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TUMOUR MARKERS IN CHERNOBYL ACCIDENT RECOVERY WORKERS IN THE LATE POST-ACCIDENT PERIOD

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ABSTRACT

Tumour markers (TM) are base plasma proteins with a carbohydrate component, produced by various types of tumor cells.

84 male liquidators aged from 30 to 50 y.o. were examined in the clinic of All-Russian Center of Emergency and Radiation Medicine in September 1994-April 1995. External irradiation exposure amongst liquidators varied from 2 to 30 sGr. TM concentration in serum and plasma were determined by conventional ELISA methods (CEA, AFP, CA19-9, PSA, NSE).

The first (control) group was composed of liquidators with no GI tract pathology. The second group consisted of 28 liquidators with irradiation - induced cytogenetical disturbances in peripheral blood lymphocytes. The third group consisted included 28 liquidators with chronic GI tract deseases.

In control group, levels of CA 19-9, CEA and AFP amounted to 4.7± 0..4 U/ml, 2.4± 0.8mg/ml, 2.1± 0.2 IU/ml, correspondingly. The CA 19-9 level has been shown to increase statistically significantly in the second (14.5±1.5 U/ml) and in the third group (17.8± 1.2 U/ml). A simultaneous elevation of CA 19-9 and CEA was found in 7.1% of the liquidators of the third group, the CA 19-9 level changes ranging from 63 to 708 U/ml. The mean value of PSA in all three groups remained within the discrimination concentration limits and amounted to 2.5± 0.4 U/ml. Concentration of NSE was equal to 29.9± 7.2 mg/ml in all three groups.

Based on the data on frequencies of the tumour marker elevation, a group of 6 was selected.This group required a detailed dynamic examination because of the problem of remote consequences of the effect of complex factors of the Chernobyl Atomic Station accident upon its victims.

INTRODUCTION

Tumour markers (TM) are base plasma proteins with a carbohydrate component, produced by various types of tumor cells. Numerous data [1,2,11] show that presence and concentration of TM in blood correlate with the presence and growth of malignant tumours in the individual concerned. Chronic disease and benign conditions can also affect TM concentration. The problem of discrimination between benign and malignant conditions by TM concentration is not yet solved.

Two oncofetal markers - AFP and CEA and carbohydrate antigen CA 19-9 are used for digestive system organs monitoring. In healthy individuals AFP concentration does not exceed 10 IU/ml [5,6], CEA - 5 ng/ml [8], CA 19-9 - 37 U/ml [5,6]. In case of primary hepatocellular, germ cell [12], gastric, colorectal carcinoma those levels could be increased ten-fold and more. Elevated serum levels of AFP, CEA, CA 19-9 are also seen in liver cirrhosis, viral and chronic active hepatitis, infectious mononucleosis, pancreatitis, peptic ulcers [7].

Prostate-specific antigen (PSA) is used for monitoring prostate status. It is used for differential diagnosis between benign prostatic hyperplasia and prostate adenocarcinoma [11].

NSE (Neuron-specific enolase) can be used as an apudoma (e.g. insuloma, pheochromocytoma, etc.) [9] and small-cell lung carcinoma marker.

Chernobyl accident recovery workers (liquidators) tend to reveal complicated course of somatic (including gastrointestinal) disorders. They are also at high risk group for developing pre-cancer and neoplastic conditions.

TM were studied in liquidators as a part of tumours screening programme. High-risk group was formed based on the results of the study.

MATERIALS AND METHODS

84 male liquidators aged from 30 up to 55 y.o. were examined in the clinic of All-Russian Center of Emergency and Radiation Medicine in September 1994 - April 1995. External irradiation exposure amongst liquidators varied from 2 to 30 sGr. TM concentrations in serum and plasma were determined by conventional ELISA methods (CEA, AFP, CA 19-9, PSA and NSE test-kits were obtained from Hoffman-La-Roshe, Switzerland).

Upper limits of serum/plasma concentration of tumour markers in healthy persons were considered as "cut-off" values [1]. Those limits were set as 5 mg/ml for CEA, 10 IU/ml for AFP, 37 U/ml for CA 19-9, and 10 U/ml for PSA respectively.

All 84 liquidators were divided into three groups (n=28). After examination no pathology were seen in the first group of patients. Patients of the second group had demonstrated irradiation-iduced changes in peripheral lymphocytes (decentric or ringcentromere chromosomes), but no other pathology. Patients of the third group were diagnosed as having various gastrointestinal disorders (chronic gastritis, gastroduodenitis, peptic ulcers of stomach and duodenum).

RESULTS AND DISCUSSION

TM concentration values presented in Table I. Mean serum CEA, AFP, CA 19-9 concentrations did not exceed normal values. The third group patients demonstrated elevated levels of CEA, AFP, CA 19-9 comparing to the patients of the first and the second groups. The difference in CA 19-9 serum concentrations between the first group (4.7± 0.4 U/ml) and the third group (17.8± 1.16 U/ml) was statistically significant (P>95).

Table I

TM serum concentrations (X± m)

Group of patients	CA 19-9	CEA	AFP	PSA
Group # 1 (n=28)	4.70± 0.40	2.40± 0.77	2.10± 0.20	2.60± 0.50
Group # 2 (n=28)	14.50±1.50	2.26± 0.31	3.98± 0.61	2.50± 0.35
Group # 3 (n=28)	17.80± 1.16	3.55± 1.20	4.38± 0.85	2.45± 0.22

Mean PSA values were within reference range (up to 10 U/ml) in all groups. PSA concentration varied from 2.5 up 3.5 U/ml, e.g. at the moment of liquidators examination no signs of prostate pathology were revealed by chemistry tests.

The analysis of serum CA 19-9, CEA, AFP concentrations distribution showed raised CA 19-9 levels (45-63 U/ml) in 14.8% of cases in group # 3. One patient has CA 19-9 concentration - 708 U/ml. Patients with serum CEA and AFP elevated levels have not have figures of concentrations more than 10 mg/ml for CEA and 20 IU/ml for AFP correspondingly.

In the first and second groups only occasional elevations above "cut-off" value were observed. Those figures are presented at Table II.

Table II

Distribution of the elevated TM serum levels (%)

Tumour marker	Group # 1	Group # 2	Group # 3
CA 19-9	0	4.8	14.8
CEA	3.5	0	21.4
AFP	0	5	8
PSA	0	0	0

If pathologic changes of TM concentrations were seen on admission, TM levels were checked during staying in the clinic and after treatment course aimed to differentiate specific and non-specific CEA, AFP, CA 19-9 concentration changes. In most of the patients of the third group conventional treatment were beneficial for reducing CEA, AFP and CA 19-9 levels. No such changes in group # 2 and # 1 were observed (Table III).

Table III

Distribution of the elevated TM serum levels (%) after treatment

Tumour marker	Group # 1	Group # 2	Group # 3
CA 19-9	0	4.8	7.1
CEA	3.5	0	7.1
AFP	0	5	0

Simultaneous elevation of both CA 19-9 and CEA were seen in two patients of the third group (7.1%). One patient has demonstrated stable elevation of CA 19-9 - 708 U/ml and 690 U/ml before and after treatment respectively.

High risk group of six patients was formed in accordance with these results, for more thorough examination of digestive system organs and regular follow up TM control (Table IV).

Table IV

CA 19-9, CEA, AFP serum levels in high- risk group

Patient/group	CA 19-9 U/ml	CEA ng/ml	AFP IU/ml
Patient 1 (gr. 1)	15.7	5.5	2.0
Patient 2 (gr. 2)	95	0.4	3.0
Patient 3 (gr. 2)	21	1.5	24
Patient 4 (gr. 3)	690	1.6	4.4
Patient 5 (gr. 3)	63	6.0	1.8
Patient 6 (gr. 3)	41	31	5.0

NSE levels were also checked in plasma of liquidators. In the second group mean NSE level was 50.7± 13.7 ng/ml, in the first group - 25.7± 5.3 and in the third group - 29.9± 7.2 ng/ml respectively. NSE plasma concentration 22 ng/ml was chosen as a discriminatory value. Although NSE elevated may serve as a high- risk factor for lung carcinoma and neuro-endocrine system carcinoma, instability of lymphocytes, platelets and red blood cells membrane of liquidators may also cause this elevation. The investigation requires continuation.

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