A88 Experimentally Induced Rib Fractures Using Euthanized Burmese Pythons (*Python Bivittatus* Kuhl): A Comparison of Compression Impacts to Inform Pediatric Rib Fractures in Humans

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Learning Overview: After attending this presentation, attendees will have a better understanding of rib fracture location as a consequence of experimentally induced compressive forces using euthanized Burmese python thorax sections to inform pediatric rib fracture analysis for infants 0 to 1 year of age.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing evidence for interpreting rib fracture location consistent with anterior to posterior compression and posterior to anterior compression using Burmese pythons (*Python bivittatus* Kuhl) of size and thorax dimensions similar to human infants from birth to 1 year to inform cases of pediatric rib fracture analyses.

In Florida, forensic anthropologists assist medical examiners and child protection investigators by assessing fracture patterns in dead and living pediatric patients, respectively. Since the " ... possibility of child abuse is often overlooked in clinical practice," forensic anthropologists tend to be called more often to assist medical examiners with pediatric autopsies because both healed and acute injuries inform the medical examiner's analysis of cause and manner of death.[1] Even with the inclusion of the forensic anthropologist at autopsy, distinguishing acute accidental from acute non-accidental injuries is difficult and may result in confusing findings.

Physical child abuse has been linked to extrinsic stressors such as poverty and un- or underemployment of parents and caregivers.[2] Importantly, both extrinsic variables have risen with the COVID-19 pandemic, thereby making research that investigates methods that help to identify pediatric fractures at autopsy timely and important. Until now, most research into the etiology of blunt skeletal fractures have involved experimental studies on non-human exemplars (*S. scrofa* or pig and *O. cuniculus* or rabbit) and meta-analyses using clinical and medical examiner cases.[3-5]

In 2017, Florida Gulf Coast University's (FGCU) Human Identity and Trauma Analysis program partnered with the Conservancy of Southwest Florida as part of a larger project to remove invasive Burmese pythons from the Everglades. Using Burmese pythons as an exemplar for human infant cadavers (between birth and 1 year of age), an Instron® 5544a apparatus (1,500mm/min) was used to induce anterior ($N = 30$) and posterior ($N = 30$) compressions on the python samples ($N = 60$). Fracture location was recorded following Love and colleagues to find and determine if the exemplar fracture location patterns correlated to those seen in infants with accidental and non-accidental injuries to the thorax from published research.[6] In addition to the four regions of classification by Love and colleagues (anterior, anterolateral, posterolateral, and posterior), a fifth region was included, for fractures located laterally where the anterolateral and posterolateral regions meet.

Results of the experiment revealed 28 of the 60 total samples (46.6%) presented with rib fractures. From the 30 anterior compression tests, 13 samples (43.3%) presented fractures (total = 34) located on the anterior ($N = 12$), anterolateral ($N = 13$), lateral ($N = 3$), and posterolateral ($N = 6$) aspects of the ribs. Posterior compression tests revealed that 15 of the 30 samples (50%) presented with fractures (total = 24) located on the anterior ($N = 6$), anterolateral ($N = 1$), lateral ($N = 4$), posterolateral ($N = 12$), and posterior ($N = 1$) aspect of the ribs. A total of 1,438 ribs were observed, with only 54 ribs (0.04%) having fractures. These findings were consistent with previously published research that found that anterior to posterior manual compression (such as cardiopulmonary resuscitation) presented anterolateral or anterior fractures.[7] In addition, this study evidenced posterior and posterolateral rib fractures from posteroanterior compression, as expected.

This study fills a gap in the research by experimentally inducing rib fractures using non-human exemplars, *Python bivittatus* Kuhl (Burmese Pythons), that allow multiple samples to be used from one specimen. Specifically, the long bodies of these euthanized invasive species allow 8–10 rib cages comprising 24 ribs of the same size to be impacted. By ensuring the continuity of the rib sections, this study created a sample comparable to the sizes of infant thoraxes. In addition, while this research sheds light on the likelihood that distinct rib fracture patterns may enable analysts to indicate whether the impact was from the front or back of the infant, these unexpected results indicate that caution should be used when interpreting fracture patterns and even more so when extrapolating from non-human exemplars to human remains.

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Pediatric, Rib Fracture, Compression

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