

Adrenal Ascorbic Acid in Male and Female Rats after Total Body X-Ray Irradiation.* (19314)

B. C. WEXLER, R. PENCHARZ, AND S. F. THOMAS.

From the Research Laboratory for Experimental Biology, Stanford Research Institute, the Department of Anatomy, Stanford University School of Medicine, and the Medical Research Foundation, and the Clinic, Palo Alto.

Stress situations are associated with fluctuations in the ascorbic acid content of the adrenal gland(1,2). It has been suggested that the extent of the drop in the ascorbic acid level may be a measure of the severity of the emergency situation(3). There is evidence that the drop in adrenal ascorbic acid is causally related to ACTH. We are currently interested in the effects produced by partial and total body irradiation, and in the protection, if any, afforded by the spleen, adrenal, or other organs. It was of interest, therefore, to determine the ascorbic level of the adrenals of rats after X-ray irradiation.

Methods. The animal material included 128 male and female rats (Long-Evans), 80 to 90 days of age, divided into 7 experimental and one control group. X-rays administered were generated by a 250 KV machine. The total dose was 625 r. Two filters, 0.25 Cu and 0.5 Aluminum were used. The Half-Value-Layer in copper of the filter beam, using 250 KV, was 1.05 mm. The measurements were determined in air by the position occupied by the center of the animal's body. The dose rate was 410 per min. at 60 cm. Back scatter was eliminated by the use of a cardboard box 5 cm in depth, which separated the animal from an X-ray permeable plastic table. One, 3, 6, 12, 24, 48, and 96 hours following exposure the animals were sacrificed individually by decapitation. Immediately following, the adrenals were removed, dissected free of extraneous tissue, weighed on a Roller-Smith balance, and homogenized in cold 2.5% metaphosphoric acid. The Cole-

man spectrophotometer was used for ascorbic acid determination(4).

Results and conclusions. The adrenals of the males showed a marked depletion of ascorbic acid after one hour. There was a rise after 12 hours with a return to normal after 48 to 96 hours. Diarrhea was observed in half of the animals in the 48-hour group and in a more severe form in all of the animals in the 96-hour group. The animals in the latter group were sluggish and exhibited priapism. Diarrhea was observed in 50% of the females after 96 hours. They were sluggish and at necropsy the intestines were observed to be distended with gas and the adrenals were a dark, cherry red color. The weights of the adrenals of the 96-hour male group were twice that of the other males. The 48- and 96-hour groups were the only ones to show loss in body weight. The average loss was 16 g in the former and 53 g in the latter (Table I). The

TABLE I. Changes in Adrenal Ascorbic Acid in Male and Female Rats (Long-Evans) Following Total Body X-ray Irradiation. Eight animals in each series.

Time, hr	Adrenal* wt, mg	Body wt, g	mg ascorbic acid/100 g adrenal with S.E.M.	P value
Males				
U†	15.9	230	444 ± 7.3	N‡
1	17.8	228	228 ± 27.6	.0001
3	17.6	228	301 ± 22.5	.0001
6	17.4	215	396 ± 18.3	.0164
12	18.5	228	414 ± 18.3	.1336
24	17	228	493 ± 16.8	.0093
48	16.9	202	448 ± 16.8	N‡
96	30.5	187	444 ± 45	N‡
Females				
U†	23.5	160	429 ± 6	N‡
1	23.5	156	298 ± 20.3	.0001
3	27.5	215	447 ± 6.3	.0394
6	24.7	174	483 ± 17.3	.0032
12	29.4	191	463 ± 7.5	.0004
24	34.6	218	423 ± 18.5	N‡
48	28.8	221	518 ± 7.4	.0001
96	34.9	206	430 ± 18.5	N‡

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* Wt of single adrenal. † untreated. ‡ normal.

loss of weight was greater in the males than in the females. There was no correlation between ascorbic acid content and adrenal weight. It will be seen that although the adrenals were larger in the females than in the males, their ascorbic acid content was less (Table I). The drop in ascorbic acid was less precipitous in the female 1-hour group than in the corresponding male series and the return to the normal level was more rapid in females. Another difference between the two sexes was a secondary rise in ascorbic acid in the female. Repetition of the experiment yielded identical results. The adrenals of the male were more hypertrophic than those of the females. While there is no complete explanation of the changes which follow X-ray irradiation, the observation of Sayers and Sayers(5) that progesterone blocks ACTH release, combined with the experiments of Snyder and Wyman(6), who have shown that progesterone has twice the potency of DOCA in maintaining adrenalectomized hamsters, are of interest in that they suggest a possible ex-

planation of the less precipitous fall in adrenal ascorbic acid in the female rat. Finally, the possibility that the gonads may play a role in this mechanism is suggested by the experiment of Wexler(7) which showed less depletion of ascorbic acid in animals with intact ovaries.

Summary. Total body X-ray irradiation is associated with a marked depletion in adrenal ascorbic acid. The decrease in ascorbic acid is more marked in the male rat than in the female.

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Tolerance of Normal and Adrenalectomized Rats for Cortisone Acetate.* (19315)

DWIGHT J. INGLE.

From the Research Laboratories, The Upjohn Co., Kalamazoo, Mich.

Howard(1) has commented upon "the almost uniform finding that an organism is highly oversensitive to a hormone that it lacks, and the corollary that the normal is relatively insensitive to doses of a hormone which would seriously injure the deficient animal." Thus, the depancreatized rat has a less-than-normal tolerance to insulin(2), and removal or destruction of the thyroid decreases the tolerance for large doses of thyroxin(3). Selye(4) has reviewed the evidence that adrenalectomized animals and patients with Addison's disease are more sensitive than normal to over-dosage with 11-desoxycorticosterone acetate.

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In the present experiments large doses of cortisone acetate were administered to adrenalectomized and to sham-operated force-fed rats. The adrenalectomized rats lost more weight, excreted more glucose and showed a greater incidence of gross pathologic changes than did the non-adrenalectomized rats.

Methods. Male rats of the Sprague-Dawley strain having an initial weight of approximately 300 g were used in these experiments. The animals were placed in metabolism cages and were force-fed a medium carbohydrate diet(5) by stomach tube each morning (8:30 to 9:15 A.M.) and afternoon (4:15 to 5:00 P.M.). The technics and diet were modifications of those described by Reinecke, Ball, and Samuels(6). The experiments were carried