

Pediatric Sex Group Differences In Location of Snakebite Injuries Requiring Antivenom Therapy

Michael J. Matteucci, MD^{a,b}, Jennifer E. Hannum, MD^a, Robert H. Riffenburgh, PhD^{c,d},
Richard F. Clark, MD^a

^aDivision of Medical Toxicology, UCSD Medical Center, San Diego

^bDepartment of Emergency Medicine, Naval Medical Center, San Diego

^cClinical Investigation Department, Naval Medical Center, San Diego

^dDepartment of Mathematics and Statistics, San Diego State University, San Diego

ABSTRACT

Objective: The objective of this study is to examine the patterns of snakebite injury in pediatric patients that require antivenom therapy and to evaluate whether and when sex group differences exist.

Methods: We performed a nationwide, multicenter, retrospective evaluation of 24 regional poison centers from 2002 and through 2004 of data for antivenom therapy for Crotaline snakebites. Data points abstracted included the age of the victim, sex of the victim, and location of bite. We calculated contingency tables of the data with statistical significance by Fisher's exact test.

Results: We evaluated 204 records that involved pediatric patients; 3 of the patients had no recorded age. In 16 of the records, the bite location was not documented (2 children and 1 unknown age) or was listed as head/neck (1 child). These records were not included in the data analysis. There were bites in 136 males and 65 females. Males were more likely than females to suffer an injury to the upper extremity (56.6% vs. 26.2%; $p < 0.01$). Males were more likely to suffer injuries to the upper extremity in all age groups ($p < 0.05$) except for the group aged 10 through 12 years; in the group aged 10 through 12, we did not see significant differences between the sexes ($p = 0.729$). Males are more likely to suffer an upper extremity bite with increasing age ($p = 0.029$), while females showed no significant change in the location of bites ($p = 0.223$).

Conclusion: Male children were more likely than female children to suffer Crotaline snakebites that required antivenom therapy. In this population, significant differences between locations of snakebites were found. Males were more likely than females to be bitten in the upper extremities. This difference appears as early as 1 to 4 years of age.

INTRODUCTION

Unintentional injuries are the leading cause of death in children, adolescents, and young adults [1,2]. Particularly in adolescents, sex is significantly related to the incidence of unintentional injury, and males are more susceptible to injury than females [3]. There are sex differences between the types (such

as substance abuse, sports, and employment) and frequency of risky behavior [4]. When snakebite injuries in children have been examined, males are more frequently bitten than females [5–8].

A difference in bite location between the sexes has not previously been studied. This study seeks to determine the ages when differences in snakebite locations first occur.

Keywords: snakebite, sex group, pediatrics

Notes: Source of Funding: This study was funded by Fougera. Abstract Presented: This study was presented in abstract form at the 2006 North American Congress of Clinical Toxicology.

Corresponding Author: Michael J. Matteucci, MD, Emergency Department, Naval Medical Center, 34800 Bob Wilson Dr., San Diego, CA 92134. Email: michael.matteucci@med.navy.mil

MATERIALS AND METHODS

Our institution's Human Research Protection Program approved this study. The term "sex" in this manuscript refers to the gender classification, male or female, of the injured subject. This is in accordance with the Institute of Medicine's recommendations for research [9].

We reviewed a data subset collected from a multi-center retrospective study of the recurrence of local effects and coagulopathy associated with antivenom therapy for Crotaline snakebite. The original study involved 17 hospitals and 24 regional poison centers. Data were collected in a standardized fashion from inpatient hospital charts and poison center records of patients who had received antivenom therapy (whole-IgG or Fab-fragment preparations) from January through December 2004. Poison centers with fewer than 15 records in that period also collected data from January 2002 through December 2003. Due to possible duplication of patients from poison center and hospital records, only poison center data was utilized for this study. The poison centers were located in 13 states (Alabama, Arizona, California, Florida, Kansas, Louisiana, Maryland, Nebraska, New Mexico, South Carolina, Texas, Virginia, and Washington). The data points abstracted in this study include: age of victim, sex of victim, location of bite (upper extremity, lower extremity, head or neck), and month of bite. Subjects were grouped by age: Less than 4 years of age, 4–9 years of age, 10–12 years of age,

and 13–18 years of age. There is no clear consensus in behavior literature for age grouping, and so these groupings were based upon observations by the authors and other pediatricians and emergency physicians approached by the authors.

Statistics: We calculated contingency tables of the data with statistical significance given by Fisher's exact test.

RESULTS

We abstracted a total of 832 poison center records. Of these 832 records, 204 records involved pediatric patients, 625 adults, and 3 records did not record an age. In 16 records, the bite location was not documented (2 children and 1 unknown age) or was listed as head/neck (1 child). We did not include these records in the data analysis.

The season in which a snakebite took place showed no difference in the sex of the bite victim (*Table 1*) or the bite location (*Table 2*). Overall, twice as many males were bitten as females (136,65), and males were more likely than females to suffer an injury to the upper extremity (56.6% vs. 26.2%; $p < 0.01$) (*Table 3*). Bite injuries were reported in 42 children less than 4 years of age, in 66 aged 4–9 years, in 36 between 10–12 years of age, and in 57 between 13–18 years of age. Males were more likely to suffer injuries to the upper extremity in all age groups ($p < 0.05$) except for the group aged 10–12 years; in the group aged 10–12 years,

Table 1: Sex of child by season of bite

Sex	Season				Total
	Winter	Spring	Summer	Fall	
Boys	11	51	58	18	138
	8.00%	37.00%	42.00%	13.00%	100%
Girls	2	18	36	10	66
	3.00%	27.30%	54.50%	15.20%	100%
Total	13	69	94	28	204

Winter = January–March; Spring = April–June; Summer = July–September; Fall = October–December. (p = 0.212)

Table 2: Location of bite by season of bite

Location	Season				Total
	Winter	Spring	Summer	Autumn	
Hand/Arm	9	33	36	16	94
	9.60%	35.10%	38.30%	17.00%	100%
Foot/Leg	4	35	56	12	107
	3.80%	32.70%	52.30%	11.20%	100%
Total	13	68	92	28	201

p = 0.109

Table 3: Sex of child by location of bite

Sex	Location		Total
	Hand/Arm	Foot/Leg	
Boys	77	59	136
	56.60%	43.40%	100%
Girls	17	48	65
	26.20%	73.80%	100%
Total	94	107	201

p < 0.001

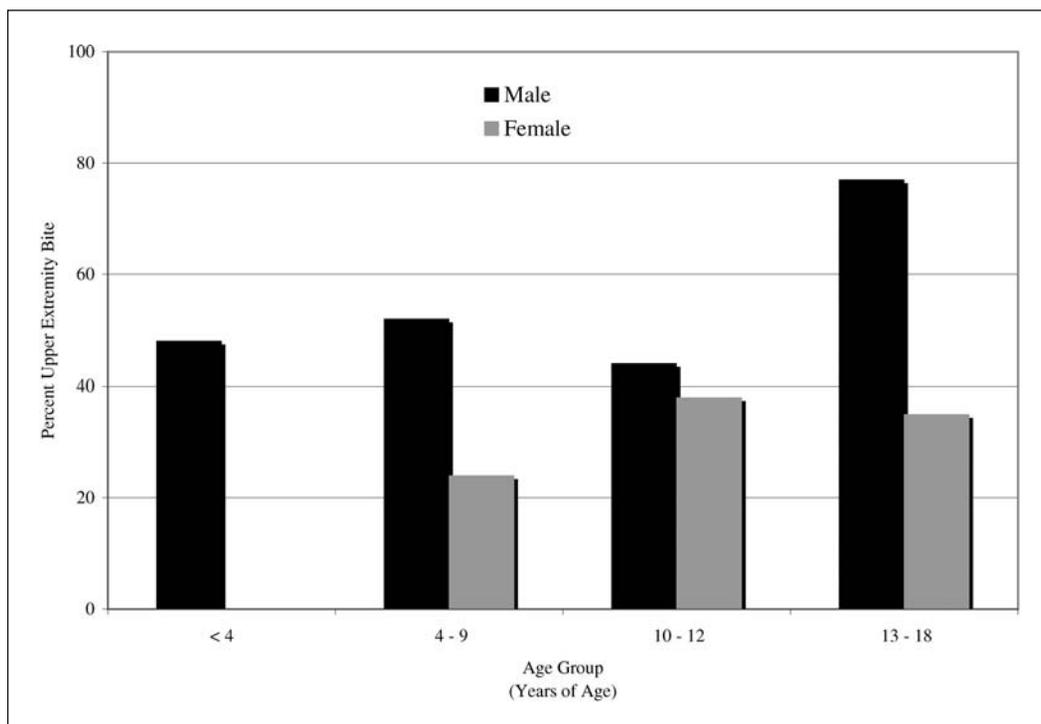


Figure 1: Upper Extremity Bite by Sex and Age

there was no significant difference between the sexes ($p = 0.729$) (Figure 1). The percentage of males with a bite to the upper extremity increased with increasing age ($p = 0.029$). Females did not show a significant change in location ($p = 0.223$).

DISCUSSION

In all pediatric age groups (1–18 years of age), accidental or unintentional injuries are the most common cause of death [2]. Differences in risk behavior between sexes have been noted. For instance, in studies of pediatric injury rates, males are injured more commonly. A study of 87,000 Massachusetts children and adolescents demonstrated a male:female injury ratio of 1.66:1 [3]. While the etiologies of this difference are likely multifactorial,

sex-specific differences in risk-taking behaviors have been implicated. In a study that evaluated risk-taking behavior in motor vehicle drivers, adolescent and young adult males were more likely than other groups to score higher on questionnaires regarding driver aggression, thrill seeking, and risk acceptance [10].

Although there is generally a male-dominant trend in injury, it is unclear if there is an age when risk-taking behaviors first appear and are responsible. In one study of children 6–10 years of age, younger age of males and females was associated with decreased ability to identify risk factors [11]. In females, the perceived vulnerability to injury predicted an injury risk rating. In males, the perceived severity of the potential injury predicted an injury risk rating. There was no influence of age in this study. A study of third, fifth, and seventh graders demonstrated that males

were more likely than females to make *very* risky choices when their peers were present, but males were just as likely as females to make risky choices when their peers were absent [12].

The data from the present study demonstrates that males are more likely than females to suffer a Crotaline snakebite that is subsequently treated with antivenom (2.1:1). This finding is consistent with previous studies of overall injury ratios and studies of snakebites where the male:female snakebite ratio has ranged from 1.4:1 to 2.8:1 [3,5–8].

This study also demonstrates that snakebite injuries, requiring antivenom therapy, to the upper extremity are more common in males in all age groups except for the group ages 10–12, where there is no statistical significance. It is plausible that this difference in bite location is due to a difference in risk-taking behavior in males and females. Purely unintentional bites seem more likely to occur in the lower extremities because the victim unintentionally startles the snake. Upper extremity injuries, however, may be due to play or investigative behaviors as the victim reaches for the snake. If this assumption is true, a difference in risk-taking behavior is evident at a very early age. Early interventions to prevent such behavior may be indicated.

There are several limitations to this study. This study only examined patients who received antivenom therapy. Those with mild or “dry” bites may demonstrate different patterns than described here. This is a retrospective review of poison center records that were obtained by telephone consultation and as such suffers from incomplete and inconsistent data. However, the data reported in this study are fairly concrete and were easily obtained during the telephone consultation. The assumption of risk-taking behavior being at least partially responsible for the locations of injuries may be incorrect and may have been from chance or another unknown variable. Further study of this hypothesis is required.

The authors have no potential financial conflicts of interest to report.

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