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Radiotherapy-Induced Alterations in Vitreous Humor: A New Potential Critical Structure

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Abstract
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Abstract

Objective: Vitreous humor (VH) is not considered as a critical structure in the radiotherapy planning process. In the present study, an experimental animal model was constructed to examine the effects of radiotherapy on VH, which appear to have important roles in maintaining eye health.

Methods: The right eyes of twelve New Zealand rabbits were irradiated 60 Gy in 3 fractions, and the contralateral (left) eyes were considered as control. Weekly ophthalmologic examination was performed after irradiation, for three months. At the end of the third month, enucleation and vitrectomy were conducted. The vitreous samples were subjected to metabolomic analyses, ELISA analyses, viscosity measurements, and electron microscopic examination.

Results: In control and experimental vitreous samples, 275 different metabolites were identified, and 34 were found to differ significantly between groups. In multivariate analyzes, a clear distinction was observed between control and irradiated vitreous samples. Pathway analysis revealed that nine pathway was affected, and these pathways were mainly related to amino acid metabolism. A significant decrease was observed in the expressions of type II, V, and XI collagens in protein level in the ELISA. There was a non-significant decrease in type IX collagen and viscosity. Electron microscopic examination revealed disrupted collagen fibrillar ultra-structure and dispersed collagen fragments in the experimental vitreous.

Conclusion: An intact vitreous is essential for a healthy eye. In this study, we observed that radiation causes changes in the vitreous that may have long-term consequences.