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Zmiany morfologiczne rzęski komórek światłoczułych w doświadczalnej retinopatii fototoksycznej

Morphologic changes in photoreceptor connecting cilia in experimental phototoxic retinopathy

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Summary:

Purpose: It has been suggested that structural alterations of the photoreceptor connecting cilium are a primary defects leading to photoreceptor degeneration in some forms of inherited retinal degenerations (5). In a series of 17 eyes with retinitis pigmentosa (RP) and with various genetic forms of RP, examined by electron microscopy, no structural abnormalities were found in the arrangement of the ciliary microtubules. However, a 10% reduction in the ciliary diameter was recorded in RP photoreceptors (12). The question arose: is thinning of the cilium a primary defect associated with RP, or a secondary abnormality related to degenerative processes in photoreceptors irrespective of the cause?

The aim of this study was to examine the photoreceptor connecting cilia in the early stages of experimental light induced retinal degeneration in the rat, by conducting a structural and morphometric survey of the relevant electron-micrographs. In addition, the effects of various fixation techniques on the ciliary structure were compared.

Material and method: Analysis of 124 transmission electron micrographs of 9 controls and 155 transmission electron micrographs of 55 light damaged animals was conducted. For the effects of fixation on morphometry 72 transmission electron micrographs from an additional 4 controls (43 negatives) and 8 light damaged animals (29 negatives) were examined. Light damage was induced by exposure to 1000 lux of white light for 120 minutes. Retinal samples were fixed either in 2,5% glutaraldehyde or by high pressure freezing followed by freeze-substitution.

Results: This study showed that one of the early morphological alterations occurring in rat photoreceptors damaged by light is a reduction of ciliary diameter of approximately 10%. It was not associated with any apparent ultrastructural changes in the axoneme. It was also found that the degree of ciliary shrinkage largely depends on the fixation technique used. Cryo-fixation followed by freeze substitution shows more shrinkage than chemical fixation by immersion in glutaraldehyde.

Conclusions: It is suggested, that reduction in photoreceptor cilium diameter is a secondary and non-specific change. It is not a unique phenomenon, observed not only in human photoreceptors, which are undergoing degeneration in RP. It can be induced in otherwise healthy rat retina, in which photoreceptor degeneration was caused by exposure to toxic levels of light.

Słowa kluczowe: rzęska fotoreceptorów, retinopatia fototoksyczna.

Key words: photoreceptor connecting cilium, phototoxic retinopathy.