W17 Postmortem Monocular Indirect Ophthalmoscopy (PMIO)

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After attending this presentation, attendees will be able to: (1) differentiate between direct and indirect ophthalmoscopy, noting advantages and limitations of each technique for the postmortem detection of fundal hemorrhages; (2) discuss the fundal location of retinal hemorrhages relative to their projected aerial image during monocular indirect ophthalmoscopy; and, (3) accurately draw retinal abnormalities observed during monocular indirect ophthalmoscopy with a simple ocular model on a fundal diagram.

This presentation will impact the forensic science community by providing an overview of PMIO, facilitating skill acquisition, and evaluating practical training and image acquisition with a smartphone.

Postmortem examination of the retina has relied on ocular evisceration. In most medical examiner/coroner jurisdictions, ocular enucleation is not a standard autopsy procedure unless child abuse is suspected, thus creating observational bias when citing the prevalence of postmortem fundal findings such as retinal hemorrhages (preretinal, flame-shaped or splinter, and dot/blot), perimacular retinal folds, retinoschisis, and postmortem artifactual retinal folds. PMIO permits examination of the decedent's posterior fundus and portions of the peripheral retina. The required equipment necessary for PMIO is relatively inexpensive and, when compared to direct ophthalmoscopy, the technique is less affected by corneal clouding, lens opacity, or vitreous hemorrhage and offers a wider field of view. PMIO uses a focal light source and an aspheric, convex condensing lens. An excellent source of coaxial illumination is a halogen or xenon surgical or procedural headlamp. This light source creates a collimated beam of light and permits the examiner to stabilize the condensing lens with both hands. Current aspheric lenses range from +14 to +40 diopters and are available in different diameters, permitting a field of view of 35°-55°. Postmortem corneal opacity may cause the fundus to appear hazy; however, by gently removing the epithelial layer of the cornea, the emergent image is usually of adequate quality to readily detect lesions such as fundal hemorrhages and retinal folds.

Learning how to perform and become proficient at PMIO can be perplexing and intimidating. Most pathology residents and forensic pathology fellows have limited exposure to indirect ophthalmoscopy. Because the projected aerial image is inverted and laterally reversed, precise descriptions or recording of fundal abnormalities can be challenging. Unlike binocular indirect ophthalmoscopy with a teaching mirror attachment, a procedural headlamp worn by the instructor does not permit the fellow or resident to view the projected aerial image simultaneously during PMIO. To address these learning obstacles it is necessary to develop tools and models to facilitate skill acquisition. Most smartphones can capture the image formed during indirect ophthalmoscopy using the smartphone's light source to illuminate the fundus. An hour or two with an inexpensive ocular model can shift the learning curve of the resident, fellow, or forensic pathologist substantially to the right in how to correctly position the light source and hold the indirect lens.

This presentation consists of an initial discussion and presentation that reviews the technique of PMIO, highlighting the optics, the equipment, and examples of abnormal fundal findings found at autopsy by PMIO and the use of a smartphone to capture the projected aerial image. Next, attendees will have a realistic learning experience by practical hands-on training with a procedural headlamp, an aspheric indirect lens, and a simple ocular model containing a variety of retinal abnormalities observed at autopsy. The ocular models have variably sized "pupillary" openings and some will have clear acetate over the openings to simulate corneal glare. Attendees will receive assistance in positioning the procedural headlamp, holding the indirect lens, viewing the projected aerial image, and accurately recording the retinal abnormalities. Attendees with smartphones can practice still image acquisition and video recording of fundal images produced by PMIO. Attendees will learn how to hold the smartphone with one hand while imaging the fundus and how to use a mini-tripod so the condensing lens can be stabilized with both hands, thus enhancing image stabilization and acquisition.

Following practice visualizing, diagramming, and image capture techniques of numerous fundal images, attendees have the option of being evaluated with a series of unknowns. Self-assessment of technical skill training and review of the unknown retinal findings concludes the presentation. As part of the presentation, attendees will be given a USB thumb drive with the introductory presentation, sample retinal images, fundal diagrams, and articles on PMIO.

Indirect Ophthalmoscopy, Retinal Hemorrhage, Smartphone