



### H145 The Histomorphology of Cranial Fracture Healing: Case Examples

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**Learning Overview:** After attending this presentation, attendees will understand the types of histologic changes that are manifest within healing cranial fractures.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by highlighting the histologic features of several examples of healing/healed cranial fractures, including samples from differing age groups, different fracture/healing time, and varying types of histology stains used.

This study recently received a National Institute of Justice grant for the investigation of cellular and morphologic characteristics of healing cranial vault fractures, to develop a time-since-fracture database specifically related to cranial fractures. This database is composed of cranial fractures with a known date and time of injury, with samples submitted to the Western Michigan University School of Medicine from numerous partner offices/institutions. The development of specific protocols for radiologic evaluation, as well as sample decalcification and processing are ongoing. A series of several stains, including hematoxylin and eosin, trichrome, and Alcian Blue/Orange G, are prepared for each sample, and a group of blinded forensic pathologist and anatomist reviewers evaluate the histologic sections for the presence or absence of numerous specific features. As the total number of samples submitted increases, the hypothesis is that a reliable, reproducible, histomorphological timeline for cranial fracture healing will be established, with possible notable variations related to fracture location, concomitant morbidities, and age of patient/decedent. This time-since-fracture database will be helpful in evaluating other forensic cases, where the timing of cranial fracture is in question.

As arrangements with partner organizations are ongoing and sample preparation protocols are being refined, the database currently contains approximately two dozen samples, with decedent ages ranging from approximately 2 months to nearly 78 years of age and known injury ages ranging from acute (minutes) to 42 years. In this initial report, this study will present examples of the types of cases currently in the database. These will include cases of acute fractures, where virtually no histologic evidence of healing exists, cases with several hours of healing, cases with days-to-weeks-to-months of healing, and cases which are, for all practical purposes, considered completely healed, with a post-injury healing time of many years. Photomicrographs of histology sections with each stain will be provided, focusing on the important aspects of the healing process that are highlighted by each stain.

Although one aim of this presentation is to provide an illustration of the histologic features of cranial fractures of varying age and in different aged cohorts, an additional goal is to use the presentation as an outreach to the forensic pathology community to recruit more partner offices/institutions for this important project. Only with a sizeable sample will this project attain the numbers necessary for reliable statistical conclusions. Cases of healing cranial fractures of definite known time-of-injury are not very common; however, with more partners involved in the study, the hope is that an adequate sample size will be attained so that this time-since-fracture database will represent a solid and reliable resource for forensic scientists faced with questions regarding cranial vault fracture healing time.

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### **Cranial Vault, Fracture, Time-Since-Injury**