Behavioral assessment of child-directed canine aggression

Ilana R Reisner, Frances S Shofer, Michael L Nance

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Objective: To characterize behavioral circumstances of bites to children by dogs presented to a veterinary behavior clinic.

Methods: Retrospective case series examining medical records of dogs presenting by referral to a university veterinary hospital for aggression and which had bitten a child <18 years old. Behavioral data included age of victim, familiarity with dog, and circumstances of bites.

Results: Records of bites to 111 children were examined. Children <6 years old were most commonly bitten in association with resource guarding (44%), whereas older children were most commonly bitten in association with territory guarding (23%). Similarly, food guarding was the most common circumstance for bites to familiar children (42%) and territory guarding for bites to unfamiliar children (53%). Behavioral screening of the 103 dogs examined revealed resource guarding (61%) and discipline measures (59%) as the most common stimuli for aggression. Anxiety screens revealed abnormalities in 77% of dogs. Potential contributory medical conditions were identified/suspected in 50% of dogs. When history before presentation was known, 66% of dogs had never previously bitten a child, and 19% had never bitten any human. Most dogs (93%) were neutered, and 66% of owners had taken their dogs to obedience training classes.

Conclusions: Most children were bitten by dogs with no history of biting children. There is a high rate of behavioral abnormalities (aggression and anxiety) in this canine population. Common calming measures (neutering, training) were not routinely effective deterrents.

Most dog bites reported to public health authorities are inflicted on children.¹ Whereas there are a number of studies reporting the epidemiologic characteristics of dog bite injury, information about the behavior of the dog or bite victim is limited.^{2–4}

Veterinary behavioral medicine is a recently recognized specialty in veterinary medicine.^{5,6} Data obtained in a veterinary behavior clinic can help pediatricians, parents, and other care givers to better understand the behavioral aspects of child-directed canine aggression, which, in turn, should lead to more effective prevention measures.

METHODS

The records of dogs presenting to the Behavior Clinic of the Matthew J Ryan Veterinary Hospital of the University of Pennsylvania (MJR-VHUP) for human-directed aggression from January 2002 to December 2005 were reviewed retrospectively. All cases in which the dog had bitten a child under the age of 18 years were included. However, bitten children for whom age or the circumstances of the bite were unknown were excluded.

A questionnaire, which included information about the dog, the owners' family, description of aggressive incidents as well as screening questions for aggressive and anxious behaviors

exhibited by the dog, was completed by each dog owner at the time of the initial appointment. In addition to completed questionnaires and aggression and anxiety screens, each medical record included referring veterinary examination and laboratory results as well as physical examination and laboratory findings conducted at the time of the veterinary behavior consultation.

Bite occurrences were categorized by familiarity of the victim with the dog and by circumstances surrounding the event. Familiar children included members of the family and/or household, or frequent visitors who were not household members. Unfamiliar children did not live in the household and were either unknown to the dog or were infrequent visitors to the home. Circumstances of bites to familiar children included resource guarding or food guarding, benign (non-aversive) interaction, aversive but non-painful interaction, aversive and painful interaction, or interaction while the dog was resting or sleeping. Circumstances of bites to unfamiliar children were categorized relative to the dog's perceived territory (house, yard, and surrounding area), and as either interactive or non-interactive.

Statistical analysis

Data are presented using frequencies and percentages. To compare children in different age groups by biting circumstances, the Fisher exact test was used. Where applicable, data are presented as differences with 95% CI. Statistical significance was defined as $p < 0.05$. All analyses were performed using SAS V.9.1 (SAS Institute, Cary, North Carolina, USA).

RESULTS

Children

A total of 145 children under the age of 18 years were bitten. Of these, 111 met inclusion criteria. Thirty four children (31%) were younger than 6 years old, and 77 (69%) were 6–17 years old. Half were boys and half were girls.

Familiar children were most commonly bitten in relation to food or resource guarding ($n = 29$; 26%) and "benign" interactions ($n = 20$; 18%) such as petting, hugging, bending over, or speaking to the dog. Presence in or entering the dog's territory was the most common situation in which unfamiliar children were bitten, regardless of whether the child was ($n = 10$; 9%) or was not ($n = 21$; 19%) actively interacting with the dog. Unfamiliar children were also bitten away from the dog's home or yard, regardless of interaction ($n = 4$; 4%) or lack of interaction ($n = 5$; 5%).

Table 1 summarizes the circumstances of the biting episode relative to both age of the child and familiarity with the dog. Children <6 years old were significantly more likely than older children to be bitten in relation to food guarding or other resource-associated aggression (44% vs 18%, difference = 26%, 95% CI 4 to 45%, $p = 0.009$) or in aversive, potentially pain-eliciting interactions such as stepping or falling on the dog (18% vs 0%; difference = 18%, 95% CI 7 to 35%, $p = 0.0006$). No differences were noted between girls and boys in any of these stimulus categories.

Table 1 Circumstances of aggression to 111 children by dogs presented to a veterinary behavior service

Category	Stimulus description	<6 years (n = 34)	6–17 years (n = 77)	p Value
Aggression to familiar children				
Resource guarding	Approaching, reaching for or touching dog while dog is near or eating/chewing food, bone or toy	15 (44)	14 (18)	0.009
Benign (non-aversive)	Petting, hugging, kissing, bending over, reaching, speaking	5 (15)	15 (19)	NS
Resting	Waking dog; interacting while dog is resting; approaching while dog is resting/lying down; lying beside recumbent dog; pushing/pulling dog off furniture	1 (3)	8 (10)	NS
Aversive, painful	Stepping on dog; pulling on hair or body; falling on to dog; trimming nails; punishment by hitting or use of leash correction	6 (18)	0 (0)	0.0006
Aversive, non-painful	Restraint/pulling by collar; grooming, towel drying; bathing; lifting; verbally scolding	0 (0)	5 (6)	NS
Aggression to unfamiliar children				
Territorial, non-interactive	In/on dog's territory, including house, yard, area surrounding home, car; child does not interact	3 (9)*	18 (23)	NS
Territorial, interactive	In/on dog's territory, including house, yard, area surrounding home, car; child interacts, eg, by speaking to dog, petting, reaching, attempting to feed, removing objects, restraining	2 (6)*	8 (10)	NS
Not territorial, interactive	Not on dog's territory; child interacts, eg, by speaking to dog, petting, reaching, attempting to feed, removing objects, restraining	0 (0)	4 (5)	NS
Not territorial, non-interactive	Not on dog's territory; child does not interact	1 (3)	4 (5)	NS
Aggression - other		2 (6)	7 (9)	†

Values are number (%). Columns may add up to more than total because children could have been bitten in more than one context (one child in <6-year-old group; six children in 6–17-year-old group).

*Total N = 33; circumstances of territorial bite were unknown for one child.

†Comparison was not performed because bite circumstances varied.

Dogs

A total of 103 dogs had bitten a child under the age of 18 years. Three quarters of the dogs were male (n = 77; 75%), and all but four males and three females had been neutered. Forty one breeds were represented. English Springer Spaniels and German Shepherd Dogs each comprised 9% of pure-bred dogs (7% of all dogs), followed by 5% each of Labrador Retrievers, Golden Retrievers, and American Cocker Spaniels (4% of all dogs). The total number of times a dog had bitten (historically) was known for 98 dogs. Nineteen (19%) presented for the single bite incident involving a child, and had never previously bitten a person of any age. The remaining 79 (81%) dogs had bitten at least one person (the same child, or a different child or adult) more than once (two bites, 15%; three bites, 18%; four

bites, 13%; five bites, 9%; more than five bites, 24%). When the historical details of bites before the current bite were known, 66% (n = 48) of dogs had never previously bitten a child. Forty four dogs (45%) had bitten a child who was a member of the family or household, and 65% had bitten either child or adult members of the family or household. Thirty five (35%) dogs had bitten only unfamiliar children. In some cases, histories were largely unknown because of age at acquisition.

Aggression screens completed by the owner of each dog revealed that the most common circumstance associated with aggression historically, to either adults or children, was resource guarding (61%) (table 2). Similarly, dog anxiety screening demonstrated common abnormal or reactive behavioral tendencies (table 2).

Table 2 Responses to canine aggression and anxiety screens by owners of 103 dogs presented to a veterinary behavior clinic with a history of biting children

Stimulus category	Positive (aggressive or anxious)	Negative (not aggressive or anxious)	Situation does not apply
Aggression screen			
Remove dog food, special food, toys (resource guarding)	48 (61)	31 (39)	24
Punish (verbally scold, correct with leash, hit)	24 (59)	17 (41)	62
Disturb while sleeping or resting; push or pull off furniture	38 (49)	40 (51)	25
Reach over or toward dog	34 (38)	56 (62)	13
Bathe, groom, or towel	21 (26)	59 (74)	23
Anxiety screen			
Anxiety related to separation from owner(s) while owner is absent	34 (35)	62 (65)	
Anxiety related to separation from owner(s) while owner is present but inaccessible	49 (51)	47 (49)	
Anxiety or fear related to thunderstorms/fireworks	47 (50)	47 (50)	
Any anxiety (either separation or storm/noise-related anxiety, or both)	78 (77)	23 (23)	

Values are number (%) or number. Aggression was directed to children, adults, or both. "Situation does not apply" refers to situations or provocations that do not occur for the particular dog. For example, resource guarding cannot be assessed if owners have not attempted to remove food or toys. In the aggression screen, positive responses refer to growling, baring teeth, lunging, snapping, or biting a person in response to the listed stimulus. In the anxiety screen, positive responses refer to trembling, panting, pacing, vocalization, destructiveness, urination, or defecation. Anxiety screen rows may not add up to 103 because of missing values.

On the basis of clinical assessment, fear-related aggression was the most common primary behavioral diagnosis in the dogs ($n = 90$; 87%), followed by resource guarding ($n = 53$; 51%), territorial defense ($n = 52$; 51%), social conflict ($n = 40$; 39%), and pain ($n = 14$; 14%). Additional diagnoses included generalized anxiety ($n = 64$; 62%), inappropriate or excessive attention-seeking behavior ($n = 36$; 35%), and clinically significant noise or thunderstorm fear ($n = 30$; 29%) and separation anxiety ($n = 18$; 17%).

On the basis of physical examination, laboratory findings, and observation, a medical problem was identified or suspected in 51 (50%) dogs. Orthopedic ($n = 18$; 20% of all dogs examined) and dermatologic ($n = 18$; 20%) conditions were most commonly identified. Other medical problems included dermal or epidermal masses and ophthalmologic, metabolic (eg, renal and hepatic), endocrinologic, and infectious (eg, *Borrelia burgdorferi*) disease.

Most owners (66%) had taken their dogs through formal obedience training classes. Twenty one families had no prior experience, as adults, with dog ownership; however, prior experience or its lack had no significant association with biting.

DISCUSSION

In this study, we describe the circumstances surrounding bites to children by dogs evaluated for aggressive behavior at a university-based veterinary behavior service. Although the epidemiology of bitten children has been reported in a number of studies, there have been few studies on the circumstances of aggression, or behavioral or medical information about the biting dogs themselves. This is the first study to examine the behavioral aspects of child-directed canine aggression from the point of view of a veterinary behavioral assessment.

Although 66% of the evaluated dogs had no prior history of biting children, behavioral abnormalities were universally present in this canine population. Historically, although 19% of dogs had never bitten before presentation, a history of aggressive behavior other than biting (eg, baring teeth) was common. Furthermore, although some types of human-directed aggression tend to be observed only in behaviorally mature dogs (starting at 1–3 years of age),⁷ aggression related to food or pain may be seen in juvenile dogs.⁸ Thus, aggression even in a puppy, and even in the absence of biting, should raise concern and consideration should be given to referral for behavioral evaluation of the dog.

Anxiety screening identified abnormalities in 77% of animals. Historical evidence of fearful or anxious behavior in response to loud noises and thunderstorms or separation from the owner may signal a predisposition to biting in threatening situations related to anxiety or fear.⁷ Dogs that react with anxiety to threatening stimuli may be more likely to react aggressively to

children, who, particularly when very young, are at risk because of their high-pitched voices, sudden movements, and inappropriate interactions.

Medical conditions were identified or suspected in 50% of the dogs evaluated. There were a number of dogs with orthopedic, dermatologic, and other disease both at the time of consultation and historically. These associated medical or painful conditions may have increased the risk of aggression. However, because of the lack of a well-animal clinic for comparison of presented dogs, it was not possible to determine whether this was higher, lower, or as expected in the patient population. Because disease and pain can increase irritability in dogs,^{9–11} even if a causal relationship is not confirmed, their presence should be an indication to separate the dog from young children until the disease has been treated or the pain reduced.

Previous reports of dog bites to children have made safety recommendations, such as neutering male dogs,² canine obedience training,¹² and avoiding specific breeds.¹³ The prevalence of males (75%) in our study is similar to other studies.² Almost all dogs, both male and female, were neutered. Although our data did not include age at neutering or whether the surgery occurred before or after the appearance of aggressive behavior, it is apparent that neutering does not guarantee a reduction of aggression in dogs. It is interesting to note that the predominant canine behavioral diagnosis, fear-related aggression, lacks sexual dimorphism,⁷ and therefore neither sex should be over-represented. However, even male-associated aggression such as territorial defense is unlikely to be eliminated by neutering.¹⁴ Regardless of neuter status, parents seeking a pet dog might be advised to seek a female. Two-thirds of the dogs in this study had been taken to training classes by their owners. It is not known whether owners had made specific efforts to train or socialize dogs to be comfortable with children. Although the success of obedience training for individual dogs was not measured, the results of this study suggest that obedience training, like neutering, will not ensure prevention of future bites to children. However, the efficacy of obedience training in reducing aggression was not specifically measured. Cohort studies would be needed to evaluate whether training (or neutering) reduces biting behavior. With the exception of the English Springer Spaniel, the breeds included in our study ranked high in American Kennel Club breed registrations and appear to reflect breed popularity. Because the total number of English Springer Spaniels in our study was small, and the study was performed at a referral hospital with a highly selected group of patients, it is safest to conclude that any breed of dog is capable of biting a child.

The findings for younger children were not unexpected. Food or resource guarding is a common behavior problem in dogs and was noted in almost two thirds of the dogs in this study.¹⁵ To be safe, children of any age should not be permitted near the dog whenever food (including human food) is present.

The meaning of “provocation” has been inconsistent in the literature and should be interpreted with caution.^{16–19} The mere presence of a parent, who may underestimate the risk of bites to young children,²⁰ may not be sufficient to prevent bites.²¹ Although it is natural to assume that hitting and other pain-inducing interactions can elicit aggression, parents and dog owners may be less vigilant when a child simply approaches or pets a dog. Similarly, for unfamiliar children, walking or cycling near a dog’s home may be provocative enough when dogs are tethered outdoors or are not securely fenced.²²

Our study focuses on children bitten by pet dogs evaluated in a secondary and tertiary care veterinary behavior clinic with a history of aggression to children. We recognize the limitations of a retrospective case series study at a referral center. Our patients are a highly selected group of dogs, and the ability to

Key points

- Children are at risk of dog bite in association with resource guarding by the dog or pain-causing interactions. Unfamiliar children are at risk of dog bite while in the dog’s home, yard, or perceived territory, regardless of whether or not they are interacting with the dog.
- All dogs evaluated for human-directed aggression in our study had a behavior and/or medical abnormality.
- Episodes of aggression were not limited to specific dog breeds, gender, neuter status, or history of training.
- The risk of biting may be increased in the presence of pain or disease in the pet.

draw generalizable inferences from them is limited. We also acknowledge the limitations of a retrospective study of self-report and self-assessment (of their pets) by dog owners seeking help for problem behavior. However, we do attempt to better characterize this common clinical problem from the unique perspective of the canine behavioral analysis.

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Authors' affiliations

Ilana R Reisner, Frances S Shofer, Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, PA, USA
Michael I Nance, Department of Surgery, The Children's Hospital of Philadelphia, PA, USA

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Correspondence to: Dr I R Reisner, Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, 3900 Delancey St, Philadelphia, PA 19104-6010, USA; reisner@vet.upenn.edu

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Webcast: International Forum on Quality and Safety in Health Care

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The webcast includes the following, in either English or Spanish translation:

- **Donald M Berwick**: Can health care ever be safe?
- **Richard Smith**: What the quality movement can learn from other social movements
- **Lucian Leape and Linda Kenney**: When things go wrong: communicating about adverse events
- **John Prooi and Harry Molendijk**: Partnering for patient safety