Fatal Dragging Deaths with Soft Tissue and Bone Grinding Injuries

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ABSTRACT

The classic grinding/dragging cutaneous injury has a target-like appearance, often with postmortem features and possible associated underlying bone grinding trauma. It is important that forensic pathologists be able to recognize and identify such injuries. In this report, we present two cases of classic grinding/dragging injuries that resulted in death. *Acad Forensic Pathol.* 2016 6(4): 709-719

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INTRODUCTION

Vehicle versus pedestrian (and vehicle versus bicyclist/motorcycle/moped/scooter) collisions frequently result in skin injuries that can be described as “friction abrasions,” “brush burns,” or “road rash” (1, 2). These injuries are often related to the victim making contact with a hard road surface. When the victim is actually overrun by a motor vehicle, the skin trauma may be related to contact with the roadway, the undersurface of the vehicle, or both. In such instances, the cutaneous injuries are typically severe, sometimes with associated underlying soft tissue or bone injuries. If a victim is actually dragged underneath the vehicle for a substantial distance, relatively characteristic “fric-

Image 1: A dragging injury of the victim's right upper extremity from Case 1. Note the target-like appearance of the wound. Note also the piled-up, loose skin/soft tissue tags near the elbow, indicating that the direction of applied force was from distal to proximal.

tion/grinding” injuries can be produced, involving skin, soft tissue, and sometimes bone. Death is a frequent outcome, and there are often many lethal injuries identified at autopsy, making the determination of whether or not the victim was conscious while being dragged under the vehicle difficult, if not impossible.

Although classic friction abrasions are common in vehicle versus pedestrian (and other) incidents, extensive grinding injuries related to the victim being pinned and dragged under the vehicle are less common, typically because drivers usually stop before driving great distances. This report presents two examples of friction/grinding/dragging injuries and addresses the difficulties incurred when faced with questions concerning consciousness, mechanisms of death, and timing of death.

CASE REPORTS

Case 1

A 45-year-old woman was attempting to intervene in an altercation at a bar parking lot when she stood in front of a vehicle as one of the participants in the altercation was attempting to flee. The driver intentionally ran over the woman, and she became pinned under the vehicle. Instead of stopping, the driver traveled 1.9 km along a roadway before the body finally became dislodged from underneath the vehicle. The victim was dead at the scene. The driver of the vehicle was apprehended by police. His blood alcohol content was 106 mg/dL.

A full autopsy disclosed multiple severe injuries, including classic dragging/grinding injuries of the arms and hands (**Images 1 and 2**), legs and feet (**Image 3**), back (**Image 4**), and head (**Image 5**), where there was a grinding injury complex that extended through the entire skull and underlying dura, with exposure of the brain. Internal injuries consisted of craniocerebral trauma, with subdural hemorrhage, subarachnoid hemorrhage, brain contusions and skull fractures, extensive rib/chest wall injuries, multiple pelvic fractures, and injuries of the lungs, heart, diaphragm, liver, and spleen. Also present were mild to moder-

ate coronary artery atherosclerosis and emphysema. Postmortem blood toxicology revealed the following: ethanol, 236 mg/dL; 11-nor-9 carboxy THC, 14.5 ng/mL; and delta-9 THC, 8.4 ng/mL. The cause of death was multiple severe injuries. The manner of death was homicide.

The driver of the vehicle was charged on multiple counts and pled guilty to operating a vehicle while intoxicated causing death, and leaving the scene of an accident. He received a 20-year sentence.

Case 2

A 53-year-old man was riding on a moped with his girlfriend when they were struck from behind by a pickup truck. Witnesses stated that the man remained conscious initially, and was screaming for help, as he was dragged on the roadway, underneath the pickup truck for over 500 m before his body was dislodged. He was pronounced dead at the scene. His girlfriend

sustained severe injuries but survived. The driver of the truck did not stop and has not yet been apprehended.

A full autopsy was performed, which disclosed extensive injuries, including characteristic dragging-type grinding injuries of his legs (**Images 6 and 7**), left elbow (**Image 8**), and right toes (**Image 9**), with underlying bone involvement. A comminuted fracture of the right lower leg was associated with extensive soft tissue injury. Internal examination revealed subdural hemorrhage, multiple right-sided rib fractures, right lung lacerations, and a right hemopneumothorax. Also noted was mild coronary artery atherosclerosis, emphysema, and hepatic cirrhosis. Toxicology testing of postmortem blood disclosed the following: ethanol, 143.3 mg/dL and benzoylecgonine, 77 ng/mL. The cause of death was multiple blunt force injuries. A police investigation had not yet been completed at the time the final autopsy report was issued; consequently, the manner of death was undetermined.

Image 2: Another dragging injury complex involving the dorsal surface of the right hand in Case 1. Again, note the target-like appearance of the wounds.

Image 3: A) Two separate dragging injuries on the back of the right lower extremity from Case 1. In addition to the target-like appearance of both wounds, note the bone grinding injuries of the heel, and the postmortem appearance of the calf wound margins. **B)** A closer view of the heel injury. Note the partially avulsed skin remaining attached to the distal-most end of the wound, indicating that the direction of applied force was from proximal to distal.

Image 4: A) Extensive dragging injuries on the back of the victim in Case 1. Note that much of the skin surface is totally absent, and the presence of large areas demonstrating the classic dry, yellow postmortem appearance. Note also the posterior pelvis on the left (arrow), with extremely smooth, flat grinding injuries. B) A close-up photograph of the pelvis grinding injury.

DISCUSSION

Although dragging/grinding injuries are not especially common, several reports exist within the forensic literature (1, 3-10). Hochmeister et al. discuss different positions of being pinned under the automobile and the repercussions of each position of grinding (3). Fukushima et al. present a case where a pedestrian was dragged approximately 600 m (0.37 miles) before being admitted to the hospital and expiring (4). A series of three cases was presented where the distance dragged ranged between 500 m and 2000 m;

alcohol played a role in two of the three fatalities (5). Fujiwara presented a series of three cases that focused on the histological patterns that result due to dragging injuries (6). In a freak accident, a boy riding his bicycle was reportedly hit, caught underneath, and consequently dragged approximately 45 km by a truck before being discovered by the truck operator (7). A case is described where the dragged individual was determined to die on impact (8). Train-related dragging deaths are also described within literature; the distance of dragging in these cases was much longer than typical distances in cases involving automobiles

Image 5: Note that much of the skin of the scalp is no longer present in the victim from Case 1, as it was avulsed during the infliction of trauma. Note the target-like appearance of the underlying skull, with full-thickness grinding injuries, with disruption of the dura, allowing visualization of the underlying brain.

(9, 10). These reports show the variety of circumstances in which dragging and grinding injury-related cases can result in death, and the skin and underlying soft tissue and bone injuries portrayed in each report are very similar to those in the two cases presented here.

While dragging type injuries do not occur as often as other types of injury, dragging and grinding injuries have characteristic patterns that can help investigators determine when it has occurred. Classic patterns produced tend to be target-like in appearance, with deeper injuries centrally, tapering to more superficial injuries peripherally, often with a postmortem appearance along their margins. The more severe injuries are frequently associated with underlying bone grinding-type trauma having a very smooth, flat surface. Depending on the nature of the case, the directionality of dragging may be able to be determined based

on piled-up, loose soft tissue/skin tags or partially-avulsed soft tissue at one end of the wound margin, indicating that the application of force was directed from the opposite end of the wound toward the end having the tags of tissue. This is especially exemplified in **Images 1 and 3B**. Close examination of the bone grinding injuries, with or without consultation with a forensic anthropologist, could theoretically provide similar information regarding directionality. The identification of dragging/grinding injuries on a body may help to provide valuable information to police regarding the nature of a death in a body found along a roadway or elsewhere.

Although dragging/grinding injuries can produce the aforementioned characteristic patterns, it is important to note that the dragging mechanism involved in the production of these classic injuries may also result in a

Image 6: The left knee of the victim in Case 2. Note the relatively smooth, flat grinding injury of the distal femur. The target-like appearance is most evident on the thigh (right) as opposed to the shin (left).

variety of nonclassic dragging-related injuries. These are represented by nonspecific, blunt force injuries, such as abrasions, lacerations, contusions, fractures and avulsion injuries, without the classic dragging/grinding appearance.

While dragging/grinding injuries have a characteristic appearance, other processes encountered by forensic pathologists can occasionally mimic such injuries. Each is characterized by a roughly target-like appearance, although most do not have underlying bone injury. They include a variety of injury types, such as thermal burns (including muffler burns) (1), chemical burns, electrocutions, and certain blunt force and sharp force injuries (11). Rarely, decomposition can produce similar-appearing skin changes. In addition, certain natural disease processes may mimic the target-like appearance of grinding skin injuries. Examples include skin ulcerations of a variety of types, including decubitus ulcers, where bone exposure is possible, and severe stasis dermatitis changes (12). As

with many cases within forensic pathology, context is the key to differentiating these mimics from one another along with careful examination of the wounds.

An important and logical question to be asked by the family and others regarding dragging deaths is whether or not the forensic autopsy can determine if the victim was dead on impact or if death was the sole result of the dragging/grinding injuries sustained from contact with the car and ground. Unfortunately, this determination is not typically able to be made through the forensic autopsy findings alone. Eyewitness accounts and corroborative evidence need to be considered. For example, in the second case presented, witnesses actually heard the victim yelling as he was being dragged to death. The fact that dragging/grinding injuries are typically very localized suggests that the victims were either physically unable to move the body part being dragged, or were unconscious and therefore unable to voluntarily move the body part. The fact that many of these injuries display a postmor-

Image 7: The right leg injury complex in Case 2, with massive injuries. Note the extensive grinding injury of the distal femur (arrow).

tem appearance provides confirmation that the victims were likely deceased during injury infliction, or at the very least, at the end of the period of injury infliction. In some cases, there may be absence of lethal internal injuries; in these cases, external trauma with hemorrhage is likely the mechanism of death, and the dragging/grinding injuries likely played a major role. In most cases, however, just as in typical pedestrian versus motor vehicle deaths, numerous internal injuries are evident, and determining exactly how and when these injuries occurred in relation to the body versus vehicle or body versus roadway interactions, is not possible. In these cases, the dragging/grinding injuries may have played a contributory mechanistic role in death, but the presence of other lethal internal injuries provides evidence that the dragging/grinding injuries were not the sole mechanism involved. In certain instances, collaboration with accident reconstructionists

and biomechanical engineers may allow certain questions to be addressed more completely (13-15). Questions regarding vehicle speed at impact may also be addressed by these special types of investigation (16).

In both of the cases presented, the motorists fled the scene after the victims' bodies became dislodged from underneath their vehicles. It is important in such cases, as with all hit-and-run scenarios, for forensic pathologists to carefully examine the body and clothing of the victims for trace or other evidence that might be able to be linked back to the vehicle. Items such as vehicle parts and paint chips may provide valuable evidence for such a linkage. Victim clothing should be retained as evidence, as should exemplar samples of blood and hair for possible comparison to blood/hair found on a suspect vehicle (1, 2).

Image 8: The target-like appearance of this relatively shallow dragging injury involving the left elbow of the victim in Case 2.

For pedestrians and cyclists, safety around motor vehicles should be reinforced to avoid similar scenarios from occurring. Pedestrians and cyclists should avoid confrontation with persons who are driving motor vehicles, as exemplified in Case 1. Pedestrians and cyclists should also avoid being under the influence of drugs or alcohol. In Case 1, it is likely that the victim's drunken state contributed to the tragic events that led to her death. Whether or not the victim's intoxication contributed to the incident in Case 2 cannot be determined with certainty; however, one could argue that, at the very least, his mental and physical abilities to react to potential dangers were likely less than optimal. For motor vehicle operators, constant awareness of pedestrians and cyclists is essential, as is avoiding drugs and distractions. After striking a pedestrian or cyclist, the lawful and ethical action for motorists is to immediately stop, call for emergency assistance, and render aid, if possible.

CONCLUSION

The classic grinding/dragging cutaneous injury has a target-like appearance, often with postmortem features and possible associated underlying bone grinding trauma. Although questions regarding consciousness or timing of death often occur in relation to dragging death situations, such questions are difficult if not impossible to answer in most instances, based solely on autopsy findings alone. Pathologists should always work collaboratively with police investigators to understand the history of the case, including witness statements, before attempting to answer such questions in the context of the physical autopsy findings. Finally, correctly identifying grinding/dragging injuries in found bodies can provide valuable information to police investigators and help bring justice and closure to scenarios that otherwise might remain unsolved.

Image 9: Dragging injuries of the right toes in Case 2, with associated bone grinding injuries.

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