It has been reported by Mialhe-Voloss1) and Rochefort et al.2) that neurogenic stimuli caused a significant depletion in corticotropic activity of the posterior pituitary, whereas ACTH content of the anterior pituitary was decreased following somatic stimuli. The findings were supported by the study of Smelik3) who found that in neurohypophysectomized rats the effect of epinephrine and neurogenic stress on the adrenal cortex was entirely abolished without impaired response to systemic one. From the results he inferred that psychic stimuli act on the ACTH present in the posterior lobe through the mediation of endogenous epinephrine. However, our previous experiments4) demonstrated that the administration of epinephrine into normal rats did not cause significant change in the ACTH content of the posterior lobe, though. It is questionable whether the posterior lobe ACTH possesses physiological importance. The present experiments were carried out to clarify the role of the posterior lobe ACTH in adrenocortical stimulation in response to stress, using adeno-hypophysectomized rats.

METHODS

Male Wistar rats, weighing approximately 150 g, were used throughout the experiments. Complete hypophysectomy and adeno-hypophysectomy were performed via the parapharyngeal approach under hexobarbital anesthesia. The rats were treated with Aureomycin (Lederis) to prevent postoperative infection and used for experiments 7 days after the surgery. The pituitary gland was carefully inspected macroscopically for completeness of the removal of anterior lobe and for damage to the posterior lobe tissue.

Epinephrine was injected subcutaneously in a dose of 0.03 mg per 100 g body weight. Under Nembutal anesthesia both adrenal glands were excised quickly and the blood was drawn from the abdominal aorta.

Corticosterone content in the adrenal and blood plasma was determined by the fluorimetric method of Moncloa et al.5) using the Farrand spectrofluorometer, and ascorbic acid by the method of Roe and Kuether6).
RESULTS

One week after adenohypophysectomy a marked atrophy of the adrenal gland, similarly to that after total hypophysectomy, was noticed. The average weight was 17.9±1.20 mg in 14 adenohypophysectomized rats and 17.3±1.45 mg in 7 totally hypophysectomized ones, while that of 15 normal rats 31.3±1.11 mg.

Corticosterone content in the adrenal gland was markedly decreased after both adeno- and total hypophysectomy, averaging 10.3±2.84 γ per g and 11.3±3.14 γ per g respectively. These figures were 17 to 19 per cent of the normal content (58.6±3.67 γ per g in 18 determinations). Since the adrenal weight was significantly small in these operated rats, if the content was expressed in terms of γ per gland, the figures will be 0.09±0.025 γ in adenohypophysectomized rats and 0.10±0.026 γ in totally hypophysectomized ones, while that in normal control rats was 1.11±0.074 γ.

Thirty minutes after subcutaneous injection of epinephrine in a dose of 0.03 mg per 100 g body weight, the content increased to 85.7±3.32 γ per g and 1.48±0.061 γ per gland in the control group, while no increase in the content was observed in the adenohypophysectomized one, without any deviation from the pre-injection level (13.8±1.03 γ per g, 0.13±0.010 γ per gland).

Changes in plasma corticosterone levels are shown in Fig. 1. One week after adeno- and total hypophysectomy the levels decreased significantly (P<0.01), as compared with the resting level of normal rats. There was no difference in the plasma corticosterone content between these two operated groups. After injection of epinephrine the corticosterone level markedly increased in normal rats, from 13.6±1.03 γ per cent to 31.0±2.30. On the other hand, in adenohypophysectomized rats no change was observed.

Fig. 1. Changes in plasma corticosterone levels.

□ Resting level
■ After epinephrine
Similar results were obtained in the adrenal ascorbic acid concentration. Both adeno- and total hypophysectomy resulted in a marked depletion in the ascorbic acid content and no further decrease occurred following the injection of epinephrine, while in control rats the administration of epinephrine caused a marked depletion in it (Fig. 2).

![Figure 2](image.png)

**DISCUSSION**

The present experiments showed that the corticosterone content in the adrenal gland and blood plasma and the adrenal ascorbic acid concentration in adenohypophysectomized rats one week after the surgery were decreased to the same levels as those found in totally hypophysectomized ones, and that the administration of epinephrine into adenohypophysectomized rats did not cause any increase in the corticosterone levels nor depletion in the adrenal ascorbic acid content. It will be inferred that ablation of the anterior lobe did entirely abolish the secretion of ACTH. It is unlikely that corticotropic activity of the posterior lobe plays an important role in response to stress. The inference will be supported by our previous observations that the corticotropic potency in the posterior lobe scarcely changed following epinephrine, hypertonic saline, Pitressin, or acute exposure to severe heat. The results of our present study are in accord with those reported by Fisher and De Salva and Smelik et al. The former authors showed that 24 hours after surgery, adenohypophysectomy blocked both the increase in plasma corticosterone and the depletion of adrenal ascorbic acid content following epinephrine. The latters reported that in adenohypophysectomized rats the plasma corticosterone content could not be raised following neurogenic stimuli. The possibility suggested by Smelik that neurogenic stimuli cause the
release of ACTH from the posterior lobe is not conceivable. In the absence of functional neurohypophysis, neurogenic stimuli, epinephrine and vasopressin did not show any activation of the adrenocortical secretion (unpublished data). CRF which is possibly accumulated in the posterior lobe may be essential for the release of ACTH.

As to the origin of the corticotropic activity in the posterior lobe, MIALHE-VOLOSS\(^1\) assumed that the activity originates from the anterior lobe, since isolated posterior pituitary did neither contain nor produce corticotropin. She also stated that the corticotropic activity was not due to MSH from the intermediate lobe. ROCHEFORT et al.\(^2\) presumed a binding of the hormone by the neurohypophysial tissue. According to SMELIK et al.\(^3\), about 75 per cent of the original corticotropic activity of the posterior lobe was lost during one week after adenohypophysectomy. This evidence may suggest that a considerable part of posterior lobe ACTH is derived from the anterior lobe. A finding that subcutaneous injection of a long-acting ACTH into adenohypophysectomized rats were incapable of increasing the corticotropic activity of the posterior lobe\(^4\), suggests that circulating ACTH is not the source of the posterior lobe ACTH. Recent report of KONIJNENDIJK and DE WIED\(^10\) showed that chromatographic pattern of the posterior lobe ACTH was different from that of the anterior lobe ACTH, indicating that the principles from the both lobes are not identical. This observation may suggest that a part of the posterior lobe ACTH is derived from other than the anterior lobe. However it may be assumed that the ACTH in the posterior lobe is not important physiologically.

**SUMMARY**

Adrenal atrophy produced by adenohypophysectomy was the same in extent as that after total hypophysectomy. In adenohypophysectomized rats the corticosterone levels in the adrenal gland and blood plasma and the adrenal ascorbic acid concentration were decreased to the same levels as those found in totally hypophysectomized ones. Administration of epinephrine into adenohypophysectomized rats did not cause any increase in the corticosterone levels nor depletion in the adrenal ascorbic acid concentration.

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**REFERENCES**


2) ROCHEFORT, G.J., ROSENBERGER, J. AND SAFFRAN, M. Depletion of pituitary
corticotrophin by various stresses and neurohypophyseal preparations. J. Physiol. 146: 105, 1959.


6) Roe, J. H. and Kuether, C. A. The determination of ascorbic acid in whole blood and urine through the 2,4-dinitrophenylhydrazine derivative of dehydroascorbic acid. J. Biol. Chem. 147: 399, 1943.


