

Lamina Cribrosa Capillaries Straighten as Intraocular Pressure Increases

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PURPOSE: The purpose of this study was to visualize the lamina cribrosa (LC) capillaries and collagenous beams, measure capillary tortuosity (path length over straight end-to-end length) , and determine if capillary tortuosity changes when intraocular pressure (IOP) increases.

METHODS: Within 8 hours of sacrifice, 3 pig heads were cannulated via the external ophthalmic artery, perfused with PBS to remove blood, and then perfused with a fluorescent dye to label the capillaries. The posterior pole of each eye was mounted in a custom-made inflation chamber for control of IOP with simultaneous imaging. Capillaries and collagen beams were visualized with structured light illumination enhanced imaging at IOPs from 5 to 50 mm Hg at each 5 mm Hg increment. Capillary tortuosity was measured from the images and paired two-sample t-tests were used to assess for significant changes in relation to changes in IOP.

RESULTS: Capillaries were highly tortuous at 15 mm Hg (up to 1.45) . In all but one eye, tortuosity decreased significantly as IOP increased from 15 to 25 mm Hg (P < 0.05).
CONCLUSIONS: Although high capillary tortuosity is sometimes regarded as potentially problematic because it can reduce blood flow, LC capillary tortuosity may provide slack that mitigates against reduced flow and structural damage caused by excessive stretch under elevated IOP. We speculate that low capillary tortuosity could be a risk factor for damage under high IOP.

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