A112 Direct and Indirect Blunt Force Trauma on the Cranium: Any Visible Differences

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After attending this presentation, attendees will have a better understanding of the possibility of discriminating between the types of cranial fractures resulting from blunt force trauma produced by direct and indirect strikes.

This presentation will impact the forensic science community by providing an empirical experiment model to understand the mechanics of fractures produced as a result of blunt force cranial trauma when the force is applied in both a direct and indirect way.

The majority of studies on the infliction on blunt force trauma to the cranium use mechanical methods (e.g., drop hammers) to produce fractures. These tools require adjustments of both the specimen, to allow for trauma to be inflicted to specific regions, and the amount of force necessary to produce a fracture with each strike.

The goal of this preliminary study was to create an experimental model with participants that inflict blunt force trauma to produce a more realistic fracture pattern.

Twenty adult pig heads (*Sus scrofa domesticus*) were struck with a 16-ounce claw hammer by five right-handed male participants between 20 years and 25 years of age. Specimens were placed in a custom-designed denim bag housed within a holding frame securely suspended by ratchet straps. Each skull was assigned an individual identification code based on both the type of strike (direct or indirect) and the sequence in which trauma was inflicted. For the purpose of this study, a direct strike refers to an over-the-head strike from the right-hand side of the body and an indirect strike refers to an over-the-head strike from the left-hand side of the body. The participants were instructed to strike the frontal region of four pigs' heads using the flat rounded surface of the hammer; two heads were struck using a direct overhead strike and the remaining two heads using an indirect overhead strike. After hot-water maceration, a visual analysis of fractures was performed by comparing with images and descriptions published in previous studies.[1-3]

A total of 16 fractures were observed (average length 42.9mm, width 31.0mm), and the number of lesions produced by indirect strikes (n=9) appear to be larger than direct strikes (n=7). This trend seems to be statistically not significant, but the small sample size must be taken into consideration. A larger sample, for example, may help to discriminate between the types of strike inflicted. Further research involving a quantitative measuring tool (e.g., accelerometer) could also improve the understanding of the dynamics of the force applied to produce trauma.

An additional outcome of this preliminary study is the creation of a flowchart as a supporting tool to identify the fracture type in a more objective and reliable way. The flowchart allows classifying five different types of fractures (linear, superficial depressed, depressed, comminuted, and depressed comminuted) according to the macroscopic characteristics observed on the bone.

Presented here is a pilot study that, even if limited by the small sample size, demonstrates the potential of an empirical experiment and provides an intuitive flowchart that describes the features of the fractures produced as a result of blunt force trauma. Furthermore, this flowchart has the potential to be a more objective method for the description of injuries which could be shared by forensic practitioners.

Reference(s):

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3. Sölvadóttir A., Thomsen H. *Biomechanical investigation of skull fracture* (thesis). Technical University of Denmark, Denmark, 2014. Available at http://www.pmik.dk/StudentProjects/Master-Skull-Fracture-Eyja-Helle.pdf (Accessed 17 October 2014).

Cranial Fracture, Blunt Force Trauma, Biomechanic

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