

Antidiuretic Effect of Posterior-Pituitary Extract in Completely and Partially Hypophysectomized Rats.*

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That the reabsorption of water by the renal tubules is delayed by the action of the antidiuretic principle of the posterior hypophysis is well recognized. To offset this, a diuretic principle of the anterior hypophysis has been postulated, but there is yet no experimental evidence to substantiate such an assumption.¹ The purpose of the present investigation is to secure some information on the mechanism of action of the hypophysis in influencing the renal function and the water metabolism of the body.

Material and Method. Male albino rats of the same stock, weighing between 120 and 200 g, were employed. The technic of hypophysectomy was by a para-pharyngeal approach, in the main, similar to that described in Burn's textbook.² Evipal given intraperitoneally one mg per 10 g of body weight was used as the anesthetic agent. Within one to 2 minutes after the administration of evipal, the animal undergoes surgical anesthesia, which lasts from 20 to 30 minutes. The evipal solution should be freshly prepared since its potency diminishes on long standing.

For removal of the posterior hypophysis, the thin portion of the anterior lobe over the posterior lobe was incised with a fine dental hook; the posterior lobe was then pulled out gradually with the tip of a capillary tube connected to a suction pump.

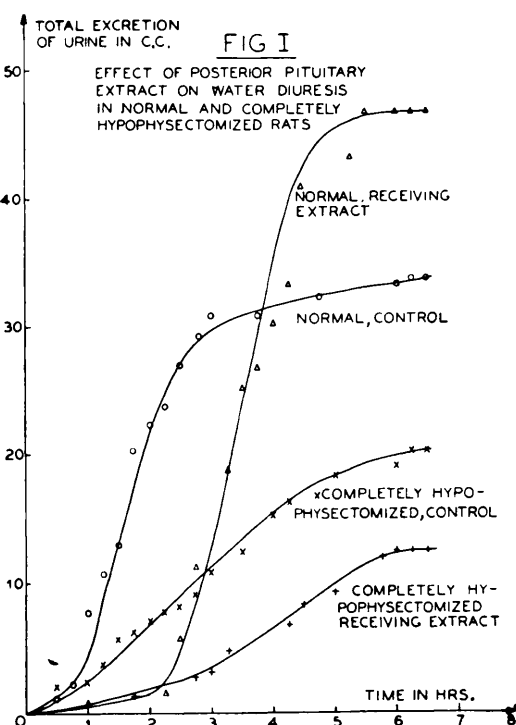
The anterior lobe was removed by suction in 2 halves after it had been divided in the middle portion and detached from the posterior lobe of the hypophysis.

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¹ Richter, C. P., *Am. J. Physiol.*, 1934, **110**, 439.

² Burn, J. H., *Biological Standardization*, Oxford University Press, 1937.

At autopsy, the posterior hypophysis of rats after removal of the anterior hypophysis was found to be enlarged and soft in consistency. No gross changes of the anterior hypophysis could be detected in animals after removal of the posterior hypophysis.

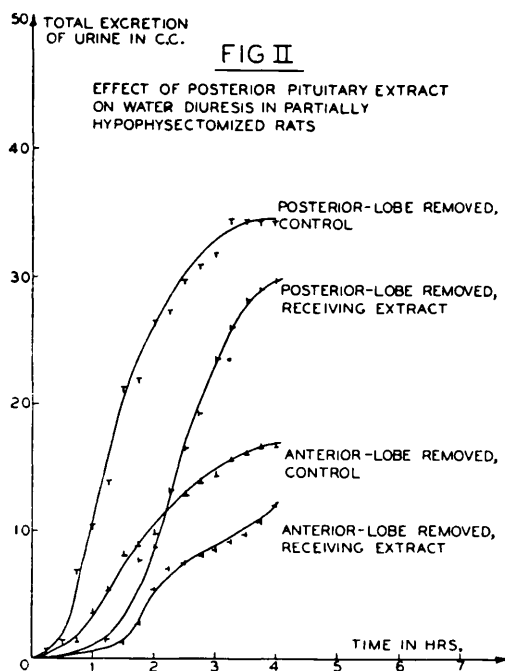


The posterior-pituitary extract was prepared according to the directions given in U.S.P. XI.

For the estimation of antidiuretic potency of the posterior pituitary extract, the procedure described in Burn's textbook was used.

Results and Discussion. The curves in Fig. 1 represent the complete data of one of 6 experiments using 24 normal and 24 completely hypophysectomized rats (2-8 weeks after operation). The total quantity of urine excretion was plotted as the ordinate and the

time in hours as the abscissa. The graphs indicate that water diuresis in rats is greatly decreased both in rate and in quantity by hypophysectomy. The excretion of urine in hypophysectomized animals is so slow that the time at half maximum excretion for the



4-hour interval is of little significance in the estimation of the antidiuretic potency of the posterior-pituitary principle. In fact, as judged by the standard deviations of the time at half maximum excretion of urine in hypophysectomized rats receiving the posterior-pituitary extract (171 ± 33 min) and that in controls (130 ± 9 min), the antidiuretic effect of the posterior-pituitary principle is hardly indicated in these experiments.

In order to see whether the decrease of efficiency in urine excretion is due to the lack

of the anterior-lobe or the posterior-lobe of the hypophysis, the next series of experiments was conducted in 4 groups of rats as follows: (1) normal, (2) completely hypophysectomized, (3) anterior-lobe removed, and (4) posterior-lobe removed. The data in Fig. I and II indicate that (1) the normal rats and those without the posterior hypophysis and (2) the completely hypophysectomized rats and those without the anterior hypophysis responded in a similar manner both in the rate of excretion and in the quantity of urine excreted.

Experiments were also conducted in these 4 groups of animals using 0.9% saline as the diuretic agent. The posterior-pituitary extract, as observed by others,³ was found to have no antidiuretic effect on saline diuresis in normal rats. The same results were obtained in completely and partially hypophysectomized animals. As in the case of water diuresis, the excretion of urine is slower in completely hypophysectomized rats and those after removal of the anterior hypophysis than in normal rats and those after the removal of the posterior hypophysis.

It remains to be investigated as to how the activity of the anterior hypophysis influences the excretion of water by way of the kidney.

Summary. Water diuresis in rats is greatly decreased both in rate and in quantity by complete hypophysectomy or by removal of the anterior hypophysis. Completely hypophysectomized rats are not suitable for the estimation of the antidiuretic principle of the posterior hypophysis. Rats after removal of the posterior hypophysis respond to the antidiuretic principle of the posterior-pituitary extract similarly as the normal animals.

³ Smith, H. W., *The Physiology of the Kidney*, Oxford University Press, 1937, p. 215.