W15 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 retinal 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 on a fundal diagram and capture the projected aerial image with a smartphone.

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

Postmortem examination of the retina has relied on ocular enucleation. In most medical examiner/coroner jurisdictions ocular evisceration 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 (subinternal limiting membrane, flame-shaped or splinter, and dot/blot), perimacular retinal folds, retinoschisis, and postmortem artefactual 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. PMIO uses a focal light source and an aspheric, convex condensing lens. An excellent source of paraxial illumination is a smartphone or a surgical or procedural headlamp using a halogen or xenon light source. The headlamp 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 come 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 recordings of fundal abnormalities can be challenging. Unlike binocular indirect ophthalmoscopy with a teaching mirror attachment, an instructor and the fellow or resident cannot 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. 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 workshop consists of an initial discussion and didactic presentation reviewing the technique of PMIO, highlighting the optics, 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 simple ocular models containing a variety of retinal abnormalities observed at autopsy. Attendees will receive assistance in positioning the procedural headlamp, holding the indirect lens, viewing the projected aerial image, and accurately recording the retinal abnormalities on fundal diagrams and their smartphones. Attendees with smartphones can practice still image acquisition and video recording of fundal images produced by PMIO and will learn how to hold and stabilize the smartphone while imaging the fundal findings in the ocular models.

Following practice visualizing and diagramming numerous fundal images, attendees will 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 workshop. Attendees will be provided fundal diagrams and articles on PMIO.

Indirect Ophthalmoscopy, Retinal Hemorrhage, Smartphone

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