CLINICAL STUDY

Serum concentrations of LH and FSH in the healthy newborn

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Abstract

Objective: A sex difference in fetal and neonatal pituitary–gonadal function has been well documented. The aim of the following study was to determine sex differences and patterns of basal LH/FSH in the neonatal period.

Design: Peripheral venous blood was obtained from 164 healthy full term newborns (91 males, 73 females) for clinically indicated laboratory examinations.

Results: In male newborns, LH values were initially low (days 1–5), increased between days 6 and 10, and reached maximum levels between days 16 and 20. Levels of FSH were initially low (days 1–5), increased between days 6 and 10 and reached maximum levels between days 11 and 15. In female newborns, LH levels were generally lower than in newborn boys; levels were initially low, then increased between days 11 and 15 and reached maximum levels at the end of the newborn period. FSH values were generally higher than in newborn boys; there were initially low values with a first peak between days 11 and 15 and a second peak between days 21 and 28.

Conclusions: LH values in male newborns were higher and exceeded values in female newborns, whereas FSH values in female newborns exceeded male newborn values. Male newborns do not exhibit any peaks of LH and FSH activity, whereas female newborns exhibit two FSH peaks during this period.

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Introduction

Normal function of the hypothalamic–pituitary–gonadal axis is crucial for mammalian reproduction. Experimental evidence obtained in several species suggests that this axis is functional during fetal and neonatal life (1, 2). Cross-sectional studies of plasma gonadotrophin and sex steroid concentrations in human fetuses and newborns have lent support to this concept in humans (2, 3). However, there are at present few data on the dynamics of pituitary gonadotrophin secretion in humans before the age of 6 weeks (4). On the other hand, a sex difference in fetal pituitary–gonadal function has been well documented (2, 5–7). It has been reported that transient activation of the pituitary–gonadal axis occurs, and sex differences in circulating gonadotrophin levels are present during the first few months of life and that there is a significant difference between term and preterm infants (8, 9). The aim of our study was to determine sex differences and patterns of basal luteinizing hormone (LH) and follicle-stimulating hormone (FSH) in the first 28 days of life.

Design

From 164 healthy, full term neonates (91 males and 73 females), LH and FSH levels from day 1 to day 28 of life

were determined. The newborns did not suffer severe distress. Blood was sampled for hemoglobin, bilirubin, glucose and other determinations as clinically indicated. The remainder of the blood was then used for LH and FSH determinations. It was confirmed in retrospect that the blood sampled was from healthy newborns. Blood was sampled from each neonate only once.

Methods

Peripheral venous blood was collected by venipuncture for clinically indicated analysis between 0800 and 1000 h. Serum FSH and LH concentrations were assayed using a standard RIA method (Serono MAIA clone, Freiburg, Germany). In our laboratory the intra-assay coefficient of variation for LH was 4.5% and 5.4% for FSH. The cross-reactivity of the LH assay was 3% for human chorionic gonadotrophin. The minimum detectable levels of LH and FSH were 0.15 mIU/ml and 0.3 mIU/ml respectively. The sensitivity of the assay, i.e. the detection limit, was defined as the concentration of the LH or FSH equivalent to the mean c.p.m. of the zero standard plus 2 s.d., or roughly double the c.p.m. of the zero standard. The Mann–Whitney test was applied for comparison of LH and FSH values between columns

Table 1 Pooled LH and FSH values (means $\pm$ s.d.) from male newborns.

Age (days)	n	LH	FSH
1–5	30	0.39 $\pm$ 0.48, median 0.20	0.96 $\pm$ 0.60, median 0.85
6–10	15	2.31 $\pm$ 2.29, median 1.50	2.91 $\pm$ 4.38, median 1.40
11–15	17	3.55 $\pm$ 2.84, median 2.90	3.71 $\pm$ 2.69, median 3.00
16–20	14	4.13 $\pm$ 2.76, median 3.65	2.63 $\pm$ 1.45, median 2.15
21–25	7	2.86 $\pm$ 1.51, median 2.70	2.50 $\pm$ 1.51, median 2.10
26–28	8	2.22 $\pm$ 2.37, median 1.40	2.25 $\pm$ 0.81, median 2.40

Table 2 Pooled LH and FSH values (means $\pm$ s.d.) from female newborns.

Age (days)	n	LH	FSH
1–5	31	0.48 $\pm$ 0.66, median 0.20	2.00 $\pm$ 1.37, median 1.80
6–10	17	0.45 $\pm$ 0.33, median 0.30	2.44 $\pm$ 2.52, median 1.40
11–15	8	1.58 $\pm$ 1.28, median 1.60	8.16 $\pm$ 4.27, median 8.95
16–20	6	1.03 $\pm$ 1.39, median 0.35	1.62 $\pm$ 1.05, median 1.90
21–25	3	0.46 $\pm$ 0.25, median 0.50	7.07 $\pm$ 5.92, median 3.90
26–28	8	2.75 $\pm$ 2.39, median 2.80	9.74 $\pm$ 9.89, median 6.15

and for comparison of gonadotrophins between newborn males and females.

Results

Blood was collected from 164 healthy newborns (91 male and 73 female newborns) for the determination of LH and FSH values. Pooled data (mean $\pm$ s.d. and median) from newborn males and females are shown in Tables 1 and 2. Differences in LH values between males and females (measured between days 16 and 20 and 21 and 25) were statistically significant, with male values clearly exceeding female values. However, FSH concentrations were significantly higher in females on days 1–5, 11–15 and 26–28 (Table 3).

In male newborns LH values exceeded FSH values whereas in female newborns FSH values were always greater. In male newborns LH values were higher, and FSH values lower, than in female newborns. The number of peaks for FSH during the neonatal period is higher in females than in males.

Table 3 Mann–Whitney test for comparison of pooled male and female LH and FSH values.

Age (days)	LH	FSH
1–5	p 0.4086 (ns)	0.0011
6–10	p 0.0910 (ns)	0.9103 (ns)
11–15	p 0.0756 (ns)	0.0183
16–20	p 0.0057	0.3119 (ns)
21–25	p 0.0167	0.0667 (ns)
26–28	p 0.7209 (ns)	0.0047

ns, not significant.

Discussion

Although there are reports on neonatal serum gonadotrophin and sex steroid levels, there are few sequential studies (8). It has been shown that male newborns have higher LH values than female newborns (10). It has also clearly been established that premature newborns have substantially higher neonatal gonadotrophin levels compared with mature newborns (11). Although the changes in LH and FSH concentrations could be coincidental, this is clearly the situation in clinical conditions when blood is sampled at random times. Our results demonstrate a wide inter-individual variation for LH and FSH values in male and female newborns but clearly show that LH values dominate in the male newborn and FSH values dominate in the female newborn. Mean LH values show a stable elevation in both female and male newborns, whereas FSH demonstrates two clear peaks in the females. The sample size was small and there were days when few data were collected, so the results of our study must be interpreted with caution. A large variation in LH and FSH concentration is evident and can be mostly explained by the pulsatility of gonadotrophin secretion at this age and again in adolescence and adulthood (12). Nevertheless, defining the range of the mean values and the trends for neonatal gonadotrophin secretion could be helpful in the evaluation of intersexual states, gonadotrophin deficiency or gonadal dysgenesis.

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