Abstract Title:

Estimation of Gestational Age by Smartphone Ophthalmoscope Assessment of Anterior Lens Capsule Vascularity in Preterm

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Introduction: The disappearance of the anterior lens capsule vascularity (ALCV) is a normal embryological process and has a high correlation with gestational age (GA) at delivery in preterm neonates. Furthermore, ALCV may disappear linearly after delivery in preterm neonates, potentially providing a longer window for postnatal GA assessment than current methods. Using a novel smartphone-based ophthalmoscope we have obtained images of the ALCV to determine GA. This can be especially helpful when early ultrasound gestational dating is not available or is unreliable. Our primary aim was to validate the use of a handheld smartphone ophthalmoscope to capture images of ALCV and quantify the complexity and branching of ALCV using Sholl analysis.

Methods: ALCV images were taken within 48 hours of delivery using a Panoptic® ophthalmoscope with an iExaminer® (Welch-Allyn) adapter connected to an iPhone 4s. These tools provide a mobile and

inexpensive image capture system for clinical use. Images were captured by retracting the eyelids with cotton-tipped applicators without the use of mydriatics. The captured ALCV images were contrast-enhanced and reduced to 8-bit greyscale using FIJI (fiji.sc). We then used the Sholl analysis plug-in within fiji to quantify the extent of branching and intersections within the vascular tree.

Results: Six preterm babies with GA ranging from 32 to 36 were enrolled within 48hrs of birth. Images amenable to Sholl analysis were captured successfully from all six babies. Sholl analysis was able to determine key parameters in quantification of the vascularity, including the number of intersections, intersection radius, ramification index, and critical radius in each image, and each parameter tended to decrease as GA increased.

Conclusion: Using a smartphone ophthalmoscope, it is possible to obtain the images of ALCV. The use of Sholl analysis allows us to quantify the regression of ALCV and correlate those changes with advancing postnatal age. This novel application of smartphone ophthalmoscopy and automated ALCV image analysis may provide a safe, accurate and noninvasive technology to estimate postnatal GA in preterm neonates. A larger study is underway to compare smartphone determination of GA with ultrasound estimated GA.