Simultaneous Measurement of Human Prolactin and Growth Hormone Levels in Maternal and Fetal Serum and Amniotic Fluid

Nobuaki Furuhashi, Takao Fukaya, Hideaki Kono, Osamu Shinkawa, Toru Takahashi and Masakuni Suzuki

Department of Obstetrics and Gynecology, Tohoku University School of Medicine, Sendai 980


Growth hormone (GH) and prolactin (PRL) in maternal and fetal serum and amniotic fluid were measured simultaneously by radioimmunoassay at term deliveries of 20 normal mothers. The PRL level of amniotic fluid was significantly higher than that of maternal and fetal serum. The fetal GH level was significantly higher than the maternal and amniotic levels of GH. There was no significant correlation among hormone levels of maternal and fetal sera and amniotic fluid. These data suggest that PRL and GH levels of maternal and fetal sera and amniotic fluid are controlled separately.

It is well known that PRL and GH have similar chemical structures and overlapping biological actions. There were many reports on the measurement of human PRL and GH in amniotic fluid (Genetet et al. 1970; Tyson et al. 1972; Ben-David et al. 1973; Fang and Kim 1975; Schenker et al. 1975; Biswas 1976; Chochinov et al. 1976; Clements et al. 1977; Ratnam et al. 1977). On the other hand, the exact physiological role of human amniotic PRL and GH, and the interrelationship between PRL and GH in maternal and fetal serum and amniotic fluid are still unclear. Therefore, in order to study these relationships, maternal, fetal and amniotic PRL and GH were measured simultaneously in normal term deliveries.

Materials and Methods

Subjects. The study was carried out on a total of 20 normal mothers and their fetuses consisting of 10 males and 10 females in the 38th to 42nd gestational weeks. Mean birth weight was 3,356 g. Simultaneous maternal and umbilical cord blood samples were obtained at normal vaginal delivery. Amniotic fluid was aspirated and collected by a syringe just before the membrane rupture, then centrifuged at 2,300 rpm for 10 min and supernatant was stored at -20°C until assay.

Radioimmunoassay. PRL and GH levels of sera and amniotic fluid were determined by double-antibody radioimmunoassay methods reported previously (Furuhashi et al. 1980). The coefficients of variation of these methods were less than 15%.

Received for publication, March 14, 1983.
Statistical analysis. Data were subjected to the Student's t-test for significance of difference. Correlation coefficients and analysis of variance and covariance were calculated by a microcomputer TRS-80 (Radio Shack, Fortworth, Texas, USA).

RESULTS

The mean (±S.E.) levels of PRL and GH of the maternal and fetal sera and the amniotic fluid are shown in Table 1. In amniotic fluid, the PRL level was 1,087±146.5 ng/ml, significantly higher (p<0.001) than that of the maternal serum (251.8±34.8 ng/ml) and the fetal serum (367.7±30.4 ng/ml). The fetal PRL level was significantly higher (p<0.02) than the maternal PRL level. The fetal GH level was 14.32±1.84 ng/ml, significantly higher than that of the maternal serum (4.04±0.49 ng/ml) and the amniotic fluid (1.78±0.38 ng/ml). The maternal GH level was significantly higher (p<0.001) than that of the amniotic fluid. There was no significant correlation among hormone levels of maternal and fetal sera and amniotic fluid. Neither was there any significant correlation between PRL and GH levels.

DISCUSSION

It is well known that PRL and GH have similar chemical structures and overlapping biological actions. Primates are unique among vertebrates in having growth hormones that are intrinsically lactogenic in action (Schindler 1982). So, PRL and GH are called 'lactogenic hormones'. A number of studies have been done for the measurement and characterization of PRL and GH in amniotic fluid (Genetet et al. 1970; Tyson et al. 1972; Ben-David et al. 1973; Fang and Kim 1975; Schenker et al. 1975; Biswas 1976; Chochinov et al. 1976; Clements et al. 1977; Rathonam et al. 1977). On the other hand, there were a few reports investigating the correlation between PRL and GH in maternal and fetal sera and amniotic fluid (Tyson et al. 1972; Chochinov et al. 1976). In our study, we have investigated the interrelationship between PRL and GH in maternal and fetal serum and amniotic fluid.

It has been realized that the level of PRL was far greater in amniotic fluid than in maternal and fetal blood (Tyson et al. 1972; Fang and Kim 1975; Schenker et al. 1975; Biswas 1976; Chochinov et al. 1976; Clements et al. 1977; Rathonam et al. 1977). On the other hand, there were a few reports investigating the correlation between PRL and GH in maternal and fetal sera and amniotic fluid (Tyson et al. 1972; Chochinov et al. 1976). In our study, we have investigated the interrelationship between PRL and GH in maternal and fetal serum and amniotic fluid.

It has been realized that the level of PRL was far greater in amniotic fluid than in maternal and fetal blood (Tyson et al. 1972; Fang and Kim 1975; Schenker et al. 1975; Biswas 1976; Chochinov et al. 1976; Clements et al. 1977; Rathonam et al. 1977). On the other hand, there were a few reports investigating the correlation between PRL and GH in maternal and fetal sera and amniotic fluid (Tyson et al. 1972; Chochinov et al. 1976). In our study, we have investigated the interrelationship between PRL and GH in maternal and fetal serum and amniotic fluid.

It has been realized that the level of PRL was far greater in amniotic fluid than in maternal and fetal blood (Tyson et al. 1972; Fang and Kim 1975; Schenker et al. 1975; Biswas 1976; Chochinov et al. 1976; Clements et al. 1977; Rathonam et al. 1977). On the other hand, there were a few reports investigating the correlation between PRL and GH in maternal and fetal sera and amniotic fluid (Tyson et al. 1972; Chochinov et al. 1976). In our study, we have investigated the interrelationship between PRL and GH in maternal and fetal serum and amniotic fluid.
We confirmed these results reported by others. There was no significant correlation between the PRL levels of amniotic fluid and fetal or maternal sera as reported previously (Tyson et al. 1972; Fang and Kim 1975; Schenker et al. 1975; Biswas 1976; Clements et al. 1977). Amniotic fluid PRL is considered to have osmoregulatory effects on amniotic fluid volume (Josimovich 1977; Leontic and Tyson 1977; Leontic et al. 1979). The origin of amniotic fluid PRL is not well known. Amniotic fluid contains a variety of PRL isohormones (Ben-David and Chrambach 1974; Rogol and Chrambach 1975), which differ heterogeneically from maternal PRL to a greater degree than they do from fetal PRL (Fang and Kim 1975). The conflicting evidence exists in favor of a fetal (Fang and Kim 1975; Clements et al. 1977), maternal (Josimovich et al. 1974; Schenker et al. 1975), and decidual (Riddick and Daly 1982) source.

There were only a few observations on the amniotic fluid GH level (Genetet et al. 1970; Tyson et al. 1972; Chochinov et al. 1976), and the results indicated that at term the GH level in amniotic fluid was lower than in maternal and fetal blood. We confirmed these results. Also, we found that the fetal GH level was higher than maternal and amniotic fluid GH levels. There was no significant correlation between the amniotic fluid GH level and that in the fetal or the maternal compartment. On the other hand, Kaplan et al. (1972) suggested that the progressive rise of the amniotic fluid GH to term was correlated well with increased pituitary content and fetal serum GH level and contrasted with the lack of change in maternal serum GH throughout gestation. The reason of this discrepancy is still unclear. It is most likely that the source of GH in amniotic fluid is fetal rather than of maternal origin (Schindler 1982). On the other hand, the physiological role of the fetal GH and the amniotic GH is not exactly known. In anencephalus, even though the fetal GH level was lower than the normal fetus due to the absence of the hypothalamus, the fetal growth of anencephalus was not so retarded. So, we have speculated that the fetal GH was not essential for fetal growth (Furuhashi et al. 1980). Chochinov et al. (1976) reported that there was a significant correlation between GH and PRL in amniotic fluid. In this study, we could not find any significant correlation between PRL level and GH level in maternal and fetal serum or in amniotic fluid. PRL from amniotic fluid and serum was found to be a single biologically and immunologically active protein hormone distinct from GH on the basis of its free mobility and net change. It may be possible to speculate that human GH and human PRL have individual endocrinological control mechanisms during pregnancy.

Acknowledgment

We would like to thank Miss M. Okudera for typing this manuscript.
References


