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Diurnal Variation of Plasma Cortisol Levels in Infancy

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ABSTRACT

Normal children and adults show diurnal variation of plasma cortisol levels reaching peak values around 08.00 h and lower values around 24.00 h. Despite numerous studies on diurnal variation of plasma cortisol levels in children, the age of appearance of a circadian rhythm has not been definitely established. The purpose of this study was to investigate the development of cortisol circadian rhythm in infancy. In seventy healthy, full-term infants, less than six months old, plasma cortisol was measured at 10.30 h and 22.30 h. The mean ± SEM values of daytime plasma cortisol at one to four weeks of life were 159 ± 41, 116 ± 43, 240± 54 and 456 ± 95 nmol/l and the night-time values were 129 ± 40, 99 ± 44, 131 ± 78 and 430 ± 105 nmol/l, respectively. No statistically significant differences were found between daytime and night-time cortisol values during the first four weeks of life. In contrast, the daytime values of plasma cortisol were 295 ± 62 at the age of 2-3 months, 211 ± 43 at 4-5 months and 291± 31 nmol/l at 6 months of life, and night-time values were 166 ± 52, 119 ± 35 and 109 ±21 nmol/l, respectively, which were statistically significant ($p < 0.05$). These data clearly indicate that cortisol circadian rhythm starts between the second and third month of life.

KEY WORDS

cortisol, circadian rhythms, diurnal rhythms, infant

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INTRODUCTION

Circadian rhythmicity is one of the prominent features of environmental adaptation in animals and humans /1/. Many biological functions including hormonal secretion /2/ show diurnal variation, which is closely related to the alternation of day and night cycles. The regulation of biological rhythms is dependent both on intrinsic factors, such as the integrity of the suprachiasmatic and paraventricular nuclei of the hypothalamus, as well as extrinsic influences, the most important of which is the alternation of environmental light. It is well known that the activity of the hypothalamic-pituitary-adrenal axis shows a typical circadian variation in animals /3-6/ and man /7-9/. Serum cortisol levels in normal subjects vary during a 24 h period, reaching peak values around 08.00 h and lower values around midnight. The variation of serum cortisol levels follows similar changes in ACTH secretion. Despite the extensive research on diurnal variation of serum cortisol levels, the age of emergence of a diurnal rhythm has not been definitely clarified. The purpose of this study was to determine the time of appearance of cortisol circadian rhythm in infancy.

MATERIALS AND METHODS

Seventy normal, full-term infants, less than six month old, were studied after parental consent and approval by the Hospital's Ethics Committee. Forty of them were less than one month of age and thirty were between one month and six months of age. Ten different infants were studied at each age period. These infants were seen for a routine check-up and their physical examination, body weight, height and head circumference were within normal limits. One ml of blood was drawn from each infant at 10.30 h and 22.30 h. The plasma was immediately separated and frozen at -80°C until analysis.