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The Impact of Maternal Iodine Status during Pregnancy on Maternal and Perinatal Outcomes

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Abstract: ***Objectives: The objective of this study was to assess the impact of maternal iodine status during pregnancy on maternal and perinatal outcomes. Material and Methods:This retrospective study was conducted on 295 healthy pregnant women who were attended routine antenatal clinic at Zeynep Kamil Maternity and Pediatric Research and Training Hospital in May 2013 and May 2014. Spot urine samples were collected in order to measure iodine levels. An iodine level below 150 µg/L was considered as iodine deficiency. The cases were grouped according to their urine iodine levels. Statistical Package for the Social Sciences (SPSS; Version 20.0, Chicago, IL, USA) was used for statistical analyses. Results: Mean maternal age was 29±6 years, mean neonatal birth weight was 3290±545 grams and mean urinary iodine level was 79±58 µg/L. 271 cases (91.9 %) were defined as iodine deficient. Preeclampsia was determined in 19 cases (6.4 %) and 16 of them were in iodine deficient group. Gestational diabetes were determined in 30 cases (10.2 %) and 28 of them were in iodine deficient group. 14 cases were required neonatal intensive care unit (NICU) follow up and 13 of them were in iodine deficient group. There were no statistically significant difference between the groups for mode of delivery, preeclampsia, gestational hypertension, gestational diabetes mellitus and need for NICU (P=0, 106; 0, 207; 0, 547; 0, 756; 0, 889). Mean neonatal serum TSH level was 3, 4±2, 1 mIU/L in iodine deficient group and 4, 3±2, 2 mIU/L in without iodine deficient group. There were no statistically significant difference between groups in neonatal serum TSH levels (P=0, 310). There were also no correlation between maternal urinary iodine level and birth weight and neonatal serum TSH levels. Conclusion: We concluded that there were no increased risks in adverse maternal and neonatal obstetric outcomes in iodine deficient cases if TSH levels were in normal limits. So we do not offer routine iodine replacement in pregnancy if they were not living in endemic iodine deficient areas.***

Keywords: Pregnancy; thyroid; iodine deficiency; pregnancy outcomes

1. Introduction

Iodine which is an essential element for the production of the thyroid hormones, has a crucial role in the development of the central nervous system, and takes place in many metabolic reactions. It is estimated that 35% of the population worldwide have insufficient iodine intake (1). Iodine deficiency is associated with infertility, miscarriage, stillbirth, increased infant mortality, cretinism, congenital abnormalities, impairment of neurodevelopment, and psychomotor defects (1). Furthermore, iodine deficiency is a serious public health problem and the most common preventable cause of mental retardation in childhood (2). The iodine requirements are higher in pregnant women due to increase in maternal thyroxine (T4) production, increased iodine clearance, and iodine transfer to fetoplacental unit (3).

Severe maternal iodine deficiency during pregnancy results in a reduction in maternal thyroxine production, inadequate placental transfer of maternal thyroxine, and impairment of fetal neurodevelopment. On the other hand, excess exposure to iodine during pregnancy may cause fetal hypothyroidism and goiter (4). The World Health Organization (WHO) recommends 250 mcg of iodine daily during pregnancy and lactation. Iodine is cleared from the circulation by the thyroid and kidney. Because more than 90% of dietary iodine appears in the urine, urinary iodine (UI) can be used as a sensible marker of the recent iodine intake in pregnant women. Iodine deficiency is considered to be a major problem when the median UI falls below 150 µg/L (5).

The objective of this study was to assess the impact of maternal iodine status during pregnancy on maternal and perinatal outcomes.

2. Material and Methods

This study was conducted on 413 healthy pregnant women at any gestational age who were attended a routine antenatal clinic at Zeynep Kamil Maternity and Pediatric Research and Training Hospital in May 2013 and May 2014. Mothers with a known history of thyroid disorders, chronic illnesses, or taking medication that might affect the thyroid function were excluded.The obstetric and clinical features of patients were reviewed and 118 cases were excluded as they did not deliver at our hospital. Total 295 cases were included in the study. UIC is usually measured in spoturine specimens from pregnant women. Spot urine samples were collected and the collection tubes were frozen on the same day at –20°C until laboratory investigations could be performed. Spectrophotometric determination of urinary iodine was performed by the Sandell-Kolthoff reaction.An iodine level below 150 µg/L was considered as iodine deficiency. The cases were grouped according to their urine iodine levels below and above 150 µg/L. The TSH, free T3 (FT3), and free T4 (FT4) in the blood of the mother and heel-prick blood TSH levels from newborns were measured. Newborns with serum TSH ≥10mIU/L were considered abnormal at first postnatal week and were recalled for further evaluation. Adverse pregnancy outcomes were defined as preeclampsia, gestational hypertension (GHT), placental abruption, placenta previa, gestational diabetes (GDM), preterm labor (delivery before 37 weeks), preterm rupture of membranes (PROM) and newborn intensive care unit admission.

Informed consent was obtained from all patients and the study was approved by the Ethics and Clinical Investigation Committee of Zeynep Kamil Maternity and Pediatric Research and Training Hospital. (Date and number: 15th of August 2014/ 139)

Statistical Package for the Social Sciences (SPSS; Version 20.0, Chicago, IL, USA) was used for statistical analyses. Kolmogorov-Smirnov test was used for the assessment of the normality of data. In addition to mean, standard deviation for descriptive statistics, counts and percentages were run to determine categorical data. Also, Chi-square test was performed for the relationship between the categorical variables. Spearman correlation was used to calculate correlation coefficients. Results were evaluated with a confidence interval of 95%, and $p<0.05$ was considered statistically significant.

3. Results

The study includes a total of 295 pregnant women at any gestational age . The majority of women in both groups were multiparous. There was no significant difference between groups in terms of age, gestational age, or gravidity. The mean maternal age was 29 ±6 year and the means gestational age at delivery and birth weight were 39±2 weeks and 3290±545 gram respectively.The median urinary iodine concentration (UIC) in our population was 79± 58 µg/L and 91.9% (n=271) of cases had iodine levels below the WHO recomendations for pregnant women of 150–249 µg/L.Mean values for urinary iodine and mean serum TSH levels of mothers and mean serum TSH levels of newborns were shown in table 1.

Among the cases, preeclampsia prevalence was 6.4% (n=19), gestational diabetes was 10.2% (n=30), gestational hypertension was 2, 4% (n=7), preterm labor was 10.5% (n=31), abrupsio placenta was %0, 7 (n=2). There was only one case with premature preterm membrane rupture and no plasenta previa cases in the study cases (Table 2).

Preeclampsia prevalence at the cases with iodine deficiency and normal urinary iodine levels were 5.9% (n=16) and 12.5% (n=3) respectively. However, this difference was not statistically significant (p=0.207). Gestational diabetes prevalence at the cases with iodine deficiency and normal urinary iodine levels were 10.3% (n=28) and 8.3% (n= 2) respectively. And, this difference was not statistically significant (p=0.756). There was also no statistically significant difference between the groups regarding to gestational hypertension with iodine deficiency and normal urinary iodine groups (n=6, 2, 2% vs n=1 , 4, 2%) (p=0, 547)Also, preterm labor prevalence at the cases with iodine deficiency and at normal iodine level was %10, 7 (n=29) and %8, 3 (n=2) respectively. There was no statistically significant difference between the cases with iodine deficiency and normal iodine levels regarding to preterm labor (p=0.713). It was found that 55% (n=163) of the deliveries were caesarean sections (C/S), and 45% (n=131) were spontaneous vaginal deliveries (SVD). There were no statistically significant differences between the motherswith iodine deficiency and normal urinary iodine levels regarding the mode of delivery (c/s %55, 2 vs %55, 4 and vaginal delivery %48, 4 vs 44, 6) (p=0.948). No statistically significant difference was found between the iodine deficient and normal ıodine level cases in means of neonatal intensive care unit admission (%4, 8 vs %4, 2) (p=0, 889). (Table 3).

The mean neonatal serum TSH levels was 3, 4±2, 1 mIU/L and no infant was diagnosed as being congenitally hypothyroid. A Spearman's correlation was run to determine the relationship between maternal urinary iodine levels and neonatal TSH levels, birth weights. There was not a significant correlation between maternal urinary iodine level and neonatal serum TSH values ($r_s = .072$, $p > .05$). Also, there was not correlation between maternal urinary iodine levels and birth weights ($r_s = .010$, $p > .05$).

4. Discussion

Iodine which is an essential element for the production of the thyroid hormones, has a crucial role in the development of the central nervous system, and takes place in many metabolic reactions. It is known that iodine deficiency that is a serious public health problem and the most common preventable cause of mental retardation in childhood, is associated with cretinism (2). On the other hand, excess iodine intake during pregnancy may be associated with transitory hypothroidism and goiter in the newborn (4). Because more than 90% of dietary iodine appears in the urine, urinary iodine can be used as a sensible marker of the recent iodine intake in pregnant women. Iodine deficiency is considered to be a major problem when the median UI falls below 150 µg/L (5). Kut et al found that the median UIC of pregnant women was 149.7 µg/L (range 20.9–275.1 µg/L) and half of their subjects were below the level of 150 µg/L (6) . The median urinary iodine concentration in our population was 79± 58 µg/L and 91.9% (n=271) of cases had iodine levels below the WHO recomendations for pregnant women of 150–249mg/L (1.2–2.0 mmol/L). Similarly, Oral et al. found the median UIC of the 3487 pregnant women was 73 mg/L and they observed 90.7% (n=3214) of pregnant women had UI levels below 150 mg/L. In addition, they detected that there was no statistically significant differences for median UICbetween trimesters. Due to iodine deficiency beginning from the early gestational weeks in their study group, they recommended routine iodine supplementation for all women planningpregnancy(7). It is suggested that iodine deficiency treatment at late pregnancy improves infant cognitive deveopment but Zimmermann et al reported that cretinism can only be prevented when urinay deficiency is treated in early pregnancy (3).

In their study, van Mil et al showed that children whose mothers had low urinary iodine levels during pregnancy, had worse scores for impaired functioning at the age of 4 (8). Futhermore, Roman et al found that maternal hypothyroidism in early gestation was associated with autistic symptoms in the childhood (9). We do not followed the children for cognitive, intellectual development during childhood. So we had no idea about the intellectual development.

In their study, Guducu et al reported that mothers of infants with small for gestational age had higher mean TSH values when compared to mothers of infants with appropriate for gestational age and large for gestational age infants. They found an association between high TSH levels in the first trimester and low birth weight (10). Fuse et al. suggested that neonatal TSH was not affected by maternal iodine UI levels (5). Similarly, we did not find a significant correlation between urinary iodine and TSH values. Also, there was not correlation between maternal urinary iodine levels and birth weights.

Cleary- Goldman et al reported that there was not an association between adverse pregnancy outcomes and subclinical hypothyroidism during pregnancy (11). Contraversally, Anne-Dorthe et al. indicated an association between subclinical maternal hypothyroidism and adverse pregnancy outcomes (12). Unlikely, Wilson et al. reported that subclinical hypothyroidism during pregnancy increased the risk of severe preeclampsia (13). In our study, preeclampsia prevalence at the cases with iodine deficiency and normal urinary iodine levels were 5.9% (n=16) and 12.5% (n=3) respectively. However, this difference was not statistically significant (p=0.207). Also, we did not find statistically significant difference between the cases with iodine deficiency and normal iodine levels regarding to gestational diabetes, gestational hypertension, and PROM. This may be due to none of our patients was diagnosed as havingsubclinical hypothyroidism.

Anne-Dorthe et al. reported that postpartum hemorrhage risk was higher in women with subclinical hypothyroidism compared to euthyroid women. Also, they observed that subclinical hypothyroidism was associated with birth complications due to prolonged gestation. In their study they determined that subclinical hypothyroidism could cause to adverse pregnancy outcomes due to insufficient mitochondrial function and ATP production (12).

5. Conclusion

We did not determine any association with maternal urinary iodine levels of the euthyroid pregnant women and adverse pregnancy outcomes. So we do not offer routine iodine replacement in pregnancy if they were not living in endemic iodine deficient areas. But, larger further studies are required to evaluate the maternal urinary iodine level and development of adverse pregnancy outcomes.

References

[1] Ghirri P, Lunardi S, Boldrini A. Iodine supplementation in the newborn. Nutrients. 2014;6(1):382-90.
[2] Yaman AK, Demirel F, Ermis B, Piskin IE. Maternal and neonatal urinary iodine status and its effect on neonatal TSH levels in a mildly iodine-deficient area. Journal of clinical research in pediatric endocrinology. 2013;5(2):90-4.
[3] Zimmermann MB. The effects of iodine deficiency in pregnancy and infancy. Paediatric and perinatal epidemiology. 2012;26 Suppl 1:108-17.
[4] Velasco I, Martin J, Gallego M, Gutierrez-Repiso C, Santiago P, Lopez-Siguero JP, et al. Maternal-fetal thyroid function at the time of birth and its relation with iodine intake. Thyroid : official journal of the American Thyroid Association. 2013;23(12):1619-26.
[5] Fuse Y, Ohashi T, Yamaguchi S, Yamaguchi M, Shishiba Y, Irie M. Iodine status of pregnant and postpartum Japanese women: effect of iodine intake on maternal and neonatal thyroid function in an iodine-sufficient area. The Journal of clinical endocrinology and metabolism. 2011;96(12):3846-54.
[6] Kut A, Gursoy A, Senbayram S, Bayraktar N, Budakoglu, II, Akgun HS. Iodine intake is still inadequate among pregnant women eight years after mandatory iodination of salt in Turkey. Journal of endocrinological investigation. 2010;33(7):461-4.
[7] Oral E, Aydogan Mathyk B, Aydogan BI, Acikgoz AS, Erenel H, Celik Acioglu H, et al. Iodine status of pregnant women in a metropolitan city which proved to be an iodine-sufficient area. Is mandatory salt iodisation enough for pregnant women? Gynecological endocrinology : the official journal of the International Society of Gynecological Endocrinology. 2015:1-5.
[8] van Mil NH, Tiemeier H, Bongers-Schokking JJ, Ghassabian A, Hofman A, Hooijkaas H, et al. Low urinary iodine excretion during early pregnancy is associated with alterations in executive functioning in children. The Journal of nutrition. 2012;142(12):2167-74.
[9] Roman GC, Ghassabian A, Bongers-Schokking JJ, Jaddoe VW, Hofman A, de Rijke YB, et al. Association of gestational maternal hypothyroxinemia and increased autism risk. Annals of neurology. 2013;74(5):733-42.
[10] Guducu N, Gonenc, G., Isci, H., Yigiter, A.B., Dunder, I. Higher TSH levels in the first trimester of pregnancy are related to lower birth weight Eastern Journal of Medicine. 2013;18(4):172-5.
[11] Cleary-Goldman J, Malone FD, Lambert-Messerlian G, Sullivan L, Canick J, Porter TF, et al. Maternal thyroid hypofunction and pregnancy outcome. Obstet Gynecol. 2008;112(1):85-92.
[12] Anne-Dorthe Feldthusen JL, Palle L. Pedersen, Tina Toft Kristensen, Jan Kvetny. Pregnancy-induced alterations in mitochondrial function in euthyroid pregnant women and pregnant women with subclinical hypothyroidism; relation to adverse outcome. Journal of Clinical & Translational Endocrinology 2014;1:13-7.
[13] Wilson KL, Casey BM, McIntire DD, Halvorson LM, Cunningham FG. Subclinical thyroid disease and the incidence of hypertension in pregnancy. Obstet Gynecol. 2012;119(2 Pt 1):315-20.

Table 1: Iodine status and TSH levels

Mean Urinary Iodine (µg/L)	79±58
Urinary Iodine Status (N/%)	
Iodine Deficient	271 (%91.9)
Normal Iodine Level	24 (%8.1)
Mean Maternal Serum TSH (mIU/L)	1, 63±0, 66
Mean Neonatal Serum TSH (mIU/L)	3, 4±2, 1

Table 2: Prevalence of pregnancy complications

	(N)	%
Preeclampsia	19	6, 4
Gestational Diabetes	30	10, 2
Gestational Hypertension	7	2, 4
Preterm Labor	31	10, 5

Abruptio Placenta	2	0, 7
PPROM	1	0, 3
Placenta Previa	0	0

Table 3: Pregnancy outcomes and mode of delivery between the groups.

	Iodine deficiency group (%) (N)	Normal ıodine level group (%) (N)	P value
Preeclampsia	5, 9% (16)	12, 5% (3)	0, 207
Gestational diabetes	10, 3% (28)	8, 3% (2)	0, 756
Gestational Hypertension	2, 2% (6)	4, 2% (1)	0, 547
Preterm Labor	10, 7% (29)	8, 3% (2)	0, 713
Caeserean Section Vaginal Delivery	55, 4% (150) 44, 6% (120)	52, 2% (13) 44, 8% (11)	0, 948
NICU Admission	4, 8% (13)	4, 2% (1)	0, 889

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