Dog bite injuries in children – a review of data from a South African paediatric trauma unit

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Background and objective. Dog bites are a major cause of preventable traumatic injury in the paediatric population. We aimed to determine the epidemiology of dog bite injuries in a group of South African children with a view to developing potential preventive strategies.

Design, setting, subjects. A retrospective review was done of patients presenting with dog bite injuries to the trauma unit at the Red Cross War Memorial Children's Hospital in Cape Town over a 13.5-year period.

Results. We identified 1 871 children treated for 2 021 dog bite injuries during the study period. Dog bites accounted for 1.5% of all trauma unit presentations. Male children accounted for 68% of the patients. Children under 6 years of age were more likely to have sustained injuries to the head, face or neck, while children older than 6 years more commonly received injuries to the perineum, buttocks, legs or feet. Younger children were more likely to be attacked at home and older children outside the home. The most frequent injuries were superficial, and the majority of patients were treated with simple medication, dressing or suturing. There were no dog bite-related fatalities.

Conclusion. The relationship between the geographical location of dog attacks on children and the age groups attacked suggests that strategies to prevent dog bites should target both parents supervising younger children at home, and older children who encounter dogs outside the home.

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Dog bites are a major cause of preventable traumatic injury in the paediatric population. Although rarely fatal,[1] dog bite injuries sustained by children can be devastating, with adverse sequelae both cosmetically and psychologically.[2] The annual frequency of dog bite injuries in children has been estimated at 22 per 1 000 children, less than half of which present to medical facilities.[3] Previous studies have described the epidemiological aspects of dog bites in children admitted to paediatric trauma units[4-6] and presenting to emergency departments.[7-10] This investigation aimed to determine the epidemiology of dog bite injuries in children presenting to the Trauma Unit of the Red Cross War Memorial Children's Hospital in Cape Town, and to compare the pattern of dog bites in this population with those published in the literature, with a view to developing potential preventive strategies.

Methods

We reviewed all paediatric patients who suffered dog bite injuries presenting to the Trauma Unit at Red Cross War Memorial Children's Hospital in Cape Town, from 4 March 1991 to 25 October 2004. Patient data were obtained by searching the Child Accident Prevention Foundation of South Africa (CAPFSA) trauma registry for entries listing 'dog bite' as the cause of injury. Trauma records were reviewed for patient age and gender, environmental information (time and month of attack, geographical place where the bite occurred) and treatment information (anatomical site and pathology of injury, treatment, and hospitalisation). Injuries were classified as minor (superficial laceration/abrasion/contusion, treated in the trauma unit and discharged) or significant (complicated laceration/fracture or admitted to the trauma ward or life-threatening injury).

Differences in geographical location and anatomical sites of dog bite injury between children younger than 6 years and 6 years and older were compared using chi-square tests. An age of 6 years was set as the cut-off point to acknowledge the physical and behavioural characteristics associated with young preschool children.

Results

We identified 1 871 children treated for dog bite injuries in the trauma unit during the study period, from a total of 125 677 patient visits during this period. Dog bites therefore accounted for 1.5% of all trauma unit presentations. There were 1 265 male children (68%), and 606 female children (32%). Age was not recorded for 2 female and 7 male children. The mean age of the remaining children was 6.84 ± 3.30 years (range 2.5 months - 18.5 years). The peak incidence was noted in children aged 4 - 7 years old (Fig. 1). Five hundred and forty-six bites (29%) occurred between the summer months of November

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and January. Seven hundred and forty-three patients (40%) presented to hospital between 12h00 and 18h00, and 891 children (48%) presented between 18h00 and 0h00. A large proportion of all attacks occurred either inside or outside the victim's own home and at the home of friends or family (Table I). Children younger than 6 years old were more likely than older children to be attacked inside their own home (p = 0.0001). Children 6 years old and older were more likely than younger children to be attacked on a road or pavement (p = 0.0000) or in a public place (p = 0.011). No other associations were found between age and geographical place of attack.

The breed of dog involved in the attack was recorded for only 25 children (1%). The most common breeds were pit bull terriers (N = 7) and German shepherd (N = 6). In 10 cases more than one dog was noted to have been involved in the attack, and in a further 4 cases either known rabies or rabid behaviour was reported in the dog.

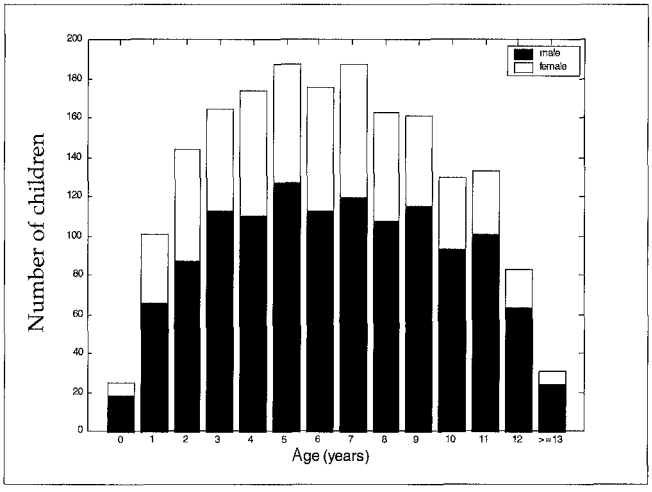

Fig. 1. Number of male (N = 1 258) and female (N = 604) children by age presenting with dog bite injuries.

A total of 2 021 dog bite injuries were sustained by the 1 871 children. Overall, the most commonly injured anatomical locations were the leg or foot and the head, face or neck (Table II). Children younger than 6 years of age were more likely than older children to sustain injuries to the head, face or neck (p = 0.0000). Children 6 years or older were more likely than younger children to sustain injuries to the perineum or buttock (p = 0.0003) and to the leg or foot (p = 0.0000). No association was found between age group and frequency of injuries to the trunk, shoulder, arm or hand.

The majority of injuries (N = 1 718, 85%) were minor, including superficial lacerations, abrasions and closed tissue injuries (Table III). Significant injuries (N = 303, 15%) included complicated lacerations, joint injuries and fractures, concussions, neurovascular injuries and amputations. Most patients were treated with simple medication, dressing or suturing (Table III). Two patients presented to the trauma unit in a state of shock and required complex resuscitation, and 92 children (5%) required a general anaesthetic. One hundred and fifty-one patients (8%) were admitted to the trauma ward or directly to another ward, including the intensive care unit, as a result of the attack. There were no dog bite-related fatalities.

Limitations

Several limitations must be considered in relation to this study. Because less than 50% of dog bites are reported to doctors,[3] our data may not be representative of all children sustaining dog bite injuries in our population. One and a half per cent of

Table I. Geographical place of occurrence of dog bite injuries in children aged less than 6 years and 6 years or older (N (%))

Place of occurrence	< 6 years	≥ 6 years	Unknown age	Total
Own home inside	114 (14)	91 (9)	2 (22)	207 (11)
Own home outside	303 (38)	365 (34)	3 (33)	671 (36)
Other home inside	45 (6)	49 (5)	1 (11)	95 (5)
Other home outside	152 (19)	215 (20)	1 (11)	368 (20)
Road or pavement	123 (15)	247 (23)	2 (22)	372 (20)
Public place	16 (2)	44 (4)	0 (0)	60 (3)
Other/unknown	44 (6)	54 (5)	0 (0)	98 (5)
Total	797	1 065	9	1 871

Table II. Anatomical sites of dog bite injuries in children aged less than 6 years and 6 years or older (N (%))

Anatomical site	< 6 years	≥ 6 years	Unknown age	Total
Head, face or neck	421 (50)	211 (18)	1 (11)	633 (31)
Trunk	65 (8)	66 (6)	1 (11)	132 (7)
Shoulder, arm or hand	141 (17)	203 (17)	0 (0)	344 (17)
Perineum or buttock	36 (4)	96 (8)	1 (11)	133 (7)
Leg or foot	187 (22)	586 (50)	6 (67)	779 (39)
Total*	850	1 162	9	2 021

*Some patients presented with more than one injury.

Table III. Description of dog bite injuries

Injury description	No. of patients (%)
Minor	1 718 (85)
Laceration – superficial	1 241 (61)
Abrasions/closed tissue	439 (22)
Other	38 (2)
Significant	303 (15)
Laceration – complicated	242 (12)
Orthopaedic (joint injury/fracture)	20 (1)
Concussion	12 (1)
Neurovascular	7 (0)
Avulsion/amputation	6 (0)
Other	16 (1)
Total*	2 021

*Some patients presented with more than one injury.

trauma unit presentations in our study population were as a result of dog bites, while Schalamon *et al.*[6] and Kahn *et al.*[9] reported that dog bites accounted for 0.31% and 0.24% of paediatric trauma-related hospital visits, respectively. The comparatively large proportion of visits to the trauma unit attributable to dog bites in our study population may be related to referral patterns in our primary health care system,[11] or to patterns of child and dog supervision and behaviour in the study population.

Some of our data are incomplete with regard to exact circumstances of the dog bite – the breed of the dog and whether the dog was provoked before biting were not recorded in all cases. Previous studies have addressed these issues.[5,7-9] Finally, delays between time of injury and time of seeking treatment may have affected the validity of using time of presentation as a surrogate marker for time of injury.

Discussion

Children are at greater risk of being bitten by a dog than any other age group,[12] and the problem occurs worldwide. In this study, 68% of children bitten were boys, and the peak incidence of dog bites was at age 4 - 7 years. These demographic data are consistent with other reports of dog bites in children presenting to paediatric emergency and trauma units,[5,8-10] and may reflect the natural behaviour of young boys, including yelling and grabbing, which puts them at risk for dog bite injuries.[13,14] Our results suggest that dog bites are more likely to occur in the afternoon and evening during summer vacation months when children are more likely to be playing outside. Our results also support previous findings that dog bites more often occur at the family home or at the homes of friends or relatives,[15] therefore involving the family pet[16] or one familiar to the child.[6] This highlights the fact that a known dog cannot necessarily be regarded as a safe dog.[17] The higher likelihood of younger (rather than older) children being bitten inside their own home and of older (rather than younger) children being bitten while on a road or on the pavement, reflects the level of mobility of these age groups.

While we cannot draw conclusions from our limited data on dog breeds, the higher number of children attacked by pit bull terriers and German shepherds is consistent with the literature – pit bull-type dogs have been shown to be involved in a high proportion of fatal human attacks,[18] while German shepherds and Dobermans accounted for a large proportion of dog bites in children in a recent study.[6] No information is available regarding numbers of the individual breeds in our patient drainage area. Caution must be exercised when interpreting dog breed data because of unreliability of identification and uncertainty of breed assignment by owners.[15]

Ten children were the victims of a multiple dog attack. All dogs are social animals that have an innate pack instinct. Dogs acting in packs are known to be far more dangerous than the same animals as individuals; in the case of domestic dogs, the pack is most often the human family unit.[19] A social hierarchy within the pack allows members to assume their place and to function accordingly.[20] Any change to this hierarchy is potentially dangerous, for instance the family dog may challenge a new member of the pack (e.g. a new baby).

Our results suggest that bites to the head, face and neck in younger children (< 6 years) and to the lower limbs in older children (≥ 6 years) are the most common age-specific anatomical locations for dog bite injuries. This is in agreement other reports in the literature.[6,8,9] Because of their short stature, injuries to young children are often to the head, neck and face and may be life threatening.[1,21] Scarring is a common consequence of dog bites, and severe emotional stress may be associated particularly with wounds to the face.[6]

Of the 2 021 injuries sustained by our patient group, most were classified as minor injuries such as superficial lacerations and abrasions. Most minor injuries were treated with simple medication, dressing or suturing. Management of dog bite wounds, including appropriate tetanus and rabies prophylaxis, has been reviewed previously.[22,23] This study did not look at the significant psychological impact of dog bite injuries in children.[2]

The public health implications of dog attacks are significant and there needs to be increased awareness of the risks to young children. Guidelines on dog bite prevention are largely unevaluated and there are very few interventional studies aimed at reducing the incidence of dog bites. Studies of dog behaviour suggest that risk factors for dog bite attacks include the dog's genetic predisposition towards aggressiveness, its level of training, maltreatment, hunger and territorial instinct; and the behaviour, age and size of the victim.[19] It has been suggested that scientists should do research on the relationship between animals and humans to identify ways in which to reduce the risk of bites.[24] Dog behaviour experts recommend behaviour modification techniques to treat aggressive dogs.[25] Studies have shown that certain breeds of dogs and male dogs of unneutered status are more likely to bite.[26] A recent randomised trial[27] conducted among school children has shown

that education programmes can alter behaviour towards dogs in the short term. Our findings on the geographical place of dog attacks suggest that interventions should be designed both for parents supervising younger children at home and for older children who encounter dogs outside the home.

In summary, our results support the findings of previous studies, viz. that the typical child injured by a dog is a boy, aged between 4 and 7 years, bitten at home or at the home of a friend or relative, in the afternoon or evening, and during summer.

This largely preventable cause of childhood trauma is multifactorial. Preventive strategies should be multidisciplinary in approach and aim to modify behavioural patterns of the pet owner, child and dog. Dog bite prevention information based on responsible dog ownership, parental supervision of children around dogs and appropriate behaviour around dogs should be provided.

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References

1. Sacks JJ, Lockwood R, Hornreich J, Sattin RW. Fatal dog attacks, 1989-1994. *Pediatrics* 1996; 97: 891-895.
2. Peters V, Sottiaux M, Appelboom J, Kahn A. Posttraumatic stress disorder after dog bites in children. *J Pediatr* 2004; 144: 121-122.
3. Kahn A, Robert E, Piette D, De Keuster T, Lamoureux J, Leveque A. Prevalence of dog bites in children: a telephone survey. *Eur J Pediatr* 2004; 163: 424.
4. Avner JR, Baker MD. Dog bites in urban children. *Pediatrics* 1991; 88(1): 55-57.
5. Gandhi RR, Liebman MA, Stafford BL, Stafford PW. Dog bite injuries in children: A preliminary survey. *Am Surg* 1999; 65: 863-864.
6. Schalamon J, Ainoedhofer H, Singer G, *et al*. Analysis of dog bites in children who are younger than 17 years. *Pediatrics* 2006; 117: E374-E379.
7. Bernardo LM, Gardner MJ, O'Connor J, Amon N. Dog bites in children treated in a pediatric emergency department. *Journal of the Society of Pediatric Nurses* 2000; 5(2): 87-95.
8. Bernardo LM, Gardner MJ, Rosenfield RL, Cohen B, Pitetti R. A comparison of dog bite injuries in younger and older children treated in a pediatric emergency department. *Pediatr Emerg Care* 2002; 18: 247-249.
9. Kahn A, Bauche P, Lamoureux J. Child victims of dog bites treated in emergency departments: a prospective survey. *Eur J Pediatr* 2003; 162: 254-258.
10. Centers for Disease Control and Prevention. Nonfatal dog bite-related injuries treated in hospital emergency departments - United States, 2001. *Morb Mortal Wkly Rep* 2003; 52: 605-610.
11. Kale R. South Africa's health - restructuring South Africa's health-care - dilemmas for planners. *BMJ* 1995; 310: 1397-1399.
12. Love M, Overall KL. How anticipating relationships between dogs and children can help prevent disasters. *J Am Vet Med Assoc* 2001; 219: 446-453.
13. Mathews JR, Lattal KA. A behavioral analysis of dog bites to children. *J Dev Behav Pediatr* 1994; 15(1): 44-52.
14. Beaver BV, Baker MD, Gloster RC, *et al*. A community approach to dog bite prevention. *J Am Vet Med Assoc* 2001; 218: 1732-1749.
15. Ozanne-Smith J, Ashby K, Stathakis VZ. Dog bite and injury prevention - analysis, critical review, and research agenda. *Inj Prev* 2001; 7: 321-326.
16. De Munnynck K, Van de Voorde W. Forensic approach of fatal dog attacks: a case report and literature review. *Int J Legal Med* 2002; 116: 295-300.
17. Beck AM, Jones BA. Unreported dog bites in children. *Public Health Rep* 1985; 100: 315-321.
18. Sacks JJ, Sinclair L, Gilchrist J, Golab GC, Lockwood R. Breeds of dogs involved in fatal human attacks in the United States between 1979 and 1998. *J Am Vet Med Assoc* 2000; 217: 836-840.
19. Kneafsey B, Condon KC. Severe dog-bite injuries, introducing the concept of pack attack - a literature-review and 7 case-reports. *Injury* 1995; 26(1): 37-41.
20. Riegger MH, Guntzelman J. Prevention and amelioration of stress and consequences of interaction between children and dogs. *J Am Vet Med Assoc* 1990; 196: 1781-1785.
21. Calkins CM, Bensard DD, Partrick DA, Karrer FM. Life-threatening dog attacks: A devastating combination of penetrating and blunt injuries. *J Pediatr Surg* 2001; 36: 1115-1117.
22. Stefanopoulos PK, Tarantzopoulou AD. Facial bite wounds: management update. *Int J Oral Maxillofac Surg* 2005; 34: 464-472.
23. Presutti RJ. Prevention and treatment of dog bites. *Am Fam Physician* 2001; 63: 1567-1572.
24. Garner P, Gibson ME, Wilson C. The animal kingdom bites back. *BMJ* 1994; 309: 1676.
25. Voith VL. An approach to ameliorating aggressive behavior of dogs toward children. *Modern Veterinary Practice* 1981; 62(1): 67-70.
26. Gershman KA, Sacks JJ, Wright JC. Which dogs bite – a case-control study of risk-factors. *Pediatrics* 1994; 93: 913-917.
27. Chapman S, Cornwall J, Righetti J, Sung L. Preventing dog bites in children: randomised controlled trial of an educational intervention. *BMJ* 2000; 320:1512-1513.

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