A1 The Introduction of a Cranial Gunshot Trauma Photographic Atlas

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Learning Overview: After attending this presentation, attendees will be familiar with a new resource to be utilized in forensic gunshot analyses. This novel Cranial Gunshot Trauma Photographic Atlas presents a photographic series of 45 human crania that have been subjected to ballistic trauma under controlled conditions.

Impact on the Forensic Science Community: This presentation will impact the forensic science community in terms of the competence and performance of attendees by the availability of a Cranial Gunshot Trauma Photographic Atlas that can assist with understanding a baseline of damage to be expected from a specific shooting scenario. This will assist practitioners in analyzing gunshot trauma from unknown forensic scenarios by increasing the knowledge of how extrinsic variables affect patterns of gunshot trauma.

The Cranial Gunshot Trauma Photographic Atlas is a uniform series of professional photographs that were taken following controlled gunshot experiments to 45 donated human heads. While high-quality photos of cranial gunshot trauma are found in books and scientific articles, these images are limited in scope and are often from instances of gunshot trauma where certain extrinsic and intrinsic variables are unknown. The Atlas introduced here highlights the patterns that exist in cranial gunshot trauma when certain variables are controlled.

The controlled shooting experiment was designed to test the effects of bullet construction on cranial gunshot trauma patterns. To do this, the experiment controlled for extrinsic variables, including weapon, shooter, distance, caliber, and bullet velocity. Donated, fleshed human heads (*n*=45; 23 females, 22 males; age at death 54–90 years) were shot once by the same expert marksperson with a Smith and Wesson® model 438 J-frame revolver with a 1⅞" barrel. The ammunition used was .38 Special Winchester® Train and Defend™ in both full metal jacket and jacketed hollow point constructions. Each round weighed 130 grains; this allowed control for differences in resultant trauma due to bullet mass and to instead isolate the effects of bullet construction. The shots were all from a distance of three yards and either from an anterior direction through the frontal bone or from a lateral direction through either the temporal bone or parietal bone. A ballistic chronograph was used to record the impact velocity of each shot, and a fleece backstop was in place behind the head to contain bullets from perforating shots. Post-shooting, all heads were sectioned to allow for endocranial observation, then macerated using standard methods.

Within the Atlas, each individual skull is depicted by professional photographs, including, but not limited to: entrance and exit wounds from both ectocranial and endocranial views; a 360-degree rotational series of the cranium; specific views of gunshot-related fractures; and any present pathology unrelated to gunshot trauma. The known ages and sexes of each individual are listed along with bullet construction and velocity data. All skulls were scanned for bone mineral density, and these values are also included in the Atlas. Including these data is intended to allow practitioners to observe how factors such as shot location, age, sex, and bone mineral density affect patterns of gunshot trauma. The anticipated value of this Atlas will be in its comparative strength for practitioners who are faced with analyzing gunshot trauma with unknown extrinsic factors.

The Cranial Gunshot Trauma Photographic Atlas is available for forensic practitioners by request and is in a PDF file format to allow for ease of use. There is also potential to expand the Atlas by adding photographs from any future controlled gunshot studies and continuing to further the biomechanical understanding of cranial gunshot trauma.

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