



Original Contribution

PATHOMORFOLOGICAL CHANGES IN SOME GLANDS OF INTERNAL SECRETION IN PIGS AFTER IRRADIATION AT 3.0 AND 4.5 GY

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ABSTRACT

The exposure to ionized radiation always results in systemic structural and functional alterations whose extent depends on both the exposure dose and many other environmental factors. The pituitary-adrenal glands, pituitary-thyroid gland and pituitary-genital glands axes are parts of the endocrine system that is a central regulator of the normal functioning of the organisms and its performance under changed conditions such as exposure to radiation.

The purpose of this study was to establish the morphological changes and to compare tissue alterations in pituitary gland as a central organ of the endocrine system, and structural alterations in adrenal glands – peripheral glands of internal secretion.

The experiment was performed with 10 male pigs, crosses of Big White x Landrace at the age of 45 days, irradiated at 3.0 Gy and 4.5 Gy.

During the necropsy, a gross anatomy evaluation of pituitary and adrenal glands was done. Specimens for histological examination were collected, fixed in 10% neutral formalin and stained with haematoxylin/eosin.

It was shown that the pituitary gland had a higher morphological resistance to ionized radiation and that the changes in its parenchyma were not consistent even after irradiation at 4.5 Gy. The dystrophic changes in the adrenal cortex were much more severe for both used doses and they were responsible for the altered function of these glands.

Key words: pigs, irradiation, pituitary gland, adrenal glands, pathomorphology.

The most important merit of functional radiobiology is undoubtedly the determination of the dose dependences and post irradiation systemic reactions, induced by the injury of cellular systems with various functions that throws light onto the leading role of the nervous, endocrine, bone marrow and gastrointestinal syndromes in the outcome of exposure to increased doses of radiation (1, 2).

The gathered data in the respective scientific

fields indicate that in these events, primary roles are played mainly by the axes pituitary-adrenal glands, pituitary-thyroid gland and pituitary-genital glands as parts of the endocrine system – a central unit of regulation of systemic functions under both normal and altered conditions (3, 4, 5).

The exposure to ionized radiation always results in structural and functional systemic changes, whose extent depends on exposure dose but also on many other environmental factors (6, 7).

The purpose of this study was to establish the morphological changes and to compare tissue alterations in pituitary gland as a central organ of the endocrine system, and

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structural alterations in adrenal glands – peripheral glands of internal secretion.

MATERIAL AND METHODS

In this experiment, 10 male pigs, crosses of Big White x Landrace at the age of 45 days, were used. The following groups were formed on the basis of exposure dose: **Group 1** – irradiated at 3.0 Gy (n=5); and **Group 2** – irradiated at 4.5 Gy (n=5);

The animals were under control until the observation of clinical signs or lethal issue.

The experiment was performed under conditions ensuring the homogenous gamma ray irradiation on a Rocus-M facility with ^{60}Co as a source of radiation.

After the death of animals, they all were necropsied. After gross anatomy evaluation of pituitary and adrenal glands, the radiation-induced alterations were described. The specimens obtained for histological examination were fixed in 10% neutral formalin, stained with haematoxylin-eosin and the structural alterations were then described.

RESULTS AND DISCUSSION

The inspection after the autopsy revealed changes typical for the acute form of radiation disease. On the background of massive haemorrhages and haematomas in

subcutaneous tissue, muscles and nearly all internal organs, there were haemorrhages in adrenal glands of animals exposed to both doses – 3.0 and 4.5 Gy. Unlike adrenal glands, the gross examination of pituitary gland did not reveal any significant alterations, although there were disseminated brain haemorrhages, embracing the meninges and the hemispheres. This finding was probably due to the fact, that mammalian pituitary gland is considered to be a relatively radiation-resistant organ (1).

The histological examination of adrenal glands confirmed the macroscopic picture. The changes in adrenal cortices after gamma irradiation at 3.0 and 4.5 Gy were similar but at a different extent. The focal haemorrhages and the initial necrobiotic changes in the glandular parenchyma, observed after exposure to 3.0 Gy (**Fig. 1**), were significantly more pronounced and more severe in animals irradiated at 4.5 Gy (**Fig. 2**). Despite the reported literature data about only minor morphological changes in the cortex of adrenal glands (8), our results were corresponding to other published data (9) according to which, morphological alterations of the cortical and medullary layers of adrenal glands occurred in the early post irradiation terms.

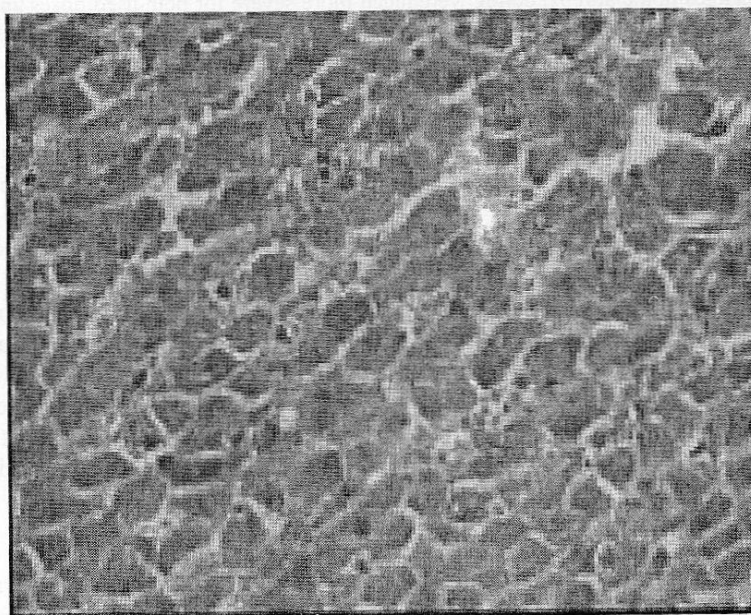


Fig.1. Adrenal gland of a pig irradiated at 3.0 Gy. (magn. 10x40)

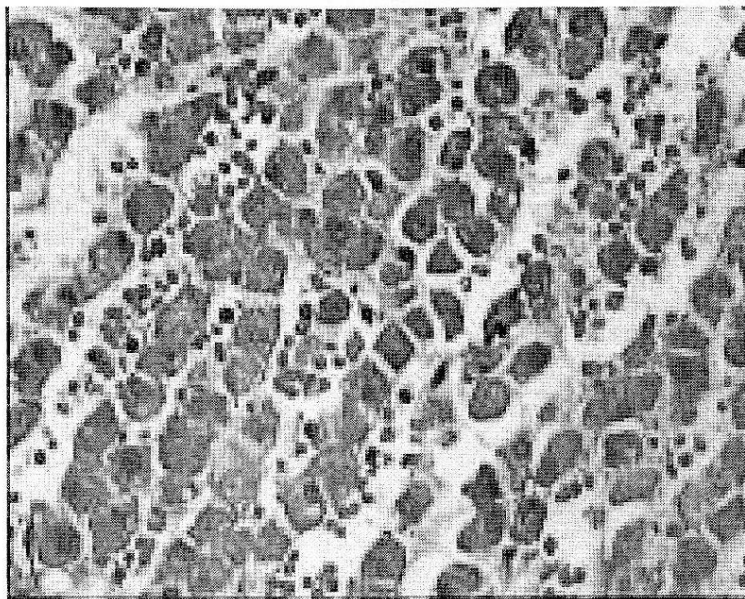


Fig.2. Adrenal gland of a pig irradiated at 4.5 Gy. (magn. 10x40)

Histological alterations of the pituitary glands in animals, irradiated at 3.0 Gy were not observed whereas in those exposed to 4.5 Gy, the changes were of polymorphic character and were weak. They consisted in mild haemodynamic damages – vascular hyperaemia and dilatation (**Fig. 3, Fig. 4**). There were no necrotic or necrobiotic changes regardless of clearly manifested circulatory disorders. Other investigators had also reported that extensive doses of total irradiation resulted in development of morphological traits, indicating for an intermittent enhancement or suppression of the pituitary function, accompanied by altered ratios of secretory cells (10).

CONCLUSIONS

1. The examination of pituitary gland evidenced its higher morphological resistance to ionized radiation as compared to adrenal glands.
2. The changes in pituitary parenchyma after irradiation even at 4.5 Gy were not consistent, but only circulatory disorders were observed.
3. The dystrophic changes in adrenal cortices for both used irradiation doses were considerably more severe and a cause for the altered function of the glands.

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