

Program#/Poster#: 47/B20
Abstract Title: Thickness and Histological Changes in Optic Nerve-Sectioned Chick Retina
Presentation Start: Sunday, Apr 25, 2004, 10:30 AM -12:30 PM
Location: Hall BC
Reviewing Code: 116 animal models: eye growth regulation – AP
Author Block: V.Choh, J.Banh, C.F. Wildsoet. School Optometry, Univ California-Berkeley, Berkeley, CA.
Keywords: 671 retinal degenerations: cell biology,521 ganglion cells,584 microscopy: light/fluorescence/immunohistochemistry

Purpose: In chickens, optic nerve section results in shorter than normal eyes that are hyperopic as a consequence. In addition, retinal ganglion cells are lost in response to the axotomy. This study was undertaken to characterise the time course of retinal thickness changes and cell loss in the retina.

Methods: White Leghorn chicks (*Gallus gallus domesticus*; n=19) were unilaterally optic nerve-sectioned (ONS) at 1 day of age. Contralateral fellow eyes were left unoperated. Retinal thicknesses were measured using high frequency A-scan ultrasonography prior to ONS and then again after 1, 3, 5 and 7 days. Other birds were sacrificed 3, 5, 7, 10 or 14 days after ONS (n=3 per group) and eyes were enucleated, then processed for histological analysis.

Results: In keeping with expected axotomy-related cell loss, retinas in ONS-eyes became progressively thinner ($p < 0.0001$) starting 3 days after ONS. Retinal thinning paralleled a progressive loss of cells from the ganglion cell layer (GCL; $p = 0.0011$), with cell numbers in ONS-eyes becoming significantly reduced relative to fellow eyes beginning 5 days post-ONS (mean \pm sd: -184 ± 71). Apoptotic activity, determined by TUNEL staining, was evident in the GCL of ONS-eyes (fraction of apoptotic cells: $3.1 \pm 0.8\%$) at 3 days post-ONS, peaking at 5 days post-ONS (fraction: $19.2 \pm 12.3\%$) before subsequently declining and levelling off to fellow eye levels starting at 10 days post-ONS. Paradoxically, retinal thicknesses increased over the first 3 days both in ONS-eyes (change: $17.2 \pm 1.4 \mu\text{m}$) and to a lesser extent, in fellow eyes (change: $9.9 \pm 11.5 \mu\text{m}$). Except for the initial thickening, retinas in fellow eyes remained unchanged in thickness ($p < 0.6503$) and in GCL cell numbers ($p = 0.4260$).

Conclusions: The finding that apoptotic activity precedes retinal thinning and GCL cell loss indicates that ONS-related cell death was mediated, at least in part, via apoptotic pathways. The results showing early retinal thickening were a surprise given the long-held tenet that post-hatch retinal cells are terminally differentiated. Our preliminary data based on BrdU staining indicates the presence of mitotic cells in the various retinal layers, which is consistent with a report of mitotic activity in retinal cells at the ciliary margin (Fisher and Reh, 2000). That such mitotic activity is decreased with age, together with the finding that retinal thickening was not seen when ONS was undertaken in older birds (data not shown), suggest that retinal cell proliferation may contribute to the observed retinal thickening.

Commercial Relationship: V. Choh, None; J. Banh, None; C.F. Wildsoet, None.

Grant Identification: NEI Grant RO1 EY012392-04