EXPERIENCE IN TREATMENT OF THE RADIATION SYNDROME IN ACCIDENT VICTIMS EXPOSED WITH NON-UNIFORM DISTRIBUTION OF THE DOSE WITHIN A BODY.

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Summary. Experience in diagnosis and treatment of radiation accident victims undergone to radiation exposure with non-uniform distribution of the dose within a body is presented and the most significant features of medical management of such patients are discussed. The term "compound radiation injury" is proposed to use for this form of radiation disease. Treatment of compound radiation injury demands a participation of very qualified specialists. The first medical aid and management should include careful body surface monitoring. Beside daily haematological observation and cytogenetic study with corresponding treatment, careful observation and registration of skin reaction are necessary. Some features of treatment are the following: more early administration of antiinfectious means, including isolation in sterile room, timely surgicall intervention, prophylacsis and treatment of endogenic intoxication improving of microcirculation, long time follow up study with pathogenic therapy.

Accidental exposure to people in most cases characterized with non-uniform distribution of absorbed dose within a body. The difference between the local and total dose (or dose to bone marrow) can be 20 - 30 times and more. Such type of exposure brings to development several syndromes, among which skin injury and especially necrosis of the skin are of greate importance. Clinical course of these cases is much more severe than in classical form of acute radiation disease.We use the term "compound radiation injury" for that. The frequency of such cases among all cases of acute radiation disease is close to 50 %.

Non-uniformity of distribution of dose can be conditioned by several factors,among which short distance or close contact a source to the body is the most important. Another significant factor is an energy of radiation, its penetrating ability. Gamma - beta or gamma-neutron exposure, typical for reactor accident, leads to specifical type of dose distribution with significant overexposure to skin and underlying tissues.

For successful management of compaund radiation ingury (CpRI) good knowledge on condition of exposure with all details is quite important. This can help in estimation of actual dose distribution, evaluation of local and whole body dose. All means must be used : careful study of the accident circumstances, simulation of the accident with using different type of dosimeters, calcullation, biological dosimetry (chromosome aberration analysis of blood cells and bone marrow from several parts of the body), electron spin resonance dosimetry of biological tissues and clothing.The last one sometimes can be especially useful.

Clinical course of CpRI characterized with more short latent period, since severe skin radiation injury develope earlier than cytopenia. The period of main manifistations is more severe because of often septical complications and very severe pain syndrome. More long period of high fever, significant decrease of mass of body, more early and deep anaemia, disproteinaemia, high tachycardia and neurological disorders all together form the syndrome of endogenic intoxication(SEI), too typical for CpRI.
The SEI can be a cause of death, as it was in most of chernobyl lethal cases.

As it was shown in special study, the degree of the SEI depends on the size of skin lesions, especially on the mass of skin in zone of necrosis, and less depends on the severity of bone marrow syndrome.Repeated plasmaferesis was one of the most effective therapy procedure for detoxication.

Late period of CpRI is also much more severe: amputative defects and cataracts are the main consequences of the CpRI.These patients need more long careful surveillance and treatment. Some of them are invalides.

Planning of treatment in acute phase of the CpRI and in period of late effects should be based on early diagnostic and prognostic evaluations. For diagnosis of severity of bone marrow syndrome the rulles ellaborated previously [1] for bone marrow exposure appeared to be the most useful and help to predict the time and degree of cytopenia. The significance of evaluation of the size of skin injury has already been mentioned.For this the registration of early erythema considered to be important. Prognostical evaluation of the severity of skin syndrome is more difficult, since affected by many factors: type of radiation, its energy, size and place of skin lesion and so on...

However, in any case, careful day-by-day observation of skin reaction with photo and/or video registration is very useful. In our practice we use also the registration of skin reaction as a function of time by means of arbitrary skin reaction scores elaborated for this purpose.

Day-by-day development of symptomes of injury, as well as, the process of healing can be registered and presented in form of curve (the scale of scores and two examples of its use is shown on the fig 1).These examples demonstrate two different situations with various values of the rate of skin reaction (RSR), designated as index "J" .The analysis of a number of such curves brought us to the conclusion that the RSR could serve as a prognostical criterion. This is because the analysis has shown that there was some critical value of index "J" beyond which surgical intervention became a necessity. Moreover, it was found from retrospective analysis that some dependance pertained between this value and the time of operation; the higher the RSR, the earllier the operation became essential;(fig 2) this means that estimation of the RSR can help to predict the need and time of surgical intervention[2]. Timely operation is essential to prevent the severe SEI and to evoid secondary changes in exposed and adjacent tissues.

However, observation and registration of skin reaction is not enough to make a choice of the type of operation (amputation, its level, necroectomia, type of grafting and so on).It was shown by T.Protasova (unpabllished data) that pathomorphological findings in skin exposed to radiation can serve as a some sort of biological dosimetry and hence as a prognostic test. Three zones of character changes were considered. The first - was a zone of total necrosis, the second - the zone of injury with possible reparation, the third - the zone of relatively safe tissues. Pathomorphological findings in these zones were discribed for various periods of time elapsed since exposure. The main recomendation was to use skin biopsy for diagnosis of severity of skin lesion, and to perform operation, if necessary, in the periphery of the third zone. The best time for operation was indicated between the third week and third month.

In conclusion we would like to summarise, that:

The first medical aid in case of CpRI should include careful radiomonitoring of skin surface; careful dosimetric study with using all of possible means and methods; careful observation and registration of skin reaction; more early administraation of antiinfectious means; prophylacsis and treatment of endogenic intoxication; early

prophylacsis of skin necrosis, improving of microcirculation; timely and radical surgical treatment; long time follow up study of patients.

References

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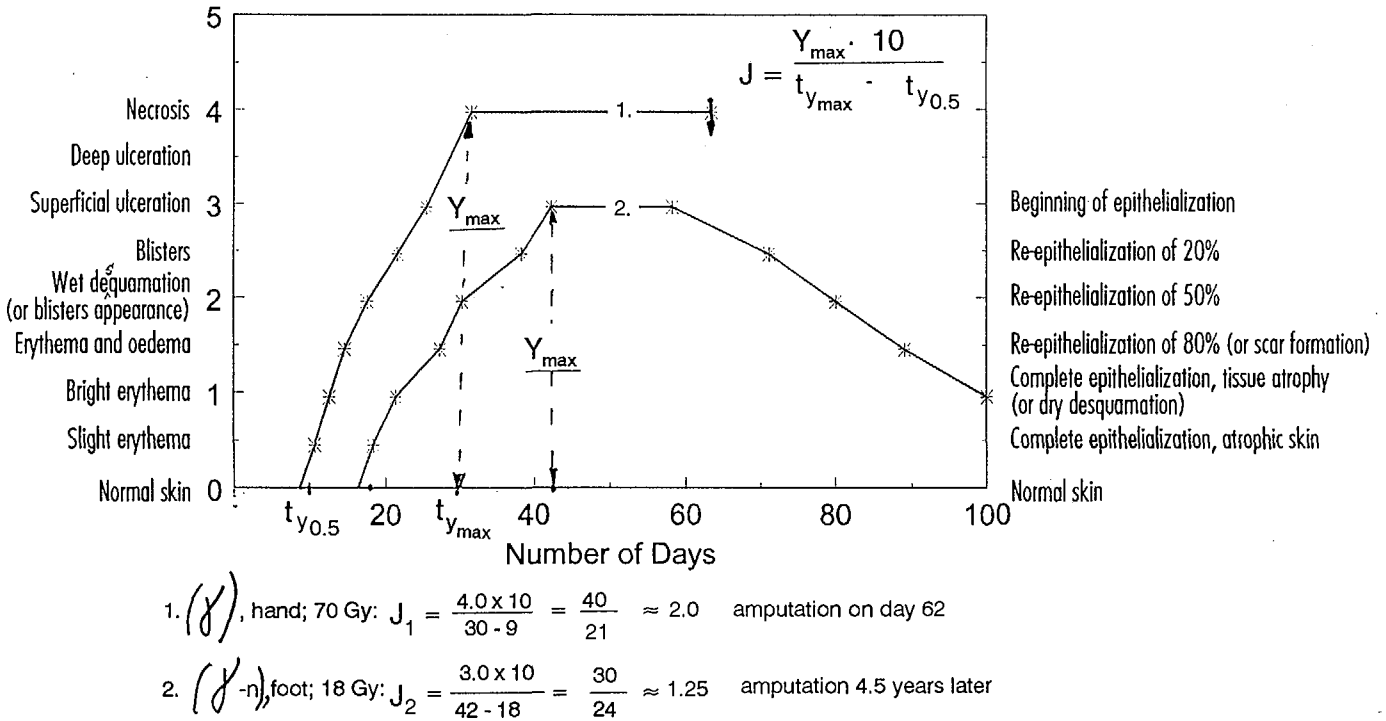

1. (γ), hand; 70 Gy: $J_1 = \frac{4.0 \times 10}{30 - 9} = \frac{40}{21} \approx 2.0$ amputation on day 62

2. (γ-n), foot; 18 Gy: $J_2 = \frac{3.0 \times 10}{42 - 18} = \frac{30}{24} \approx 1.25$ amputation 4.5 years later

Fig. 1: Description of the scale of scores and two examples of its use

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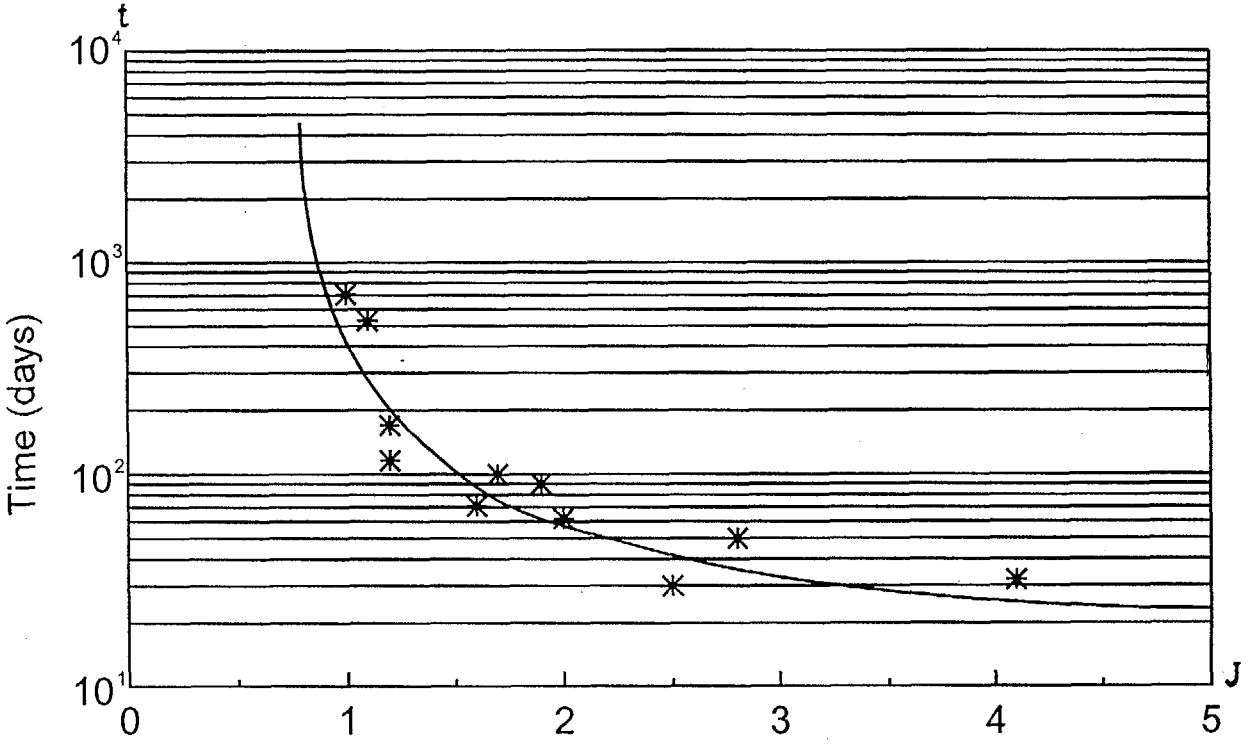

Fig. 2: The dependence of the time (t) at which amputation becomes essential on the rate of skin reaction (J)

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