H7 Primary and Secondary Skeletal Blast Trauma

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After attending this presentation, attendees will understand some of the basic principles of explosives, blast trauma, skeletal injury mechanisms, and fracture patterns, and will learn the results of an experimental study on primary and secondary blast trauma, specifically skeletal fracture and dismemberment patterns resulting from various controlled explosive events.

This presentation will impact the forensic science community by assisting anthropologists in interpreting skeletal fracture patterns related to blast trauma.

Forensic anthropologists have become increasingly involved in criminal, humanitarian, and conflict-related investigations that involve human skeletal remains. Skeletal trauma interpretation is often an important aspect of these investigations. In recent wars and terror events, most injuries of the skeletal system have been caused by exploding ordnance. Within the anthropological literature, however, studies of skeletal trauma emphasize blunt, sharp and ballistic trauma, with little mention of skeletal trauma resulting from blasts. Explosive weapons are designed to be destructive through the sudden pressure change caused by the blast, or by spreading shrapnel which acts as small projectiles, both of which may result in skeletal fractures and dismemberment. In order to properly interpret skeletal fracture patterns resulting from blasts, it is important to understand the mechanisms of skeletal blast trauma, and to document known blast trauma patterns.

While there is an abundance of literature on blast trauma, particularly in medical and orthopedic journals, the focus of these studies is generally mortality and treatment of blast injuries. Moreover, most of these papers are case reviews, with very few controlled, empirical studies having been conducted. This project examines primary (resulting from blast wave) and secondary (resulting from disintegrated, penetrating fragments) blast trauma to bone in semi-controlled environments, and documents skeletal fracture and dismemberment patterns.

Pigs (*Sus scrofa*) procured from a local farmer were used as test specimens. Specimens were exposed to explosive events of varying explosive type (including C4, det cord, PETN, and pipe bombs), charge size (ranging from 0.5-10lbs of C4, up to 120 feet of det cord, and 1ft^2 of PETN), and distance (ranging from contact to several feet away). Specimen and test preparation were carried out in conjunction with and under the supervision of explosives experts. Following the explosive events, the remaining biological material was retrieved and transferred to the FBI Laboratory where the specimens were macerated in warm water, and reconstructed using Duco cement. Specimens were examined radiographically, visually, and microscopically. The extent and pattern of skeletal fracture and dismemberment was documented, along with any other pertinent observations.

Skeletal trauma from the blast events observed in this study tended to be extensive, presenting as complex, comminuted fractures with numerous small, displaced bone splinters and fragments. Traumatic amputation of the limbs and cranium was also observed. Skeletal injuries were concentrated in areas nearer the explosion, but there was generally no identifiable point of impact. Fracture patterns were more random in appearance than those typically associated with ballistic or blunt force injury events. Fractures tended to be more extensive on long bone shafts, though proximal and distal ends were also affected.

The patterns found appear to be uniquely associated with blast trauma, or at least differ enough in quality and extent to appear distinct from other types of well-documented skeletal trauma (such as ballistic, sharp force, and blunt force). These results may therefore assist forensic anthropologists and other forensic examiners in the interpretation of skeletal trauma by enabling them to differentiate between blast trauma and trauma resulting from some other cause. It is important, however; to consider the various factors affecting trauma and trauma variation including the bone type, injury location, and all available contextual information.

Forensic Anthropology, Blast Trauma, Skeletal Fractures

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