LETTERS TO THE EDITOR

Dose Received by Lymphocytes in the Course of Labeling Techniques Using Tc-99m

Several recent publications have described labeling techniques for lymphocytes using Tc-99m (*1–4*). All these techniques require an incubation phase involving a maximum irradiation risk for lymphocytes placed in suspension for 10–20 min in a physiologic solution with a high radioactive concentration—several dozen millicuries in a few cubic centimeters. One is especially prone to forget that Tc-99m emits not only gamma photons at 140 keV but also, among other things, low-energy photons (gammas at 2 keV, fluorescent x-rays from 18–20 keV) as well as internal conversion electrons with low and moderate energies (*5*). Internal conversion electrons have a range of a few microns and it is difficult to take them into account in the calculation of the absorbed dose. X-ray and gamma photons of low energy have, on the other hand, a mean free path much greater than the diameter of lymphocytes (10 μ).

It seemed interesting to make an estimate of the dose delivered to the lymphocytes during their incubation phase. In order to accomplish this, we took as data our own working conditions, i.e., 25 mCi in a volume of 2.2 cm^3 and an incubation time of 15 min.

Taking into account only gamma and x-ray emissions, we can consider that, under the conditions defined above, the lymphocytes will receive a dose on the order of 25 rads. If the internal-conversion electrons were to have an energy and a range such that they penetrate the lymphocytes extensively, they would contribute a supplementary dose on the order of 60 rads. On the other hand, their low penetration and their low energy must force us to exercise great restraint in postulating this result.

In order to confirm the order of magnitude of the doses received by the lymphocytes, measurements were carried out with thermoluminescent dosimeters (disks of lithium borate and teflon, and lithium borate powder), whose variable geometry was not comparable to that of the lymphocytes but whose slight thickness (reduced to 0.13 mm) allowed us to approach the problem experimentally.

Several successive measurements were carried out leading to—according to the type of dosimeter—a dose on the order of 20–50 rads. Account was taken of the fact that the particles that penetrated only slightly could contribute only in a small measure to the dosimeter response; the dose measured possibly led to an underestimate of the dose delivered to the lymphocytes.

We conclude that the dose due to the most highly penetrating photons, which is relatively easy to determine, is on the order of 25 rads. The dose due to the very weakly penetrating particles, whose biologic interpretation is more difficult to establish, seems to be on the order of several dozen rads. To these doses, additional irradiation during the course of centrifugation and in vivo irradiation must be added, but we have no calculation scheme that permits us to estimate these effects.

The exceptional radiosensitivity of lymphocytes is well known. A spectacular decrease in the rate of circulating lymphocytes can be obtained by radiotherapy sessions delivering 6 rads to the spleens of patients with chronic lymphocytic leukemia (*6*). Studies of the DNA of normal rabbit lymphocytes have recently shown irreversible lesions after a single dose of 12 rads in vivo (F. Laval and M. Tubiana, personal communication).

In murines, doses as low as 50 rads in vitro have been shown to cause a marked reduction in the secondary migration of the lymphocytes occurring between 4 and 24 days after cell injection, and the B cells appear to be extremely radiosensitive (*7,8*).

We therefore suggest that results recorded in vivo using similar labeling techniques be scrutinized carefully, and that all efforts be made in order to define labeling conditions reducing the irradiation level to which the lymphocytes are exposed.

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Localization of Tc-99m Pyrophosphate in Muscle after Exercise

Radionuclides, particularly those used in bone scanning, have been reported to concentrate in infarcted myocardium (*1–3*), and in skeletal muscle in patients with dermatomyositis (*4,5*) and myositis ossificans (*6*). We wish here to report a patient in whom marked uptake of radiotracer in