

Urinary Excretory Rate of Adrenalectomized Rats.

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The excretory rates of 10 normal mature rats were followed for 15 days on the following diet: 0.5% solution of sodium salts (consisting of 7 parts NaCl to 3 parts NaHCO₃) for drinking water; 25 cc. of milk (canned, Carnation) and one-half of a slice of white bread daily; "Fox Chow" kept in the cages at all times as a staple.

After 15 days, bilateral adrenalectomy was performed on 6 of these animals and sham operations on the other 4, these being kept as controls. The diet used has been shown to preserve the lives of adrenalectomized rats for a month or more.^{1, 2, 3} The rats after operation were in good condition, gaining an average of 0.31 gm. per day during the 3 weeks after adrenalectomy.

Each rat's cage rested on supports inside the edge of a 12-inch milk funnel. The urine was collected in a beaker fastened to the base of the funnel. Food was placed in dishes set into the side of the cage as is done in bird cages.

All adrenalectomized rats except one showed on autopsy no macroscopic adrenal tissue. This animal survived in good health for 22 days after withdrawal of the bread and milk and the salt drinking water. When sacrificed, autopsy showed a piece of adrenal tissue 3 mm. in diameter. This rat's excretory rate did not vary from normal.

The remaining 5 adrenalectomized rats were observed for 23 days. Then the sodium solution and the bread and milk were withdrawn from the diet, leaving "Fox Chow", with occasional lettuce and meat scraps as the diet and tap water as the drinking solution. Three of these animals died at 6 days after the change in diet, one at 9 days and one at 10 days.

The urinary excretory rate of normal rats, as measured by our technique, was about 4 cc. per day. After adrenalectomy, if life were preserved by means of the bread and salt diet, the rats developed a considerable diuresis, each rat excreting about 20 cc. per day.

¹ Cleghorn, R. A., Cleghorn, S. M. M., Forster, M. G., and McVicar, G. A., *J. Physiol.*, 1936, **86**, 229.

² Swann, H. G., *Am. J. Physiol., Proc.*, 1936, **113**, 129.

³ Swann, H. G., *Am. J. Physiol.*, in press.

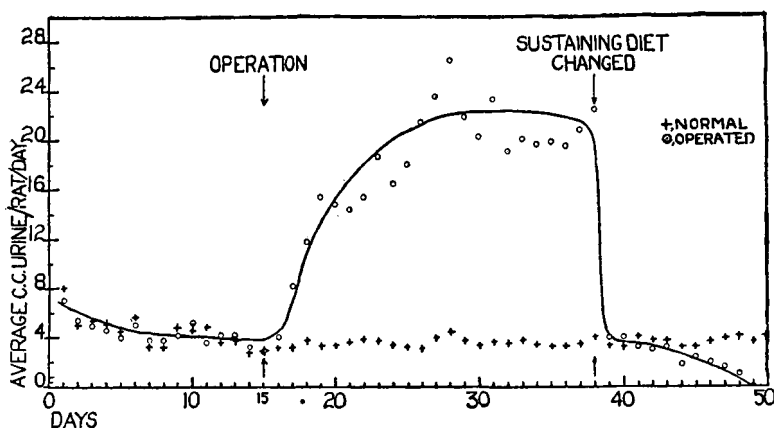


FIG. 1.

Urine excretion rates of normal and adrenalectomized rats on identical diets.

This is approximately 5 times the normal rate. The controls during this period did not vary from the normal excretory rate that had previously been established. When the life sustaining diet was removed from the operated animals, the polyuria disappeared within 24 hours. Subsequently, as death approached, the excretory rate dropped to subnormal. When the unoperated controls were subjected to the same dietary regime, including all the changes, their excretory rates did not vary appreciably.

The data of 5 adrenalectomized rats (Fig. 1) are here included. In other studies of 12 adrenalectomized rats maintained in good health by dietary measures, the excretory rates of rats have been measured. These rats all conform to those which are here reported.

That we are dealing here with a relatively large diuresis is indicated by the following facts: removal of the posterior hypophysis in rats causes a long-continued diuresis.^{4, 5} When the excretory rates of such rats (24 in number) are measured by our technique, it is found that they excrete about 12 cc. per day. This is considerably less than the daily excretion here reported after adrenalectomy, *viz.*, 20 cc. In one extreme case of an adrenalectomized rat (not included in this group), the urinary output was about 48 cc. daily during one week.

Silvette and Britton have reported⁶ that the excretory rate of rats in adrenal insufficiency is less than normal. This we have confirmed. Jiminez similarly reported⁷ that the terminal stages of adre-

⁴ Richter, C. P., *Am. J. Physiol.*, 1934, **110**, 439.

⁵ Pencharz, R. I., *PROC. SOC. EXP. BIOL. AND MED.*, 1936, **34**, 14.

⁶ Silvette, H., and Britton, S. W., *Am. J. Physiol.*, 1933, **104**, 399.

⁷ Jiminez, D., *Abstr. J. Am. Med. Assn.*, 1936, **107**, 1422.

nal insufficiency in humans are accompanied by an oliguria. This report indicates that diuresis accompanies relief from adrenal cortical insufficiency.

Summary. After adrenalectomy, rats given a life-sustaining diet show a urinary excretory rate approximately 5 times normal. When the life-sustaining diet is changed to a non-sustaining diet, the excretory rates drop to normal and below, with death ensuing.

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Renal Blood Flow After Subtotal Nephrectomy.

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Arterial hypertension has been produced in animals by two methods of damaging the kidneys, (a) by renal ischemia due to a clamp which narrows the lumen of the renal artery,¹ and (b) by subtotal nephrectomy.^{2, 3} With the latter method in the rat, observations have shown that in the first month after operation there is no hypertension although the amount of renal tissue is at a minimum (100 mg. per 100 sq. cm.) and there are polyuria and increased blood urea concentration (200 mg. %). Hypertension does not appear until the second month, when there are proteinuria and greatly hypertrophied renal stumps (200 mg. per 100 sq. cm.).

If the renal tissue had hypertrophied more rapidly than its vascular supply, thus causing a relative ischemia, the mechanism of the hypertension would be analogous to that in dogs with a clamp which narrows the lumen of the renal artery. To test this hypothesis, the rate of renal blood flow was studied.

Methods. Subtotally nephrectomized^{2, 3} rats 2 weeks and 5 months post-operatively and unilaterally nephrectomized rats were used. Under ether anesthesia the abdomen was opened. Because of renal-splenic adhesions the gastro-splenic ligament was divided between ligatures; veins from the adrenal, leg, and testis were tied. The aorta and inferior vena cava were tied just below the entry of the left renal vein. Finally the inferior vena cava just cephalad to the renal vein was closed with a small bulldog clamp, and the left renal

¹ Goldblatt, H., *et al.*, *J. Exp. Med.*, 1934, **59**, 347.

² Chanutin, A., and Ferris, E. B., Jr., *Arch. Int. Med.*, 1932, **49**, 767.

³ Rytand, D. A., and Dock, W., *Arch. Int. Med.*, 1935, **56**, 511.