RADIATION PROTECTION - SELECTED TOPICS
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GENERAL DISCUSSION ABOUT ENZYMES ACTIVITIES OF RADIATION INJURY

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ABSTRACT

Researching reliable and practical biological indicators of radiation injury, however, is very interesting and considerable department of scientific studies, practical and theoretical. Enzymes activities are among biochemical indicators which are changed after radiation injury. Activity of these specific proteins is important in regulation of every biochemical reaction in existing beings. Biologycal macromolecules can be damaged by radiation or the cell permeability can be changed. All of these influence directly on enzymes activities. In this paper we present the review of the all important enzymes, indicators of the radiation injury, which variances on reference to normal values are significant of the functional and the structural changes of essential organs.

INTRODUCTION

The biological effects of ionizing radiation represent the consequence of the radiation energy apsorption in the tissue which is otherwise energetically stable. There are two theories explaining the effect of ionizing radiation on living matter. Firstly, "the target theory", according to which there is a "direct" effect of radiation, meaning that the ionizing particle directly damages, i.e. ionizes a biologically important molecule. Secondly, the theory of "loose radicals" which comprises the so-called indirect damage of molecules. Creating loose radicals which react with biologically important molecules damaging

them by oxidation or turning them into organic radicals, the biochemical disorder further causes morphological changes of the cell, which can lead to an immediate or reproductive death of cells.

DISCUSSION ABOUT ENZYMES ACTIVITIES OF RADIATION INJURY

Enzyme activity is among the biochemical parameters changing after radiation exposure of an organism. The activity of these specific protein-biocatalysts is important also for the regulation of all biochemical reactions in living beings. There is an infinite number of enzyme systems, and the factors influencing their induction and activity regulation are almost imposible to asses. Therefore, research of the influence of ionizing radiation on enzyme systems in vivo has shown that enzyme systems radiated in vivo behave differently than in case of in vitro radiation. That is self-explanatory, since in the case of radiation in vivo, we deal with a far more complicated system than the hydric systems are, so that the processes which develop under the influence of ionizing radiation in vitro cannot be compared with the processes happening in the cell.

While testing enzyme activity due to radiation damage in vivo it is not possible to know whether the enzyme has been altered directly, or whether other parts of the cell have suffered damage as well.

The serum enzymes derive from various organs which secret them into the serum. Enzyme activity changes after radiation can be the result of the release of enzyme from their intercellular bonds in radio-sensitive tissues and their penetration of circulation and urine.

Table 1. shows activity changes of various enzymes in the serum and urine after radiation (Altman I.K., 1970).

Research concerning the influence of radiation on enzyme systems in vivo so far do not make it possible to form a common, general conclusion about the influence of radiation on enzyme activity. It has been establieshed that the radiation effect varies from system to system, even from organ to organ for the same enzyme system. Some enzymes get activated by certain amounts of radiation, while others remain inactivated or unchanged under the same conditions.

The assumption about the "release" of enzymes from their intercellular bonds and their penetration into the plasma and urine has been experimentally confirmed for a number of enzymes. The International Agency for Atomic Energy issued a recommendation after the Chernobyl accident and pointed to

Table 1.

Enzyme	Species	Changes	Notes
AST ALT	Rabbit	Serum, increase, first day 180,6 mC/kg	
	Rat	Serum, unstable, first day	AST increase, decrease without changes 3h - 3days
	Mouse	Serum, increase 6 - 8h 129-258 mC/kg	AST and ALT
ALD	Rabbit	Serum, increase, Ist day 193,5 mC/kg	With rabbits and guinea pigs under continual radiation othee serum enzymes are in decrease
LDH	Rat Monkey	Serum, unstable increase 1-2 days Increase Ist day 6 -7Gy	Temporary increase with the rabbit 193,4mC/kg with the goat increase after combining exterior and interior radiation. Increase with the mouse, esp. LDH faction. MDH changes in the blood of patiens under radiotherapy related to tumor destruction.
Lipase	Rat	Serum, increase 2 nd day 154,8mC/kg	Changes of the isoenzyme with rats clearing factor of lipase increased with rats after 206,4mC/kg
Beta-glucuro-nidase	Man	Urine, increase, 1 - 3 weeks	
Peptide hidrolaze	Dog	Increase 4-5 days	In urine, before death, with the rabbit, no effect with man.
DN-ase II	Man Rat	Urine 1 - 3 weeks	With the rat in the plasma, as well, no changes after radiotherapy with man.

the necessity of monitoring the level of enzyme activity in the serum: alaline-transaminase, alpha-amilase, aspartate-transaminase, aldolase, creatine-kinase as well as its isoenzymes, gama-glutamile-transferase, lactate-dehydrogenase and its isoenzymes, and alkali-phosphatase.

Measuring of enzyme activity is the basis for studying the kinetics of all enzyme reactions. Enzymes are accelerators of chemical reactions and in order to determine their activity we must measure the speed of reaction. This is done by determining the disappearance of substratum or appearance of a product in relation to time. Instead of these parameters, with many dehydrogeneses it is possible to measure the change of concentration of the cosubstratum NADH. Since, as a rule, the speed of reaction in longer intervals is not constant, the values of the changes in the first minutes after the begining of the reaction are extrapolarised in the starting or initial speed. There are many commercial tests for the quantitative determination of the activity of the quoted enzymes. It is thereby possible to obtain quick and accurate results, the procedure is simple and the possibility of error ultimately reduced.

It would be all means be indispensable to determine screening methods for the determination of activity of these significant enzymes so that the results obtained would be comparable among various laboratories. Such an experience would definitely offer an even better and more complex information about the importance of biological catalysts with patients who have experienced an accident or whose health is damaged by radiation.

CONCLUSIONS

At this moment there is no laboratory-chemical research method which would enable a clear, homogenous radiation diagnosis and target therapy.

The situation we face with patients suffering from radiation damage is complicated to that extent, that no information can be neglected: only a combination of more research findings can offer information necessary, but that requires many more discoveries, complex research of the radiation disease, taking into consideration, as well, patients undergoing radiation therapy.

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