ANIMAL ATTACKS AND INJURIES

Contents

Fatal and Nonfatal

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Introduction

Since the evolution of humans, there has been interaction between human beings and animals for a whole host of different reasons, either through human control and mastery of animals, such as the keeping of food animals and agriculture and companion animals, or more simply, with human beings as part of the food chain as an example of prey for an animal.

As a result of the diversity of animals within different continents and countries, detailed local knowledge of the fauna may assist in the interpretation of injuries that are perceived to have been caused by animals. However, as the world grows smaller and nonindigenous animals are kept, this geographical specificity ever diminishes. This also applies to increasing tourism.

As in all ecosystems, there exist complex relationships between all animals, including humans, although to some extent we have removed ourselves from some of these natural interactions.

When an individual dies without immediate intervention from authorities, such as in an isolated dwelling or a remote region, he/she simply becomes part of the ecological cycles relevant to that region. In this context companion animals dependent upon their keeper for care and food may simply view the body now as a source of nutrition, leading to postmortem depredation. Such depredation may present a series

of bizarre changes to law authorities that may be perceived as suspicious or even thought of as homicide.

Knowledge of the local ecology, of which the fauna is but one part, may assist in the interpretation of a crime scene. Hence the natural processes of decomposition with the well-documented entomological successions that visit a corpse may be of great value in estimation of the time of death. Similarly, the finding of a specific animal species, or marks left by such a species, may aid in consideration of the locus of a crime or of sites of body storage.

Injuries caused by animals may be virtually pathognomic of that animal or nonspecific, and it is here that local knowledge of the fauna may be of value. A limited survey of some of the injuries will now be undertaken, passing through various orders of animals.

Mammals

Mammals include some of the largest carnivores on the planet, including the felids (cats) and canids (dogs), together with bears. Such animals are well equipped to prey on a range of animals, including human beings, with powerful jaws and claws and shearing teeth. The sheer size and speed of many of these animals are relevant to the rapid overpowering of an individual. The victim of such an attack will have invariably suffered multiple and severe injuries as a result, and it may be that identification of the deceased presents a problem owing to the extent of the injuries and the secondary depredation that may occur. Indeed, the level of secondary scavenging may make the task of identifying original injuries difficult, if not impossible, in areas that are well populated by such animals. Injuries observed will represent a mixture of laceration from claws, and the parallel nature of such injuries may give an assessment of the size of animal involved, together with bite marks. Such marks, if in isolation, may present a clean appearance suitable for appropriate photography and odontological interpretation. Distances between certain teeth may assist in the assessment of animal size. Defense injuries may be seen upon the body, but overpowering by large animals may preclude identification of such changes. Certain animals such as bears may show a predilection for the face. Underlying tissues and organs will be crushed and lacerated, and possibly absent either from direct ingestion by the animal or secondary scavenging.

It is of course not only the carnivores from higher animal orders that present a danger to humans. The large herbivores present a risk, either from accidental injuries as a result of size, or from defense of territory or their young. Within agriculture, many of the beasts of burden present such a size that if an individual becomes interposed between the animal and another firm surface, crushing may become a distinct possibility. Death may then result from traumatic asphyxia, or from multiple crushing injuries to the chest, abdomen, and head. Usually the history and setting should readily explain the situation. Aggressive behavior from bovines may result in goring by the horns, with major internal injury and hemorrhage. Similarly, trampling from stampede may cause multiple blunt injuries, with occasional recognizable patterns. Specifically, horseshoes may leave a patterned mark upon the body, following kicks or stampedes from equids. In more tropical climes, animals such as the hippopotamus, rhinoceros, and elephant are well known for the danger that they present to human life, causing more fatalities than more expected animals such as predatory carnivores.

Odontological assessment may assist in defining the species of animal. Furthermore, recovery of hairs from the body may allow comparison with animal hair collections.

Most fatal animal attacks are caused by large animals where the size and power of that animal simply overpower the individual. However, as in many aspects of forensic medicine, the young, old, or infirm may be particularly at risk from attacks from smaller animals that in other circumstances would be relatively innocuous. In addition, lack of experience in handling an animal may result in provocation of that animal and resultant aggressive and dangerous behavior. The author has seen an example of a baby killed by three ferrets that had escaped their cage: death occurred through shock and blood loss as a result of multiple bites.

Dog attacks may be encountered now that ownership is so widespread. Studies have shown that the majority of attacks occur on the owner's property, with a quarter caused by dogs on the loose. There are many complex factors that relate to dog attack; particularly relevant is their pack animal hierarchy, with animals sometimes testing the victims of attack in terms of dominance. Individual animals may be responding to cruel treatment or as a response to pain. They may be unfamiliar with a victim and see him/her as a threat. Children are most at risk from dog attack, with those aged between 1 and 4 years sustaining the most serious injuries. Dog breed is relevant, with Pit Bull Terriers, German Shepherds, and Rottweilers most commonly associated with attacks, both fatal and nonfatal. These are inherently aggressive and powerful dogs so perhaps these findings are not surprising. Such attacks may result in multiple and severe bites, with powerful jaws capable of severely lacerating tissues and injuring underlying muscle and even bone. Peripheries may be at risk, as when an individual

attempts to defend him/herself. The author has recently seen a case where a dog attacked an individual who was suffering a seizure. In this attack the larynx was severely crushed, with compromise of the airways.

Attacks from packs may result in considerable mutilation of the body. In the peri- and postmortem period, a dog may cause injuries. Dogs may paw at their owners if in a collapsed state, leaving parallel abrasions and lacerations. Once dead, depredation may occur, especially if the animal is locked within the dwelling. This is a simple reaction for the search for food. It has been recorded that animals have absorbed drugs from the bodies of their owners following such depredation. The extent of such depredation may be extensive, with exposed parts of the body reduced to skeleton in a short time. Injuries may be difficult to distinguish from true marks of violence, and in this case examination of the dog for tissue around the mouth or even the stomach contents may be of value. A further case is quoted whereby two individuals were noted to be engaged in a severe altercation: one of the pair was found dead a short time later. The ears were missing and parallel lacerations were found, causing obvious concern to the police. The deceased had died of a coronary thrombosis, and collapsed. In the perimortem period his five dogs had become excited and frightened, leading to this perimortem attack.

In the living, bite marks may be examined and considered by a dental specialist to consider the size of the dog that caused the injury. The prominent canid canine teeth produce characteristic bite marks. Extensive surgery may be required following an attack and the chance of infection, both local and systemic, from the bacterial flora of the dog's mouth, should not be overlooked.

Birds

The majority of birds will not present a risk to humans. Their usual interaction will be through depredation of the dead (or nearly dead) body. One possible exception is the large flightless birds, such as the emu, rhea, ostrich, and cassowary. As a result of their flightless condition they have powerful muscular legs, equipping them for rapid transit over the ground. Attacks have been recorded where severe penetrating lacerations have been sustained by individuals when the bird was approached, leading to torrential hemorrhage and disemboweling.

Reptiles and Amphibians

One of the first animals to come to mind will be the crocodilians. Noted for their hunting skills, the larger species such as the Nile crocodile, *Crocodylus niloticus,* give rise to fatalities. Their habit of sudden explosive ejection from the water to grasp the prey, followed by rolling underwater, is a devastatingly successful method of attack. Few animals are so readily able to disarticulate a limb, demonstrating the animal's power. Death is usually due to drowning. The teeth marks may give a clue as to the nature of the attacking animal, as the arcade of puncture wounds may be highlighted by the position of the fourth premaxillary tooth, that may be seen in the animal with the jaws opposed. Frequently bodies may be decomposed and significantly scavenged as a result of the crocodilian habit of storing corpses underwater to allow softening and easier removal of tissues.

The Komodo dragon may give rise to fatalities. Its mouth flora is populated by pathogenic bacteria that give rise to septicemia. In its small natural environment, such a mechanism guarantees food in spite of the animal's relative lack of agility. If threatened, the Gila monster may inject venom that is capable of causing death through severe cardiac compromise.

Of course, snakes are a group that gives rise to many injuries or deaths. Venomous snakes may cause death following envenomation either by neurotoxic or hematotoxic methods. The former may rapidly cause death as a result of respiratory paralysis. Hematotoxins cause progressive hemorrhage and disseminated intravascular coagulation and run a more protracted course. Neurotoxic snakes often leave inconspicuous bites whereas hematotoxic snakes leave bites that swell and bleed. Identification is paramount and local casualty departments often have an identification guide to facilitate administration of the correct antivenom. Laboratory tests may also be employed.

Constricting snakes may cause death from crush asphyxia. Frail and small individuals are more at risk, especially babies and small children. Fatal snake attacks are now encountered more frequently in nonindigenous areas due to the keeping of exotic species.

The highly colored arrow frogs from the Amazon are well known for their secretion of toxins upon the skin. Although used by native Indians on their arrows to kill small monkeys, fatalities do not usually occur in humans.

Fish

Death may occur as a result of interaction with fish and other marine life. The most obvious example is the shark: a large number of species are capable of attacking and causing significant injuries to human

beings. Limbs may be grasped first, leaving curved bite marks representing the dental arcade of the animal. The power of the animal is reflected in the incision through different layers of tissues, including bone, in a similar way to crocodilians. Victims may be considerably disrupted following feeding of the sharks. Brushing of the rough shark skin against the individual may give rise to multiple dermal abrasions.

The piranha is always considered to be capable of stripping a body of flesh within minutes, although this has never been substantiated. Nonetheless, these fish have extremely powerful jaws and can produce multiple bites of about 3 cm diameter.

Some fish are capable of producing an electric shock, such as the electric eel, the electric catfish, and the electric ray. The charge is rarely of sufficient strength to kill.

A variety of fish are capable of envenomation by means of defensive spine, but these rarely cause death; rather there is more pain at the site of the sting.

Lower Marine Creatures

Many smaller creatures are capable of inflicting significant stings that on rare occasions cause death. The jellyfish can cause widespread stings, particularly the larger species with long tentacles, such as the Portuguese man o' war. They give rise to acutely painful erythematous and edematous lesions in the shape of the touching tentacle.

Cone shells use a very sharp poisonous barb to hunt, and may cause injury if accidentally stepped on, leaving a single penetrating injury at the site of injury.

Arthropods

This vast and diverse group includes insects, spiders, and scorpions, and centipedes, all of which have members dangerous to humans. In terms of injuries, often a small and inconspicuous sting injury is present, accompanied by varying degrees of edema and erythema.

Wasp and bee stings are common. They may prove fatal when large numbers of stings are sustained, such as in swarm situations. Individual stings may prove fatal when the subject is allergic, and develops fatal anaphylaxis.

Flies, particularly blowflies, may be of value in entomological consideration of a body or scene. Some researchers have investigated the uptake of drugs from a dead body upon which they are feeding for a qualitative assessment – this is called forensic entomotoxicology.

Ants, particularly in tropical climes, may sting causing painful but local reactions. They may be a common visitor to the corpse, and can produce curious serpiginous lesions that may be mistaken for marks of violence. Marks at the limits of clothing, e.g., at the collar, may cause artifact such as apparent ligature marks.

Spiders and scorpions are generally less dangerous than is popularly believed. Nevertheless, several powerful toxins are produced by species such as *Latrodectus*, the black widow, to name but one. With spiders a paired set of puncture wounds may be seen, corresponding to the fangs.

Summary

This has been a brief summary of the injuries, fatal, and nonfatal, that may be encountered following human interaction with animals. As in all aspects of forensic medicine, the history and setting are of vital importance, but as stated, with a smaller world and increased travel, pathologists may see exotic lesions not encountered before. It is worth noting the interaction of animals with the dead body, and the artifacts that can be produced.

See Also

Animal Attacks and Injuries: Predation; **Entomology**; **Odontology:** Bite Mark Analysis; **Venom**; **Veterinary Aspects of Forensic Medicine, Wild Animals**

Predation

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Introduction

Lethal injuries sustained from animal attacks are uncommon in most medicolegal practices; their frequency and nature vary among geographical regions of the world. Antemortem animal injuries can be the direct or indirect cause of death, especially in cases where the victim is very young or incapacitated by disease.

Taphonomic changes induced by animal activity are however very common; most forensic practitioners have encountered them in their daily practice. Bodies that have been left undisturbed for various lengths of time usually present some degree of animal disturbance; the assessment of the ante- and perimortem injuries in these cases can pose some difficulty.

Combination of perimortem and postmortem injuries is frequently encountered, especially where the fauna is abundant, i.e., rural areas. Moreover, as animals are driven out of their natural habitats more attacks are observed. Still, numerous attacks occur in known animal–human settings like zoos, circuses, and the private domain (house, garden, etc.).

The circumstances surrounding the incident are a necessary tool for treatment planning and future prevention of similar cases. When only "dry bones" survive, the identification of the manner and cause of death can only be achieved by taphonomical methods. Under such conditions the circumstances of death might be obliterated by postmortem processes; animal activity on cadavers plays a major destructive role due to animals' tendency to dismember the body as well as damage the tissues. Moreover, natural conditions such as water, vegetation, and sun exposure influence the final condition of the body.

A further phenomenon to be considered when conducting forensic examinations is the prevalence of zoonotic diseases that are transferred through contact between humans and animals. The prevalence of infectious diseases has increased considerably in the wake of animal domestication; increasing population morbidity is associated with sedentism and population density concomitant with agriculture and urban life.

Zooarcheologists, forensic pathologists, and anthropologists have developed differential diagnostic criteria to identify diverse predators and their remarkable patterned injuries on bones.

The pathognomonic and taphonomic findings associated with animal attacks can be described according to the taxonomic classification of the injuring agent.

Insects and Arachnids

Ticks are blood-feeding external parasites of mammals, birds, and reptiles throughout the world. Ticks can cause paralyses, toxicoses, and allergic reactions and are vectors of a broad range of viral, rickettsial, bacterial, and protozoan pathogens. There are hard ticks – Ixodidae – and soft ticks – Argasidae. Approximately 12 argasid species (*Argas* and *Ornithodos*) are frequently found attached to humans who enter tick-infested caves and burrows. Hard ticks have three distinct life stages: larva, nymph, and adult; the completion time of the entire life cycle may vary from less than a year in tropical regions to over 3 years in cold climates, where certain stages may enter diapause of several years until hosts are again available.

Death caused by insects' stings is seldom due to envenomation but rather to some form of anaphylactic shock. Bees and wasps are the most commonly involved insects in these types of death. Most stings are evinced as a small red lesion surrounded by a pale rim and a pink flare. Occasionally, multiple and very closely grouped stings are the result of an attack of swarms of wasps or bees accidentally or intentionally disturbed.

During postmortem examination, insects may be observed within the clothing of the victim and the bee sting may be found embedded in the injury itself. Postmortem findings may include pathognomonic signs of hepatic and renal failure and rhabdomyolysis.

There are very few taphonomic changes associated with these insects although, since they are parasitic on the maggots of other insect species that colonize bodies and in a few instances on the decomposing body itself, they tend to affect the entomologic assessment of the postmortem interval.

Scorpions and spiders are responsible for very few deaths, although they are invariably poisonous. The general rule is that the danger of any given venom is inversely proportional to the weight of the victim; thus it follows that lethality is most commonly associated with children. The examination of the body discloses a relatively unremarkable local lesion, sometimes a closely spaced double injury, erythema, local pallor, and ulceration, depending on the species involved and on the survival period. Autopsy findings are nonspecific and include pulmonary and brain edema, local necrosis, disseminated intravascular coagulopathy, and myocardial damage.

Anthropophagic activity of various insects – such as ants, cockroaches, and beetles – can sometimes simulate antemortem trauma; these are mostly superficial skin defects, arranged in linear or circular formations (**Figure 1**).

In all cases of suspected insect and arthropod attack an enzyme-linked immunosorbent assay (ELISA) test should be used for the identification of the specific immunoglobulin E, complemented by serum assay for tryptase. Recent investigation on the postmortem detection of anaphylaxis suggests that the assay of serum tryptase by itself should not be relied upon, especially in the latter postmortem stages.

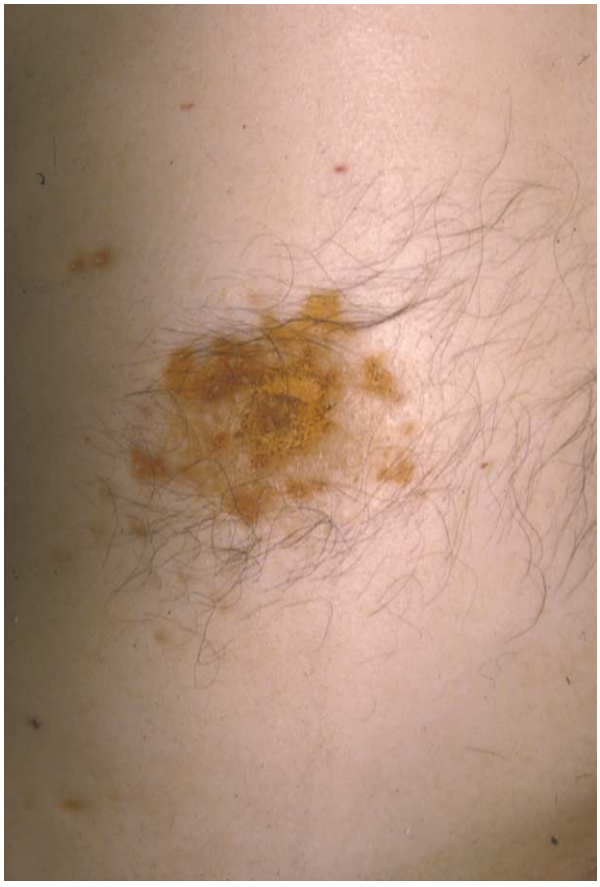

Figure 1 Anthropophagic activity of insects causing superficial skin defects, arranged in linear or circular formations.

Marine Animals

Death by marine animals is mostly associated with attacks of large fish – such as sharks, barracudas, and moray eels – and with poisoning by venomous fish and to a lesser extent by soft-bodied animals like hydroids. While attacks of marine fauna can cause intense pain from envenomation, death is unlikely to occur from the sting itself unless the victim is allergic to the venom; however, the intense symptoms caused by the envenomation may lead to drowning due to collapse.

Death due to direct trauma from schools of small fish such as the South American piranha fall mostly in the realm of folklore; similarly, some species of eel that produce an electric jolt of up to 500 V are unlikely to cause death. Nevertheless, these types of attack can render the victim at risk of death by drowning.

The postmortem changes associated with the anthropophagous behavior of small fish are notorious; these creatures feed on easily accessible soft tissue such as eyes, lips, and digits (Figure 2) and have been known to gnaw on bone. The telltale marks of their teeth can be seen on the margins of the wound as a row of connected small semicircles, the size of the fish's teeth. Similarly, small crustaceans that adhere to most surfaces slowly destroy the cortical surface of the bone.

Figure 2 Postmortem changes associated with small fish that feed on soft tissue like eyes, lips, and fingers and gnaw the bone.

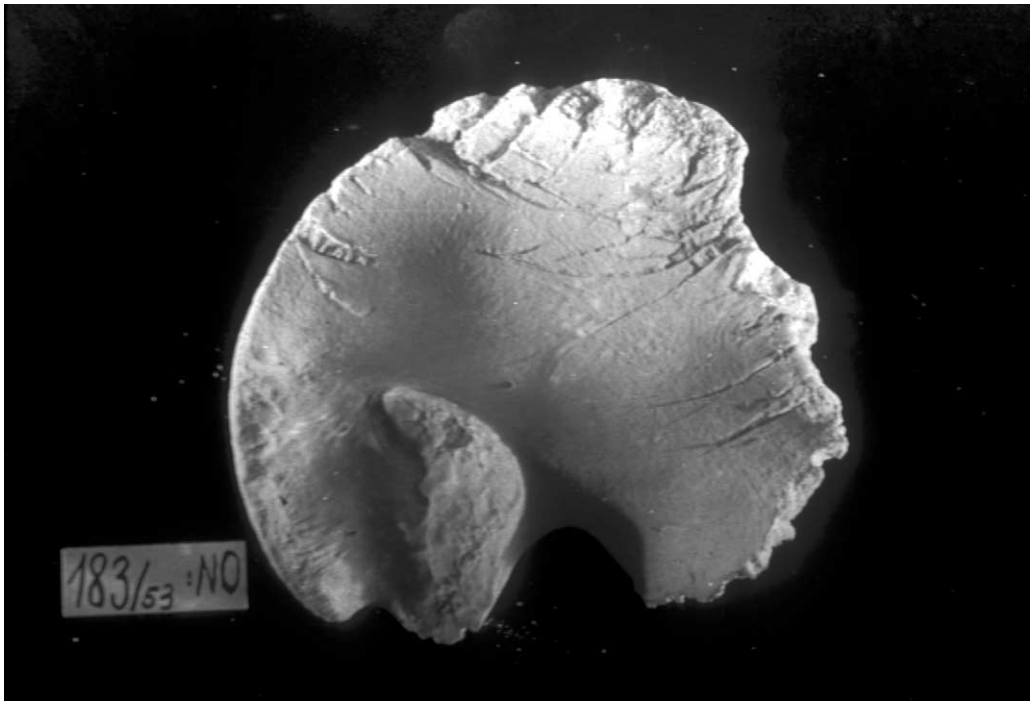

Figure 3 Telltale marks of shark teeth on a human os coxa. Note the distance between the scratches on the bone that fit the shape of the shark teeth.

The majority of marine fauna lethal attacks are associated with sharks: there are about 50 reported attacks annually, of which approximately 7% are lethal. Sharks attack in both shallow and deeper water. The types of injury are related to the type of attack and to the size and species of the shark. While feeding, their serrated sharp teeth that are set in consecutive rows leave pathognomonic signs, i.e., gouges, deep cuts, and avulsion of soft tissue. Being unable to chew their prey they strip it, thus they tend to attack the extremities from the thigh down (Figure 3). When bumped into at a high speed, shark's skin causes long deep regular abrasions in the victim's skin and its underlying tissue.

Rodents

Deadly attacks by rodents are extremely rare; they are usually associated with small children of low socio-economic background or debilitated persons. In these cases death, commonly caused by large species of rats, is due to blood loss resulting from multiple rat bites; subcutaneous bleeding around the wounds is the main indication that the injuries were inflicted while the victim was still alive. Autopsy findings often reveal signs of hypovolemic shock.

Postmortem scavenging is common among wild and domestic rodents; they are well known to alter or destroy the indicators of the cause of death and preclude the visual identification of the victim. Rodents tend to gnaw on bone, to wear down on their incisors, leaving telltale sets of parallel striations on the osseous cortex. Postmortem rodent-caused injuries are usually wedged, paired, clean, small incisions without subcutaneous bleeding (Figure 4).

Porcupines are known to collect and modify both dry and meaty bones. They leave a typical pattern of gnawed trails, thinning the bones in a fan-shaped pattern and creating "windows" in the shaft produced by heavy gnawing and scooping out material (Figure 5).

Birds

Serious injuries from birds resulting in death are very rare. The forensic literature mostly records postmortem stablike or puncture wounds caused by the hard bills of crows, owls, buzzards, or seagulls. Scavenging is a common feeding behavior of various species of birds, and remains are often completely defleshed in a matter of hours by these efficient foragers. Damage to bone occurs from the stripping

Figure 4 (A, B) Postmortem injuries made by rodents – paired incisions without subcutaneous bleeding.

and tearing action of the beaks and talons and small punctures and scratches on bone cortical surfaces are left.

Finally, there have been instances where small birds have utilized the thoracic cavity of a skeletonized individual for nesting.

Small Carnivores

"Man's best friend" – the domestic dog – accounts for the majority of deaths caused by animal attacks. Attacks occur most often in the household domain, frequently against children and old adults. The majority of the lesions occur on the head, neck, and face, although they can be seen on the upper and lower extremities as well. The wounds are characterized by pairing of injuries resulting from the canine teeth, along linear parallel abrasions. Dogs can sometimes inflict blunt-force trauma by lifting their heads rapidly when excited, striking the victim in the throat area. Pets can sometimes paw their dead owners in an attempt to rouse them, inflicting groups of parallel abrasions that can be confused with injuries associated with assault.

Figure 5 Bones with typical fan-shaped gnaw pattern consistent with porcupine behavior.

Canids leave typical postmortem damage patterns over the bones, characterized by rounded punctures, peglike penetrating injuries, and shallow scratches. Severe damage caused by gnawing of the softer bony parts (proximal epiphyses) is frequently detected.

Pack attacks by feral or wild dogs and wolves pose a greater danger of fatal injuries, similar to those produced by single animal attacks but often covering a larger area of the body. Not many reports have been related to deadly attacks of wolves on human; they are more often associated with attacks on flock animals. Overpopulation of foxes near or even in settled areas must be considered as dangerous. The scavenging behavior of packs of foxes can produce postmortem artifacts that can be easily misinterpreted as perimortem injuries.

Large Carnivores

Wild game attacks on humans occur mainly in rural areas, natural parks, zoos, and circuses. Large cats such as lions and tigers have been known to assault humans, although humans do not constitute their natural prey. The primary injuries sustained from these attacks are a series of parallel abrasions, multiple deep bite injuries, and lacerations with an abraded rim, consistent with the tapered claws of the animal. Punctured wounds similar in shape to those inflicted by smaller carnivores are often observed in the neck area of the victim. Shaking the victim by the neck is not uncommon, resulting in hypertension injuries. Furthermore, feeding on carcasses results in eventration, loss of tissue, and extensive bone injury.

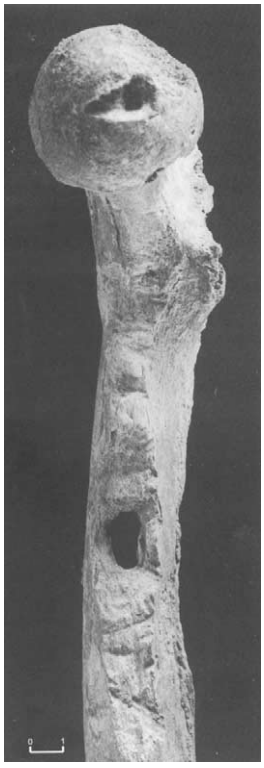

Figure 6 Human modified bones from a Chalcolithic mortuary site at Kissufim Road, Israel. Carnivore modification on a right femur diaphysis, medial view. Reproduced from Le Mort F, Rabinovich R (2002) The taphonomic and mortuary practices. In: Goren Y, Fabian P (eds.) *Kissufim Road: A Chalcolithic Mortuary Site Antiquities Authority,* pp. 66–81. IAA reports monograph series no. 4. Jerusalem, Israel.

Attacks by hyena are uncommon, though they have been reported from Ethiopian villagers. Hyenas are known to plunder graves, dispersing the remains and

leaving a puzzling scene for the unsuspecting investigator (Figure 6). Many carnivores crack bones with their teeth – the propensity of hyenids to feed on large diameter bones is legendary. Both species, spotted hyena (*Crocuta crocuta*) and striped hyena (*Hyaena hyaena*), tend to take chunks of their prey to their den, breaking and damaging the bones. Unique morphological features of hyena teeth and skull are associated with bone cracking. In addition to the morphological adaptations to lifting and carrying large and heavy loads, their ability to remove and destroy carcasses is noteworthy; scratches, furrows, puncture marks, and gnawed areas are typical of bone damage by hyena (Figures 7 and 8).

Figure 7 Hyena gnawing marks on a camel mandible. Note the amount of severe gnawing and of missing bone.

Figure 8 Typical gnaw marks on a donkey right humerus produced by hyenas. Notice (A) the missing epiphyses and (B) the typical pit and scratch marks.

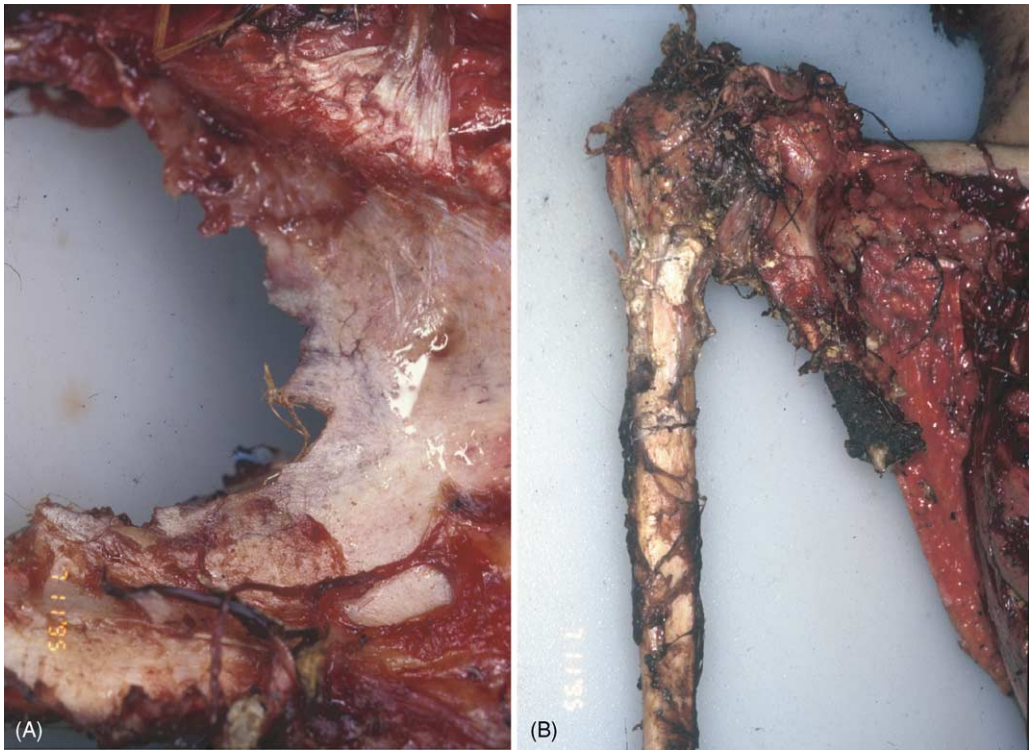

Figure 9 Taphonomic changes on cadaveric remains produced by wild pig feeding.

Human–bear conflict resulting in attacks has become less rare as bear populations have increased. Bears tend to bite, puncture soft tissues (i.e., abdomen), scratch the neck, thighs, and hips, and leave tracks at the crime scene. Cases of injuries or lethal attacks are known to be caused by the grizzly bear (*Ursus arctos horribilus*), black bear (*U. americanus*), and brown bear (*U. arctos*).

Large Herbivores

Farm animals such as cows, bulls, and horses tend to produce blunt-force and crushing injuries. The majority are nonspecific injuries produced by the weight of the animal pressing the victim against a wall or a fence. Notwithstanding, specific injuries often produced by kicking and trampling are consistent with the shape of the hoofs, while bull-goring wounds vary between clean lacerations produced by the tip of the horns to large irregular penetrating injuries.

Crushing and trampling are common features caused by the largest herbivores, i.e., elephants, rhinoceros, and hippopotamus. Their attacks are a known cause of death in rural Africa as well as of handlers in zoos. The injuries encountered at autopsy may include piercing by tusks and crushing injuries as the result of being trapped in a confined space by the bulk of the animal.

There are no reports of postmortem injuries produced by farm herbivores, although omnivores like domestic pigs have been known to feed on cadavers (Figure 9).

Reptiles

Snake attacks are not very common; most bites are what experts call “dry bites,” in which no venom is released. A majority of those bitten are snake handlers or individuals who have snakes as pets. Though snake bites are rarely fatal, when left untreated they can result in severe tissue damage or loss of fingers, toes, or limbs. Typically, poisonous snake bites cause intense pain and swelling at the site of the injury. Tingling around the lips and tongue, abnormal bleeding, and muscle weakness may also occur. Traumatic asphyxia due to the tendency of some species of snake to squeeze the victim has been known to occur. Teeth marks can be seen on the victim in the form of small puncture marks.

Crocodiles and alligators are widespread all over the world. Most attacks are known from Australia, Tanzania, and Florida. People tend to be attacked near water, or while swimming, and quite often the victim

is pulled into the water. The powerful jaws of these reptiles are known to cause severe injuries, tearing and dismembering body parts. Injuries may vary from minor lacerations and puncture wounds to major abdominal chest and limb trauma. Fatal victims are often found dismembered and decapitated.

Summary

At first glance, animal attacks would appear to be easily identified and the classification of the wounding agent a straightforward endeavor. In fact, a variety of animals can leave similar patterns of damage, and when other taphonomical processes are engaged, such as exposure to sun or water, the medicolegal investigation is further obscured.

The careful documentation of scat, hair, footprints, and claw marks can serve as auxiliary proxies for the exact identification of the animal responsible for the attack. The magnitude of the damage changes along the animal's guild, mainly by feeding behavior and size (i.e., carnivores versus herbivores, small or large), thus lion and fox are unlikely to leave similar damage patterns.

In theory the size of a wound serves as an indicative measure of the wounding animal, but it is not accurate enough to separate between animals of similar body and dental size. Thus, we can differentiate relatively easily the damage caused by a mouse and a wolf, but less so that caused by a tiger and a hyena. If severe damage to bones is involved, including cracked long bones, then we can safely assume that we are dealing with hyena postmortem activity.

The location of the damage along the body, its description, and the probability of a certain animal to be the cause of death should be taken into consideration while examining any case. Familiarity of the forensic practitioner with the local fauna and with the various aspects related to taphonomic changes of the cadaver is of paramount importance in the correct assessment of animal perimortem and postmortem attacks.

See Also

Animal Attacks and Injuries: Fatal and Nonfatal; **Anthropology:** Archeology, Excavation and Retrieval of Remains; Bone Pathology and Antemortem Trauma

Further Reading

Animal attack: www.igorilla.com/gorilla/animal/.

Baum J, Kahila Bar-Gal G (2003) The emergence and coevolution of human pathogens. In: Greenblatt CL, Shpigelamn M (eds.) *Emerging Pathogen: Archaeology, Ecology and Evolution of Infectious Disease*, pp. 67–78. Oxford, UK: Oxford University Press.

Binford LR (1981) *Bones: Ancient Man and Modern Myths*. New York: Academic Press.

Brain CK (1981) *The Hunters or the Hunted? An Introduction to African Taphonomy*. Chicago, IL: University of Chicago Press.

Caldicott DGE, Mahajani R, Kuhn M (2001) The anatomy of a shark attack: a case report and review of the literature. *Injury, International Journal Care Injured* 32: 445–453.

Horn K, Halsey JF, Zumwalt E (2004) Utilization of serum tryptase and inmunoglobulin E assay in the postmortem diagnosis of anaphylaxis. *American Journal of Forensic Medicine and Pathology* 25: 37–43.

International Shark Attack File (ISAF) www.flmnh.ufl.edu/fish/Sharks.

Iscan MY, McCabe BQ (2000) Animal effects on human remains. In: Knupfer JC (ed.) *Anthropology, Encyclopedia of Forensic Sciences*, pp. 196–206. San Diego, CA: Academic Press.

Norwood S, McAuley C, Vallina Van L, *et al.* (2000) Mechanisms and patterns of injuries related to large animals. *Journal of Trauma: Injury, Infection and Critical Care* 48: 740–744.

Rothschild MA, Schneider V (1997) On the temporal onset of postmortem animal scavenging. "Motivation" of the animal. *Forensic Science International* 89: 57–64.

Tsokos M, Schulz F (1999) Indoor postmortem animal interference by carnivores and rodents: report of two cases and review of the literature. *International Journal of Legal Medicine* 112: 115–119.