

ULTRADISPERSED DIAMONDS OF DETONATION SYNTHESIS AS A MEANS TO CORRECT THE PROCESS OF PROTEIN AND LIPID PEROXIDATION UNDER CANCER GROWTH

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It is well-known that cancer growth is accompanied by pronounced disorders in the ratio of anti- and prooxidants in the organism, the changes in the level of active oxygen species (AOS) and the intensity of radical processes in the organism housing the tumor [1].

Pronounced changes in the level of peroxidation processes in laboratory animals suffering Pliss limphosarcoma were experimentally registered. At the terminal stage of the tumor growth the moderate decrease in the level of the initiated proteins peroxidation in plasma and the growth of proteins peroxidation in red cells in comparison with the reference group was observed. So the tumor growth leads to the redistribution of active oxygen species among different targets resulting in disturbances in peroxidation processes on the organism level. Minding the mentioned above disorders, the antyioxidant therapy is desired. Sterically blocked phenols are known to slow down the tumor growth [1]. Ionol is one of the most thoroughly investigated cytostatic preparations within the phenol series. Traditional antioxidants usually comprise in their structure –OH and –NH₂ fragments. Common anticancer medicine, doxorubicene, also possesses the mentioned above moieties.

Nanodiamonds of detonation synthesis (NDs) belong to the class of nanostructured materials which contain various functional groups on the surface of particles determining specific chemical properties of the material. In particular, heterocyclic fragments, C(O)NH₂, –OH and –NH₂ functional groups are present on the surface of NDs' garins [2].

So the antioxidant effect of the NDs may be expected. The antioxidant activity of sterically hindered phenols, e.g. 4-methyl-2,6-bis(tert.butyl)phenol (ionol) is a well-known fact. As for nanodiamionds, their antioxidant activity was proved by the ability of NDs to suppress the initiated chemiluminescence in the suspension of liposomes. Hence the modifying effect of NDs with respect to the

essentially shifted peroxidation processes during the tumor growth was anticipated. The low toxicity of NDs (LD₅₀ > 7000 mg/kg, per os) as well as the unique combination of functional groups on their surface that is hardly possible to get for individual compounds are their pronounced advantages [2].

The positive effect of NDs' application was achieved in the limited preliminary clinical tests on the patients suffering different forms of cancer in its IY stage [2].

Minding the potential ability of ionol, doxorubicene and NDs to influence the processes of peroxidation an investigation of the changes in the level of peroxidation of proteins in blood of healthy animals treated with this material was carried out.

It was found out that treatment with all mentioned preparations resulted in the lowering of the level of initiated peroxidation of proteins in serum while the corresponding index in red cells changed only slightly.

Treatment with all above preparations also resulted in the pronounced decrease in the spontaneous peroxidation of proteins both in serum and red cells.

Treatment of the tumor bearing animals with antioxidants such as ionol, cytostatic – doxorubicene and NDs greatly changed the pattern of protein peroxidation. The use of all mentioned medicines led to further moderate decrease in the level of the initiated peroxidation of lipids in serum and to the decrease in the level of the initiated peroxidation of proteins in red cells. In the case of cytostatic – doxorubicene the growth of the level of initiated peroxidation of proteins was registered in comparison with that for the intact group and the group of cancer suffering animals deprived of any medical treatment. So the redistribution of AOS between serum and red cells during tumor growth takes place and doxorubicene is the only preparation in the studied capable set to change it.

Ionol and NDs are able only to depress the total level of peroxidation of proteins. As for the spontaneous peroxidation of proteins, the growth of limphosarcoma results in the pronounced rise in protein peroxidation in red cells accompanied by no changes in the level of peroxidation in serum. The level of peroxidation of proteins in red cells is lowered under treatment with doxorubicene. Treatment with ionol didn't show any reliable changes in the level of spontaneous peroxidation of proteins in red cells in comparison with the group deprived of medical treatment.

The changes in the level of spontaneous peroxidation of serum differ from those in red cells. In comparison with the intact group at the terminal stage of tumor growth the moderate decrease in the level of spontaneous peroxidation of proteins is observed. Under treatment with ionol and doxorubicene the tangible depression of spontaneous peroxidation of proteins in serum is observed compared with the group devoid of any medical treatment. Treatment of animals with NDs leads to the pronounced growth in spontaneous peroxidation of proteins in comparison with the group devoid of medical treatment, this index being even greater than for the intact group.

Under the conditions of the growth of Pliss limphosarcoma the overall level of the initial peroxidation of proteins (both in serum and red cells) slightly raises and treatment with ionol and NDs leads to the depression in the level of the overall initiated peroxidation. Treatment with doxorubicene results in the detectable growth in the total level of initiated peroxidation.

Under the conditions of the growth of limphosarcoma the growth in the spontaneous peroxidation of proteins is the same as that for the initiated process.

Under treatment with ionol and NDs the levels of spontaneous peroxidation of proteins are close to that in the intact group.

Treatment with doxorubicene results in a distinct depression of the total spontaneous peroxidation

of proteins. So under medical treatment the redistribution of active oxygen species among the multitude of cell targets takes place.

Having summarized all types of proteins peroxidation, it may be concluded that at the terminal stages of Pliss limphosarcoma growth the total level of peroxidation of lipids exceeds that for the intact group. Treatment with doxorubicene, ionol and NDs results in a moderate reduction of peroxidation. Under the chosen therapeutic doses the extent of proteins peroxidation varies only slightly.

Under treatment with ionol, NDs and doxorubicene the considerable growth in peroxidation of lipids takes place both in red cells and serum. Treatment with doxorubicene leads to the most pronounced effect in the peroxidation growth of lipids. Within the experimental series of preparations NDs occupies the intermediate position.

Probably the use of the above preparations leads to the intense destruction of the tumor cells resulting in the growth of the level of lipids peroxidation. The essential changes in the peroxidation process under tumor growth as well as under treatment with antitumor substances used in the investigation should result in the changes in the activity of antioxidant enzymes both under normal progression of the tumor and under medical treatment.

In the preliminary experiments the pronounced changes in the activity of the key antioxidant enzyme, superoxide dismutase, under treatment with doxorubicene were demonstrated. Such effect is a serious drawback of this medicine.

References

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