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STUDY OF THE POST-IRRADIATION SYNDROME IN HUMANS

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STUDY OF THE POST-IRRADIATION SYNDROME IN HUMANS

J. J. Nickson, M.D.

Abstract

1. Irradiation of Patients

A patient with carcinoma of the cervix with bilateral pulmonary metastases has been irradiated with an estimated midplane tissue dose of 150 r and will be followed, primarily for lipoprotein modification, over an extended period of time.

A patient receiving 150 r total body irradiation has been studied on post-irradiation days 3, 28, and 52 for cholesterol, phospholipid, and lipoprotein fractions. Results were indicative of decreased clearing activity. The usual hematologic pattern was seen, with marked decreases in WBC, granulocytes, and platelets beginning about the 18th day and reaching lowest values in the period between the 27th and 32nd day. Recovery to control values were achieved for platelets by the 42nd day, for WBC by the 52nd day, but lymphocytes remained below control values at this time.

2. Animal Studies

Data on the question of the Bohr shift in the hemoglobin dissociation curve as a modifier of oxygen tension following total body irradiation of the experimental animal is of sufficient interest to warrant continuation of this study.

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Progress Report

1. Irradiation of Patients

One patient was irradiated on November 30, 1956. The patient is a middle-aged white female; her primary lesion is carcinoma of the cervix with bilateral pulmonary metastases. Her condition is not susceptible of amelioration by any conventional method of treatment. Since she is in good general condition and her family situation permits her prolonged absence from home, we will be able to study her over a long period of time. She will be studied primarily for lipoprotein modification after having received an estimated midplane tissue dose of 150 roentgens.

Analysis has been completed on a patient, not previously reported, as follows.

A series of measurements has been made on the plasma of J.K., a male patient aged 42, who received 150 r total body irradiation for carcinoma of the larynx with generalized metastases. The patient showed no signs of hepatic or renal disease. Blood samples were taken one day before irradiation and 3, 28 and 52 days post-irradiation. Cholesterol and phospholipid were determined on the whole plasma. Alpha lipoprotein, total beta lipoprotein and low- and high-density beta lipoprotein fractions were separated and the S_f 0-10, 11-20, and 21-100 classes were measured in the ultracentrifuge.

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The most pertinent results are summarized in Table I. On day 3 there was a marked reduction in low-density beta lipoprotein; the cholesterol, phospholipid, S_f 0-10 and S_f 21-100 had fallen to 70% of the control values. On day 28, both alpha and beta phospholipid were low, whereas the beta cholesterol S_f 0-10 and S_f 21-100 had risen. On day 52 the alpha cholesterol was low, although alpha phospholipid had returned to the control level. The low-density beta cholesterol and phospholipid and the S_f 0-10 class were close to the control values whereas S_f 11-20 and S_f 21-100 were elevated. In summary, this patient showed a marked reduction in S_f 0-10 on day 3, and an elevation in S_f 11-20 and S_f 21-100 on day 52 indicative of decreased clearing activity.

The usual hematologic pattern was seen with a prompt fall in the absolute lymphocytes to about one-half of control values. The WBC, granulocytes, and platelets began to show a marked decrease at about the 18th day, reaching the lowest values of 50,000 platelets, 2,600 WBC, 1,300 granulocytes and 650 lymphocytes during the period between the 27th and 32nd day. The platelets had returned to control values by the 42nd day and the WBC by the 52nd day. The lymphocytes remained below control values at the time. At no time did the patient show any clinical signs of bleeding.

2. Animal Studies

Some preliminary work was completed on the question of the Bohr shift in the hemoglobin dissociation curve as a modifier of oxygen tension following total body irradiation in an experimental laboratory animal. The data, while inconclusive, are of sufficient interest to warrant continuation of the study of this possible means of modifying oxygen tension in and around cells.

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TABLE I

PATIENT J.K.: PLASMA LIPOPROTEINS, MG. PER 100 ML.

	<u>Control</u>	<u>Days after Irradiation</u>		
		<u>3</u>	<u>28</u>	<u>52</u>
<u>alpha lipoprotein</u>				
cholesterol	25	21	24	15
phospholipid	52	51	41	52
<u>low-density beta lipoprotein</u>				
cholesterol	167	126	140	162
phospholipid	130	104	90	110
S _f 11-20	24	22	24	48
S _f 21-100	73	52	81	120

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Plans for the Next Period

It is hoped that more patients will become available during the next quarter. Similar studies will be carried out. In addition, a cooperative program for doing immunological studies has been worked out with the Division of Biophysics at the Walter Reed Hospital.

Work has been started on developing a chemical dosimeter for obtaining the integral dose received by the patient under the conditions of irradiation used at this Center. The dosimetry will be done in a human phantom filled with a chemical which will measure the integral dose delivered.

Organizational changes within the Sloan-Kettering Institute, not yet definitely determined, may lead to the reassignment of the professional person primarily concerned with directing the lipoprotein phase of our work. However, it is hoped and expected that satisfactory adjustments may be made to continue this important facet of our study.

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