Original Article

Influence of perinatal factors on thyroid stimulating hormone level in cord blood

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Abstract

Background: The aim of the present study was to determine the effect of various perinatal factors on cord blood TSH among newborns in Isfahan, Iran.

Materials and Methods: This was a descriptive–analytic cross sectional study which performed in Isfahan Iran. During a period of four months, since February to May 2012 a total number of 440 newborns delivered in Alzahra and Shahid beheshti hospitals were enrolled in the study. For all newborns one mL blood sample from umbilical vein was obtained by one of the project investigators and sent to laboratory for further examinations. Cord blood TSH and birth body weight (BBW), gestational age, history of gestational diabetes mellitus (GDM), apgar at one minute, apgar at five minute, newborn gender and the mother's age were documented. Differences considered statistically significant if $P < 0.01$.

Results: 440 newborns enrolled in the study, 221 (50.2%) were male and 219 (49.8%) were female. Among study parameters, method of delivery had statistically significant relation with cord blood TSH ($P < 0.001$), and other factors such as BBW, gestational age, GDM, apgar at one minute, apgar at five minute, newborn gender and the mother's age didn't have statistically significant relationship with cord TSH level.

Conclusion: In conclusion we deduce that the only factor that can affect cord blood TSH was method of delivery. Infant with vaginal delivery has higher TSH level in cord blood. Other factors that were evaluated in this study didn't have any statistically significant relationship.

Key Words: Cord blood, perinatal factors, thyroid stimulating hormone

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INTRODUCTION

Congenital hypothyroidism (CH) is defined as thyroid hormone deficiency present at birth. Nowadays CH is the most common treatable cause of developmental delay and intellectual disability among new-borns.[1] Recent reports from different countries have shown an increase in the incidence of CH. The reason is unknown, however, it could be due to advances in screening strategies during last decades.[2] Recent studies showed the incidence of 1/3000 in western countries.[3] Asians had higher incidence of approximately 1/1000[4] and about our provincean incidence of 1/357 in live births is reported.[5] Owing to high prevalence of CH among newborns all around the world, early detection of CH Seems to be necessary.

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Most newborns with congenital hypothyroidism do not present signs and symptoms of thyroid deficiency in early infancy[6,7] which is due to passage of maternal thyroid hormones across the placenta[8] thus it is not possible to predict which infants will be affected. For these reasons, newborn screening was developed in 1970 to detect this condition as early as possible.[9]

Traditionally screening strategy was based on the collecting Blood for screening on to special paper cards after heel prick, in the first week after delivery,[10] Recent studies suggest umbilical cord blood sampling as an alternative method for this procedure due to its lower false negative results.[11-13] Currently in some countries it has been chosen for the methods of choice in the screening program.[14]

There are previous studies which suggest the relation between some perinatal factors and newborns TSH. For instance a study performed by Franklin *et al.,* mentioned that only birth body weight and method of delivery can affect thyroid hormone indices and other factors such as gestational diabetes do not influence the thyroid stimulating hormone (TSH) level.[15] On the other hand, the study which was conducted by Herbstman *et al.*, revealed the influence of gestational diabetes and maternal age on thyroid hormone status in infants.[16] As it is mentioned, although some studies have been performed in this field, however, the result is still controversial.[17-19]

The aim of the present study was to determine the effect of various perinatal factors on cord TSH level, among newborns in Shahid beheshti and Alzahra Hospital, Isfahan, Iran.

MATERIALS AND METHODS

Patients and setting

This was a descriptive-analytic cross sectional study which was performed in Isfahan, Iran. During a period of four months, since February to May 2012, a total number of 440 consecutive newborn delivered in Alzahra and Shahid beheshti hospitals were enrolled in the study. They were excluded if any of the following criteria present: Major congenital malformations, inadequate blood sample, maternal thyroid disease and their mothers refuse to participate in the research projects.

Procedure

For all the newborns that enrolled in the study, one milliliter blood sample from umbilical vein was obtained by one of the project investigators (AE) and sent to laboratory for further examinations. Complete physical examination has been performed and Apgar score for first and the fifth minute was calculated. Demographic data, gestational age, gestational diabetes and pre-eclampsia were documented in all mothers.

Variables and assessments

TSH measured by Chemi luminescence Immunoassay (CLIA) method and the value of 20 considered as cut off value for CH.[20]

Gestational age determined by maternal menstrual history. Pre-eclampsia diagnosed by the new onset of hypertension and proteinuria after 20 weeks of gestation in women without history of hypertension.[21] Gestational diabetes mellitus is defined as impaired glucose tolerance with onset or first recognition during pregnancy.[22] Apgar score was calculated by one of the research investigators (AE) considering physical examinations for signs such as heart rate, respiratory effort, muscle tone, reflex irritability and Color.[23]

Data analysis has been performed using SPSS 16 software and comparisons were made using student *t*-test, ANOVA, Pearson correlation, logistic regression, multiple regression analysis test, as needed. Written Informed consents were obtained from all parents for authorized use of their medical records for research purposes with approval of the protocol by ethical committee of our university.

RESULTS

A total number of 440 newborns were enrolled in the study, 221 (50.2%) were male and 219 (49.8%) were female. Further descriptive analysis about study variables are shown in Table 1.

We evaluated the relationships between the categorical variables and cord blood TSH level which shows relationship between method of delivery and TSH level ($P < 0.001$). In this study we also have one patient with pre-eclampsia that have a high level of TSH (TSH = 38). Newborns gender does not have any relationship with the cord blood TSH and the difference was not statistically significant between males and females ($P = 0.36$). We found five patients with gestational diabetes, the mean cord blood TSH shows no significant difference in the newborns of these patients compared with those, whose mother's pregnancy didn't complicated with gestational diabetes ($P = 0.99$). More detailed data are shown in Table 2.

We also evaluated the correlation between quantitative variable of study. None of the parameters including BBW, GA, Apgar one minute, Apgar five minute, and mother's age had statistically significant relationship

Table 1: Descriptive statistics of quantitative variables of the study

	Minimum	Maximum	Mean±standard deviation
BBW	390	4050	2961.46±518.85
GA	25	42	37.75±2.28
Apgar first minute	1	9	8.71±0.90
Apgar fifth minute	2	10	9.83±0.65
TSH	1	49	7.6±6.24
Mothers age	14	45	27.64±5.42

BBW=Birth body weight, TSH=Thyroid stimulating hormone, GA=Gestational age

Table 2: Relationships between categorical variables and cord blood TSH

	Number (%)	Cord blood TSH level	*P* value
Method of delivery			
Vaginal	171 (38.86)	9.54±8.366	<0.001*
Cesarean section	269 (61.14)	6.47±3.97	
Gestational diabetes			
Yes	5 (1.13)	7.57±2.71	0.99
No	435 (98.87)	7.59±6.10	
Newborns gender			
Male	221 (50.22)	7.93±6.30	0.36
Female	219 (49.78)	7.39±6.19	

Data are presented as number (%) and mean±standard deviation, TSH=Thyroid stimulating hormone, *=Statistically significant relationship

Table 3: Relationship among quantitative variable of study

	GA	Apgar 1 min	Apgar 5 min	Mothers age	TSH
BBW	*r*=0.50	*r*=0.22	*r*=0.26	*r*=0.03	*r*=0.007
	P<0.001*	*P*<0.001*	*P*<0.001*	*P*=0.47	*P*=0.87
GA		*r*=0.34	*r*=0.44	*r*= -0.08	*r*=0.01
		P<0.001*	*P*<0.001*	*P*=0.09	*P*=0.82
Apgar 1min			*r*=0.84	*r*= -0.05	*r*= -0.04
			P<0.001*	*P*=0.22	*P*=0.38
Apgar 5min				*r*= -0.5	*r*= -0.03
				P=0.23	*P*=0.46
Mothers age					*r*= -0.01
					P=0.81

TSH=Thyroid stimulating hormone, BBW=Body birth weight, GA=Gestational age, *=Statistically significant relationship, R=Coefficient correlation

with TSH. However, some other significant relations between BBW with GA, Apgar one minute, Apgar five minute and another relations between GA with Apgar one minute, Apgar five minute and one other relation between Apgar one minute and Apgar five minute were observed among the variables which were not in the aim of our study. Detailed data are shown in Table 3.

Linear multivariate logistic regression also were used to confirm the relationship among study variables. Significant relationship was found in method of delivery and cord blood TSH level ($P < 0.001$ and $\beta = 0.22$). Of 440 newborn that evaluated 22 (5%) found to have cord blood TSH value more than 20, these newborns were recalled for further evaluations.

DISCUSSION

As we know many perinatal factors during delivery affect TSH, but in our study, only method of delivery had statistically significant relationship with cord blood TSH. Cord blood TSH level was higher in newborns with vaginal delivery compared with the others with cesarean section. The rationale for this condition has not been well established yet; however, it could be explained by stress events during pregnancy and labour. Our findings revealed that the presence of stress factors can results in an elevation in cord blood TSH.

Although some studies have been performed in this field, however, the results are controversial[15,17,18,24,25] and sometimes paradoxical. Fuse *et al.*, performed a study on 124 healthy neonates with different types of delivery, including cesarean section, normal vaginal delivery and by vacuum extractor. They revealed that there was no statistically significant difference in cord blood TSH among neonates in study groups which is in contrast with our study.[18] Moreover in contrast with our results is the study that performed by Herbstman *et al.*, which evaluated a total number of 300 newborn. Thyroid hormone levels were measured and the association between some perinatal factors was assessed. They revealed that several perinatal factors such as maternal age, pregnancy induced hypertension, gestational diabetes, sexually transmitted disease during pregnancy, alcohol use during pregnancy and Gestational age can affect thyroid hormone status in infants.[16]

On the other hand, Kim *et al.*, in a project which was held on 130 neonates in Korea showed that cord blood TSH was affected by perinatal stress events and is significantly higher in infants born vaginally than of cesarean section which was in line with our study.[19]

Although we had a larger sample size compared with previous studies that could cause in significance in lower differences, however, we didn't find statistically significant relations among TSH and other perinatal factors such as GDM, gestational age, apgar at one min, apgar at five min, newborn's gender, BBW and mother's age on the cord blood TSH.

Moreover, we found one patient with pre-eclampsia that showed high level of TSH. This finding is in line with previous studies which evaluated the effect of pre-eclampsia on cord TSH level. They revealed that pre-eclampsia results in elevated TSH level in infants.[26,27]

The strength point of our study was the high sample

size compared with previous studies in this field, however, due to low number of pre-eclamptic patients in this study we suggest further studies with higher sample size to evaluate the effect of pre-eclampsia in thyroid hormone level in infants.

In conclusion we deduce that the only factor that can affect cord blood TSH was method of delivery. Infants with vaginal delivery has higher TSH level in cord blood. Other perinatal factors such as BBW, gestational age, GDM, Apgar at one minute, apgar at five minute, newborn's gender and the mother's age don't have statistically significant relationship with cord TSH level.

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