



Physical Anthropology Section – 2006

H28 Of Butterflies and Spirals: Interpretation of Fractures in Motor Vehicle vs. Pedestrian Accidents

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After attending this presentation, attendees will gain an appreciation for improving the diagnostic process of fracture interpretation in pedestrian victims of motor vehicle accidents. The role of the forensic anthropologist in these cases will be discussed. Comminuted fractures and analysis of direction of force will be addressed.

This presentation will impact the forensic community and/or humanity by exposing the forensic community to the advantages of a multidisciplinary approach during the reconstruction of events around a pedestrian vs. motor vehicle accident. Fracture patterns can provide a more complete understanding of the dynamics of the blunt force and the interpretation of these fractures on bare bone can help to illuminate the direction of force and may assist in the resolution of cases where charges are pending.

At the Maricopa County Forensic Science Center in Phoenix, Arizona, a multidisciplinary approach to accident reconstruction is employed. The investigating officer, pathologist, and anthropologist each bring a unique perspective to the positive outcome of these cases. An area of particular interest in recent years is the interpretation of fracture patterns in order to determine direction of force to the bones of pedestrians impacted by motor vehicles. These fractures often involve the pelvis, lower vertebral column, and lower extremities. Maceration and reconstruction can aid in the interpretation of these fractures and in the evaluation of the sequence of events surrounding the fatal accident.

In the cases presented, three victims, all pedestrians, were impacted by a motor vehicle. The pathologist obtained full body radiographs, performed complete autopsies, and removed the lower limb bones for maceration by the anthropologist. The anthropologist was asked to reconstruct the fractured bones for analysis.

In the first case, a 16-year-old girl was struck while crossing the road in a rural setting. The driver of the vehicle was impaired and charges were brought. The pathologist removed portions of the left distal tibia and fibula which were macerated and reconstructed. Analysis revealed that the victim had been struck from the right side as the left foot was bearing weight.

In the second case, a male was found on the side of the roadway in a rural setting. There were no witnesses to suggest the sequence of events causing his death. Autopsy revealed a skull fracture and badly shattered right lower leg. Radiographic analysis by the anthropologist demonstrated a Duverny's fracture of the right ilium. Based on the autopsy and lack of avulsion pockets, the pathologist surmised that the victim had been thrown from, or jumped from a vehicle, striking his head. There was concern, however, because the fractures of the tibia and fibula did not appear to support this reconstruction. The pathologist removed the shaft of the right tibia and fibula and requested maceration to enhance the diagnosis. Anthropological analysis revealed that the victim was likely struck from the right by a vehicle.

In the final case, a male was struck by a moving vehicle as he attempted to cross a busy street. The vehicle did not stop and the accident was investigated as a hit and run. Witnesses claimed that the individual was struck as he was crossing by the vehicle in the curb lane after the cars in the left and middle lanes had stopped for him. The pathologist removed the shafts of the right and left tibia and right fibula which were macerated and reconstructed to facilitate interpretation of the accident. Anthropological analysis revealed that the victim's right leg was struck from an anterior and lateral direction while the left leg was struck from a medial and slightly posterior direction.

In each of the above described cases, the leg bones of the victims' exhibited combinations of complete, spiral and comminuted "butterfly" fractures. In all cases, some reconstruction was necessary to determine the direction of force. Butterfly fractures are wedge-shaped, produced by a combination of complete transverse forces, and typically occur when the limb is weight-bearing. Since bone fails first under tension, the point of impact in a butterfly fracture is at the bottom of the wedge opposite the apex of the triangle. In one of the cases, a spiral fracture was observed on the left fibula. Spiral fractures of the distal fibula are typically caused by pronation/external rotation of the ankle joint. This individual (#3) also exhibits "boot top" fractures which are typically caused by direct or rotational forces.

The direction of force in each of these cases was discerned based on interpretation of the types and locations of the limb fractures. Careful dissection, removal, maceration, and reconstruction allow for a more intensive analysis of the direction of force and the relative position of the pedestrians legs to the vehicle. The multidisciplinary approach results in a more complete and detailed accident reconstruction in these types of cases.

Fracture Interpretation, Forensic Anthropology, Accident Reconstruction