vary from an average of 5% for pup 26, not a typical cretin, to 15% for pup 24 and 30% for pup 22. With all animals included, there is a diminution of 16% in the cretins.

These results offer additional support to the view that the thyroid hormone exerts an influence on the oxidizing systems normally present in the cells.

4338

Responses of the Kidney and Spleen to Subcutaneously Injected Epinephrin.

THEODORE KOPPÁNYI AND M. S. DOOLEY.

From the Department of Pharmacology of Syracuse University.

Halsey and Lemann[1] found that hypodermic injection of epinephrin in asthmatic patients may cause relaxation of the bronchial musculature without synchronous rise in blood pressure. This observation reopened the question of the differing sensitivity of various epinephrin receptors. C. A. Dragstedt and Huffman[2] recorded in dogs the simultaneous effects of continuous intravenous injections of epinephrin on blood pressure and intestinal motility during and after anesthesia and in the absence of drugs and anesthetics. Except under deep anesthesia, the authors were able to obtain definite blood pressure rises without intestinal inhibitions. Durant and McNinch[3] externalized the spleens of two young dogs by the Barcroft-Stephens method and took blood pressure and oncometric (spleen) tracings while the animals were unanesthetized. Intravenous injection of minimal amounts of epinephrin produced blood pressure rise and splenic constriction, but no intestinal inhibition.

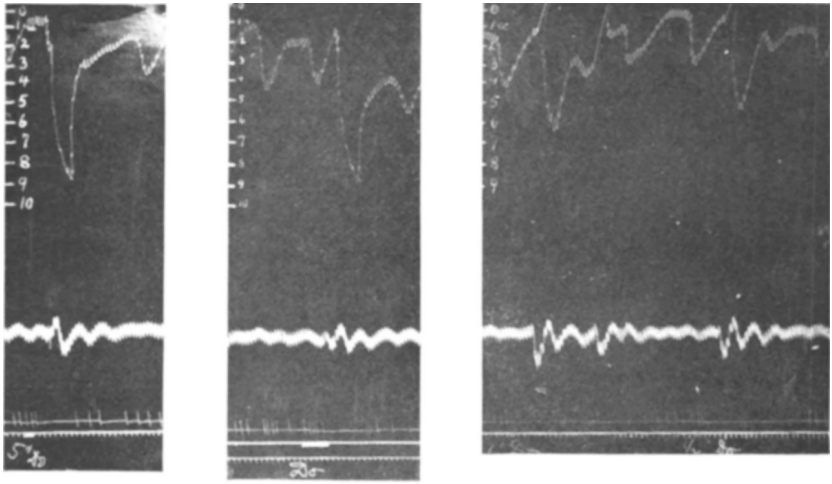
Luckhardt and Koppányi[4] developed a method which greatly facilitated the attack of our problem. This method consists of subcutaneous injection of epinephrin and massage of the injected area. Such massages produced marked blood pressure rises, but, deepening the anesthesia promptly abolished the effects of massage upon blood pressure. When the effectiveness of massages of the epinephrinized areas upon the blood pressure is thus abolished, one can observe the action which such massages exert on different organs.

[1] Meyer and Gottlieb's Pharmacology, translated by Halsey. 346.

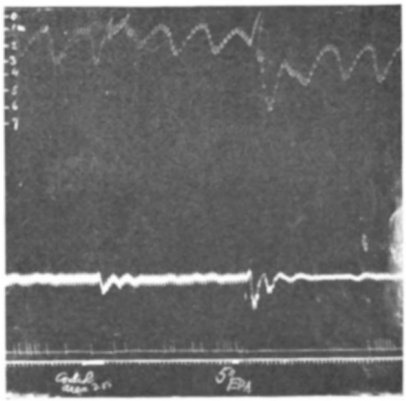
[2] Dragstedt, C. A., and Huffman, *Am. J. Physiol.*, lxxxv, 129.

[3] Durant and McNinch, *Am. J. Physiol.*, lxxxv, 364.

[4] Luckhardt and Koppányi, *Am. J. Physiol.*, lxxxi, 436.



1 2 3



4

FIG. 1.

Simultaneous record of spleen volume changes (upper tracing) and of blood pressure (lower tracing). Vertical lines on the upper horizontal base represent drops of urine. "Do" equals massage of epinephrinized area for 5 seconds. Horizontal lines at the left margin indicate calibrations of volume changes in cc. of air. Base line (lower horizontal line) represents 0 mm. of Hg pressure. Time, 5 seconds.

FIG. 2.

Same arrangement as in Fig. 1. "Do" equals massage of epinephrinized area for 25 seconds. Time 5 seconds.

FIG. 3.

Same arrangement as in Fig. 1. "Do" equals massage of epinephrinized area for one and one and one half of one second. Time 5 seconds.

FIG. 4.

Same arrangement as in Fig. 1. The first experiment represents the massage of a control, the second of an epinephrinized area. Time 5 seconds.

This study deals with the effect of massage of epinephrinized areas on volume changes in the spleen and kidney. We know that intravenously injected epinephrin produces constriction of the spleen and kidney, and because of the latter checks the flow of urine. These actions are presumably due solely to vasoconstriction in these organs.

We used dogs for our experiments. The blood pressure was recorded from the common carotid artery, and the spleen or kidney was inclosed in an oncometer connected with a recording tambour. The ureters were cannulated and the urine flow registered by a drop recorder. The dogs were anesthetized by morphine-urethane reinforced with ether. Due to the depth of the anesthesia we obtained no, or only slight elevations of blood pressure upon massage of epinephrinized areas. 2 to 3 cc. of epinephrine hydrochloride were injected subcutaneously and the injected area was repeatedly massaged. As Figs. 1, 2, 3 and 4 show, the massages were for all practical purposes unsuccessful, so far as general blood pressure rises were concerned. But while the blood pressure showed no, or only slight (2-8 mm. of Hg.), rise, or even a fall (Fig. 4); the kidney and spleen manifested very marked constriction. Simultaneously, the urine flow stopped. Every massage of the injected area produced a marked volume reduction of the spleen and kidney, though, after oft repeated massage, the effect is slightly diminished. The volume changes of the spleen and kidney are undoubtedly due to stimulation of vasoconstrictor endings, but this vasoconstriction must be compensated for peripherally and thus it does not affect the general blood pressure. Massages of control areas produced no volume changes in the spleen and kidney.

These observations show:

(a) That massage of areas injected with epinephrin may produce marked localized vasoconstrictor effects, even when the general blood pressure remains unaffected.

(b) That kidney and spleen volume changes are more easily elicited with small amounts of epinephrin than a change in general systolic blood pressure. The volume changes of these organs may be used as a reliable criterion in the bio-assay of epinephrin.