Warm-Blooded Animal Bites

R.A. Dieter, Jr[1]**,** M.D., **Robert S. Dieter**[2]**,** M.D.**, R.A. Dieter, III**[3]**,** M.D.**, D.L. Dieter**[4]**,** J.D.

[1]Past President: International College of Surgeons, International Healthcare and Surgery Center Consultant, President: Center for Surgery [2]Interventional Cardiologist. Loyola University, Maywood IL, [3]Thoracic and Cardiovascular Surgeon. University of Tennessee, Knoxville TN Attorney. Takida Pharmaceutical, Lincolnshire IL

Correspondence to: R.A. Dieter, Jr., M.D the Center for Surgery, 475 E. Diehl Rd., Naperville, IL 60563. Email: tfato@centerforsurgery.com. Fax: (630) 7990223

Background: Domestic animals are the major cause of warm-blooded animal bites around the world. The dog, the cat and human bites are the most common animal bites creating major medical and health care concerns requiring medical treatment. Transmitted zoonotic diseases (especially viral) as well as the long-term consequences of the injury are of important concern. Prevention is key both in avoidance of contact and in proper immunization and vaccination evaluation. Treatment requires appropriate examination and procedural care. Soaking and cleansing may be all that is necessary or extensive radical debridement and long-term hospitalization to avoid serious deformity and death.

Conclusion: Mammalian or Warm-blooded animal bites occur with a high frequency around the world. It is estimated that one half of the world's population will be bitten at some time during their life. Thus, avoidance is key.

Introduction

Around the world on every continent, one finds animals to a greater or lesser degree. These animals may vary in size from the small mouse to the large elephant, depending on what country and what locale you may be in. The mammals may be either domesticated or wild. They may not present as a threat until the actual occurrence. Virtually every type of animal, however, may cause a bite and the consequences thereof.

The warm-blooded mammal has a few typical characteristics including the presence of hair and mammary-secreting glands. Warm-blooded animals occur around the world. The warm-blooded animal may be plantigrade (such as the human), digitigrade (such as a dog), or unguligrade (such as the horse). Mammals may be herbivorous, carnivorous or insectivorous and, as mentioned above, they may either be domesticated or occur in the wilderness. However, the bite of mammals occurs to a higher frequency than most individuals are aware. Thus, the risk is greater than has been recognized by the average population or the average physician. For example, each year, there are approximately 4.5-5 million dog bites and a large number of cat bites in the United States. These bites may lead to serious consequences, either physically, emotionally or to death. Fatal animal bites in the United States and on the North American continent continue to occur.[1]

A review of mammals and the types of warm-blood animals that one may encounter as well as the potential for a bite has been conducted. Thus, when one studies the problem of bites, a large number of considerations must be taken into account. Table 1 lists some of the topics that one might consider regarding animal bites.

Animal bites occur throughout the world, whether it is in the tropics, the subtropics or the colder regions – on every continent. Most animal bites are not serious. The incidence and occurrence is such that it is estimated one half of the world's population will at sometime during their life be bitten by either a warm or cold-blooded animal - the majority of which will be pets or domesticated animals. Certainly the wild animals throughout the world do cause bites and trauma. However, the news media tends to spread the awareness of wild animal bites to a higher degree than they do the domestic animal trauma, even though the domestic animal trauma far outnumbers the wild animal attacks - a universal finding around the world.

Travelers, tourists and workers in unfamiliar areas should all be aware of the potential for bites and their consequences. Peace Corps volunteers, missionaries and others should be prepared for such an occurrence and have appropriate instruction and preventive measures considered prior to their travel. During these considerations, they should also review the various diseases that may be transmitted through these bites. Zoonotic transfer may include the viral diseases (such as rabies, hepatitis and HIV), bacterial (particularly from cats, dogs and humans), and the protozoa. Zoonotic diseases are more common then appreciated and the immunocompromised individual is of particular concern. It should further be recognized that many of these viral diseases are not curable – including hepatitis C and AIDS or HIV.

Thus, education for the regional inhabitant as well as the traveler is important. Health care warnings, vaccinations, CME (continuous medical education) programs, pre-travel clinics, legal and financial cost considerations should be available. In most countries, the predominant bite morbidity and mortality occurs as a result of domesticated or semi-domesticated animals. In the United States, there is estimated to be 52 million dogs and 54 million cats that may cause injury.

When one looks at the type of bites and the consequences of the bites, the treatment opportunities and potential difficulties are readily apparent. Different breeds of animals will have different types of bites and injury producing trauma (Table 2). These vary from the scratches and abrasions to the devitalization of tissue and fatal injuries. Being aware of these bites and their characteristics aids in the treatment protocol.

Domestic Animals

Dogs

As mentioned, the majority of mammal bites occur as a result of domestic animals, particularly dogs and cats, biting the individual. With the large number of dogs around the world, the incidence of bites becomes astronomical. Further, the recognition that 15-20% of these bites will become infected, especially in children, should cause one to guard against the high risk of dog bites, particularly by the strange dog. Fifty percent of all dog bites occur in children under the age of 12. Around the world, Somalia with its stray dogs carrying rabies, and Romania, with their large number of strays roaming the streets, demonstrates the potential for harm. Postmen in Taiwan and rabies in India are further examples of the dog menace. One hundred million dollars is the estimated cost per year in the United States for treatment of 15% of the dog bites. Missionaries and Peace Corps volunteers who encounter dogs attack in strange areas should receive initial therapy early. Rabies vaccine and tetanus prophylaxis should be utilized.

Cats

The second most common cause of domestic animal bites outside of the human includes the house cat. They have sharp needle-like teeth and cause an estimated 500,000 bites each year in women in the United States. These animals, in particular, may carry such diseases as Bartonella, Tularemia and Pasturella multocida organisms as well as cat scratch fever. Early antibiotic treatment with amoxicillin or cephalexin as well as Cipro and Clindamycin should be considered. These bites occur primarily in the upper extremities, especially the hand and the arm. Most such bites occur in the early adult individual between the age of 21 and 35 years. Usually the cat is known to the individual. But a large percentage of these felines may be wild or stray cats taken in for care.

Other

Other domesticated or semi-domesticated animals that cause bites include pets such as ferrets, gerbils, hamsters or rabbits. The occasional wild animal brought into the home as a pet, such as the raccoon, squirrel, skunk and monkeys may cause trauma – bite or scratch. The zoo, laboratory and private collections all carry the potential for harm.,

Table 1. Bites

I. Consequences
- A. Tissue trauma
- B. Emotional trauma
- C. Acute/ Chronic disability

II. Infectious Considerations
- A. Viral
- B. Bacterial
- C. Parasitic

III. Biting Animals
- A. Domestic
  1. Pets
  2. Semi-domestic
  3. Laboratory
  4. Private collection
  5. Working
  6. Food
- B. Wild
  1. Large or small
  2. Carnivores
  3. Forest
  4. Plains
  5. Scavenger/doglike
- C. Human
- D. Marine

A. Treatment
- A. Prevention/avoidance
- B. Antibiotics/Immunizations
- C. Wound care and surgery
- D. Data Reporting
- E. Animal Examination

V. Results
- A. Immediate Care
- B. Long term Deformity
- C. Mortality

Table 2. Types Of Bites

I. Scratches and abrasions
II. Puncture wounds
III. Crush injuries
IV. Avulsion injuries
V. Devitalization of tissue
VI. Fatal injuries

Table 3. Potential Infectious Complications of Wounds

A.	Localized Cellulites
II.	Abscess formation
III.	Osteomyelitis
IV.	Lymphangitis
A.	Subcutaneous infection
VI.	Contagious diseases
A.	Bacteraemia and endocarditis
A.	Tenosynovitis

Table 4. Prevention of Dog Attacks

I.	Do not pet strange or chained animals.
II.	Avoid leaving children alone with dogs.
III.	Do not run from a dog nor scream.
IV.	Do not disturb a nursing, feeding or sleeping dog.
V.	Do not look them in the eye.
VI.	Teach the dog to be submissive, not aggressive (particularly with reference to the pit bull).
VII.	Train the dog to be friendly and introduce him to your mail carrier and friend.
VIII.	If knocked down, curl up in a ball or put a barrier, such as your coat, forward.

Table 5. Bite Victim Therapy

I.	Patient assessment and the ABCs for airway, bleeding and resuscitation
II.	Patient identification and proper wound care in the field
III.	Obtain a history of the attack and the animal
IV.	Wound care
	A. laboratory studies and cultures
	B. Wound irrigation and debridement
	C. Systemic – including antibiotics and medications
V.	Surgery under local or general anaesthesia
	A. Appropriate debridement
	B. Orthopaedic considerations and drainage
	C. Selected closure of wounds on the face and large lacerations - not of hand
VI.	Make a drawing and photograph
VII.	Notify proper authorities
VIII.	Immunization
	A. Prophylaxis for rabies, immunoglobulin and intramuscular injection
	B. Tetanus
	C. HIV
IX.	Long-term follow up and treatment including
	A. Viral diseases
	B. Deformities and corrective surgery.

leopards and cougars may all cause harm to the caretaker or on their escape. Working Rabid animals in petting zoos have caused serious concerns. Captive lions, tigers animals are usually larger animals such as the camel or the elephant, and each of these may cause serious injury. The camel, may cause a crushing bite to the upper extremity (crushing avulsion type of injury) gangrene and fractures. They carry the Staphylococcus aureus, Epidermides bacilli and other organisms. The rogue elephant may attack without notice, and, when they have dental problems, they are of particular concern. They may carry the herpes virus and rabies. Horses may carry the horse sickness virus and the blue tongue virus. Their bite may cause fat necrosis, haematomas and injuries –especially about the face and head. Tetanus immunization, Actinobacillus and streptococci are important treatment considerations. Food animals such as cattle, sheep and goats may all create concerns. Also cattle living in the wilds may be bitten by bats or insects and carry zoonotic diseases. Rabies is of particular concern in some of these animals.

Carnivorous Animals

On almost all continents, one will find the large wild cats as well as the small house cats. However, in certain areas such as Africa and India, the lion and the tiger occur in greater numbers. They are strong, fast and powerful. Recorded history demonstrates that in Kenya 135 rail workers were killed by two lions, and in Tanganyika, 380 people were killed. They may carry their larger prey, such as a cow, on their backs. The human may be injured, particularly at night, when they are searching for water or in the national parks. The puncture by their teeth may cause meningitis or Pasturella infection. Treatment of their injury requires extensive surgical debridement and tetanus antitoxin. Lions tend to kill by grabbing the throat and causing asphyxiation.

The tigers continue to kill each year in the Outback, and again there are stories of the tiger being able to move large carcasses long distances. Particularly in India, these animals may cause shock, blood loss, scalp injuries, fractured ribs and death. The other large cats, such as leopards and cougars, may carry the Pasturella organism and they are very difficult to tame. Their wounds may cause cellulitis, fever, and adenitis and require intensive therapy. Jaguars, cheetahs, ocelots all are fast and cunning. The bear, there being three main types—the black, the brown and the polar—may all be dangerous to the individual. The black bear usually will run from the human but may climb trees and may cause an occasional unprovoked attack. The brown bear may cause skeletal fracture injury, carry rabies, hepatitis, distemper, trichinella and other organisms. The fast, large and powerful polar bear will attack literally anything that moves as a potential food source.

Other Animals

The tree and the forest mammals such as the ape or the monkey, may be used in research, but also occur in the wild, and are scratchers and biters. They teach their young by biting and wrestling with them. Their injuries in the tropics are well documented. They carry a large number of bacteria in their mouth, and they may transmit a number of zoonotic diseases including viruses. The sloth and panda, however, do not appear to cause many bites, whereas the squirrel will bite and scratch on being trapped or cornered. Plains animals, including the rhinoceros and hippopotamus, are large, heavy animals. The hippopotamus may cause injury both on land and in water and may drown their victim or cause crushing injuries.

The rhinoceros and the water buffalo may gore and trample. Other plains animals, such as antelope and zebra, tend to run. But the wild dogs—the wolf, the hyena, the dingo—all may carry rabies and transmit this to the human or to the domestic animal. They tend to bite lower. Prophylaxis against rabies and tetanus should be foremost in the treatment program along with antibiotics.

Marine mammals, such as the whale and the dolphin, uncommonly cause bites - but may. The dolphin may carry Brucellosis. The beaver, the otter and the mink have sharp teeth and bite viciously. Flying mammals, including bats, the vampire bats, or flying squirrels, may all bite, scratch and carry multiple disease organisms such as fungal, bacterial and viral. Encephalomyelitis, histoplasmosis, and the screw worm may all be considerations. Rabies shots and animal autopsy are necessary when one is bitten by bats. Rodents usually bite low,

but they carry fleas and other considerations that one must be aware of. These include hantavirus from their droppings, leptospirosis from the non-bite situation, rat bite fever, tularaemia, sporotrichosis and hemorrhagic fever. Fatal rat bites are uncommon unless they are in small children or alcoholics. The plague organism may be carried by the rodent, and therefore elimination of rodents and rat-proofing buildings are particularly important. Tularaemia in rodents as well as Brucellosis and Lassa fever may occur. The Australian mammals, including the kangaroo and the wallaby, tend to kick more than bite, but salmonella and pseudomonas as well as staphylococcus and streptococcus organisms have been cultured from these animals.

Human Bites

This is one of the most serious types of bites and they usually occur as a result of three types of trauma—self-inflicted, such as nail biting and thumb sucking, bite wounds from fighting or lovemaking, and clenched fist injuries, which occur as a result of intentional combat. The latter usually occur when striking an individual in the mouth or teeth. The injuries occur far more commonly than one is aware, and many times the treatment of such is ignored for a long period of time. These lovemaking bites may affect the breasts, the lips, the genitals and the neck. The human bite may carry a large number of both anaerobic and aerobic organisms. Infections as a result of staphylococci, streptococci, haemophilus and other organisms are relatively common. Antibiotic therapy, drainage and immobilization all may be necessary, but one should be further aware that hepatitis organisms as well as the HIV organism may be transmitted in the human situation. Most such human injuries, however, occur in the upper portion of the body, particularly the upper extremity, head and neck.

Prevention and Treatment of Mammal Bites

Prevention certainly is a key to avoidance of any serious injury. One should be aware of the potential for injury when around an animal, particularly a strange animal (Table III). A number of safety precautions have been recommended, with regard to the dog and the cat (Table 4).

Treatment of mammal bites is an everyday occurrence in most busy emergency rooms. The treatment may be directed both at the initial injury but also at the potential complications of this attack. Table 5 outlines the treatment of mammal bites and their consequent injury. In addition to the necessity for treatment, one should be aware of the various places around the world where information regarding treatment and prevention is available. Therefore, the Centers for Disease Control and Health Information for the International Traveller should be contacted. The International Medicine Society, Tropical Medicine Society and Travel Medicine Advisory Newsletter should all be good sources of information as well as the World Health Organization (WHO) publications. Recognizing the incidence of these bites, success varies with the magnitude of the bite trauma and the availability of treatment facilities. Therefore, recognition of the problem and appropriate resuscitative efforts must all be a part of the treatment protocol for the individual victim. The overall success may depend on access to intravenous fluid resuscitation, intravenous antibiotics, respirator care, long-time hospitalization and feeding as well as the simple home care protocol. . One should appreciate the necessity of cleanliness and culture, both anaerobic and aerobic, of the wound created. Avoidance and prevention again are of greater importance.

Summary

Warm-blooded animal bites occur worldwide from a large number and variety of animals. Each animal species may carry its own particular peril and injury potential. Treatment depends on the type of animal and the bite. Awareness and prevention are primary in the avoidance of major injury and healthcare risks.

Reference

1. Textbook of Tropical Surgery. Kamil and Lumley. Chapter 256 Warm-Blooded Animal Bites. Dieter, R.A.Jr., Dieter, R.S., Dieter, R.A.III, Dieter, D.L., Gulliver E. Westminster Publishing Limited London 2004: 1136-1147.