

Activated retinal glia mediated axon regeneration in experimental glaucoma

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Glaucoma, a leading cause of blindness, is a neurodegenerative disease characterized by progressive loss of retinal ganglion cell axons in the optic nerve and their cell bodies in the retina. Reactive retinal glial changes have been observed in glaucoma but the role of such glial changes in the pathogenesis of the condition remains unclear. In the present study we found that retinal ganglion cells in an experimental animal model of glaucoma have an increased axon regenerative potential.

Regeneration of adult rat retinal ganglion cell axons after optic nerve crush was significantly increased in vivo when combined with intraocular pressure-induced experimental glaucoma. This enhanced axon regeneration response was correlated with a significant increase in activation of glial fibrillary acidic protein+retinal glia. Using a dissociated retinal ganglion cell culture model we showed that reducing the number of activated retinal glia with a glial specific toxin, α -Aminoadipic acid, significantly reduced the growth potential of retinal ganglion cells from glaucomatous rat eyes, suggesting that activated retinal glia mediate, at least in part, the growth promoting effect.

This was shown to be mediated by both membrane-bound and soluble glial-derived factors. Neurotrophin and ciliary neurotrophic/leukemia inhibitory factor blockers did not affect the regenerative potential, excluding these growth factors as principal mediators of the enhanced growth response occurring in glaucomatous retinal cultures. These observations are the first to reveal that retinal ganglion cells from glaucomatous rat eyes have an enhanced regenerative capacity. Furthermore, our results suggest that activated retinal glia mediate at least part of this response.

Further work to understand and enhance the regeneration-promoting effect of activated retinal glia is required to determine if this approach could be useful as part of a therapeutic strategy to encourage optic nerve regeneration in glaucoma.

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