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Nygaard Wulff, Marianne; Dahlin, Lars

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PO Box 117
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Dog bite injuries to the hand

Author: Marianne Nygaard & Lars B. Dahlin.

Department of Hand Surgery, Skåne University Hospital Malmö, Sweden.

Correspondence: Marianne Nygaard, MD, Andreas Bjørns Gade 28 4.th, DK – 1428 Copenhagen,

Denmark. Telephone: +45 29659796

E- mail: solskin@dadlnet.dk

Abstract

Dog bites to the hand and forearm are common. Although bites are usually minor, aggressive dogs may cause extensive bites developing to a public health problem. In a database review of dog bites to the hand applied to Emergency Department or to a Department of Hand Surgery in Malmö, Sweden 2008-2009, we found 81 cases (42 men and 39 women) median age 45 (range 2–88) years. Three of 81 (4%) were children younger than 11 years. Six of 81 (8%) of the patients included had bilateral injuries. Seventy-five patients were treated at the Department of Hand Surgery, where 31 of 75 (41%) were admitted to hospital in 181 days (median 4, range 1-20). The injuries included lacerations of the skin, muscle, and tendons, as well as fractures, arterial and nerve injuries, and traumatic amputations of fingers. Some cases developed infections, necrosis of muscle and skin, arthritis, osteomyelitis, and even sepsis. A total of 96 operations were done for 51 patients (median 1, range 1-8) and the patients had 343 (median 2, range 0-22) outpatient visits. Almost half of the bites occurred when the patients was trying to separate two fighting dogs. The size of lacerations increased with the size of the dog. Serious infections were found independently of size.

We suggest that education of the owners and the public, reporting of all bites and control of animals are some of the actions to reduce decrease the number of attacks. At least one serious case could have been prevented if the dog had been put down after a previous serious attack.

Introduction

It has been estimated that the relative risk of being bitten by a domestic animal during a lifetime is about 50%, of which dog bites accounts for 80%-90% [1]. Twenty-eight percent of all children have a calculated risk of being bitten by a dog at least once [2]. The hand and forearm are involved in 18% to 68% of all dog bites [3-5]. The incidence varies from country zone to city areas (71.8 to 18.6/100 000) and among nationalities [2,4,6-8]. In a Belgian study, the incidence of dog bite was 1% per year [4]. In United States about 4 million dog bites were recorded annually [9] causing 7.1 deaths/ 100 million populations. Fifty-seven percent of the victims were less than 10 years of age [5,10].

The exact incidence is difficult to evaluate, as minor cases are usually treated by a family member or friend (59%) and are never recorded, while others are treated in primary care (34%) [2].

However, in more serious cases with extensive tissue damage, infection, or loss of function, the patient needs specialist treatment and operation. In these cases the media and public opinion are usually eager to suggest interventions of how to prevent future occurrences. It has been suggested that some dog breeds should be prohibited. Dog bites to the hand may cause loss of function, and time off work, and costs for society for admission to hospital, operation, rehabilitation, and social security, are high [5]. Nevertheless, very little is recorded or documented and debates are often emotionally based debates.

To supply fact to future debate, we present a retrospective review of the epidemiology and morbidity associated with dog bites to the hand and the forearm recorded at the Emergency Department and Department of Hand Surgery, in Malmö, Sweden 2008-2009.

Patients and methods

We retrospectively reviewed the database of all who attended to the Emergency Department and the Department of Hand Surgery, Malmö, Sweden, 2008-2009.

The Department of Hand Surgery treats patients with severe injuries of the hand and forearm. The population includes the southern part of Sweden (1.5 million habitants) including Malmö city (286535 registered in habitants at 1. January 2009).

The code W54.99 (dog bite injury to the hand or forearm) was used in the search for patients. An additional search was made to find patients recorded with an incorrect code, which was done electronically in computerised patient records (Filemaker system) for sentences containing "hundbett" (dog bite) or "biten av hund" (bitten by a dog), 2008 to February 2009. Thereafter a new electronic patient record system, Melior, was introduced. The total number of dog bites recorded in the Emergency Department and the Department of Hand Surgery, 2008 and 2009 was also obtained.

All records were evaluated retrospectively, with respect to the patient's clinically data, age, date of injury, sex, side, month for incident, and when possible, dog's breed, and circumstances of injuries. The number of outpatient visits, days in hospital, and numbers of operations, as the damaged structures diagnosed peroperatively, and the results of microbial culture were also recorded. Data were noted and recorded in a database for further analyses.

Results

Patients

A total of 100 patients fulfilled the criteria. After we had reviewed the records, 19 patients were excluded for various reasons, including incorrect code, dual registration 2008 and 2009, fracture as a result of playing with a dog, or having reconstructive surgery because of an incident before 2008.

In 2008 and 2009, a total of 69 and 107 dog bites in the whole body were recorded. The forearm and hand was involved in 36 (52%) and 45 (42%) patients, respectively of the total number of recorded dog bites. Among these 81 patients there were 42 men and 39 females. The median age of the included patients was 45 years (range 2-88). The age group 31-70 years accounted for 56/81 (69%) of the patients. Three of 81 (4%) were younger than 11, and 23/81 (28 %) were older than 60 (Figure 1).

Twenty-six cases were residents of Malmö; so the incidence for hospital treated dog bites in the hand and forearm in Malmö was ~ 4.5/100.000 year.

Most of the patients, 74% (n=60), contacted a medical specialist immediately after the injury, although 11% (n=9) waited 2 days, and 1% (n=1) 5 days. Five (6%) did not seek medical care until a week later, and one was not treated until 17 days after the incident, for necrotic tissue and arthritis.

The right hand was bitten in 45/81 (56%), the left in 29/81 (36%), and the injuries were bilateral in 6/81 (8%) of the cases. Variation due to season was demonstrated, Figure 2.

Only 6/81 (7%) had their final treatment at the emergency department. The remainder (n=75) were referred to the Department of Hand Surgery for further examination and treatment. In this group, 31/75 (41%) were admitted to the hospital for a total of 181 days (median 4, range 1-20). Nine patients were in hospital for one week or more.

Two of the three children younger than 11 years were admitted to hospital for a total of 8 days (median 3, range 0-5) and had three operations. Among those older than 60 the rate of admission was 9/23 (39%) for a total of 64 days (median 0, range 0-19), with 35 operations (median 1, range 0-6). The 81 patients had a total of 343 outpatient visits.

Injuries

Injuries ranged from minor wounds to major lacerations. Fifty-one patients had a total of 96 operations (median 1, range 1-8). Peroperatively we found 5 digital nerve injuries (one bilateral), 2 radial nerve lacerations, 6 digital artery injuries (one bilateral), one injury to the radial artery, and injuries to 3 digital veins. Six extensor tendons were injured; 2 were necrotic. In addition, we found 5 flexor tendon injuries, 2 injuries to pulleys, 2 collateral ligament injuries, and 10 fractures. The fractures were of the radius, ulna, carpal, metacarpal, and phalangeal bones, and there was even one ruptured triangular fibrocartilagenous complex. There were also 3 dislocated joints in two patients, and 3 traumatic amputations of fingers in three patients; a thumb, an index, and a middle finger.

Complications

Eighteen patients had simple infection such as abscess; 9 developed skin necrosis; 9 had muscle ruptures and necrosis involving both extrinsic and intrinsic muscles; 2 had with tendovaginitis; 2 had arthritis; and one developed osteomyelitis. One patient even developed sepsis. The main indication for operation in children was to explore the wound. In adults the indication for operation was deep infection, skin and muscular necrosis, tendon and vascular repair, and revision after traumatic amputation.

The operations included 30 wound explorations, debridement, tendon repair or reconstruction, reconstruction and osteosynthesis, three splitskin transpositions, two full skin transpositions, one tendon transfer, one arteriovenous end-to-end graft, and one end-to-end repair of the radial artery. For 9 patients who were in hospital for more than a week, the operations included microvascular surgery, skin grafting, or revision as result of a serious infection. Only two of the patients in hospital were not operated on, and were treated with intravenous antibiotics only.

Bacterial culture

The most common bacteria found were *Staphylococcus Aureus*, *Pasteurella Multocida*, and *Haemophilus Influenzae*. In one case *Escherichia coli* was found.

The dogs and circumstances of injuries

Conditions of bites and dogs were mentioned in 54/81 (67%) of the records. Of those, 25/54 (46%) of the accidents occurred in attempt to separate two fighting dogs. The remaining bites occurred as simply attacks, Figure 3.

The patient's relation to the dog was mentioned in 49/81 (61%) of the records, of those 21/49 (43%) were bitten by their own dog; in the remaining cases the dog was unknown.

The dog breed was mentioned in 31/81 (38%) of the records, and included German shepherd (n=6), of 3 were police dogs; Rottweiler (n=6), American Staffordshire crossbreed (n=2), (same dog), Golden retriever (n=2), Labrador (n=2), Bull terrier (n=2), "fighting dog", St. Bernard, Siberian husky, Dachshund, Terrier (not further specified), and a poodle, (n=1 each). From this it was not possible to calculate a relative risk for dog breeds.

Patients in hospital and more serious cases were bitten by a German shepherd (22 ward days and 8 operations), a Rottweiler (32 ward days and 9 operations), whereas one victim was a vet bitten while anaesthetising the dog, 2 patients were children, and two were adults with traumatic finger amputations. The most serious bites from an American Staffordshire cross breed (28 ward days and 12 operations), and a Bull terrier (2 ward days and 2 operations). In another serious case the dog's breed was not mentioned; this patient was attacked while having an epileptic seizure. The remaining patients were not admitted to hospital. Two patients, both older, had two incidents recorded, each with one year between the attacks. One of the dogs was a poodle.

In two serious cases the same dog was involved with only one month between the two attacks, the latest attack being on the owner. The patients, both women, were in hospital in 8 and 20 days, and had 4 and 8 operations, respectively. One is still waiting for a final operation. In both cases the dog attack spontaneously and was not in a fight with another dog.

Discussion

We found that a large number of serious dog bites involve the hand and the forearm and often occur when trying to separate two dogs fighting when at least one of the dogs is owned by the injured person. All breeds are capable to attack; the greater the biting force the higher the risk of lacerations of the soft tissue, although small bites may often be neglected causing, both patient and doctor delay in the treatment of infections. The injury pattern in the hand and forearm differs for children and adults. Children were most often admitted to hospital for exploration of the wound; whereas adults were treated for serious tissue damage and infections. Dogs usually attack other dogs. Rarely, but seriously, some of the dogs in this series had directly attacked humans.

The incidence of dog bites in the present study was comparable to that in previous studies [3-5]. However, since only patients admitted to hospital were included, the number is probably underestimated.

An increase in dog attacks on children was seen during the spring and summer [10]. Georges and Adesiyun suggested that the increase may be related to the children's summer holiday and therefore they were more exposed to dogs [2]. We found no injuries during the first three months of 2009. We suggest that warm clothing, such as gloves, may be protective.

The larger number of admissions to hospital among children may be explained by difficulties in evaluating neurovascular status in infants; so the wound must be explored. Adults may consult the hospital later and only when an infection has already developed, interventions will be needed more often. Older patients may also have an increased risk for infection because of coexisting diseases.

As in previous studies we found that *S aureus* and *P multocida* were the most common microbes [9,11]. In general, most bites from dogs are polymicrobial with a mean of 2.8 to 3.6 bacterial species isolated/ wound [11]. The *P multocida*

infections are characterised by rapid development within 24 hours in 70% of the cases and 48 hours in 90% of cases. A rare, but potential fatal, infection is that of *Capnocytophaga canimorsus*, which caused sepsis and disseminated intravascular coagulation, participates in patients with predisposing factors, which we did

not find. Serious infections were seen independently of the size of the dog. We recommend that a specimen is always taken for microbiological examination.

A remarkably high risk of a dog bite was found when trying to separate two fighting dogs, which happened in around half of the injuries. According to Benson et al., the safest way to separate the animals is to grab the hind limbs of the animal and pull it away [5]. Dogs most often attack dogs, which is why the constant use of a lead may also prevent some injuries. People should be told how to react when witnessing a dog fight.

In Sweden, approximately 800,000 dogs are registered [12] (Swedish population 9.354.461, "Befolkningsstatistiken; 2009"). As there is no valid register for dog attacks and breeds, it is difficult to assess which breeds are responsible. However, Rottweiler, German shepherd, and American Staffordshire terrier were mentioned most often in the records; police dogs were recorded in three cases. These breeds are common; so statistically this will increase the risk. German shepherds are a breed commonly used by the police. Consequently, these dogs are trained to attack by order, to use a "full mouth bite", and to hold the suspect when needed [13]. In previous studies, Pit bull terriers, Rottweilers, and German shepherds were found to be the breeds most often involved in both fatal and non-fatal dog attacks. Children were the main victims [6,10].

The size of the injury was related to the size of the dog. Not surprisingly the bite force increased with body and skull size and body weight [14]. The bite force also correlated to the skull shape, which was indexed by (skull width x100/skull length). The bite force increases from dolichocephalic (39%) to mesaticephalic (52%) to brachycephalic (81%).

To minimise the number of serious injuries various solutions have been suggested [15]. Sacks et al [10] and Lazzeti [16] proposed a guide for selection of the dog breed combined with education of both the owner and the dog. When an accident has happened it is also important to know what to do. Information about precautions and early sign of infections in relation to dog bites is crucial. Reporting of bites to track the size of the problem, and to focus on the most accurate interventions, would be appropriate and helpful in evaluating the size of the problem and the effect of political attempts to reduce dog attacks. There is yet no Swedish database to answer this question.

Animal control has been introduced in some countries as Breed-specific legalisation, which includes banning of certain decided dangerous breeds, and Non-breed specific legalisation, which includes different regulations to promote responsibility on the owner the dog owner regardless of the breed [8]. The breed-specific legalisation has apparently not prevented any attacks. There has been a strong support for laws for regulating dangerous dogs, since Sacks et al. found that 21% of the dogs responsible for fatal attacks had a history of aggression, [10].

In Sweden it is prohibited to own a dog that behaves aggressively, and Pit-bull terriers have been prohibited since 1997. To require an aggressive dog, to be put down, the police have to seek the opinion of a veterinary surgeon unless it is acutely dangerous. This may reduce the usefulness of the law. One seriously injured patient did contact the police, and putting down the problematic dogs could have avoided at least another serious case.

Benson et al. calculated that the mean expenditure for a patient who needed larger debridements, repair of nerve and tendon, and intravenous antibiotics were about SEK 544000/patient (USD 77,730) [5]. For only the nine patients in the present study who were admitted to hospital for seven days or more that would have been an expenditure of about SEK 4.9 million (USD 700,000). Rehabilitation visits to the physiotherapist, and the occupational therapist were not included. In addition, some patients continued treatment as outpatient at their home hospital or are due to return for further reconstructive surgery in the future. These treatments were not included in the present paper, neither was social security, lost days at work or complications caused by pain from adhesions, lost fingers, lost mobility, muscle, and tendon necrosis.

In conclusion, a dog breed and biting database will provide documentation for potentially dangerous breeds, and gives us the possibility to evaluate interventions made to reduce dog bites. To balance the daily social benefits with various dog breeds and simultaneously decrease the risk of aggressive attacks will be difficult and needs wisdom and facts.

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References

- [1] Goldstein EJ. Management of human and animal bite wounds. *J Am Acad Dermatol* 1989;21:1275-9.
- [2] Georges K, Adesiyun A. An investigation into the prevalence of dog bites to primary school children in Trinidad. *BMC Public Health* 2008;8:85.
- [3] Grant I, Belcher HJ. Injuries to the hand from dog bites. *J Hand Surg* 2000;25B:26-8.
- [4] Van Eeckhout G, Wylock P. Dog bites: an overview. *Eur J Plast Surg* 2005:233-8.
- [5] Benson LS, Edwards SL, Schiff AP, Williams CS, Visotsky JL. Dog and cat bites to the hand: treatment and cost assessment. *J Hand Surg* 2006;31A:468-73.
- [6] De Keuster TC, Lamoureux J, Kahn A. Epidemiology of dog bites: a Belgian experience of canine behaviour and public health concerns. *Vet J* 2006;172:482-7.
- [7] Gilchrist J, Sacks JJ, White D, Kresnow MJ. Dog bites: still a problem? *Inj Prev* 2008;14:296-301.
- [8] Rosado B, Garcia-Belenguer S, Leon M, Palacio J. Spanish dangerous animals act: effect on the epidemiology of dog bites. *Journal of Veterinary Behavior* 2007;2:166-74.
- [9] Presutti RJ. Prevention and treatment of dog bites. *Am Fam Physician* 2001;63:1567-72.
- [10] Sacks JJ, Lockwood R, Hornreich J, Sattin RW. Fatal dog attacks, 1989-1994. *Pediatrics* 1996;97:891-5.

- [11] Griego RD, Rosen T, Orengo IF, Wolf JE. Dog, cat, and human bites: a review. *J Am Acad Dermatol* 1995;33:1019-29.

- [12] Räddningsverket/NCO 2008-05-05 SK. Därför biter hundar människor. Räddningsverket . 5-5-2008. Report.

- [13] Meade PC. Police and domestic dog bite injuries: What are the differences? What are the implications about police dog use? *Injury Extra* 2006;37:395-401.

- [14] Ellis JL, Thomason J, Kebreab E, Zubair K, France J. Cranial dimensions and forces of biting in the domestic dog. *J Anat* 2009;214:362-73.

- [15] MMWR. Dog-bite-related fatalities--United States, 1995-1996. *MMWR Morb Mortal Wkly Rep* 1997;46:463-7.

- [16] Lazzetti L. Anticipatory Guidance: Having a dog in the family. *J Pediatr Health Care* 1998;12:73-9.

Figure 1. Age distribution of patients who had a dog bite to the hand or forearm in 2008 (black) and 2009 (white). The age of the total group ranged from 2 to 88 years. The mean age was 46 (median 45).

Figure 2. The seasonal distribution of numbers of dog bites to the hand and forearm received in 2008 (black) and 2009 (white).

Figure 3. A boy aged 12 was attacked by a Rottweiler, resulting in lacerations bilaterally to his hands and forearms (a) left and (b) right forearm.

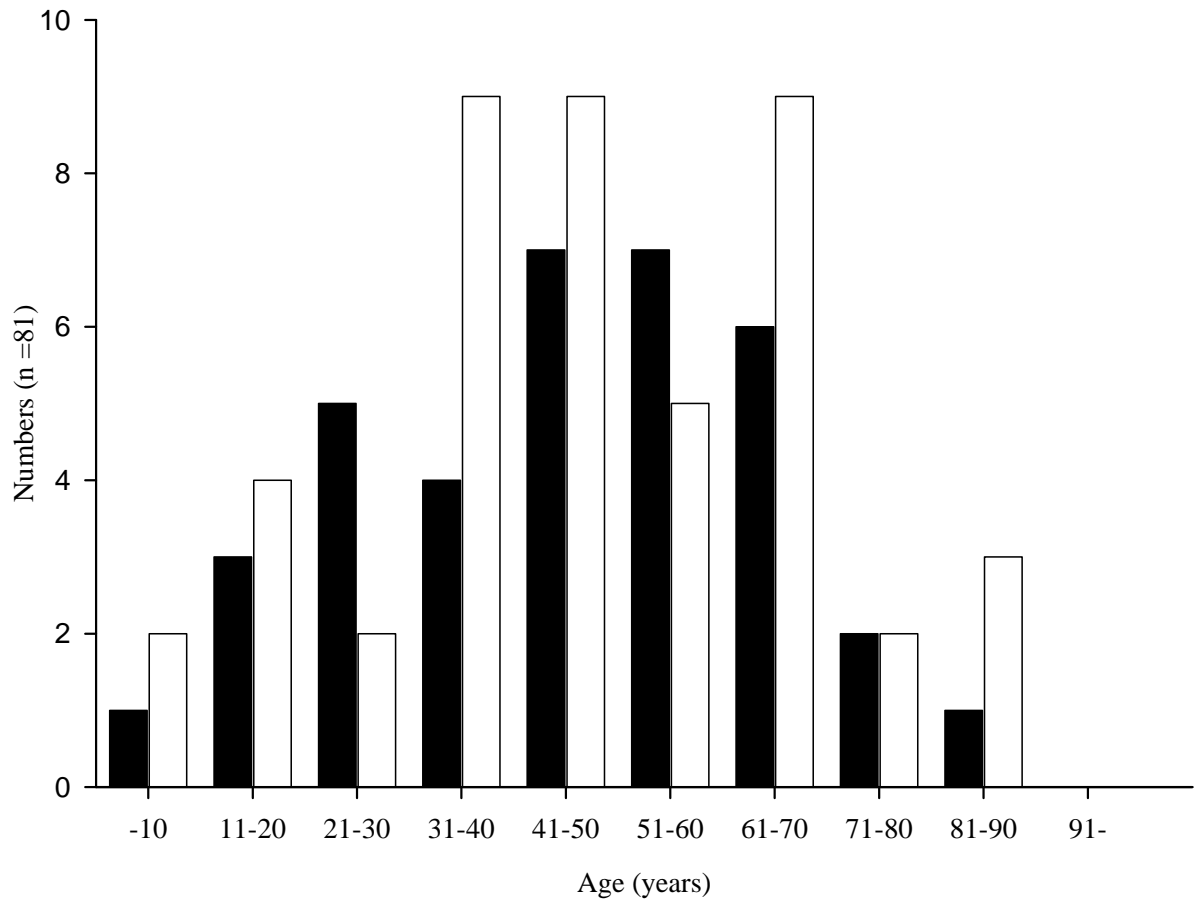


Figure 1.

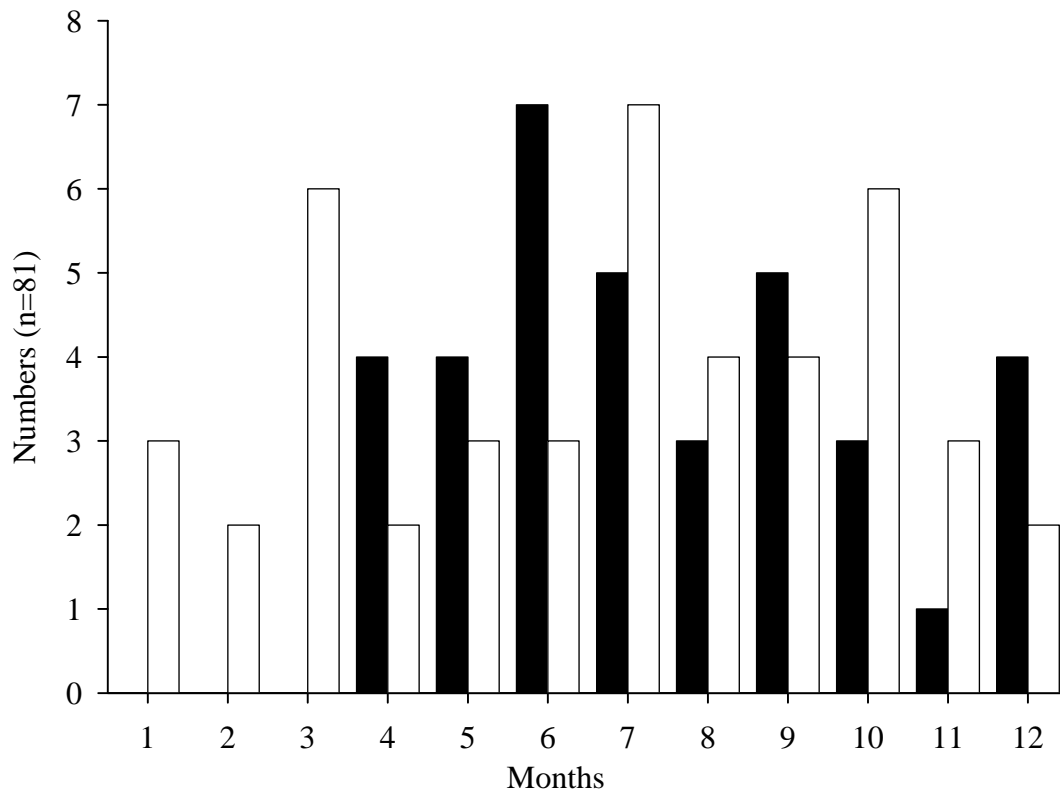


Figure 2.



Figure. 3.