

2. The delayed kidney injury in acute bichloride intoxications has been constantly associated with the development of an acid intoxication. The severity of the damage to the cells of the convoluted tubules and the extent of fatty infiltration in the cells of the ascending limb of Henle's loop show a correlation with the degree of acid intoxication.

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Relation of the spinal cord to the spontaneous liberation of epinephrin.

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1. In acute experiments on cats, anesthetized with urethane, section of the spinal cord in the cervical region caused no demonstrable diminution in the rate of liberation of epinephrin from the adrenals as tested by allowing the adrenal blood collected in a cava pocket to elicit eye-reactions (after preliminary excision of the superior cervical ganglion). Four such experiments were made. The cord section in one of these was between the third and fourth cervical vertebræ, in another opposite the body of the fourth cervical vertebrae, in a third just below the body of the fifth cervical vertebra, and in a fourth cat between the fifth and sixth cervical vertebræ. In the second of these animals the blood was collected from the adrenal vein before and after section of the cord. The epinephrin assay (by rabbit intestine segments) gave the same output of epinephrin per minute after as before the section. The blood flow from the adrenals was much slower after the section, but was correspondingly richer in epinephrin.

2. In two survival experiments the cord was cut in the cervical region (in one just above the body of the last cervical vertebra, in the other at the level of the body of that vertebra). In the first cat, the superior cervical ganglion had been previously excised. Two days after the cord section adrenal blood was tested by the cava pocket method and gave good eye reactions, indicating

a fairly good liberation of epinephrin (at least 0.0004 mgm. per minute). In the second experiment blood was drawn three days after the cord section and tested on rabbit intestine and uterus segments. Good concentrations of epinephrin were found (1 : 1,500,000 in the fourth adrenal sample, more than 1 : 2,500,000 and less than 1 : 1,500,000 in the second adrenal sample). Although the blood flow was small (0.3 gm. per minute for the second sample) a substantial liberation of epinephrin was demonstrated.

3. In one acute experiment, the spinal cord was cut between the fifth and sixth cervical vertebræ. The pupil reaction was not noticeably diminished. The cord was then severed between the fourth and fifth dorsal vertebræ. The pupil reaction could no longer be obtained. When the cord was now stimulated with induction shocks between the fifth and sixth dorsal vertebræ, and blood collected in the cava pocket during stimulation, good eye reactions were elicited on releasing the pocket.

4. In one survival experiment, the cord was cut between the fifth and sixth dorsal vertebræ. Three days afterwards the adrenal vein blood was tested by the cava pocket method but no eye reactions could be obtained. The pupil gave a good reaction with 0.2 c.c. of 1 : 500,000 adrenalin. On intestine segments negative results were obtained with adrenal blood, although a concentration of 1 : 60,000,000 adrenalin in indifferent blood caused a distinct effect. It was shown that the adrenal vein blood could not have contained 1 : 100,000,000, and that the discharge of epinephrin per minute could not have been at most 0.000003 mgm., that is, not one hundredth of the output to be expected in a normal cat under the experimental conditions. It was not demonstrated that any epinephrin was present.

5. In three of the cats with the cervical card transected (1 survival, and 2 acute experiments), the effect on the eye reactions of severing nerves containing the fibers concerned in the liberation of epinephrin (sympathetics and splanchnics in thorax, splanchnics in abdomen, and other nerves coming to semilunar ganglion, lumbar sympathetic chain) was studied. The eye reactions still obtainable from the adrenal blood after the cervical section were greatly weakened or abolished after the division of those nerves.

6. It seems to follow from these observations, that liberation

of epinephrin from the adrenals is still sustained after division of the cord in the cervical region at the levels mentioned, and that this liberation takes place through the splanchnic and other nerves known to be concerned when the spinal cord is still connected with the brain. The contrast between the epinephrin output when the cervical cord has been divided and when the dorsal cord has been divided at the levels mentioned is very great.

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Quantitative experiments on the liberation of epinephrin from the adrenals after section of their nerves, with special reference to the question whether epinephrin is indispensable for the organism.

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1. We showed in a previous paper¹ by the blood pressure and eye reactions that after section of the nerve supply of the adrenal no demonstrable liberation of epinephrin was present in cats as long as five weeks after the nerve section.

2. As it is easier to detect very small concentrations of epinephrin by the rabbit intestine and uterus segments, we have made a series of experiments (on 7 cats) in which these tests were used to supplement the eye reactions. In all the animals one adrenal was excised and the nerves of the other cut.

In a cat tested two weeks after the operation, it was shown that the adrenal blood serum could not have contained 1 : 300,000,000, or the blood 1 : 400,000,000, of epinephrin; and that the rate of liberation of epinephrin could not have been at most 0.000001 mgm. per minute for one adrenal. In another cat three weeks after the operation² the serum of the adrenal blood was proved to contain less than 1 : 400,000,000, and the blood less than 1 : 700,000,000 epinephrin. The output of epinephrin per

¹ *Journal of Pharmacology and Experimental Therapeutics*, 1916, VIII, 479.

² In this animal after the usual operation the left semilunar ganglion and the first ganglion of the lumbar sympathetic chain below the diaphragm were excised.