	Female	44(58.7%)	76(50.7%)
	Male: Female Ratio	1:1.41	1:1.02
4. Gestational a e weeks ±SD)		39.6 (±1.2)	39.3 (±1.1)
5. Birth weight in gram (±SD)		2003 (±188.48)	2950.2 (±283.9)
6. Maternal a e in ears ±SD		25.5 ±3.35	25.68 ±3.67)
7. BMI of mother		19.04 (±1.61)	19.83 (±1.76)
8. Hb level of mother(gm/dl)		10.94 (±0.91)	11.04 ±0.97
9. Frequency of maternal ST use per day (±SD)		4.8 (±1.7)	2.1 (±0.9)
10.Total ST user		56(74.6%)	43(28.6%)
	Jarda user	37(49.3%)	32(21.3%)
	Sada user	13(17.3%)	08(5.3%)
	Gul user	06(8%)	03(2%)
11. Frequency of maternal smoking per day (±SD)		4.7(±2.1)	1.5(±0.4)
12. Total number of smoker		11(14.6%)	06(4%)
	Cigarette Smoker	03(4%)	02(1.3%)
	Bidi Smoker	08(10.6%)	04(2.7%)
13.	**Total tobacco user**	57(76%)	47(31.3%)
	ST user	46(80.7%)	41(87.2%)
	Smoker	01(1.8%)	04(31.3%)
	Both ST users and smoker	10(17.5%)	02(4.3%)
14.	**Nontobacco user**	18(24%)	103(68.7%)

Table II: Frequency of smokeless tobacco use by mother (n=56)

Frequency/day	No (^{0}/0)	Remarks
1-3	11(19.6%)	4.8((±1.7)
>3-6	31 (55.4%)	
>6-9	12(21.4%)	
>9-12	2(3.6%)	

Table III: Frequency of smoking by mother (n=11)

Frequency/day	No (^{0}/0)	Remarks
1-3	4 (36.4%)	4.7 (±2.1)
>3-6	5 (45.4%)	
>6-9	2 (18.2%)	

Table IV: Effect of smokeless tobacco use on the development of fetus growth

	Cases	Controls	Total
Smokeless tobacco user	46	41	87
Non-tobacco user	18	103	121
Total	**64**	**144**	**208**

X^2=34.22, df=1, p <0.001.

Table V: Combined effect of simultaneous smokeless tobacco use & smoking during intrapartum period in the development of fetus growth

	Cases	Controls	Total
Both smoker & ST user	10	2	12
Non-Tobacco user	18	103	121
Total	**28**	**105**	**133**

X^2=29.03, df=l, p <0.001 (after Yates correction).

Table VI: Effect of maternal total Tobacco use during the intrapartum period in the development of fetus growth

	Cases	Controls	Total
Tobacco user	57	47	104
Non-tobacco user	18	103	121
Total	**75**	**150**	**225**

X^2=28.30, df=1, p < 0.001

DISCUSSION

This present study intends to find out the role of maternal total tobacco use during the intrapartum period in the development of IUGR new-born which could have been avoided if tobacco use was restricted during pregnancy. Prenatal tobacco divulgence has a wide variety which affects largely mortality and morbidity in newborn children [9]. The main criteria of the cases and controls included in this analysis were age, sex & gestational age of the newborn; maternal age, BMI, and hemoglobin level of mothers; absence of maternal diseases like hypertension, chronic renal disease, toxemia, maternal radiation exposure during pregnancy; multiple gestations; chromosomal anomalies and congenital or perinatal infections; and nevertheless passive smoking. A survey conducted in 1997 figured that about 47% of Bangladeshi women used betel leaves or chewed tobacco leaves. And this consumption has been growing by over 80% by 2020 [10]. Indian, Bangladeshi, and rural Sri Lankan women were found to use smokeless tobacco. In this analysis, two-thirds of the ST users used Jarda, one-fourth used sada and fewer percentages of mothers used gul and no one used more than one type of ST. Previously a study showed almost similar modes of ST ingestion among mothers of IUGR babies. Several studies with the help of the Indian population showed almost similar sorts of habits of ST ingestion among mothers of LBW babies [11, 12]. This study constituted that, IUGR babies were born by 14.65% of mothers who were smokers. Two- thirds of them smoked Bidis and the rest smoked cigarettes, other modes like hookah were not endowed. It was observed similar percentage of Bidi smoking among mothers of LBW babies in the study conducted by Krishnamurthy *et al.,* [13]. From a recent analysis, we found that almost two-thirds of the mothers of IUGR babies were ST users, one out of nine mothers used both the modes, and a single mother was found to be smoking and not using ST. Similar observations were undertaken by Rahman *et al.,* [13]. Contradictory, the percentage of smoking mothers was considerably high in Europe, Lain America, and South Africa [14-16]. In Southeast Asia smoking among women may be rare, but the use of smokeless tobacco is common though the number is increasing significantly [16]. In this study, the author observed that mothers of IUGR babies have ingested smokeless tobacco 4.8 times per day during the

Intrapartum period. Maternal smoking during pregnancy is associated with higher possibilities of miscarriage, prematurity, and birth [17, 18]. In our series mothers of IUGR babies have smoked, on average, 4.7 sticks of cigarettes or bidis per day. Hruba *et al.*, also found almost similar levels of smoking among the mothers of SGA babies [19]. A similar study took place in India that matched our findings. We found maternal smokeless tobacco use during Intrapartum state carries the risk of IUGR infants at 6.4 times that of the non-tobacco user. An Indian study carried out by the Tata Institute of Fundamental Research; found that in Mumbai pregnant women who used ST had a two- to three-fold increased risk of having an LBW infant [20]. A high amount of nicotine absorbed from a unit dose of smokeless tobacco is several folds higher (4.5mg) than that of cigarette (1mg) [21]. Smokeless tobacco ingestion by pregnant women compels a reduced volume of maternal intervillous space early morphological changes of the placenta and a reduced volume and surface area of fetal capillaries leading to chronic fetal hypoxic stress and as a result development of IUGR [22]. A study carried out in Massachusetts found that smokers were 2.43 times more likely to deliver an Il-JGR infant than were nonsmokers. Similar observations were made in different studies carried out in Germany, Brazil, and the Republic of Benin [23]. We found most of the mothers who smoked were also ST users and found continuous use of ST & smoking is significantly associated with the development of IUGR infants. Smoking during pregnancy has severe adversities such as increasing fetal carboxyhemoglobin concentration and increasing vascular resistance due to vasoconstrictive effects of nicotine and the reduced prostacyclin synthesis [24, 25]. These toxic effects of tobacco smoke or the biological response to these changes may be more triggered when a pregnant woman ingests smokeless tobacco. In our study, we found that maternal total tobacco use (ST use, smoking & combined use) during the Intrapartum period carries a possibility of births of IUGR infants at 6.9 times that of the non-tobacco user. Deshmukh JS *et al.*, observed a similar risk of having IUGR infants [25]. The nicotine contained in tobacco is a potent vasoconstrictor also affecting intrauterine vessels, with an ensuing constriction contributing to diminished blood flow to the placenta [26]. The development of IUGR associated with maternal tobacco use might therefore be related to chronic hypoxia.

Limitations of the Study

This was a single-center study with a small size, which may reflect the scenarios of the whole country.

CONCLUSION

Maternal smokeless tobacco use about 5 times a day during the intrapartum period carries an increased risk of growth of the fetus. Using Frequent Maternal smokeless tobacco during the intrapartum period carries a higher risk of growth of the fetus.

RECOMMENDATIONS

The study recommends campaign which should be carried out through media to discourage mothers from taking tobacco during intrapartum period. Special care should be given to newborn infants of mothers who had frequent use of tobacco during intrapartum period.

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Self.

CONFLICT OF INTEREST

None declared.

APPROVAL

Got from the respective department.

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