

## CLINICAL NOTE

# SERUM 17 $\alpha$ -HYDROXYPROGESTERONE, $^4\Delta$ -ANDROSTENEDIONE AND CORTISOL LEVELS IN HEALTHY FULL-TERM NEONATES

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### Abstract

**Background-**Measurement of adrenocortical steroids at birth is of paramount importance especially for early diagnosis and treatment of some grave diseases including congenital adrenal hyperplasia and adrenocortical insufficiency.

**Objective-** To determine the serum levels of 17 $\alpha$ -hydroxyprogesterone (17 $\alpha$ -OHP),  $^4\Delta$ -androstenedione and cortisol in normal full-term neonates.

**Methods-**The level of the above-mentioned corticosteroids were measured at the time of delivery, and 12 and 24 hours after birth in 15 healthy neonates by use of specific radioimmunoassays (RIA).

**Results-**The present study indicated that there are no significant differences between the adrenocortical steroid levels of the two sexes. The level of each corticosteroid declined in the first 24 hours of life.

**Conclusion-**The mean and standard deviation of the above-mentioned corticosteroids are higher (but not statistically significant) in comparison to studies conducted in different geographical areas, perhaps due to difference in race, consanguinity and high frequency of congenital adrenal hyperplasia in Iran.

**Keywords** • Newborn • 17  $\alpha$ -hydroxyprogesterone • adrenal hormones

### Introduction

Serum corticosteroid levels are of major physiological importance in the immediate postnatal period and they may be used to assess the adrenocortical involvement in various maladaptation syndromes occurring in the neonatal period like congenital adrenal hyperplasia (CAH).<sup>1,2</sup>

Based on recent studies, it is preferable that each geographical area uses its own normal data. Delayed diagnosis and treatment causes death of afflicted neonates in their first few days of life although it could be prevented easily. It seems that genetic and racial differences will cause differences between normal levels of these corticosteroids, perhaps due to consanguinity and high frequency of congenital adrenal hyperplasia.

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For the evaluation of physiological adrenocortical disorders in neonates, exact serum or plasma corticosteroids levels must be measured.<sup>3</sup> As far as we know, in Iran, the serum 17 $\alpha$ -hydroxyprogesterone (17 $\alpha$ -OHP),  $^4\Delta$ -androstenedione and cortisol levels have not been measured simultaneously in the first few hours of life. We measured these corticosteroids systematically in normal full-term neonates at the time of birth, and 12h and 24h after birth, and compared the results with those of other studies.

### Materials and Methods

A total of 15 randomly selected, healthy mothers were investigated at the time of spontaneous vaginal delivery after an uncomplicated pregnancy. They were physically normal and history of hirsutism did not exist. The hospital's Ethical Committee obtained informed

**Table 1.** Clinical data of mothers and neonates.

Characteristic	Finding
Maternal age (year)	26.5±6 (year)
Time of birth	10: 18 AM±1: 25
Male: female	9: 6
Gestational age (days)	279±7.6
Birth weight (g)	3504±454
APGAR score	9/10

consent from all mothers after approval of the study. Maternal age, fetal sex, gestational age and other pertinent clinical data are listed in Table 1.

Umbilical venous blood was obtained by needle aspiration at delivery, immediately after dissection of the umbilical cord with the placenta still *in situ*. Neonatal blood samples (2 mL), were collected by using the scalp vein needles from peripheral vein at 12 h and 24 h after birth. All neonatal blood samples were taken by an experienced neonatologist to avoid any significant stress to the neonate.

Blood samples were immediately centrifuged and the serum fraction was stored at -20° C until assay. Each specimen was tested in duplicate. The direct RIA assays were performed on serum samples as described by the manufacturers using the <sup>125</sup>I-17α-hydroxy-progesterone and <sup>125</sup>I-androstenedione RIA kits from Diagnostic System Laboratories (Webster, TX), and <sup>125</sup>I-cortisol RIA kit from INCSTAR Corporation (Stillwater, Minnesota, USA).

Differences between the groups were analyzed by student's *t-test*. In this study, results are given as mean, standard deviation (SD) and standard error (SE) for each age group.

**Table 2.** Serum levels of corticosteroids at different intervals after birth.

Corticosteroids	Umbilical vein	After 12 hours	After 24 hours
17-OHP (ng/mL)	92.4±25	13.1±2.6	9.3±3.0
Androstenedione (ng/mL)	4.5±1.9	4.4±1.2	2.9±1.0
Cortisol (ng/mL)	148±91	72±49	37±14

## Results

Serum corticosteroid levels were higher in the umbilical cord vein than in the peripheral venous serum at 12 h after birth, and the peripheral venous serum corticosteroid levels at 12 h were higher than 24 h after birth. Therefore, during the first 24 h after birth, the levels of these corticosteroids were decreasing (Table 2).

According to the neonatal sex, these corticosteroid levels were not significantly different.

Mean plasma levels of 17α-OHP and cortisol were compared with similar studies. We were unable to find data about <sup>4</sup>Δ-androstenedione in neonates in medical literature to compare with our findings. Surprisingly, the level of these corticosteroids was higher than other studies.

## Discussion

Although the normal levels of these corticosteroids in the present study is much higher than other studies (Table 3), much more work and data on adrenal hormones in the neonatal period is necessary in order to come to a reliable result.

Also, we recommend that these hormones be studied on a larger scale in different ethnic groups,

**Table 3.** Comparison of the results of the present study with other studies conducted in different centers.

Study	17α-OHP (ng/mL)		<sup>4</sup> Δ-Androstenedione (ng/mL)		Cortisol (ng/mL)	
	Male	Female	Male	Female	Male	Female
Present study	88.5±2.6	98.3±24.4	4.1±2.8	5.1±2.7	17.5±2.8	10.7±4.9
Wudy <sup>4</sup>	5.2±2.6	5±3.8	8.18±1.2	7.6±3.4	-----	-----
Lippe <sup>5</sup>	26.7±4.1		-----	-----	-----	-----
Forest and Cathiard <sup>6</sup>	18.6±9.9	30.4±13.5	-----	-----	-----	-----
Hughes <sup>7</sup>	67±12.4	60.8±11.4	-----	-----	-----	-----

## Three Different Corticosteroid Levels in Healthy Full-term Neonates

geographical regions and at various time intervals after birth.

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### References

- 1 Pang S, Murphey W, Levine LS, et al. A pilot newborn screening for congenital adrenal hyperplasia in Alaska. *J Clin Endocrinol Metab.* 1982; **55**: 413-20.
- 2 Miller WL, Levine LS. Molecular and clinical advances in congenital adrenal hyperplasia. *J Pediatr.* 1987; **111**: 1-17.
- 3 Sippell WG, Becker H, Versmold HT, Bidlingmaier F, Knorr D. Longitudinal studies of plasma aldosterone, corticosterone, deoxycorticosterone, progesterone,  $17\alpha$ -hydroxyprogesterone, cortisol and cortisone determined simultaneously in mother and child at birth and during the early neonatal period. Spontaneous delivery. *J Clin Endocrinol Metab.* 1978; **46**: 971-85.
- 4 Wudy SA, Wachter UA, Homoki J, Teller WM.  $17\alpha$ -hydroxyprogesterone,  $4\Delta$ -androstenedione and testosterone profiled by routine stable isotope dilution/gas chromatography mass spectrometry in plasma of children. *Pediatr Res.* 1995; **38**: 76-80.
- 5 Lippe BM, La Franchi SH, Lavin N, Parlow A, Coyotupa J, Kaplan SA. Serum  $17\alpha$ -hydroxyprogesterone, progesterone, estradiol and testosterone in the diagnosis and management of congenital adrenal hyperplasia. *J Pediatr.* 1974; **85**: 782-7.
- 6 Forest MG, Cathiard AM. Ontogenic study of plasma  $17\alpha$ -hydroxyprogesterone in human. Postnatal period: evidence for a transient ovarian activity in infancy. *Pediatr Res.* 1978; **12**: 6-11.
- 7 Hughes IA, Riad-Fahmy D, Griffiths K. Plasma  $17\text{OH}$ -progesterone concentrations in newborn infants. *Arch Dis Child.* 1979; **54**: 347-9.