nm/PRELIMINARY NOTE

THE BIOLOGICAL HALF-LIFE OF ^{75}Se-SELENOMETHIONINE IN MAN

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The biological half-life of ^{75}Se-selenomethionine has been determined in 9 healthy subjects and 5 volunteer male patients suffering from various malignant lymphomas (2 lymphosarcoma, 2 Hodgkins disease, 1 reticulum cell sarcoma). The subjects were given 2 μc ^{75}Se-selenomethionine i.v., and counted with a whole-body counter at intervals of 10 min, 60 min, 4 hr, 24 hr, 48 hr, 72 hr and then weekly for 100–120 days. The control subjects (all male) were selected from apparently healthy laboratory personnel.

RESULTS, DISCUSSION AND SUMMARY

The over-all disappearance curves (Fig. 1) were fitted mathematically and resolved graphically for every subject in this study. The curves of 7 out of the 9 controls were resolvable into 3 phases (A, B, C), while the 5 lymphoma patients were characterized by 2-phase curves, 1 very rapid (A) and 1 prolonged (C). The fraction (P) of the dose decaying in each phase was determined by the usual method used in resolving half-lives of mixtures of radioisotopes by decay curves. Table 1 shows the results: the biological half-lives of the three phases, T_A, T_B, T_C and the corresponding fractions P_A, P_B, P_C of the dose disappearing by these half-lives. The average biological half-life (T_b) was calculated simply by summing the products T_iP_i:

$$T_b = T_AP_A + T_BP_B + T_CB_C \text{ (all T: in days)}$$

The equation of the phase C curve may be expressed: $y = P_Ce^{-\lambda_C}$ in which t is the time elapsed in days, λ_C is the disappearance constant of phase C and P_C represents the fraction disappearing by λ_C. The equation for normals and lymphomas is shown in Fig. 1 next to the corresponding curves. Comparing the results for normals and lymphomas, there is no significant difference between the values T_A and P_A, but in addition to the absence of phase B in lymphomas, the differences of T_C, λ_C and P_C are highly significant. The difference of the calculated T_b and T_e are also within the 95% confidence limit.

The biologic interpretation of the 3-phase curve may be relevant to the observation of Awwad *et al* (*2*). T_A approximates 10 hr and may be the elimination of unbound or nonpeptide bound ^{75}Se-selenomethionine as well as relationship to the pancreatic-enteric recycling of ^{75}Se-selenomethionine. T_B

TABLE 1. BIOLOGICAL HALF-LIVES AND DOSE DISAPPEARANCE (AVERAGE VALUES ± S.D.)

	T_A(hr)	P_A	T_B(days)	P_B	T_C(days)	P_C	λ_C(days)$^{-1}$	T_b(days)	T_e(days)
Controls	9.5 ± 8	0.12 ± 0.03	8.5 ± 8	0.09 ± 0.06	91 ± 36	0.79 ± 0.07	0.0076 ± 0.003	73 ± 21	45.5 ± 10
Lymphomas	10.5 ± 9	0.07 ± 0.03	Absent		49 ± 30	0.93 ± 0.06	0.0140 ± 0.003	45.5 ± 8	33 ± 5
Significant differences (P values*)	—	—	—	—	<0.01	<0.01	<0.01	<0.05	<0.05

* Statistical evaluation performed by VA Biostatistics Support Center, Hines, Ill.

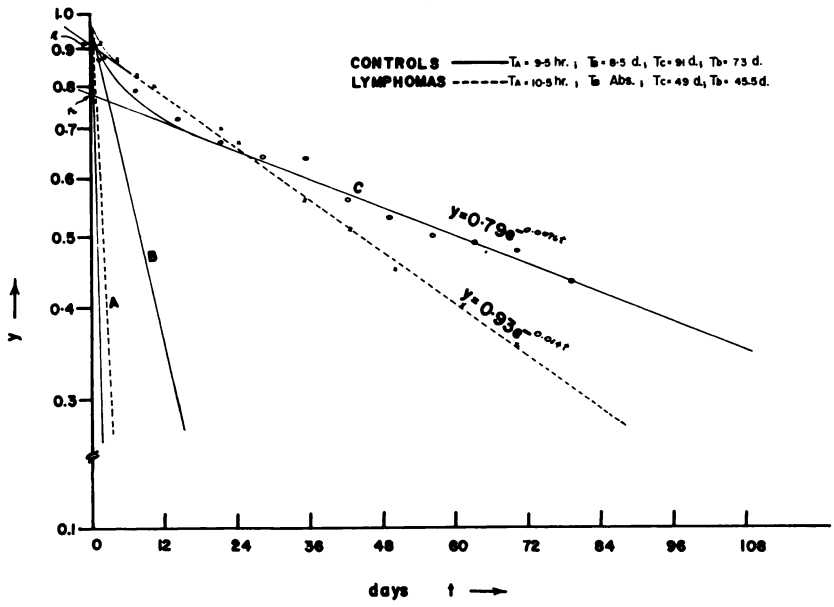

FIG. 1. ^{75}Se disappearance curves in normals and lymphomas (averages).

approximates 8 days, and while it is of the same order of magnitude as the half-time of serum protein and may represent incorporation in the relatively rapid metabolizing protein pool, no specific identification of an incorporating protein has been accomplished. It would be premature to conclude altered serum protein degradation in lymphoma. T_C approximating 90 days may represent incorporation in red cells, structural proteins and other stable protein moieties. The absence of T_B in the lymphoma patients should still be of considerable pathophysiologic significance.

From the effective half-life T_e (normals) obtained, the whole-body irradiation dose from ^{75}Se-selenomethionine injected i.v. can be calculated by the Quimby method (*1*):

$$D_\beta = \frac{73.8 \times 45.5 \times 0.0105}{70{,}000} = 0.0005 \text{ m rad}/\mu c$$

$$D_\gamma = \frac{0.0346 \times 45.5 \times 2.0 \times 126}{70{,}000} = 0.006 \text{ m rad}/\mu c$$

$E_\beta = 0.0105$ Mev

$T_e = 45.5$ days

Weight = 70 kg

$$\Gamma = 2.0 \frac{\text{cm}^2 \text{ rad}}{\text{mc hr}}$$

$g = 126$

For a tracer dose of 250 μc:

$$D_{(\beta+\gamma)} = 1.63 \text{ rad}$$

It was not previously possible to calculate this value for humans because data on the effective half-life in man were not available.

Presently, a third group of patients with pancreatic insufficiency is under investigation, as well as a study to determine the biological half-life of ^{75}Se-selenomethionine in various organs in man.

REFERENCES

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