Failure of Estradiol Benzoate Given after Birth to Prevent
the Adrenal Glands from Shrinking in Newborn Rats

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Synopsis

Two hr after birth, newborn rats were given a subcutaneous injection of 0.01 mg estradiol benzoate dissolved in 0.05 ml sesame oil. Other siblings were given sesame oil alone. Autopsy was performed on days 1, 2 and 3 after birth. Gravimetric and histologic examinations of the adrenals from these animals and from normal litter-mate controls were made together with the determination of plasma corticosterone concentrations. In all the three groups of rats, estrogen-treated, oil-treated and non-treated, the weight of the adrenal glands declined with a concomitant decrease in the plasma corticosterone concentrations. The results indicate that estradiol benzoate, when given after birth, does not prevent the neonatal adrenal from shrinking.

The adrenal glands are reduced in both size and weight for a few days after birth in the rat, a reduction being due to the shrinkage of cortical cells, especially the fascicular cells. (Josimovich et al., 1954; Cohen, 1959; Eguchi and Ariyuki, 1963). This reduction is not absolutely due to the absence of maternal ACTH (see review by Eguchi, 1969), but seemingly due to a blockade of the newborn pituitary by a markedly high level of plasma corticosterone which occurs at and just after delivery (Eguchi et al., 1976). Estradiol benzoate, when given prenatally, prevents both an extreme increase in the concentration of plasma corticosterone at and just after birth and a decline of the weight of neonatal adrenals (Eguchi et al., 1976).

The present work was designed to know whether estradiol benzoate, when given just after birth, can prevent the neonatal decline of the adrenal weight.

Materials and Methods

Rats of the Wistar strain were given a commercial diet (Oriental pellets NMF) and water, both ad libitum. Each of some 2-hr-old rats was given a subcutaneous injection of 0.01 mg estradiol benzoate (Sigma Chem. Co.) dissolved in 0.05 ml sesame oil. Similarly, some siblings were given sesame oil alone. Other non-treated litter-mates served as normal control.

To obtain gravimetric and histologic data, autopsy was performed 1, 2 and 3 days after birth. The animals were killed by decapitation. Both adrenals were weighed on a Sartorius microbalance with a sensitivity of 0.01 mg and fixed in Bouin’s fluid. The specimens were embedded in paraplast (Sherwood), cut serially at 7 μm and stained with hematoxyline and eosin.

To obtain data on plasma corticosterone concentration, blood samples were collected into heparinized tubes. After centrifugation, the concentration of plasma corticosterone was determined by the fluorometric method of Glick et al. (1964).
Results

The weight of the adrenal glands declined in all the three groups day by day regardless of whether the animals were given estrogen or oil 2 hr after birth or nothing (Fig. 1). Histologic appearances of the adrenals in these rats were almost identical, showing shrinkage and vacuolation of the cortical cells. Descending curves of the plasma corticosterone concentrations of the neonatal rats were also almost identical among the three groups (Fig. 2).

Comments

The prevention of the neonatal decline of the adrenal weight and adrenocortical cells by injected estrogen before birth is thought to be a result of a disruption of the corticosteroid-synthesizing system in the fetal adrenal (Eguchi et al., 1976). This disruption is reflected by a depression of histochemical activity of 3β-ol dehydrogenase in the fetal adrenal and by a prevention of increase of plasma corticosterone level at birth (Eguchi et al., 1976). The neonatal decline of the adrenal weight in normal state is presumably a result of the blockade of the newborn pituitary by a high level of plasma corticosterone, as stated in the introduction. Therefore, the observed failure of estradiol benzoate given after birth to prevent the neonatal decline of the adrenal weight would be interpreted in terms of an event after the blockade of the newborn pituitary which was already induced by a high level of plasma corticosterone at birth.

In conclusion, estradiol benzoate is effective before birth (before the rise of plasma corticosterone level), but not effective immediately after birth (after the rise of plasma corticosterone level) in preventing the neonatal adrenal from shrinking.

Fig. 1. The adrenal weight of newborn rats and of those treated with estradiol benzoate and oil 2 hr after birth. Vertical bars indicate SEM, and the number of animals used is in parentheses. Δ, estradiol-treated rats; ○, sesame oil-treated rats; ●, normal control rats.

Fig. 2. The plasma corticosterone concentration of newborn rats given estradiol benzoate or oil 2 hr after birth and of normal controls. Vertical lines show SEM, and the number of animals is in parentheses. Δ, estradiol-treated rats; ○, sesame oil-treated rats; ●, normal control rats.

References