

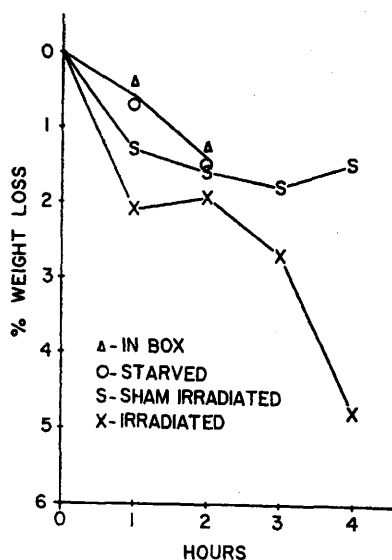


FIG. 2. Loss of body wt resulting from x-irradiation and from 3 control procedures.

greater than that observed for the sham-irradiated group during the first hour. During the next hour the animals were returned to their cages and they ingested some food and water. There was a slight weight gain, but this was promptly reversed, and after 3 hrs the weight of the irradiated group became progressively lower while the sham-irradiated animals recovered lost weight. As seen

in Table I, much of the weight loss of the irradiated animal, even at this early period, can be explained in terms of a loss of muscle mass.

Summary. The weight changes observed in 15 tissues at 9 different periods following total body irradiation with an LD₅₀ dose (700 r) of x-ray have been described and statistically evaluated. The loss of muscle mass explains the major portion of the body weight loss which is seen in the rat during the first 4-6 days following irradiation. Though the percentage weight loss was greater in spleen, thymus and marrow, these tissues are too small to have an appreciable effect upon total body weight change.

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Vit. B₁₂ Distribution, Determined by Surface Body Counting Following Parenteral Administration of Co⁶⁰ Vit. B₁₂* (22188)

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In a preliminary report it was stated(1) that following intramuscular injection of 1 μ g of Co⁶⁰ vit. B₁₂ maximal radioactivity was detected over the liver, spleen and left kidney, in the order named. Activity persisted over the hepatic area during periods of observation in all cases, and ranged up to 315 days. More recently, Glass and his co-workers reported

studies in subjects who received Co⁶⁰ vit. B₁₂ parenterally(2). Their results showed essentially the same pattern of distribution as those previously described from our laboratory.

The present report is a detailed description of our findings on a large group of patients, and a comparison of these results with 6 persons receiving Co⁶⁰ Cl₂.

Materials and methods. The first batch of Co⁶⁰ vit. B₁₂ had a specific activity of 0.240

* Co⁶⁰ Vit. B₁₂ and Co⁶⁰ Cl₂ were supplied by Merck and Co., Rahway, N. J.

TABLE I. Distribution of Radioactivity following Intramuscular Injection of 1 μ g of Co⁵⁸ Vit. B₁₂ (Containing 0.045 μ g Co).

Age	Diagnosis	Observation, days	Disappearance from site of inj., hr			Radioactivity over liver			Radioactivity over spleen			Radioactivity over left kidney		
			Max active- ity after inj., days	Duration of plateau, days	Total ac- tivity, days	Max active- ity after inj., days	Duration of plateau, days	Total ac- tivity, days	Max active- ity after inj., days	Duration of plateau, days	Total ac- tivity, days	Max active- ity after inj., hr	Duration of plateau, days	Total ac- tivity, days
47	Normal	315	4	3	315	3	44	315	3	37	166	4	37	166
30	"	98	3	3	98	3	34	98	3	27	98	1	37	55
79	Arteriosclerosis	64	3	1	64	1	63	64	1	56	64	2	3	64
63	Compensated cardiac	145	3	1	145	1	144	145	3	82	122	1	26	89
58	<i>Idem</i>	131	3	3	131	3	101	131	1	54	131	4	34	55
47	Rheumatoid arthritis	155	3	2	155	2	72	155	4	71	141	1	29	64
49	<i>Idem</i>	157	4	1	157	1	156	157	6	47	157	3	47	69
52	Cirrhosis of liver	61	3	2	61	2	27	61	1	52	61	1	40	61
64	<i>Idem</i>	182	3	4 (hr)	182	4	133	182	30 min.	29	182	30 min.	15	90
75	P. A. untreated	93	3	1	93	1	92	93	1	78	93	1	16	93
50	<i>Idem</i>	11	3	2	11	2	9	11	4 hr	11	11	4	5	11
61	Gaucher's disease	131	3	1	131	1	130	131	1	116	117	2	45	55
34	Lymphosarcoma	84	4	2	84	2	25	84	4 hr	41	84	4	8	27
45	Polycythemia	80	4	3	80	3	77	80	1	17	80	*	*	*

* Not counted.

TABLE II. Distribution of Radioactivity following Intramuscular Injection of 1 ml of Co⁵⁸ Cl₂ (Containing 0.042 μ g of Co).

Age	Diagnosis	Observation, days	Disappearance from site of inj., days			Radioactivity over liver			Radioactivity over spleen			Radioactivity over left kidney		
			Max active- ity after inj., days	Duration of plateau, hr	Total ac- tivity, days	Max active- ity after inj., hr	Duration of plateau, hr	Total ac- tivity, days	Max active- ity after inj., hr	Duration of plateau, hr	Total ac- tivity, days	Max active- ity after inj., hr	Duration of plateau, hr	Total ac- tivity, days
75	Hypertension	77	77	1	20	1	12	20	1	12	5	1	2	4
84	Arteriosclerosis	"	70	2	23	2	4	23	2	4	8	2	2	2
64	Congenital heart disease	"	77	2	55	1	24	55	1	24	20	8	12	2
64	Diabetes mellitus	"	70	1	13	1	6	13	1	24	13	1	6	1
77	P. A. untreated	42	13	2	7	2	4	7	2	3	3	2	4	4 hr
73	Cirrhosis of liver	"	42	2	20	2	12	20	2	4	7	4	4	24 "

$\mu\text{C}/\mu\text{g}$. At a later date this was increased to $0.760 \mu\text{C}/\mu\text{g}$. Each dose was diluted with sterile distilled water so that 1 ml contained $1 \mu\text{g}$ of radiovitamin ($0.045 \mu\text{g Co}/\mu\text{g}$ of vit. B₁₂). The $\text{Co}^{60} \text{Cl}_2$ contained $0.042 \mu\text{g}$ of Co^{60}/ml solution and had a specific activity of $1.86 \mu\text{C}/\mu\text{g}$. All administered doses were 1 ml in volume and were injected into the right deltoid muscle, using a 1-inch 22 gauge needle. A well-shielded sodium iodine crystal scintillation counter having an aperture of 2 cm was placed over 1) site of injection (deltoid muscle), 2) precordium, 3) lower right chest (liver), 4) lower left chest (spleen), 5) left lumbar region (left kidney), 6) lower end of sacrum, 7) lateral aspect of thigh. Radioactivity was recorded for 5-minute periods over each site within $\frac{1}{2}$, 1, 2, 3, 4, 8, 12, and 24 hours after injection. Thereafter, measurements were made at 2, 3, 5, and 7 day intervals for periods ranging from 11 to 315 days. Background counts were subtracted from observed values. No correction was made for Co^{60} decay, since even up to 315 days the correction for physical decay would amount to less than 15%. All but 4 patients were inmates of a chronic disease hospital and received the same diets unless precluded by specific therapy.

Results. Fourteen subjects received $1 \mu\text{g}$ of Co^{60} vit. B₁₂ intramuscularly as described above. The results are tabulated in Table I. Since no significant level of radioactivity was observed over the precordium, sacrum and thighs, these sites were excluded from this table. Activity was always detectable over the liver, spleen and left kidney within 30 minutes after injection, so that the first column under each organ records time after injection when maximal number of counts was noted. In general the highest radioactivity was detectable over the liver, with less activity over the spleen and left kidney in the order named.

Six subjects received 1 ml of $\text{Co}^{60} \text{Cl}_2$ (containing $0.042 \mu\text{g Co}^{60}$) intramuscularly. These data are shown in Table II. The pattern of absorption from the site of injection and distribution over the liver, spleen and

kidney as measured by surface body counting are entirely different from those following Co^{60} vit. B₁₂ administration.

From the above results it is apparent that with the wide variations in time required for achievement of maximal radioactivity after injection, duration of plateau and persistence of activity over the organs named, no clear-cut pattern was observed in healthy or diseased state. Age of subject did not appear to be a factor either. The results in 2 untreated cases of pernicious anemia, one of whom was in moderately severe relapse, were most surprising, since radioactivity was detectable over the liver for as long as individuals were studied.

Since previous animal studies have shown that following parenteral administration of Co^{60} vit. B₁₂ to rats, radiovitamin is found in the liver, spleen and kidney after 3 to 4 days (3,4), it is probable that the radioactivity measured in the present studies represent the B₁₂ complex with Co^{60} still attached. The results with $\text{Co}^{60} \text{Cl}_2$ help to confirm this conclusion.

Conclusions. 1. Following intramuscular administration of $1 \mu\text{g}$ of Co^{60} vit. B₁₂ to normal persons and patients with various medical disorders, radioactivity disappeared from site of injection in 3 to 4 hours. 2. Maximal radioactivity was detected over the liver, spleen and left kidney regardless of clinical condition or age of subject. The wide variations preclude any typical pattern for normal or diseased states. Previous animal studies with Co^{60} vit. B₁₂ and present investigations with $\text{Co}^{60} \text{Cl}_2$ suggest that the measured radioactivity represents vit. B₁₂ complex in organs named.

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