

SPECIAL ARTICLES

THE EFFECT OF HYPOPHYSECTOMY ON ADRENAL MEDULLARY SECRETION IN DOGS

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Von Euler and Luft observed that the administration of ACTH and cortisone produces a decrease in the excretion of norepinephrine (NE) in the urine, while epinephrine (E) remains unchanged.^{1,2} They suggested, therefore, that ACTH and cortisone have an inhibiting effect on the release of NE. Hökfelt studied the content of catechol amines in the adrenal glands after hypophysectomy and found a significant decrease in their NE content, while the E content was normal or only slightly decreased.³

The propose of this study was to investigate the effect of hypophysectomy on adrenal gland catechol amine secretion in dogs.

Materials and Methods

Five dogs, under pentobarbital anesthesia, were hypophysectomized using the parapharyngeal approach. A polyethylene catheter was placed in the right lumbo-adrenal vein and a polyethylene choker was placed around the vein proximal to the gland in such a fashion as to make possible the intermittent collection of adrenal venous effluent. The completeness of the operation was checked by measuring adrenal vein blood corticosteroid levels in all dogs. Six additional dogs without hypophysectomy were subjected to the same procedure as the controls. Hypoglycemia was produced by the intravenous administration of crystalline insulin, one unit per kilogram of body weight. Blood from the cannulated adrenal vein was collected in 15 ml graduated tubes. The plasma was separated by centrifugation and placed under refrigeration at -20 C until analyzed.

Catechol amines in the adrenal vein blood were measured by the Weil-Malherbe method,⁴ as modified successively by Aronow,⁵ and Goldfein, et al.^{6,7}

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Results

Before insulin administration, the mean values of catechol amines in the adrenal vein blood plasma of the control and experimental dogs were 0.0124 micrograms per minute and 0.0292 micrograms per minute, respectively for norepinephrine, and 0.0467 micrograms per minute and 0.0864 micrograms per minute respectively for epinephrine. After insulin administration, the mean highest output of catechol amines in the adrenal vein blood plasma of the control and hypophysectomized dogs was 0.1112 micrograms per minute and 0.5955 micrograms per minute respectively for norepinephrine, and 1.2090 micrograms per minute and 1.8618 micrograms per minute respectively for epinephrine (Table 1).

TABLE 1

<i>Adrenal vein catechol amine output before and after insulin administration, one unit/per Kg B.W.</i>					
<i>No. of dogs</i>		<i>Norepinephrine output microgram/minute per dog</i>		<i>Epinephrine output microgram/minute per dog</i>	
		<i>Basic output</i>	<i>Highest output</i>	<i>Basic output</i>	<i>Highest output</i>
<i>Normal control dogs</i>	1	0.0330	0.2200	0.2220	2.0300
	2	0.0060	0.1700	0.0230	1.6500
	3	0.0110	0.0390	0.0210	1.4150
	4	0.0015	0.0180	0.0023	0.2340
	5	0.0127	0.1436	0.0074	1.8923
	6	0.0106	0.0768	0.0046	0.0312
	<i>Mean values</i>	0.0124	0.1112	0.0467	1.2090
<i>Hypophysectomized dogs</i>	1	0.0263	0.1730	0.1056	1.1960
	2	0.0242	1.0620	0.0336	2.1000
	3	0.0210	0.3430	0.0798	2.2120
	4	0.0340	0.2146	0.1260	2.2450
	5	0.0406	1.1850	0.0874	1.5560
	<i>Mean values</i>	0.0292	0.5955	0.0864	1.8618

Discussion

The hypophysectomized dogs showed a higher output of catechol amines, particularly of norepinephrine, before insulin administration, than the control animals. It was found that the basic output of NE and E was, respectively, about four-fold and two-fold higher in the experimental animals than in the

normal control group. This observation may suggest that the pituitary gland does influence adrenal medullary secretions. During insulin-induced hypoglycemic shock there was a greater increase in both E and NE output in the experimental dogs than in the control animals. Augmentation of NE output was more significant than that of E output; the former being six times greater, the latter about 1.5 times greater in the experimental animals compared to the control animals. These results may support the conclusions of Hökfelt with regard to rats, and von Euler's conclusions regarding human subjects, that the pituitary does influence adrenal medullary action. Other factors, however, such as the markedly increased sensitivity of the experimental animals, particularly to hypoglycemic stress or blood loss during the operation, must be considered. In human subjects, however, the investigator observed no apparent pituitary or adrenocortical control of E and NE secretion.

Summary

Five hypophysectemized dogs and six normal control dogs were subjected to hypoglycemic shock and the catechol amine output of their adrenal vein blood was measured. The experimental dogs showed a higher output of catechol amines, particularly of NE, both before and after insulin-induced hypoglycemia, than did the control animals. These findings may suggest that the pituitary gland has an inhibitory action on adrenal medullary secretion in dogs.

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