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HEALTH SURVEILLANCE OF MEDICAL PERSONNEL OCCUPATIONALLY EXPOSED TO IONIZING RADIATION SOURCES: BIOMONITORING AND DOSIMETRY

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ABSTRACT

The aim of this work is to present the complete results of periodical health surveillance of medical personnel occupationally exposed to ionizing radiation sources, conducted according to established law regulations in Croatia. The report comprises a total of 21 examinees (11 female, 10 male), mean age 43,19 ± 9,85 years, originating from different professional groups and working in a radiation zone 14,7 ± 8,27 years on the average. Within the framework of this study, the results of their biomonitoring, including haematological parameters (whole blood count), ophthalmological findings (fundus oculi), cytogenetic test (conventional structural chromosomal aberration analysis) and peripheral blood flow survey (capillaroscopy and dermothermometry) will be presented. Filmdosimetric data for the referred period will also be reported.

INTRODUCTION

Since ionizing radiation was first recognized as having harmful effects, efforts have been made to reduce it's noxious impact on human health. Among other radiation protection measures, health surveillance of professional groups at risk became regular. This report is aimed at presenting the results of such a health survey in the group of radiological workers from one of the Croatian regional medical centers. The survey was designed in accordance to the valid Croatian law regulations (1).

SUBJECTS AND METHODS

Twenty-one subject (11 women, 10 men), mean age 43.19 (± 9.85) years, occupationally exposed to ionizing radiation sources for 14.70 (± 8.27) years on the average, were included into the program.

Prior to the examination, a detailed questionnaire was fulfilled comprising data on personal, family and occupational background of each subject. Data on extraoccupational exposures were also recorded. The data provided on confounders were as follows:

a) There were 8 smokers and 13 nonsmokers in the group.
b) Nine subjects underwent some of the common radiodiagnostic procedures within one year prior to the survey.
c) Four subjects were on some of the common drugs within one year prior to the survey.
d) One of the subjects suffered from viral hepatitis six months prior to the survey.

The health survey program comprised:

1. Standard physical examination;
2. Standard haematology (whole and differential white blood count);
3. Ophthalmological examination (fundus oculi);
4. Conventional structural chromosomal aberration analysis according to the standard protocol (2);
5. Peripheral blood flow survey via serial application of wide-field nailfold capillaroscopy and dermothermometry according to the own protocol (3).

Since all the subjects are constantly equipped with personal monitoring film (KODAK type 2), filmdosimetric data for the relevant period are also reported.

RESULTS AND COMMENTS

Overall results of haematological examination, cytogenetic testing outcome and peripheral blood flow survey are presented in Tables I - III . Data on personal filmdosimetric monitoring are provided for each subject in Table IV. Other findings were within physiological boundaries.

The principal aim of this report was to point out that even among common groups of radiological workers, under regular workplace conditions, certain bioindicators can still reveal preclinical changes in their health status. Therefore, constant dosimetric and health surveilance of these groups becomes necessary. Nevertheless, personal background of the exposed subjects, kind of professional activity, workplace conditions and exposure regimens should always be taken into account when estimating an individual health risk related to occupational radiation exposure.

No. of subjects having findings	E	L	Eo	Baso	Seg	Non-seg	Ly	Mo
within NLR	17	17	12	21	4	19	4	19
↓ NLR	4	0	0	0	11	2	1	2
↑ NLR	0	4	9	0	6	0	16	0

Legend:

No = number
NLR = normal laboratory range
↓ = below
↑ = beyond
E = erythrocytes
L = leucocytes
Eo = eosinophiles
Baso = basophiles
Seg = segmented leucocytes
Non-seg = non-segmented leucocytes
Ly = lymphocytes
Mo = monocytes

Standards ("IMI" - Haematological lab):

E	(male)	4.4 - 5.8 x 10^{12}/L	Eo	1 - 3 %
	(female)	3.8 - 4.9 x 10^{12}/L	Baso	1 %
L	(male)	3.5 - 8.0 x 10^{9}/L	Seg	54 - 62 %
	(female)	4.0 -10.0 x 10^{9}/L	Non-seg	3 - 5 %
			Ly	25 - 33 %
			Mo	3 - 7 %

Table I: Haematology (whole and differential white blood count) - overall findings.

TNo of subjects analyzed	Normal	findings	Aberrant	findings
	No	%	No	%
21	16	76	5	24

TNo of cells analyzed	total	S	S B	D	S B	A	c	D	i c
	AB (%)	TNo	%	TNo	%	TNo	%	TNo	%
4200	2.42	36	0.85	30	0.71	31	0.73	5	0.11

Legend:

No = number
TNo = total number
AB =aberration
SSB = single-strain break
DSB = double-strain break
Ac = accentric
Dic = dicentric

Table II: Cytogenetic testing outcome.

No of subjects having	No	%
both findings normal	3	14.2
only capillaroscopic finding altered	6	28.5
only thermometric finding altered	1	4.7
both findings altered	11	52.3

Table III: Peripheral blood flow survey - overall results.

Subject	TRD (μGy)/NIF
1	0/0
2	50/1
3	0/0
4	0/0
5	0/0
6	360/5
7	480/4
8	0/0
9	80/1
10	240/4
11	0/0
12	400/6
13	80/1
14	0/0
15	0/0
16	0/0
17	0/0
18	0/0
19	0/0
20	50/1
21	0/0

Legend: **TRD** = Total radiation dose received within 1 year prior to the survey
NIF = Number of irradiated films in the reffered period

Footnote: Doses reported as "0" are actually doses below 0.03 mGy i.e. below the sensitivity of "KODAK Type 2" personal dosemeter.

Table IV: Data on personal filmdosimetric monitoring.

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