Plasma 17OH-progesterone concentrations in newborn infants

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Summary Plasma concentrations of 17OH-progesterone were determined in 60 normal newborn infants aged between 3 and 36 hours. Mean levels decreased rapidly during this time after removal of the placental contribution of this steroid. A further 70 normal infants, studied between ages 2 and 7 days, showed a mean plasma 17OH-progesterone concentration of 3.5 nmol/l (1.2 ng/ml). By comparison, plasma concentrations in untreated infants with congenital adrenal hyperplasia were markedly raised. At 36 hours of age, there was an obvious difference between plasma levels of this steroid in normal and affected infants. Determination of plasma 17OH-progesterone concentrations are valuable in the evaluation of disorders of sexual differentiation and electrolyte balance in newborn infants, provided due care is given to the timing of sample collections.

Patients and methods

Mixed cord blood samples were obtained from 19 babies (10 boys and 9 girls) immediately after cord clamping. Their gestational ages ranged from 37 to 41 weeks. Capillary blood was collected by heel prick from 60 infants who were products of uneventful term pregnancies. There were 32 boys and 28 girls, whose postnatal ages ranged from 3 to 36 hours at the time of sample collection. Maternal consent for the study was obtained in each case. Plasma samples collected from 70 infants up to 7 days’ postnatal age and sent to this laboratory were also available for analysis. Several infants with CAH due to C-21 hydroxylase deficiency were studied during the first week of life before starting steroid replacement therapy. Their plasma 17OH-progesterone concentrations were compared with those determined in normal infants.

Plasma 17OH-progesterone was measured by radioimmunoassay (RIA) using an antiserum kindly donated by Dr D. L. Loriaux, NIH, Bethesda. The sensitivity of the assay was 4 pg/tube using 200 μl plasma. Apart from 11-deoxycortisol (3.3%) and 21-deoxycortisol (1.6%), the cross-reactivity of the 17OH-progesterone antiserum with numerous other steroids, including progesterone, was less than 0.1%. The intra-assay coefficient of variation was ± 6.3%; the inter-assay coefficient of variation was ± 7.5% (high pool) and 11.9% (low pool). All RIA data processing was performed using the method of...
Rodbard and Hutt (1974) and quality controlled by the method of Kemp et al. (1978). The mathematical relationship between plasma concentration (Y) and the age of the newborn infant (t) was reasonably described by a power function of the form $Y = At^b$ within the time-span of sampling. The index of determination was 0.72 and values of A and B determined by least squares analysis of data contained in Fig. 1, using a linear transformation of this equation, were 151 and −0.906 respectively.

**Results**

Mean values for plasma 17β-progesterone concentrations in mixed cord blood were $203 \pm 37.8$ SD nmol/l (69 ± 12.9 ng/ml) for boys and $184 \pm 34.5$ SD nmol/l (62.6 ± 11.7 ng/ml) for girls. There was no significant sex difference. The individual plasma 17β-progesterone concentrations for 60 newborn infants in relation to postnatal age are shown in Fig. 1. The line represents the mean plasma 17β-progesterone concentration for the whole group of infants, there being no significant difference between mean concentrations in boys and girls. The mean plasma 17β-progesterone concentration fell rapidly after birth, from 45 nmol/l (16 ng/ml) at 12 hours, to 8.5 nmol/l (2.9 ng/ml) at 24 hours, and 6 nmol/l (2 ng/ml) by 36 hours of age. This represents a 32-fold decrease from the mean cord plasma 17β-progesterone concentration. The pattern of plasma 17β-progesterone concentrations in normal infants during the first week of life is shown in Fig. 2. Mean levels reached a nadir of about 3.5 nmol/l (1.2 ng/ml) by 7 days of age. This contrasts with plasma 17β-progesterone concentrations in untreated CAH infants during the first 7 days of life. At 12 hours' postnatal age, there was a wide difference between plasma 17β-progesterone concentrations in normal and CAH infants. By the 2nd day there was a 40-fold

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**Fig. 1** Plasma 17β-progesterone concentrations in normal infants during the first 36 hours of life. The line represents the mean plasma concentration of this steroid in baby boys and girls.

*Conversion*: SI to traditional units—17β-progesterone: $1$ nmol/l = 0.31 ng/ml.

**Fig. 2** Plasma 17β-progesterone concentrations in normal and CAH infants during the first 7 days of life. The line represents the mean and the shaded area encompasses the range of plasma concentrations in normal babies. Also shown are individual plasma 17β-progesterone concentrations determined in untreated CAH infants. □ represents a value of 2430 nmol/l (826 ng/ml).
difference in mean plasma 17OH-progesterone concentrations.

Discussion

This study confirms previous reports of a raised cord plasma 17OH-progesterone concentration reflecting placental production of this steroid (Jenner et al., 1970; Lippe et al., 1974; Winter et al., 1976). There are two recent studies which give data on plasma 17OH-progesterone concentrations during the first 24 hours of life of newborn infants (Forest and Cathiard, 1978; Sippell et al., 1978). Both report the rapid fall in plasma levels within hours of birth, reaching a nadir by about 5 to 7 days of age. The results now reported confirm and extend this observation in a larger group of infants also studied during the first week of life. As measurement of plasma 17OH-progesterone is so valuable in the early diagnosis of CAH, a comparison was made between results of plasma 17OH-progesterone determinations in normal and CAH infants. The data clearly show that, by 36 hours' postnatal age, there is a pronounced difference between the two groups.

Congenital adrenal hyperplasia is the most common cause of ambiguous genitalia of the newborn (Hughes, 1977). In many instances, plasma 17OH-progesterone measurements will also aid in the assessment of other conditions. In addition, some infants who are stressed—for example, due to infection—have concentrations of plasma 17OH-progesterone up to 30 nmol/l (10 ng/ml) at 5 to 7 days of age. However, plasma 17OH-progesterone concentrations exceed 200 nmol/l (68 ng/ml) in untreated CAH infants of this age.

Therefore, determination of plasma 17OH-progesterone concentrations in the neonatal period can be extremely useful for the differential diagnosis of ambiguous genitalia, electrolyte disturbances, or for the investigation of baby boys with a positive family history for CAH (Hughes and Winter, 1977). It is recommended that plasma samples should be collected after 24 hours' postnatal age in order to eliminate the placental influence on plasma 17OH-progesterone levels. The exact age of the infants, in hours, at the time samples are collected should be known.

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References


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