

## H4 Fatal Systemic (Paradoxical) Air Embolism Diagnosed by Postmortem Funduscopy

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**Learning Overview:** After attending this presentation, attendees will be able to identify distinctive retinal air emboli associated with systemic air embolism.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by reinforcing the necessity for dedicated postmortem fundal examinations.

Due to its uncommon occurrence, few clinicians or pathologists have seen patients or decedents with systemic air embolism. Likewise, its clinical signs—skin marbling (*livedo reticularis*), lingual pallor (Liebermeister’s sign), frothy arterial bleeding, and Retinal Air Emboli (RAE)—are not well known. The millwheel murmur characteristic of venous air embolism is typically absent in arterial air embolism. The unique funduscopy findings of RAE include conspicuous intravascular air columns and bubbles and pale silvery streaks representing spectral glare highlighting air-filled retinal blood vessels.

**Case Report:** An 8-month-old infant with a distended abdomen arrived at the emergency department *in extremis*. Found unresponsive at home, resuscitative efforts were unsuccessful, with death pronouncement occurring 65 minutes after the public safety answering point call. Five hours after death, postmortem indirect and direct ophthalmoscopy detected a few scattered splinter retinal hemorrhages over the posterior poles and distinctive RAE—intravascular air emboli interspersed between blood columns and silvery outlines of retinal blood vessels. Postmortem radiography disclosed intravascular air, subcutaneous emphysema, rib fractures, and a pneumoperitoneum. Autopsy confirmed those findings and detected cerebral and cardiac intravascular air bubbles as well as severe abdominal trauma with hepatic, pancreatic, mesenteric, and duodenal/jejunal lacerations with resultant pneumo-hemoperitoneum. A 1.5cm transmurular tear in the inferior vena cava’s ventral wall allowed air into the right heart and a patent foramen ovale permitted systemic (paradoxical) air embolism.

Categorized as venous, arterial, or paradoxical, air embolism is infrequent but can be catastrophic with significant morbidity and mortality. It has occurred following penetrating or blunt trauma, pulmonary barotrauma, surgical procedures, vascular catheterization, intraosseous infusion, hemodialysis, mechanical ventilation, bronchoscopy, pulmonary fine-needle aspiration, endoscopy, placenta previa, Caesarean section, criminal abortion, and intra-operative blood recovery. Descriptions of RAE in published case reports and case series are scarce and none contains photographic images of RAE.<sup>1-4</sup> The first recorded case with depictions of RAE was in 1914 by Wever who illustrated air bubbles and “silvery glittering rods” within the retinal vasculature of a 25-year-old man with pulmonary abscesses who died suddenly following a pulmonary vein erosion during Paquelin thermocautery.<sup>5</sup> Subsequent line drawings or artistic renditions of RAE have occurred in four case reports—a non-fatal case following maxillary sinus irrigation published in 1920, two occurrences associated with suboccipital pneumoencephalography described in 1957 and 1958, and a fatality during laser bronchoscopic resection of a bronchogenic carcinoma reported in 1988.<sup>6-9</sup>

While there are a few descriptions and illustrations of RAE, there are no published photographic images of RAE in infants, children, or adults. This case report describes and photographically documents classic RAE associated with fatal systemic (paradoxical) air embolism. These crucial retinal findings emphasize the importance of consistent and thorough postmortem fundal examinations.

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### Retinal Air Emboli, Air Embolism, Funduscopy