

MANAGEMENT OF DOG BITES: A Case Report

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INTRODUCTION

Dogs associate closely with humans in today's society and they are a part of many households across America. In addition, they play an active role in entertainment, sports, law enforcement, agriculture, and in helping the disabled. With so many roles, it is sometimes hard to remember that man's best friend can still pose a threat to humans. Since dog bites are a preventable public health problem, the third full week of May has been established as National Dog Bite Prevention Week set forth by the Centers for Disease Control and Prevention, the American Veterinary Medical Association (AVMA) and the US Postal Department.¹

In 2 separate studies, it was estimated that roughly 4.7 million people in 1994 and 4.37 million people in 2001-2003 were bitten annually, with 836,000 (19%) seeking medical attention. This equates to about 1.5% of the population bitten annually and 0.3% requiring medical attention.^{2,3} Of the individuals seeking medical attention, approximately 16 fatalities occur yearly, which is about 0.0002% of the total population bitten.¹ It has also been documented in multiple studies that the highest rate of dog bite hospitalizations and emergency department treatments occur among boys ages 1-9 years.^{2,4,6} Children are common victims because of their aggressive play, lack of caution, and mistreatment of animals. Between 60% and 78% of dog bite victims are familiar with the dog(s) involved or the animal's owner; while members of households with dogs were more likely to be bitten than those from households without dogs.^{2,4,6}

There have been no studies isolating the number of dog bite injuries specifically to either the foot or the lower extremity; however, it has been estimated that up to 60,000 bite wounds to the foot and 660,000 to the lower extremity occur per year in the US.⁶ One study concluded that bite wounds were as high as 7% to the foot and 43% to the lower extremity from data collected on 457 individuals.⁷ Dire, however, reported that of 765 dog bite wounds in 704 patients, 15.9% involved the leg and only 1.7% involved the foot.⁸

COMPLICATIONS AND HEALTH PROBLEMS

Through direct trauma, dog bites to the foot typically can involve a variety of injuries including abrasions, puncture wounds, lacerations, fractures, and digital amputation(s). Depending on the size of the animal involved, crush injuries with or without fracture can also result, as large dogs are capable of exerting jaw pressures up to 450 pounds per square-inch.⁹ Potential complications of dog bite wounds to the foot include soft tissue infection and osteomyelitis, foreign body, fracture, loss of function of digits or limb, and digital amputation or limb loss.

Peripheral vascular disease, diabetes, and immunocompromised states all predispose patients to poor healing and increased susceptibility to infection.¹⁰ Dire found that patients older than 50 years of age had a six-fold higher infection rate than younger patients.⁸ It is estimated that between 3% and 18% of dog bites become infected, with occasional complications including meningitis, endocarditis, septic arthritis, and septic shock. Besides the problems associated with infection, dog bites can also cause psychological trauma, disfiguring injuries requiring reconstructive surgery, hospitalizations, and even death.² In a 2004 Belgium study, post-traumatic stress disorder was recorded in more than half of the children who had experienced dog bites.¹¹ A total of 31,000 patients in 2007 alone underwent reconstructive surgical procedures as a result of dog bites.¹²

Death resulting from dog bites is very rare, particularly in industrialized countries; however, developing countries may experience higher death rates secondary to dog bites in part because of the risk from rabies infection. Overall, 99.9% of human rabies deaths worldwide are from dog bites.¹³ Interestingly though, fatalities do occur, as reported by Sacks, who has conducted multiple studies summarizing dog bite related fatalities (DBRF) in the US. Between 1979 and 1996, dog attacks resulted in more than 300 human DBRF, with most victims being children.^{14,15} He also concluded that although over 25 different breeds of dogs were involved in 248 DBRF between 1979 and 1998, pit bull-type dogs and Rottweilers were involved in more than half of the deaths.¹⁶ DBRF was defined as a human death caused by trauma from a dog bite.



Figure 1. Initial clinical appearance



Figure 2. Radiographic view.

CASE REPORT

A 53-year-old woman with no significant medical history presented to the emergency department with a complaint of pain and swelling to her right foot. The patient reported that the family's 2-year-old pit bull bit her foot after becoming startled as she walked past the dog. At the time of the injury, the patient was walking only with socks on. She was transferred immediately to the hospital where clinical examination revealed a puncture wound on the plantar medial aspect of the right hallux, probing 1.5 centimeters into soft tissue but not to bone (Figure 1). Cultures unfortunately were not obtained by the emergency personal at this time. In addition to the puncture wound, the second and fourth digits were swollen and painful on palpation. The second toe appeared stable; however, the fourth digit appeared very dusky from the proximal interphalangeal joint to the end of the digit, and the toe did not blanch. Radiographs revealed a transverse fracture of the proximal phalanx of the second digit with moderate displacement and a distal fracture of the middle phalanx of the fourth digit (Figures 2 and 3).

The puncture wound was irrigated with a diluted povidone-iodine solution and packed with one-quarter inch plain packing. The second digit was stabilized to the third digit, and the fourth digit was cleansed with an antiseptic scrub and loosely bandaged. Although the fourth digit was in a contracted position, it was not manipulated because of the dusky nature of its appearance. The patient received tetanus prophylaxis and was



Figure 3. Radiographic view.

discharged with a surgical shoe, crutches, and a two-week course of Augmentin.

Cultures of the puncture wound were obtained 2 days following the injury at the first office visit. The wound was irrigated again with a diluted povidone-iodine solution, no osseous structures were palpated on deep probing, and the wound was packed. On immediate follow-up visits, the puncture wound was packed until successful skin closure, and culture results were negative. With the risk of possible soft tissue infection to the adjacent hallux, surgical intervention of the second phalangeal fracture was delayed. Aggressive treatment involving the fourth digit was also delayed secondary to the vascular embarrassment to the digit. On a subsequent visit the toenail eventually fell off,

however, the fourth digit slowly improved. The overall improvement to the digit can be attributed to close monitoring, a fourth digit sympathetic block, controlling interdigital maceration, and time. At the time this article was written, the puncture wound to the hallux had completely healed, the second digit was asymptomatic, and the patient was scheduled to have the fourth toe straightened.

TREATMENT AND CONSIDERATIONS

Depending on the extent of the injury, treatment for dog bites can range from an antiseptic scrub accompanied with cold compress and analgesics to irrigation, debridement of devitalized tissue, and surgical intervention. Treatment for these injuries are not always straight forward as there can be many aspects to the injury. The above case presented with a puncture wound to the hallux, fracture of the second digit, and a crush injury to the fourth digit with an associated phalanx fracture. In this particular case, both soft tissue and osseous infection of the hallux was of primary concern, followed by the survival of the fourth digit.

More than 64 species of aerobic and anaerobic bacteria have been isolated from the mouth of canines.¹⁷ It is for this reason alone that cultures should be obtained prior to irrigating the wound. Specifically in dog bite injuries, α -hemolytic *Streptococcus* is most frequently isolated, however, *S aureus* and *bacteroides* are also very common.^{10,18} With so many possible contaminants from within the oral flora of a dog's mouth, polymicrobial infections should be considered first as to not overlook the potential seriousness of a severe infection. With that in mind, it has been recommended that Antibiotic therapy be aimed at the most common pathogens including *S aureus* and *Streptococcus* species.¹⁰ Broad spectrum antibiotics should be initiated until definitive cultures are obtained, as unusual susceptibility patterns of bacteria have emerged secondary to increased antibiotic resistance. The duration of antimicrobial therapy should be correlated with the severity of the injury, time to initial treatment, and overall health of the patient. Initially all dog bites should also be considered tetanus prone and individuals should have tetanus prophylaxis administered in the emergency department if they require either a booster or have no history of prior immunization.

Crush wounds are difficult injuries to treat as sometimes damage to the tissues may be so extensive that eventual amputation may be inevitable. Treating too aggressively and too early can also have devastating effects if the tissues are still in a compromised state. Following

crush trauma to the foot, the microvascular plexus at the digital level can undergo a spastic phenomenon, which can ultimately lead to vascular collapse, venous congestion, and shutdown. Venous congestion occurs resulting in a lack of ingress and egress of blood to the digit. Typical presentation of cyanotic digits include a decrease or lack of digital blanching, partial or total lack of sensation, loss of color, and lack of digital warmth. In an attempt to increase circulation to the affected region, calcium channel blockers, topical nitroglycerin, sympathetic anesthetics blocks, and keeping the extremity in a dependent position can aid in restoring blood flow. Ice should be restricted in areas of vascular compromise and limited bandaging should be applied to the affected area if any. Hyperbaric oxygen therapy can also be utilized to increase tissue oxygen tension levels.

SUMMARY

Dogs are part of everyday society in America and yet that can pose a serious threat if startled or instigated. Bite wounds are a continued health problem that can lead to serious complications including psychological trauma, disfigurement, infection, amputation, and even death. Patients with significant comorbidities are particularly at high risk for serious complications and should be treated aggressively.

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