The Correlation of Thyroid Hormone Levels and Gestasional Weeks in Amniotic Fluid at Second Trimester

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Abstract

Objective: The purpose of this study was to determine thyroid hormone levels of amniotic fluid and correlate with gestasional ages.

Methods: 125 pregnant women underwent amniocentesis procedure for prenatal diagnosis were inclueded in study between May 2004 and May 2005. Thyroid hormone levels were analyzed with using Roche E170 Modular analytics (Hitachi, Japan) system. Statistical analyses were performed by using One-Way Anova test. A value of $p<0.05$ was considered statistically significant.

Results: The mean age of patients was 34.5 ± 5.6 (21-40) The mean gestational age of patients who underwent amniocentesis was 17.88 ± 1.58 (16-20) Karyotype analysis of all patients was normal. Amniotic fluid levels of total and free T4 increased progressively with gestasional age ($p< 0.001$). Although total T3 , free T3 and TSH levels did not increase with gestasional age ($p>0.05$).

Conclusion: The levels of thyroxine (T4) hormone in amniotic fluid was higher than T3 and TSH hormones. The need of thyroxine (T4) hormone increased with gestasional age.

Keywords: Thyroid hormone, amniotic fluid, gestational age.

Ikinci trimester amniotik sıvı tiroid hormon düzeyleri ile gestasyonel hafta arasındaki ilişki

Amaç: Amniosentez uygulanan gebelerin amnion mayilerindeki tiroid hormon düzeylerini ölçmek ve bu değerlerin gestasyonel hafta ile olan ilişkisini değerlendirmek.

Yöntem: Çalışmaya, Mayıs 2004 ile Mayıs 2005 tarihleri arasında prenatal tanı amacıyla, kliniğimizde amniosentez yapılan toplam 125 gebe dahil edildi. Tiroid hormon analizleri, 1ml amnion sıvısında, Roche E170 Modular analytics (Hitachi, Japan) cihazı ile, Roche marka ticari kit kullanılarak gerçekleştirildi. Veriler, istatistiksel olarak One-Way Anova testi kullanılarak karşılaştırıldı, $p<0.05$ değeri istatistiksel anlamlı olarak kabul edildi.

Bulgular: Çalışmaya alınan hastaların ortalama yaşı, 34.5 ± 5.6 (21-40) yıl idi. Amniosentez uygulanan olguların ortalama gebelik haftası, 17.88 ± 1.58 (16-20) olarak bulundu. Tüm hastaların amniosentez sonucu normal karyotip olarak tesbit edildi. Olguların amnion sıvısındaki total T_4 ve serbest tiroksin (f T_4) seviyeleri, gestasyonel hafta artıkça progresif olarak artış gösterdi ($p< 0.001$). Buna karşılık total T_4 , serbest triiodotronin (f T_4) ve TSH seviyeleri gestasyonel hafta ile birlikte progresif olarak artış göstermedi ($p>0.05$).

Sonuç: Amnion sıvısındaki tiroksin (Tv) hormonun miktarının, T_4 ve TSH'a göre daha fazla olduğunu bulduk ve bu hormona olan ihtiyacın gebelik haftası arttıkça belirginleştiğini düşünüyoruz.

Anahtar Sözcükler: Tiroid hormon, amnion sıvısı, gestasyonel hafta.

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Introduction

Thyroid hormones that accelerate tissue growth synthesis through DNA and RNA synthesis are necessary for normal growth and development. Thyroid hormones are responsible for dendritic and axonal development, synaptogenesis, neuronal migration, myelinization, and cerebral differentiation in fetal period.[1]

Thyroid follicles and T_4 synthesis was detected in 10 week-fetus. As from 10th week, a growth in fetal serum TSH, T4 and Thyroid binding globulin levels was detected. Total and free T_4 level reaches the adolescent levels in 36th week. On the fourth hour following the birth, serum T_3 and T_4 hormones reach the peak level. Since iodotironin deiodinaz activity was high in placenta, transforming T_3 and T_4 into the inactive metabolites T_3 and T_4, TSH, T_3 and T_4 trespass to the fetus at low level.[3]

The purpose of this study was to determine thyroid hormone levels of amniotic fluid and correlate with gestational ages.

Methods

125 pregnant women underwent amniocentesis procedure for prenatal diagnosis were included in study between May 2004 and May 2005. All 16-20 weeks pregnants who are suggested amniocentesis accepted this suggestion. Before amniocentesis, both mother and father filled and signed amniocentesis approval form. Pregnancy age was measured by Toshiba SSH-140A, 3.5 MHz convex probe colored Doppler ultrasonography device, according to the BPD (biparietal diameter) and AC (abdominal circumference) measurements. After abdominal cleaning and cleaning of probe with povidine iodine, accompanied by the ultrasonography, transabdominal amniocentesis was applied. Punctures were performed by single usage spinal injectors varying 20-22 gauge. Thyroid hormone analysis were studied in first two mP amnion fluid before amnion fluid necessary for cytogenetic analysis was taken. Total T_3 and T_4 free triiodothyronine (f T_3), free thyroxine (f T_4) and thyroid stimulant hormone (TSH) analysis were performed by Roche E170 Modular analytics (Hitachi, Japan) system, Roche commercial kit. The cases were divided into 5 groups for amniocentesis. Group I; 16th pregnancy week (n=25), group II; 17th pregnancy week (n=25), group III 18th pregnancy week (n= 25), group IV 19th pregnancy week (n=25), group V, 20th pregnancy week (n=25). During the pregnancy, the patients with thyroid or systemic diseases weren't included into the study. All data were transferred to the software and this study was analyzed prospectively. Statistical analyses were performed by using One-Way ANOVA test. A value of $p<0.05$ was considered statistically significant.

Results

125 pregnant women underwent amniocentesis procedure for prenatal diagnosis, were included in study between May 2004 and May 2005. The mean age of patients was 34.5 ± 5.6 (21-40). The mean gestational age of patients who underwent amniocentesis was 17.88 ± 1.58 (16-20). A Positive triple test applied to 82 cases (65.6), advanced age to 20 cases (16%), maternal anxiety to 18 cases (14.4%), and amniocentesis applied to 5 cases because of mal obstetric anamnesis. Karyotype analysis of all patients was normal.

Tablo 1. Thyroid hormone values in amnion fluid, varying with gestational week.

Thyroid hormone levels	16th week Group 1	17th week Group 2	18th week Group 3	19th week Group 4	20th week Group 5	P*
Total T3 (ng/ml)	0,49±0,15	0,51±0,18	0,51±0,15	0,45±0,14	0,52±0,16	>0.05
Total T4 (ug/ml)	0,78±0,18	1,02±0,17	1,06±0,23	1,36±0,25	1,42±0,41	<0.001
Free T3 (ng/dl)	0,068±0,004	0,069±0,001	0,080±0,002	0,073±0,002	0,070±0,005	>0.05
Free T4 (ng/dl)	0,13±0,032	0,28±0,05	0,27±0,16	0,31±0,06	0,34±0,03	<0.001
(TSH) (uIU/ml)	0,42±0,15	0,38±0,1	0,37±0,15	0,36±0,13	0,43±0,14	>0.05

Total T_3 and T_4 free triiodothyronine (f T_3), free thyroxine (f T_4) and thyroid stimulant hormone (TSH) values varying according to the gestational weeks, are shown in Table 1. Amniotic fluid levels of total and free T_4 increased progressively with gestational age ($p<0.001$) (Figure 1). Although total T_3, free T_3 and TSH levels did not progressively increase with gestational age ($p>0.05$) (Figures 2 and 3).

Discussion

Clinical and experimental researches proved that thyroid hormones are essential for normal cerebral development in early fetal period and that has specific effects on olfactory bulbus, in sub ventricular zone of cerebral cortex, and in hippocampus.[1-4] It affects thyroid hormones, mitochondrial energy metabolism in short and long term.[5] It affects the lipid distribution of fetal thyroid hormones and bone differentiation in histological level.[6]

Rajatipi et al[7] observed the presence of the thyroid hormone receptors in fetus lung, on 13th gestational week. This situation proves that thyroid hormones have a role in fetal lung development in early gestational weeks.

Fetal thyroid gland isn't functional until 12th week. Fetus is under the influence of maternal thyroid hormones within the first trimester.[8] Pop et al[9] showed that the level of free T_4 in early gestational period are strong indicators for motor and mental development of the infant after the birth.

Fetal thyroid hormones are also increased in cases of vaginal delivery, prolongation of the second gestation period, fetal umbilical fetal distress, painting amnion fluid by meconium, and forceps and vacuum usage that the fetus is exposed to the intrauterine stress.[10,11] Ward et al[12] noted that maternal cardiac diseases, preeclampsia, HIV infection, diabetes mellitus have no effect on fetal thyroid hormones.

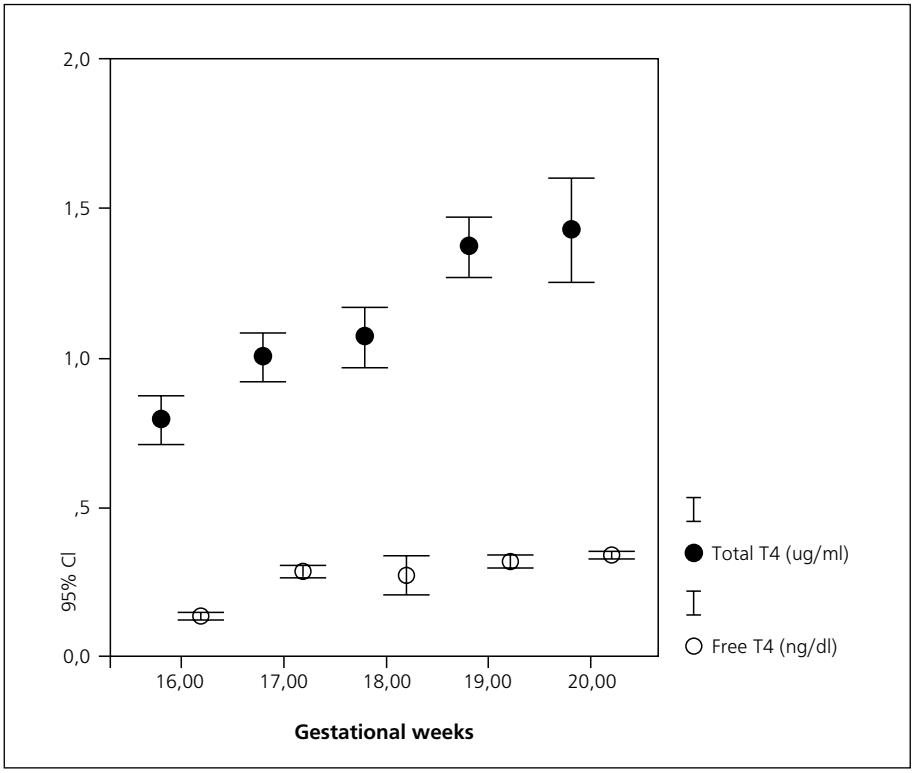

Figure 1. Total T4 and free thyroxin levels in amnion fluid, varying with gestational week

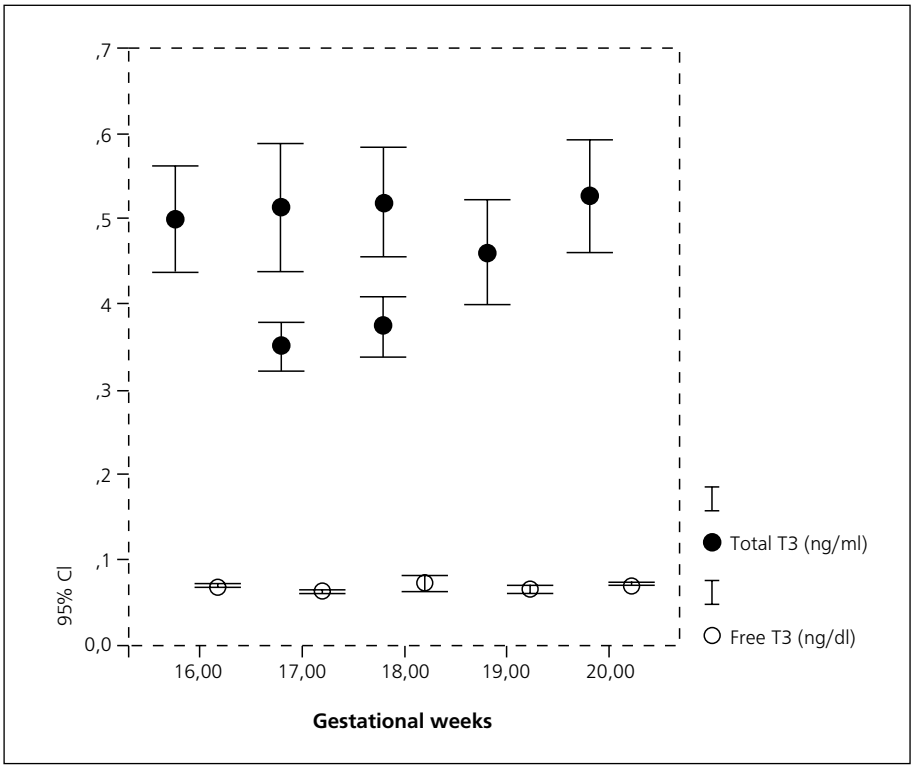

Figure 2. Total T3 and free thyroxin levels in amnion fluid, varying with gestational week.

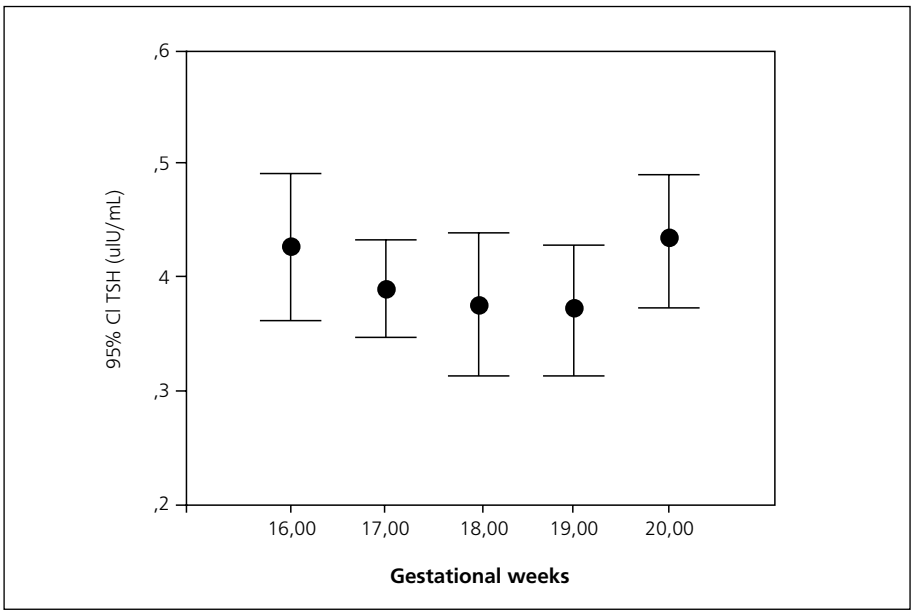

Figure 3. Thyroid stimulant hormone TSH level in amnion fluid, varying with gestational week

A growth in fetal serum TSH, T_4 and thyroid binding globulin levels occurs. TH, T_4 and T_3 levels reach the peak level in second trimester and they tend to decrease until the next term. In last

trimester, T_4 and TSH levels are higher than maternal levels however total T_4 and T_3 are lower. For Fetal thyroid hormone metabolism, second and third trimesters are critical transition period.[13]

Polk et al[14] showed that total T_4, and free T_4 levels are augment along with gestational weeks and serum T_3 levels are low. Klein et al[15] observed that fetal serum T_4, free T_4 and thyroid binding globulin levels are in a significant increase between 26th and 33rd gestational weeks, as from 34th gestational week; there isn't any change in these parameters. Sack et al determined that amniotic fluid T_4 levels are progressively elevated before 20th week, however T_3 levels didn't give a progressive increase.16

In our study, total T4 levels and free thyroxin (f T_4) levels in amniotic fluid increased progressively between 16 and 20th gestational weeks ($p<0.001$). Although total T_3 , free T_3 and TSH levels did not increase with gestational week ($p>0.05$) In fetal period, normal cerebral development, fetal bone and lung differentiation and similar cases that thyroid hormones influence, thyroxin (T_4) hormone is effective and the need for this hormone increased as gestational weeks go by. Although T_3, free T_3 and TSH levels did not progressively increase with gestational age, their presence in amnion fluid make us think that they contribute to the fetal development.

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