



A50 Fracture Patterns Associated With an Airplane Propeller Strike: A Case From the West Tennessee Regional Forensic Center

Jenna M.S. Watson, MA*, University of Tennessee, Department of Anthropology, Knoxville, TN 37996-1525; Benjamin J. Figura, PhD, West Tennessee Regional Forensic Center, Memphis, TN 38105

Learning Overview: After attending this presentation, attendees will understand the skeletal trauma patterns that result from propeller strikes and the importance of recognizing and interpreting propeller strike trauma in forensic cases.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing attendees with a better understanding of the skeletal trauma patterns that result from propeller strikes in order to improve the ability of anthropologists to recognize this type of trauma in cases in which human remains are recovered from the water and propeller trauma is possible.

Death or injury due to propeller strikes from either a boat or airplane are not common, but they do occur. In 2017, the Coast Guard documented 172 accidents involving a boat propeller, and between 1980 and 2004, the National Transportation Safety Board (NTSB) documented 80 accidents involving airport ground crew struck by airplane propellers.^{1,2} Previous studies of propeller trauma due to boat propellers have described severe blunt force injuries, such as longitudinal fractures and delamination to the cranium, and comminuted fractures or complete transection of the long bones.^{3,4} Forensic anthropologists may be asked to interpret trauma patterns on remains recovered from the water; thus, it is important for anthropologists to be able to recognize propeller trauma patterns in the skeleton. To better understand propeller trauma patterns in bone, this study examines a case of airplane propeller trauma in a ground crew member who was fatally struck by a moving airplane propeller at the Memphis International Airport in 1998. Using this known case of airplane propeller trauma, this study aims to determine whether there are distinct patterns of skeletal trauma associated with propeller strikes, and if so, to describe and document those patterns.

The bones present consisted of a skull (cranium and mandible), right radius, and right ulna, which were retained at autopsy for anthropological analysis of trauma at the West Tennessee Regional Forensic Center. All elements required reconstruction due to extensive fragmentation. After reconstruction was completed, the trauma type and patterns were described, photographed, and compared to other cases of propeller trauma described in the literature.

The cranium exhibited a longitudinal fracture running transversely across the frontal bone, as well as radiating fractures to the right side of the cranium. An area of delamination was present on the frontal bone. Scalloping and external beveling were present on the frontal bone, and internal beveling was also present at the area of delamination and on the right frontal bone near the temporal line. There was also severe fragmentation of the midfacial region resulting in complete detachment of the maxilla. The right proximal ulna exhibited a comminuted fracture and complete transection at the proximal shaft. The distal right radius also exhibited a comminuted fracture. It was possible to determine at least one impact point on the frontal bone, as well as impacts to the right elbow (proximal ulna) and wrist (distal radius).

The trauma patterns observed in this case (multiple blunt force injuries from multiple high-speed impacts) are consistent with other cases of propeller trauma described in the literature.^{3,4} A propeller strike is able to inflict multiple blows in a short period of time resulting in linear longitudinal fractures, delamination, radiating fractures, internal beveling of the cranium, and complete transection or comminuted fractures of the long bones.⁴⁻⁶ While propeller injuries are uncommon, it is not uncommon for a forensic anthropologist to observe complex trauma patterns and be asked to determine the type and direction of force, as well as the minimum number of impacts. Propeller trauma patterns could mimic other mechanisms of blunt force trauma, thus care should be taken when making interpretations of complex trauma patterns. Given the ability of propellers to inflict multiple high-speed impacts, and the propeller trauma patterns observed in this case study, additional trauma studies that explore uncommon mechanisms of blunt force trauma, such as propellers, are needed.

Reference(s):

1. United States Coast Guard. *Recreational Boating Statistics*. (2018).
2. Grabowski, Jurek G., Susan P. Baker, and Guohua Li. Ground Crew Injuries and Fatalities in US Commercial Aviation, 1983-2004. *Aviation, Space, and Environmental Medicine* 76, no. 11 (2005): 1007-11.
3. Semeraro, Dominique, Nicholas V. Passalacqua, Steven Symes, and Thomas Gilson. Patterns of Trauma Induced by Motorboat and Ferry Propellers as Illustrated by Three Known Cases from Rhode Island. *Journal of Forensic Sciences* 57, no. 6 (2012): 1625-29.
4. Stubblefield, Phoebe R. Homicide or Accident Off the Coast of Florida: Trauma Analysis of Mutilated Human Remains. *Journal of Forensic Sciences* 44, no. 4 (1999): 716-19.
5. Ihama, Yoko, Kenji Ninomiya, Masamichi Noguchi, Chiaki Fuke, and Tetsuji Miyazaki. Fatal Propeller Injuries: Three Autopsy Case Reports. *Journal of Forensic and Legal Medicine* 16, no. 7 (2009): 420-23.
6. Mann, Ronald J. Propeller Injuries Incurred in Boating Accidents. *The American Journal of Sports Medicine* 8, no. 4 (1980): 280-84.

Airplane Propeller Trauma, Skeletal Trauma, Forensic Anthropology