PERSISTENCE OF UNSTABLE CHROMOSOME ABERRATIONS IN MEDICAL STAFF OCCUPATIONALLY EXPOSED TO IONISING RADIATION

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INTRODUCTION

Chromosome aberrations in cultured human lymphocytes may serve as biological indicators of occupational radiation exposure. From earlier investigation during the history of radiation protection it is well known that the frequency of dicentrics, rings and acentric fragments remained stable for some time after irradiation (2). *In vivo* analyses of chromosome aberrations in peripheral blood lymphocytes of persons occupationally exposed to ionising radiation have shown various aberration frequencies. With this study we want to highlight the persistence of chromosome aberrations (CA) expressed as chromosome breakage in human peripheral blood lymphocytes in medical staff occupationally exposed to ionising radiation.

MATERIAL AND METHODS

The group of 46 subjects, all medical staff occupationally exposed to ionising radiation was divided into five groups. Analyses for chromosomal aberrations were repeated after 3-4 months (8 subjects), 6-7 months (12 subjects), 8-9 months (6 subjects), 11-12 months (10 subjects) and after 24 months or less (10 subjects). Lymphocytes from whole blood culture were examined for the presence of chromosome aberrations. Whole blood cultures were obtained according to routine protocol using F-10 culture medium (Gibco) containing 20 % foetal calf serum, phytohaemagglutinin and antibiotics. The cultures were incubated at 37^0 C for 48 hours. Colchicine was added during the final three hours of cultivation. Cells were harvested by centrifugation after three hours reincubation, then swelled in 0.075 M Kcl and fixed in 3:1, methanol-acetic acid fixative. Slides were stained by Giemsa method for chromosome aberrations.

RESULTS AND DISCUSSION

The examinees were divided in five groups (Tables 1-5). In the first group, in 25% of examinees obtained after 3-4 months remained unchanged, in 37.5% a decrease, and in 7.5% a increase of unstable aberrations were observed. In the second group, in 25% of examinees an increase and a decrease were observed and in 50% of examinees the finding remained unchanged. In 66.7% of subjects who were analysed 8-9 months after exposure a decrease of unstable chromosome aberrations was observed. In a fourth group, in 50% of examinees a decrease was observed, whereas in 40% the finding remained unchanged. In 60% of subjects investigated after 24 months or less (the fifth group) the finding remained unchanged. Regardless of the results, all examined subjects, except five (*), continued to work. As indicated by personnel monitor film badge, two subjects received the exposure dose that exceeded currently recommanded dose limits (**). The results point out the importance of chromosome aberration analyses for the detection of radiation induced damage, as well as the significance of implementation of protective measures. The individual differences in radiosensitivity as well as the frequency of cytogenetic aberrations depend on physiological conditions of each subject and on variability in DNA repair and misrepair processes (3). As time dependent changes in dicentrics may be subject to individual variations, it may be difficult to extrapolate from one case to another (1).The present results do not allow definite conclusions on the effects of ionising radiation during the occupational exposure, but are enough intriguing to motivate further investigations.

REFERENCES

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3. F.P. Perera , R.M. Whyatt, *Mutat.Res.* 313, 117-129 (1994).

Table 1.

	FIRST SAMPLING						3 - 4 MONTHS LATER					
Subject	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)
1	2		2	1			5		1	1		
2	2	3	2	2			5	1	5	1		
3	5	1	5	1			1					
4*	2	1	6	2			1		1	1		
5	2	1	2	1			1	3	4			1
6	1		3	1			1	1				
7	4		1	1			1	1	1	1		
8*	3	1	2	1			1		4	1	2	
9		2	5	1			1		3	1		

Table 2.

	FIRST SAMPLING						6 - 7 MONTHS LATER					
Subject	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)
10	1	1				1	4	2	4	1		
11	2	7	1	1				2	3	1		
12		2	3	1			1	5	5			
13	1	5	5				2	3				
14*	1	1	2		1		1	2	2	2		
15		6	2	1			3	3	3	1		
16*	4	2			1		1	1	1			
17		2	3	1				1	2			
18	3	2	1	1			3	1	2			
19	3	5		1				1	2		2	
20	1	1	3	2			1	2	1			
21*	2	3	1	1			2	2	2		1	

Table 3

	FIRST SAMPLING						8 - 9 MONTHS LATER					
Subject	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)
22	2	2	24	5				18	4	3		
23				1		1	1	6				
24	2	3	4	4			2	1	3			
25	2	4	2	1				2				
26	4	2	4	1				4				1
27	1	2	2	1				6	2	1		

Table 4.

	FIRST SAMPLING						11 - 12 MONTHS LATER					
Subject	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)
28	3	6	1	1			3	9	1	2		
29	2	3	1	1			2	1	1	1		
30**		1	3	1			3	9	2			
31		18	4	3			5	8		3		
32	2	4	2				1	1				
33	1	6					1					
34	1	1		2			2	6	3			
35	1	1	2	1			3	1				
36	2		1	1			1	4	1			
37	1	2	4	1			4	2	2			

Table 5.

	FIRST SAMPLING						≥ 24 MONTHS LATER					
Subject	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)	Chroma-tid break	Chromso-me break	Acentric fragment	Dicentric	Ring	Chromosome interchanges (tetraradial)
38	7	5	3	1				5	3	1		
39	1	3		1			1	4	1			
40		1	1	1			3	2	1	1		
41	3	5		1				1	2		2	
42	1	2			1		2	1	4	4		
43**	1		4	1			1	2	2	1		
44	2	3	4	1			7	5	2			
45	2	4	2				1	1				
46	1		1	1				2	3	1		
47	1		1	1			3	1				