

Activity: Is There Evidence of Trauma in the Skeleton?

Summary

Injuries to bone can occur in life (antemortem), at or near the time of death (perimortem), or after death (postmortem) when all that remains of the body is the skeleton. Determining when a bone injury occurred in relation to a person's time of death is critical in skeletal analysis and provides information about the health of a person in life, and perhaps how he or she died.

Antemortem Injury

Because bone is a living tissue, an antemortem injury will show bone repair, a sign of healing. The fracture edges may be rounded and smooth and the broken pieces may be re-joined.

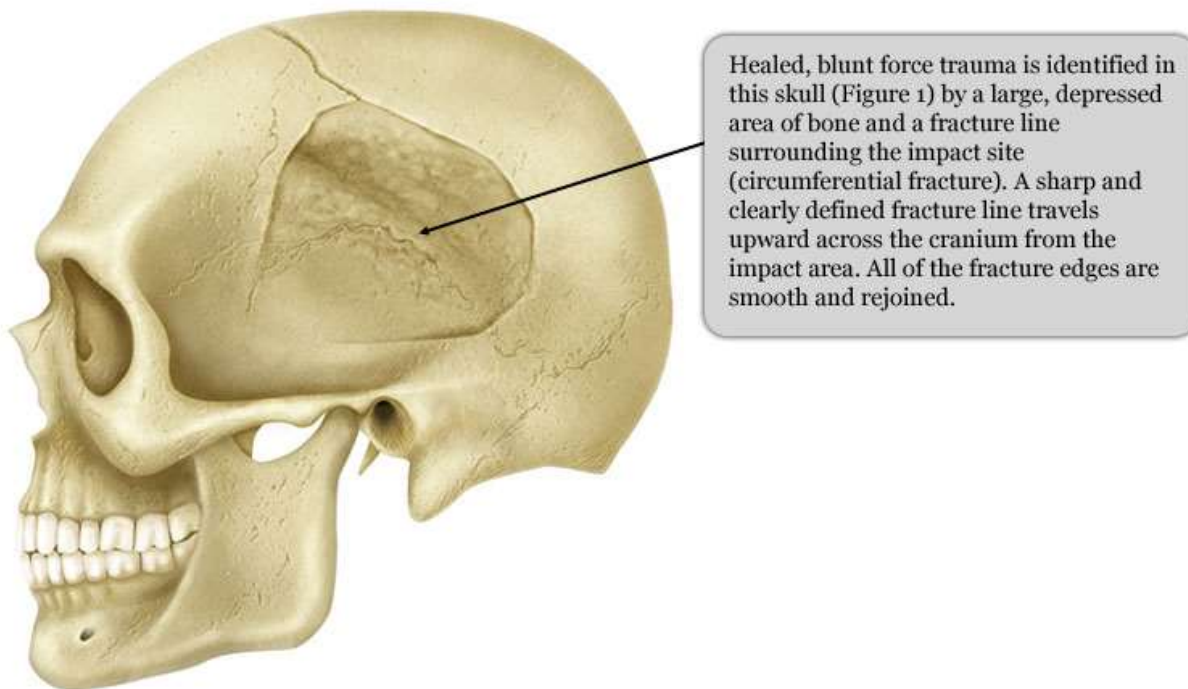


Figure 1. Skull with antemortem fracture. (Source: Smithsonian Institution)



Antemortem trauma is evident in Figure 2. The shaft near the distal (far) end of the left radius (the larger of the two lower arm bones, on the left)* is crooked, several inches from the top. The broken bone has completely joined back together, indicating the break happened long before the person died.

*(This piece of bone is at the wrist. To understand its position and location in this image, put the palm of your left hand in front of your face with the thumb pointing left. The radius is under your thumb and the ulna, the long bone on the right, is under your little finger. See Figures 5, 6 and 7 below for how smooth the shaft is before the distal end of the right radius.)

Figure 2. Radius, with antemortem injuries, and ulna. (Source: Smithsonian Institution)

Perimortem Injury



Figure 3. Skull with perimortem fracture. (Source: Smithsonian Institution)

In perimortem injuries, bone breakage patterns are similar to antemortem trauma but show no healing. In Figure 3, because the bone is still "green" or fresh when the trauma occurred, the fracture edges are sharp and clean - not jagged and torn like the edges of dry bone breaks.

Blunt force skull injuries to green bone sometimes leave identifying marks of the weapon used to inflict the trauma - in this case a blunt, oval-shaped club (Figure 4).



Figure 4. Skull with perimortem fracture. (Source: Smithsonian Institution)

The wrist often shows distinct perimortem breakage patterns. Typically, a transverse (across the bone) fracture to the distal radius happens from trying to stop oneself with an outstretched arm during a fall. (Figures 5 and 6). This type of fracture is called a *Colles' fracture*.



Figure 5. Normal, complete radius (bone of the right forearm). (Source: Smithsonian Institution)



Figure 6. Line marks the location and pattern of a Colles' fracture on the right radius. (Source: Smithsonian Institution)

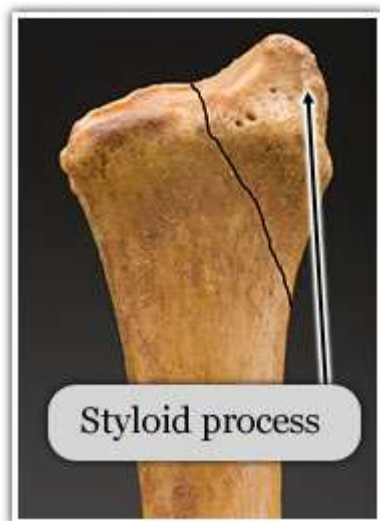


Figure 7. Chauffeur's fracture of right radius. (Source: Smithsonian Institution)

A less common and very different type of injury to the distal radius is a Chauffeur's fracture (Figure 7). Instead of running across the shaft like a Colles' fracture, this type of fracture separates the bone's distal joint surface, breaking off the styloid process (tip of the radius). The fracture line then runs diagonally into the shaft. This injury is due to a direct blow to the wrist and usually is found in men. It is commonly associated with severe trauma. The term "Chauffeur's fracture" comes from the injury sustained by people who used to crank their cars to start the engine but then received a blow to the wrist when the engine backfired and the crank whipped around in the opposite direction and whacked them on the wrist.

Postmortem Trauma



Figure 8. Skull with postmortem fracture. (Source: Smithsonian Institution)

Postmortem trauma, that which occurs after death, is typically caused by environmental conditions, such as damage by carnivores and rodents, compression from burial soils, or exposure of the bone to sun, heat, and moisture. When damage occurs after death, no healing is evident and, unlike green bone in antemortem and perimortem injuries, the bone is dry and more brittle. Dry bone fractures typically have more jagged or torn-looking edges with random patterns of breakage. The fracture edges of postmortem breaks may also look lighter in color than perimortem injuries because they have been exposed for shorter periods.

The cracks and breaks in shown in the skull in Figure 8 represent postmortem trauma. The irregular cracks have a random pattern and no impact area is evident.



Figure 9. Long bone with postmortem damage. (Source: Smithsonian Institution)

The postmortem damage in this long bone is the result of carnivore and rodent scavenging (Figure 9). Carnivore damage results in tooth punctures and crushing, typically on the ends of long bones. Rodent scavenging is evident in the fine lines marking the shaft - evidence of their teeth gnawing the bone.

Summary - Types of Injuries

- **Antemortem:** An injury that occurs before death with evidence of healing (re-formed bone with round, smooth edges)
- **Perimortem:** An injury that occurs at or around the time of death when bone is still green or fresh (sharp, clean edges), with no evidence of healing
- **Postmortem:** An injury that occurs after death, when bone is dry and brittle (jagged edges, random pattern), with no evidence of healing

The skeleton in the cellar: Ante, Peri, or Postmortem Injuries?

Notes from the forensic report of the skeleton in the cellar: *The cranium exhibits several fracture lines and slight distortion. The mid-face was displaced and the parietals have fractures that originate in the posterior right side of the vault, which was against the floor of the grave. The radiating fractures are mostly irregular and are not sharply defined.*



Figure 10. Skull from the cellar, right view.
(Source: Smithsonian Institution)



Figure 11. Skull from the cellar, left view.
(Source: Smithsonian Institution)

Further analysis in the lab identified a second fracture in the bones of the skeleton in the cellar. This fracture is present in the right radius, or bone of the right forearm.

Notes from the forensic report of the skeleton in the cellar: *The distal epiphysis (wrist end) of the radius, including the radial styloid process, was fractured off and is only partially represented. The fracture line through the ununited epiphysis continues into the shaft of the radius for approximately 31 mm. The break in the shaft did not result in complete separation, but instead is represented by a crack that extends up the bone for more than three centimeters. The directionality of the fracture is similar in both the metacarpal (hand bone) and radius suggesting a single force may have caused these breaks.*



Figure 12. Distal view of right radius of the skeleton in the cellar, palm facing the camera. The styloid process has broken off. Also, notice the longitudinal break just below this point.
(Source: Smithsonian Institution)



Figure 13. Distal view of the right radius of the skeleton in the cellar (view from the other side of the bone). (Source: Smithsonian Institution)



This page is part of the [Smithsonian's The Secret in the Cellar Webcomic](#), an educational resource from the *Written in Bone* exhibition, February 2009 – 2014.