

in hemorrhagic shock in the dog(6).

The results indicate that hemorrhage-aortic occlusion results in a repeatable type of experimental shock in the dog which simulates pure hemorrhagic shock in most of the important essentials. The method permits simultaneous and independent control of arterial perfusion pressures to different segments of the body. While it has the advantage of achieving differential perfusion without the necessity of extensive surgery or extracorporeal circulation, its application is somewhat limited by the anatomical vagaries of the arterial supply of the involved organs.

Summary. 1) A combination of hemorrhagic and partial aortic occlusion produces a controllable degree of hypotensive shock in

the dog which closely resembles hemorrhagic shock. 2) The method provides an opportunity to study the effects of differential arterial perfusion of different body segments.

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Effect of X Irradiation on Increase in Rat Liver Tryptophan Peroxidase Produced by Adrenal Steroids.* (23136)

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On the basis of measurements of liver glycogen and blood glucose in X-irradiated rats, Mole has recently taken issue with the concept that irradiation stimulates the adrenals (1). He suggested that the failure of X-irradiated adrenalectomized rats to synthesize glycogen is due not directly to lack of cortical hormones but rather to a low level of blood glucose, below the threshold for glycogen deposition; and that glycogen synthesis following administration of cortisone is the result of an increase in concentration of glucose in blood to a level favoring deposition of glycogen. Mole concludes that X irradiation has not been shown to increase adrenal activity, and that the irradiated rat actually uses cortisone more efficiently than controls.

One change which takes place in irradiated rats is an increase in tryptophan peroxidase activity of the liver(2). This increase does not occur in adrenalectomized rats, and hence resembles the increases produced by a num-

ber of amino acids and pharmacodynamically active agents(2,3,4), rather than the increase produced by tryptophan, which is considerably greater and is not prevented by adrenalectomy(3). However, the level of the enzyme can be increased in adrenalectomized rats by administration of cortisone or hydrocortisone, the response being roughly proportional to the dose over an appreciable range (5). We felt that this system would be suitable for studying any possible improvement in efficiency of utilization of the glucosteroids in irradiated animals.

Methods. Female rats of the Sprague-Dawley strain, 6 weeks old, were adrenalectomized 5 days before irradiation; during this time they received 1% saline *ad libitum*, and were injected with desoxycorticosterone acetate (1 mg/kg) on alternate days. Exposure to X rays was at the rate of 200 r/min from a machine operated at 250 kv, 15 ma, 0.5 mm Cu plus 3 mm bakelite filters, 27 cm distance. A dose of 600 r total-body irradiation was used throughout. Cortisone acetate (20 mg/

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TABLE I. Effect of X-Irradiation and Hormone Injection on Tryptophan Peroxidase Activity of Livers of Adrenalectomized Rats.

Treatment	Kynurenine formed, $\mu\text{M/hr/g}$ dry wt								
	Non-irradiated			600 r, inj. immediately			600 r, inj. after 24 hr		
	No.	Avg	σ	No.	Avg	σ	No.	Avg	σ
No inj.	23	7.4	1.9	4	7.9	.5	8	6.7	1.0
Hydrocortisone, 3 mg/kg	5	21.0	3.4	5	16.6	1.7	5	17.6	4.9
Cortisone, 20 mg/kg	5	19.6	3.9	5	14.3	2.4	5	16.1	4.5

kg) and hydrocortisone acetate (3 mg/kg) were given intramuscularly as saline suspensions either 0 or 24 hours after irradiation. Six hours later the rats were killed, and the livers rapidly excised and frozen between blocks of solid CO_2 . This treatment did not affect enzyme activity. Tryptophan peroxidase was measured by the method of Knox (3) on homogenates prepared from the frozen tissues.

Results. Table I shows that irradiation did not augment response of adrenalectomized rats to either of the steroids administered. The decreases observed in the irradiated rats are not statistically significant, although they are of interest. As reported earlier, hydrocortisone was about 7 times as active as cortisone(5) in both irradiated and non-irradiated animals.

Discussion. These data fail to demonstrate any increase in the efficiency of utilization of cortisone or hydrocortisone by the irradiated rat so far as an increase in liver tryptophan peroxidase was concerned; if anything, the response to glucosteroid injection was slightly decreased. The response of the enzyme to administration of tryptophan has similarly been shown to be unaffected by radiation, at least during the first 3 to 4 days after exposure(2,6).

Knox and Auerbach, discussing the hormone- and substrate-induced adaptations of tryptophan peroxidase, attribute the increase in activity following administration of vari-

ous compounds (histidine, epinephrine, histamine, etc.) to the effect of glucosteroids released either by direct action on the adrenals or by action of ACTH(7). Radiation also belongs in this category. The actual mechanism by which X irradiation stimulates the adrenals, as manifested by the increase in liver tryptophan peroxidase, is not known; however, it may be pointed out that maximum activity of the enzyme occurs within a few hours after initial release of histamine. There are doubtless other compounds liberated within a few hours after irradiation as a result of cellular destruction which could ultimately effect a rise in tryptophan peroxidase *via* stimulation of the adrenals.

Summary. On the basis of effectiveness in increasing tryptophan peroxidase activity of the liver, there was no evidence for an increased utilization of cortisone or hydrocortisone by X-irradiated adrenalectomized rats.

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