Amniotic Fluid β2- Microglobulin Measurements

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ABSTRACT

OBJECTIVE: To determine β2-microglobulin levels in amniotic fluid during the course of second trimester.

STUDY DESIGN: One hundred patient’s amniotic fluid β2-microglobulin levels had been evaluated retrospectively (March-October 2009). The most common amnioncentesis indication was advanced maternal age (33.3%). Others were; high risk result for triple test (18.5%), high risk result for double test (6.4%), ventriculomegaly (5.55%), obstetric history for fetus with down syndrome (4.62%), the presence of soft markers on ultrasound (13.8%), others (17.8%). Patients average gravida was 2.66 (range: 1-6), parity was 0.75 (range: 0-3), abortion was 0.65 (range: 0-3).

RESULTS: All patients were at second trimester and the average gestational week was 17.7 (range 15-22). Patients were divided into four groups (15th, 16th, 17-18th and 19-20th gestational weeks). We have demonstrated that amniotic fluid β2-microglobulin levels are increased progressively throughout the second trimester. We have specified normal β2-microglobulin values of each gestational week/period in order to be used in clinical practice.

CONCLUSION: We have demonstrated that amniotic fluid β2-microglobulin levels are increased progressively throughout the second trimester.

Keywords: Amniotic fluid, β2-microglobulin, Second trimester


Introduction

β2 - microglobulin is a surface protein that belongs to the major histocompatibility complex (MHC) Class 1 family. The MHC Class 1 is made of a heavy chain, carrying the allootypic determinants of its specificity and a non-covalent bond light chain, β2-microglobulin. β2-microglobulin stabilizes the structure of the heavy chain and allows surface MHC Class 1 antigen expression. β2-microglobulin joins the circulation as a monomer when it is separated from the heavy chain. Approximately ninety nine percent of it is reabsorbed from the proximal tubules of the kidney after glomerular filtration. Daily loss by urine is less than 400 ng. Therefore, measurement of urine β2-microglobulin levels may be an indicator of proximal renal tubuler function.

The concentration of β2-microglobulin in amniotic fluid increases progressively up to the 20-24th weeks of pregnancy. It reaches a peak level during the second trimester which is an eightfold value compared to the maternal serum level and is similar to the maternal serum concentration at term. It is believed that these changes are due to fetal renal tubular maturation.

In our study, we aimed to determine the amniotic fluid β2-microglobulin levels week by week at second trimester so that this variable can be used prenatally in order to show fetal renal function or intrauterine fetal kidney parenchyma injury.

Material and Method

We have used 100 patients’ amniotic fluid samples obtained by amniocentesis to determine β2-microglobulin levels. Necessary consent forms are signed by patients prior to entering prenatal diagnosis program and amniocentesis itself.

Amniocentesis was performed with a 21-G needle under ultrasonographic guidance. Ten to fifteen ml of amniocentesis material was used for karyotyping and 2 ml used for β2-microglobulin measurements. Karyotyping was performed by using conventional cytogentic methods and β2-microglobulin...
lin measurements were performed with radioimmunoassay techniques. The statistical software package SPSS version 17.0 (SPSS, Chicago, IL, USA) was used for data analyses.

**Results**

All patients were at second trimester and the average gestational week was 17.7 (15-22). The most common amniocentesis indication was advanced maternal age (33.3%). Others were; high risk result for triple test (18.5%), high risk result for double test (6.48%), ventriculomegaly (5.55%), obstetric history for fetus with down syndrome (4.62%), the presence of soft markers on ultrasound (13.8%) and others (17.8%).

Patients’ average (mean) gravida was 2.7 (range: 1-6), parity was 0.8 (range: 0-3), abortion was 0.7 (range: 0-3). The average (mean) β2-microglobulin value was 8.17 mg/ml (4.25-22.71). Patients were divided into four groups (15th (n=7), 16th (n=31), 17-18th (n=45) and 19-20th (n=14) gestational weeks). Beta2-microglobulin amniotic fluid concentrations during the course of second trimester gestational weeks/periods are show in table 1 and figure 1.

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![Figure 1: Amniotic fluid beta2-microglobulin level distribution according to the gestational weeks. (B2mg: Beta2 microglobulin, GW: Gestational week)](image)

Four groups compared with Kruskal Wallis test. There was statistically significant difference between four groups (p<0.001). Whereupon pair wise comparison non-parametric multiple comparison test was performed and detected statistically significant difference between four groups (p<0.05).

According to our results amniotic fluid β2-microglobulin levels are increased progressively throughout the second trimester. We measured the highest levels in the 19-20th gestational week group.

**Discussion**

β2-microglobulin is a low molecular weight protein (11.800 Daltons) of MHC Class I which is excreted only by the kidney. Approximately 99% is reabsorbed by the proximal tubules. When plasma β2-microglobulin level rises, the tubular reabsorption increases too. So urine β2-microglobulin levels are steady. Thus, β2-microglobulin becomes a specific and sensitive indicator of proximal renal tubular function. This reabsorption takes place with full capacity in term infants, however for preterm infants this is not the case. Except for dismaturation, renal ischemia, interstitial inflammation, toxins, heavy metals, etc. can lead to dysfunction of the proximal tubules. For preterm infants, who don’t have these risk factors, high levels of β2-microglobulin can be linked to proximal renal tubular dismaturation. Cole et al. suggested this theory and added that the other reason of high β2-microglobulin levels at amniotic fluid can be fractional excretion of water.

Hadenagy et al. found that amniotic β2-microglobulin levels increases progressively and makes a peak at second trimester (20-24th gestational week) and becomes equal to maternal serum level at third trimester. They mentioned that this is due to renal tubular maturation and they said that amniotic fluid β2-microglobulin levels can be used for determination of fetal age. On the contrary, Vesce F et al. studied the β2-microglobulin levels and lecithin/sphingomyelin (L/S) ratio at 14th and 42th gestational weeks. They looked for a relationship between lung maturation and β2-microglobulin levels but they didn’t find any correlation. Fetal urine β2-microglobulin value was reported to be around 6mg/ml at term pregnancy probably due to fetal kidney maturation.

In our study, we have demonstrated that amniotic fluid β2-microglobulin levels are progressively increased during the course of second trimester. We have obtained the normal amniotic fluid β2-microglobulin concentrations of second

<table>
<thead>
<tr>
<th>Groups/ β2-microglobulin(µg/l)</th>
<th>Median(µg/l)</th>
<th>IQR(µg/l)</th>
<th>Min./Max.(µg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15th gestational weeks (n=7)</td>
<td>6325.0</td>
<td>2708.0</td>
<td>4250.0-8685.0</td>
</tr>
<tr>
<td>16th gestational weeks (n=31)</td>
<td>7249.0</td>
<td>2274.0</td>
<td>5327.0-13124.0</td>
</tr>
<tr>
<td>17-18th gestational weeks (n=45)</td>
<td>8000.0</td>
<td>2093.0</td>
<td>5112.0-22712.0</td>
</tr>
<tr>
<td>19-20th gestational weeks (n=14)</td>
<td>9752.0</td>
<td>4245.25</td>
<td>6262.0-21829.0</td>
</tr>
</tbody>
</table>

*Four groups compared with Kruskal Wallis test, p<0.001*
Conclusion

In our study, we have demonstrated that amniotic fluid β2-microglobulin levels are increased progressively during second trimester gestational weeks/periods. Our results will enable us to use β2-microglobulin measurements prenatally in order to demonstrate intrauterine renal function or to show fetal renal injury due to obstructive uropathies or other urinary system problems by having amniocentesis.

References