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Abstract

The results of our study may briefly be summarized as follows: 1) The irradiation with microrays (20∼30 watts) similar as 2,000 R and 5,000 R Gamma radiation did not substantially affect the activity of fibrinolysin (SK+SD). 2) By the irradiation method so far mentioned it has been demonstrated that the fibrinolytic activity of anticoagulant of the SK+SD preparation is preserved in all the clotting systems which we used. 3) Our findings indicate that it is possible to irradiate patients for therapeutical purpose with Radarmed (electromagneticrays) provided that there is produced some enhancing influence of the same blood clotting factors or systems. Together with earlier works in this field it appears that this method of the microirradiation could provide us with an important evidence on which we can base our further in vitro and in vivo radiohematologic studies; investigations with various preparations, types of radiation that are still underway9∼16.

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INFLUENCE OF MICRORAYS ON THE FIBRINOLYTIC ACTIVITIES OF STREPTOKINASE AND STREPTODORNASE

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In the research field of radiation biology we have already reported in several papers about the disturbances of blood clotting or the arrest of blood clotting factors and systems under the influences of various types and dosages of radiation[1~5,12~16]. Such disturbances of the blood clotting system also seem to occur in the case of microray irradiation which is now common for the treatment of various diseases by using Radar Med. of Elektronik GmhH. Berlin and other companies. The microray irradiation proved to be very effective to cure the hematomas and other pathological conditions, but small purpuras are sometimes met with in the patients treated with the microray. Thus, there is great possibility that the microray irradiation may also induce the disturbances of blood clotting system resulting in the unfavorable side-effect, the appearance of purpura. So we attempted to check the possible effect of the microray on the blood clotting system. And we have observed individual partial problems of fibrinolysis *in vitro* but failed to obtain any evidence of the suspected effect of irradiation on various fibrinolysin preparations. Therefore, we first irradiated Varidase (American Cyanamid Company), Streptokinase-Streptodornase (Lederle, United States and Munich) in the doses of 2,000 R and 5,000 R.

In this paper we present briefly the results of our studies with Varidase after the microray-irradiation.

MATERIAL AND METHODS

Two different batches of Varidase, each vial containing 20,000 units of streptokinase and 5,000 units of streptodornase were used.

The following tests were applied as in a previous paper 5, but thrombelasto-

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graphy was also employed in order to study the effect of Varidase on blood clotting and fibrinolysis before and after irradiation:

(a) Clotting time of recalcinated plasma[6]; (b) thrombin clotting time[7]; (c) fibrinolytic activity on non-heated fibrin plates[8]; (d) auto-coagulogram[9]; (e) thrombelastography[17].

Vials containing streptokinase were irradiated by the Radarmed (of Dr. Szirmai). The specifications of the equipment used are as follows:

Microrays apparatus of Deutschen (German) Electronic CmbH., Berlin, TS 5302. The apparatus produces 12.4 cm long rays at the frequency of 2400 MH_Z. The amplitudes will be produced by the so-called "Ganzmetall-Mehrschlitz-Magnetoron" and due to the Radiator by a total, isolated coaxial label. The action intensity is between 1～200 watts. We usually use 20～30 watts. Studies were carried out to determine different blood clotting factors in patients before and after irradiation and also the activities of non-irradiated and irradiated streptokinase-streptodornase, 4, 48 and 96 hr respectively after irradiation. The streptokinase-streptodornase was dissolved in 20 ml of isotonic saline solution as in our pervious examinations, which was added to each vial. The vials were refrigerated when not in use. In this paper only the results of our *in vitro* examinations are described. To determine the clotting time of recalcinated plasma 0.1 ml of streptokinase was added to 0.2 ml of normal plasma and the mixture incubated for 30 min; 0.3 ml of $CaCl_2$ (M/40) was then added and the clotting time determined.

Table 1

(SZIRMAI and HAJDUKOVIĆ)

	Subject I			Subject II	
		Material			Material
	Control	Non-irradiated	Irradiated 4 h	Control	Non-irradiated
Clotting time of recalcinated plasma (seconds)	74	211/202	20—30 Watt 211/209	182	191/190
Thrombin clotting time (seconds)	20	more than 10 min.	more than 10 min.	23	more than 10 min.
Fibrinolytic activity (field in mm^2)	—	134/133	113/116	—	222/219
Auto coagulogram (%) *incubation time* / 4	26	29/31	23/22	22	36/41
10	101	57/63	64/64	103	79/81
20	102	33/35	31/30	104	54/52
60	42	19/22	11/12	33	20/21

For the thrombin clotting time 0.2 ml of plasma was incubated with 0.1 ml of streptokinase and then added with 0.3 ml of thrombin (Antithrombin Reagent Roche; 16 units dissolved in 3 ml of distilled water).

The fibrin plates were prepared with ox fibrinogen (Warner Chilcott) and thrombin. The substrate plasma used for the autocoagulogram consisted of one ml of plasma from the subject, mixed with 0.1 ml of streptokinase-streptodornase, incubated for 30 min and used as previously described[4].

For the controls in all the tests, an identical amount of the isotonic saline solution was added instead of streptokinase-streptodornase. As far as the autocoagulogram method is concerned, our work was facilitated by determining the clotting time after 4, 10, 20 or 60 min, respectively of incubation of the hemolysates and the results are given as coagulation activity in per cent (Fig. 1).

RESULTS

We present only the mean values of our results. Table 1 shows our findings in 4 subjects with non-irradiated material and material that had been irradiated 4 hr previously. Table 2 compares streptokinase irradiated 48 hr previously with non-irradiated streptokinase in 4 other subjects. Table 3 gives the condition 96 hr after irradiation in 2 subjeets.

In addition, thrombelastograms before and ofter the irradiation will be shown later.

	Subject III			Subject IV		
		Material			Material	
Irradiated 4 h	Control	Non-irradiated	Irradiated 4 h	Control	Non-irradiated	Irradiated 4 h
20—30 Watt 182/184	134	193	20—30 Watt 190/193	122	296/301	20—30 Watt 354/347
more than 10 min.	17	more than 10 min.	more than 10 min.	—	more than 10 min.	more than 10 min.
252/256	—	222	310/217	—	104/107	122/121
57/62	31	32	27/31	61	36/41	41/43
79/81	104	82	66/71	102	51/53	31/33
38/40	82	42	29/31	102	21/23	16/16
17/15	33	19	15/17	27	6/4	6/7

Table 2

(SZIRMAI and HAJDUKOVIĆ)

	Subject V			Subject VI	
		Material			Material
	Control	Non-irrediated	Irradiated 48 h	Control	Non-irradiated
Clotting time of recalcinated plasma (seconds)	112	/120	20—30 Watt 122/119	111	/116
Thrombin clotting time (seconds)	18	/93	91/87	19	/101
Fibrinolytic activity (field in mm^2)	—	132/	242/239	—	/232
Auto-coagulogram (%) *incubation time* / 4	62	/18	31/33	21	/14
10	101	/37	31/32	101	/27
20	82	/35	34/35	49	/17
60	19	31/31	26/23	21	16/15

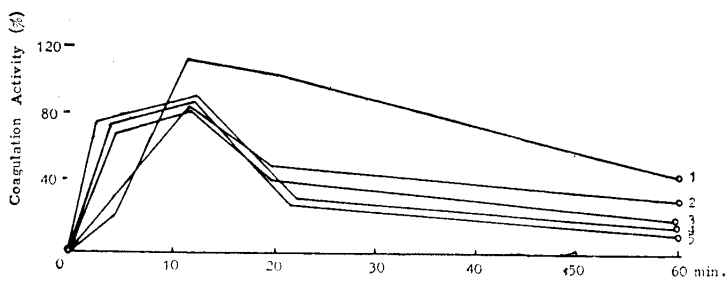

Fig. 1

(SZIRMAI - HAJDUKOVIĆ)

Auto-coagulogram in Subject II

1. Control-Autocoagulogram, 2. Coagulogram of non-irradiated material. 3. Coagulogram of irradiated material (2,000 R) (previous examinations), 4. Coagulogram of irradiated material (5,000 R) (previous examinations), 5 Coagulogram of irradiated material (20～30 Watt, micro-rays) (present examinations)

CONCLUSIONS AND SUMMARY

The results of our study may briefly be summarized as follows:

1) The irradiation with microrays (20～30 watts) similar as 2,000 R and 5, 000 R Gamma radiation did not substantially affect the activity of fibrinolysin (SK+SD).

2) By the irradiation method so far mentioned it has been demonstrated

	Subject VII			Subject VIII		
		Material			Material	
Irradiated 48 h	Control	Non-irradiated	Irradiated 48 h	Control	Non-irradiated	Irradiated 48 h
20—30 Watt 116/112	110	341/339	20—30 Watt 361/360	121	161/159	—
84/85	16	more than 10 min.	more than 10 min.	18	171/167	—
187/191	—	361/359	371/372	—	231/229	—
21/19	31	16/16	16/17	41	27/22	—
36/34	101	8/9	19/21	102	41/37	—
26/24	102	9/9	15/16	81	16/16	—
11/9	41	3/2	3/3	32	6/6	—

Table 3

(SZIRMAI and HAJDUKOVIĆ)

	Subject IX			Subject X		
		Material			Material	
	Control	Non-irradiated	Irradiated 96 h	Control	Non-irradiated	Irradiated 96 h
Clotting time of recalcinated plasma (seconds)	69	111/113	20—30 Watt 102/104	81	201/203	20—30 Watt 181/183
Thrombin clotting time (seconds)	22	181/183	182/177	20	121/151	121/122
Fibrinolytic activity (field in mm^2)	—	402/397	360/362	—	266/264	—
Auto-coagulogram (%) *incubation time* / 4	23	27/27	21/23	34	17/19	17/21
10	101	25/2[illegible]	34/35	101	33/34	27/31
20	82	29/31	32/27	91	31/32	31/33
60	86	16/16	11/12	36	11/12	9/8

that the fibrinolytic activity of anticoagulant of the SK+SD preparation is preserved in all the clotting systems which we used.

3) Our findings indicate that it is possible to irradiate patients for therapeutical purpose with Radarmed (electromagneticrays) provided that there is pro-

duced some enhancing influence of the same blood clotting factors or systems. Together with earlier works in this field it appears that this method of the micro-irradiation could provide us with an important evidence on which we can base our further *in vitro* and *in vivo* radiohematologic studies ; investigations with various preparations, types of radiation that are still underway[9~16].

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