Correlations Between Mother and Child Blood Selenium Concentrations at Birth

Yoji Deguchi and Akira Ogata

Department of Environmental Health, Fukui Medical School, Fukui

INTRODUCTION

Selenium (Se) is a component of glutathione peroxidase (GSH-PX) and has been recognized as an essential trace element in man. Possible Se deficiency has been related to Keshan Disease\(^1\), Kwashiorkor\(^2\) and sudden infant death syndrome\(^3\). Selenium concentrations in blood\(^4,5\) and hair\(^6\) have been known to decrease during early infancy partially due to a significant decrease in Se content in human breast milk associated with a lengthened period of lactation\(^7\). Therefore, young infants are likely to be exposed to the risk of Se deficiency. In order to avoid such a risk, it is desirable for newborns to take enough Se from their mothers prior to birth. However, little information is available on the relationship of blood Se levels in pregnant women and their newborns.

The purpose of this study is to investigate the relationship of blood Se levels between mothers and their newborns at birth with regard to birth weight, gestational age, parity and abortion (spontaneous and/or artificial) experience of mothers.

METHODS

Paired samples of maternal venous and umbilical cord blood were collected into plastic tubes containing ethylenediamine tetraacetic acid dipotassium salt at the time of normal delivery with the consent of 253 mothers (18-41 years of age) who delivered at a hospital in Amagasaki City (Japan) between Sept. 1983 and Jan. 1985. Se concentrations in whole blood were determined by spectrofluorometry\(^8\).

Based on birth weight and gestational age, the total 253 blood pairs were divided into 3 groups as follows:

- **Group A**: 229 pairs of term birth (37-41 weeks of gestational age) with birth weight more than 2,500 g
- **Group B**: 10 pairs of term birth with birth weight of 2,500 g or less
- **Group C**: 14 pairs of preterm birth (less than 37 weeks of gestational age)

RESULTS

Maternal and cord blood Se concentrations were in the range of 97-308 ng/ml and 91-353 ng/ml, respectively, and showed a positive correlation (\(r=0.712, p<0.001\)) as seen in Fig. 1. Neither maternal nor cord blood Se concentrations had significant correlations to mothers' age (\(r=0.044\) and \(r=0.060\), respectively).

Table 1 shows the mean concentrations of Se in maternal and cord blood. There was no significant difference in the Se levels between maternal and cord blood regardless of birth weight or gestational age. For only Group A, maternal and cord blood Se levels in multipara were significantly higher than those in primipara at \(p<0.05\) and \(p<0.01\), respectively.

Table 2 shows the correlations between mother and child Se blood concentrations. Even if the total 253 pairs were divided into 3 groups, positive correlations were also observed in respective groups. When compared by Fisher's z-transformation, the correlation coefficients in multipara were significantly higher than those in primipara at \(p<0.01\) both for Group A and B, and at \(p<0.05\) for Group C. Although data were not shown, the correlation coefficients were not changed significantly by mothers' age either in
primipara or in multipara of Group A.

Table 3 shows the correlations between maternal and cord blood Se concentrations by parity and abortion experience of mothers in the case of normal birth (Group A). Although data were not shown, neither mean values nor coefficients of variation in blood Se concentrations were changed significantly by abortion if parity was matched. In primipara, however, a significant correlation was observed only for mothers without abortion experience and the correlation coefficient of abortion-experienced mothers was significantly lower than that of mothers without abortion experience \( p<0.05 \). On the other hand, significant correlations were found in multipara without regard to abortion experience of mothers and there was no significant difference in the correlation coefficients due to abortion experience.

Table 1  Se concentrations in maternal and cord blood.

<table>
<thead>
<tr>
<th>Parity</th>
<th>Blood</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean±S.D. (ng/ml)</td>
<td>Mean±S.D. (ng/ml)</td>
<td>Mean±S.D. (ng/ml)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(N)</td>
<td>(N)</td>
<td>(N)</td>
</tr>
<tr>
<td>Primipara</td>
<td>Maternal</td>
<td>166±25* (100)</td>
<td>179±27 (6)</td>
<td>162±23 (8)</td>
</tr>
<tr>
<td></td>
<td>Cord</td>
<td>168±30* (100)</td>
<td>175±27 (6)</td>
<td>174±24 (8)</td>
</tr>
<tr>
<td>Multipara</td>
<td>Maternal</td>
<td>176±30* (129)</td>
<td>146±24 (4)</td>
<td>181±31 (6)</td>
</tr>
<tr>
<td></td>
<td>Cord</td>
<td>180±36* (129)</td>
<td>157±23 (4)</td>
<td>172±39 (6)</td>
</tr>
<tr>
<td>Total</td>
<td>Maternal</td>
<td>171±29 (229)</td>
<td>166±31 (10)</td>
<td>170±28 (14)</td>
</tr>
<tr>
<td></td>
<td>Cord</td>
<td>175±34 (229)</td>
<td>168±27 (10)</td>
<td>173±32 (14)</td>
</tr>
</tbody>
</table>

Significant differences between primipara and multipara at \( p<0.05 \) (a) and \( p<0.01 \) (b), respectively.

Table 2  Correlation coefficients between maternal and cord blood Se concentrations.

<table>
<thead>
<tr>
<th>Parity</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primipara</td>
<td>0.502**</td>
<td>0.733</td>
<td>0.667</td>
</tr>
<tr>
<td>Multipara</td>
<td>0.799**</td>
<td>0.999*</td>
<td>0.982*</td>
</tr>
<tr>
<td>Total</td>
<td>0.703**</td>
<td>0.833*</td>
<td>0.800*</td>
</tr>
</tbody>
</table>

Significant correlations at \( p<0.01 \) (•) and \( p<0.001 \) (••), respectively.

Table 3  Correlation coefficients between maternal and cord blood Se concentrations by parity and abortion experience.

<table>
<thead>
<tr>
<th>Abortion experience</th>
<th>Parity</th>
<th>1</th>
<th>2</th>
<th>3 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>(N)</td>
<td>r</td>
<td>(N)</td>
</tr>
<tr>
<td>-</td>
<td>0.622**</td>
<td>(64)</td>
<td>0.762**</td>
<td>(69)</td>
</tr>
<tr>
<td>+</td>
<td>0.246</td>
<td>(36)</td>
<td>0.752**</td>
<td>(35)</td>
</tr>
<tr>
<td>Total</td>
<td>0.502**</td>
<td>(100)</td>
<td>0.755**</td>
<td>(104)</td>
</tr>
</tbody>
</table>

Significant correlations at \( p<0.01 \) (•) and \( p<0.001 \) (••), respectively.
DISCUSSION

As far as we know, this is the first report on the Se concentrations in Japanese maternal and cord blood, and probably the first report in the world concerning the effects of parity and abortion on the mother-child correlations in blood Se levels at birth.

The blood Se levels of our subjects were about ten times as high as those of Keshan Disease patients (17±2 ng/ml)\(^9\). However, it is difficult to say that our subjects are far from the risk of Se deficiency, since blood Se levels are known to decrease during the first month after birth\(^6,5\).

As shown in Table 1, there was no significant difference in cord blood Se levels between term and preterm birth. Similar results to ours were also reported by Hågå and Lunde\(^10\) in Norway. No significant difference in the Se levels between maternal and cord blood was observed in New Zealand\(^11\), either.

Perona et al.\(^12\) reported a significant correlation of GSH-PX activity in erythrocytes between mothers and their infants (r=0.67, n=38). Furthermore, Rudolph and Wong\(^13\) observed a highly significant correlation between erythrocyte Se levels and erythrocyte GSH-PX activity in paired maternal and cord blood samples. Thus, the significant mother-child correlations in blood Se concentrations of our subjects likely reflected a close correlation in the Se levels of erythrocytes between mothers and their newborns, although Se concentrations in erythrocytes were not known because neither hematocrit nor red blood cell counts were determined in this study.

As shown in Table 2 and 3, parity and abortion had apparently significant effects on the correlations between maternal and cord blood Se concentrations. The causative factors are presently unknown. However, Se is mainly taken from foods. Thus, further studies are necessary from viewpoints of dietary habits, occupations both of mothers and their husbands, intake of heavy metals and so on. Especially, heavy metals such as mercury and cadmium seem to be very important factors since Se has been known to counteract those heavy metals in animals\(^14\) and those heavy metals have been also reported to show close correlations in blood levels between mothers and their newborns\(^15\).

SUMMARY

Selenium (Se) concentrations in 253 paired samples of maternal and cord blood were determined to investigate the mother-child correlations in the blood Se levels at birth with regard to birth weight, gestational age, parity and abortion (spontaneous and/or artificial) experience. The results are as follows.

1) No significant difference was observed in the Se levels between maternal and cord blood samples regardless of birth weight or gestational age.
2) The mother-child correlations in blood Se concentrations were positive and significantly higher in multipara than those in primipara regardless of birth weight or gestational age.
3) Abortion experience significantly decreased the mother-child correlations in primipara but not in multipara.

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出産時における血中セレン濃度の母子相関性

福井医科大学環境保健学教室
出 口 洋 二・緒 方 昭

出産時における血中セレン（Se）濃度の母子相関性が、出生時体重・妊娠週数・出産歴・流産中絶経験によってどのように異なるか検討するために、253組の母体血と子帯帯血のSe濃度を測定し、次の結果を得た。

1) 出生時体重や妊娠週数とは無関係に、母体血と子帯帯血のSe濃度には有意差が認められなかった。
2) 出生時体重や妊娠週数とは無関係に、血中Se濃度は初産の母子相関性を示し、初産よりも経産の方が有意に高かった。
3) 流産中絶経験は、初産において有意に母子相関性を低下させたが、経産においては低下させなかった。

Key words: Selenium, Mother-child correlations, Parity, Abortion experience
セレン，母子相関，出産歴，流産中絶経験

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