The Maternal Serum Cortisol Levels after the Onset of Labor

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KONO, H., FURUHASHI, N., SHINKAWA, O., TAKAHASHI, T., TSUJIEI, M. and YAJIMA, A. The Maternal Serum Cortisol Levels after the Onset of Labor. Tohoku J. exp. Med., 1987, 152 (2), 133-137 —— We measured maternal cortisol levels after the onset of labor. Blood from 82 primiparas and 48 multiparas were collected 124 times and 60 times, respectively. When duration of labor was within 3 hr, there were no differences in cortisol levels between the primiparous (n = 11, 50.4 ± 7.0 μg/100 ml, mean ± s.e.) and multiparous (n = 14, 37.8 ± 4.3 μg/100 ml). However, when duration of labor was from 3 to 6 hr, cortisol levels in the primiparas (n = 20, 59.7 ± 5.1 μg/100 ml) were significantly (p < 0.05) higher than those in the multipiparas (n = 22, 46.8 ± 2.9 μg/100 ml). In cases of duration of labor from 6 to 9, cortisol level of the primiparas (n = 24, 64.3 ± 4.4 μg/100 ml) were also significantly (p < 0.05) higher than those in multipiparas (n = 12, 49.4 ± 4.7 μg/100 ml). When duration of labor was more than 9 hr there was no significant difference in cortisol level between the primiparas and multipiparas. Maternal cortisol level had a significant (p < 0.01) negative correlation (n = 166, r = −0.243, Y = −0.09X + 30.47) with unconjugated estriol level. These data suggest that maternal cortisol levels after the onset of labor are slightly different between the primiparous and multiparous, and that maternal unconjugated estriol levels decrease owing to reduction of the fetio-placental blood circulation accompanied with uterus contraction during labor. ——— duration of labor; cortisol; unconjugated estriol

It was reported that maternal cortisol level gradually increased from beginning of pregnancy to term, and still increased after the onset of labor (Jolivet et al. 1974; Challis et al. 1983). After the onset of labor, it has been indicated that the cortisol level was somewhat related to the duration of labor and that the level reached peak just prior to delivery and decreased rapidly after parturition (Jolivet et al. 1974; Sato 1976). However, it is not still clear that the maternal cortisol level in the case of prolonged labor and in the case of induced labor. In this study, we measured the cortisol level in 184 samples obtained from 88 primiparas and 48 multiparas after the onset of labor, and investigated in those cases and the relationship with serum unconjugated estriol.
MATERIALS AND METHODS

Term pregnant women who have experienced normal pregnancy and have been delivered spontaneously without complication were the experimental population. As the control group within 7 days before the onset of labor, blood of 13 primiparas and 8 multiparas were collected. The beginning of labor was as an initiation of regular labor 6 times an hr. Mean duration of labor was $15 \pm 1$ hr (mean \(\pm\) s.e.) in the primipara and $7.6 \pm 0.8$ hr in the multipara. Blood of term pregnancies were collected from cubital veins (primiparas: 124 samples, multiparas: 60 samples). Serum was kept at $-20^\circ$C until assay. Serum cortisol levels were determined by Spac Cortisol RIA Kit (Daiichi Radioisotope Laboratory, Tokyo), and serum unconjugated levels were determined by free E3 RIA Kit (Amersham Bucking hamshire, England). Statistical analysis was made by Student t-test and liner regression analysis used by a microcomputer (TRS-80, Radio-Shack, Fort Worth, TX, USA).

RESULTS

As shown in Fig. 1, within a week before onset of labor, there was no significant difference in the maternal cortisol level between the primipara \((n = 13, 40.1 \pm 4.2 \mu g/100 \text{ ml}, \text{mean} \pm \text{s.e.})\) and multipara \((n = 18, 38.8 \pm 4.2 \mu g/100 \text{ ml})\). The group less than 3 hr after the onset of labor, cortisol level of the primipara \((n = 11, 50.4 \pm 7.0 \mu g/100 \text{ ml})\) was not significantly different from that of the multipara \((n = 14, 37.6 \pm 4.3 \mu g/100 \text{ ml})\). Both 3 to less than 6 and 6 to less than 9 hr after the onset of labor, cortisol level of the primipara was higher than that of the multipara \((p < 0.05)\). In the primipara as well as in the multipara, the longer duration of labor prolonged, the higher became maternal cortisol level as shown in Fig. 1. We could not any significant difference of cortisol levels

\[ \text{Fig. 1. Maternal serum cortisol level after the onset of labor in the group of induced labor and that of spontaneous labor.} \]

Primipara \(\text{(○—○, induced labor; △—△, spontaneous labor)}\); multipara \(\text{(|—•, induced labor; ▲—▲, spontaneous labor).}\)
Cortisol Levels during Labor

Between the induced labor group and spontaneous group, in the primipara and the multipara, respectively (Fig. 2). In this study, we have measured both cortisol (62.1 ± 1.9 μg/100 ml, mean ± s.e.) unconjugated estriol (24.6 ± 0.8 ng/ml) levels in 166 cases. There was a significant (p < 0.01) negative correlation (r = -0.243, Y = -0.09X + 30.47) between cortisol level and unconjugated level.

**DISCUSSION**

It has been reported that maternal cortisol level increases twice in the first trimester and increases more than 3 times in the third trimester as compared to the nonpregnant cortisol level (Sato 1976). Jolivet et al. (1974) reported that maternal cortisol level was significantly higher in the primipara than in the multipara before onset of labor. Our data showed that there was no significant difference in the maternal cortisol level between the primipara and multipara before onset of labor and 3 hr after onset of labor. In addition, our data showed that maternal cortisol level just prior to onset of labor was the same as the level in pregnancies those labor were planned to induce. Before onset of labor which might give physical stress or emotional stress (annoyance and anxiety) to pregnancies, maternal cortisol level in the primipara is not different from the level in the multipara. In this study, maternal cortisol level has increased gradually as the duration of labor prolonged. It took 15 ± 1.0 hr (mean ± s.e.) in the primipara and 7.6 ± 0.8 hr in the multipara to finish delivery. Nine hr after onset of labor almost all the multipara have finished parturition. In our data from more than 3 hr after onset of labor till less than 9 hr, there was a significant difference in the maternal cortisol level between the primipara and the multipara. Higher cortisol

![Fig. 2. Maternal serum cortisol level after the onset of labor. Data points are means ± s.e. *p < 0.05. Primipara (○--○); multipara (●—●).](image-url)
level of the primipara with long duration of labor than the level of the multipara suggested that primipara have been stressed more than multipara. However, our data indicated that, when duration of labor continued more than 9 hr, maternal cortisol level of the primipara was not different from that of multipara. Induction of labor and the use of oxytocin have been reported not to affect maternal cortisol levels (Tuimala et al. 1975) but Ohrlander et al. (1976) found higher cortisol levels at the beginning of labor in women whose labor was spontaneous compared to those whose labor was induced. We have investigated maternal cortisol level during labor classified by the duration of labor, but there is no difference between the induced labor group and the spontaneous labor group. In both group, when regular labor began, maternal cortisol level seemed to be influenced by the duration of labor. We have already reported the alteration of unconjugated estriol level after the onset of labor (Kono et al. 1985). In this study, our data showed that maternal cortisol level after the onset of labor negatively correlate with unconjugated estriol level as previous reports (Reck et al. 1979; Patrick et al. 1980; Challis et al. 1983). Maltau et al. (1979) have indicated that maternal stress possibly lowers maternal estriol level. And they speculated that maternal stress during labor stimulated hypothalamic-hypophyseal-adrenocortical axis, increased blood cortisol level, and suppressed blood unconjugated estriol level. These data suggested that labor increases maternal cortisol level, suppresses fetal ACTH production, and also suppress estriol production by feto-placental axis.

References