

Animal bites and stings on Guam

ROBERT L. HADDOCK, DVM *
OLIVIA L. T. CRUZ, MD **

Abstract

Dog bites were the most common type of injury due to animals treated at the Guam Memorial Hospital Authority Emergency Department during the period 1988-1994. They accounted for more patients treated than all other types of injuries due to animals combined. Children age 5-9 were the age-group at greatest risk of being bitten by dogs (annual bite rate of 256/100,000 population). Males were at greater risk of being bitten by dogs at all age groups except ages 40-49 (both sexes 102/100,000) and ages 50-59 (males 109/100,000, females 129/100,000). Snakes, jellyfish, stonefish, bees, and 'insects' were, in order, the next most common causes of animal bites or stings treated. Snake bite victims had the lowest median age (10 years) while pig bite victims were the oldest (median age of 48 years). Snake bites and jellyfish stings were the only common bites or stings that were distinctly seasonal. Visitors to the island were, in order, most frequently treated for bites or stings by sea urchins, stonefish, jellyfish, dogs, and bees.

“ Jellyfish, stonefish and insect encounters are also increasing while the number of snake bites treated have begun to decrease. ”

Introduction

Guam is an island of the Mariana group, situated in the North west Pacific ocean. It has a population of approximately 115,000 excluding United States of America (USA) military personnel. The Guam Memorial Hospital (GMH) is the only civilian hospital on Guam and its Emergency Department (ED) provides a 24 hour emergency service to Island civilians. The US military personnel generally attend the Naval regional medical centre or it's satellite clinics.

Methods

*Epidemiologist, Department of Public Health & Social Services, P. O. Box 2816, Agaña, Guam 96910. **Physician Specialist, Guam Memorial Hospital Authority, 850 Governor Carlos Camacho Road, Tamuning, Guam 96911

To characterize the extent and nature of the problem of animal bites and stings on Guam, the patient log of the Guam Memorial Hospital Emergency Department was analyzed for the years 1988 through 1994. Data collected included the month and year the treatment occurred, the type of animal inflicting the bite or sting, the age and sex of the bite victim, whether the patient was an island resident or visitor, and the residence village of local patients. In addition, if the biting animal was a dog, information was collected on the anatomical location of the bite and the breed and ownership of the animal.

Results

The number of patients treated for dog bites appear to be increasing (Table 1). They constitute by far the most common type of bite or sting, accounting for more patients than all other causes combined. Jellyfish, stonefish and insect encounters are also increasing while the number of snake bites treated have begun to decrease.

The most commonly identified breeds of biting dogs, after "unknown" and "mixed", were Pittbull (42 bites), German shepherd (31), Rottweiler (11), Doberman (10), and Chihuahua (9). The Chihuahua was the only breed for which bite victims were most likely to be members of the household owning the dog (5 of 9 or 56% of Chihuahua bites).

For males, the age group at greatest risk of dog bite was children 5-9 (324 bites per 100,000 population) while children 1-4 had the highest rate (191/100,000) among females. Males had higher dog bite rates for all age groups except ages 40-49 (102/100,000 for both sexes) and 50-59 (109/100,000 for males compared to 129/100,000 for females).

When dog bites were analyzed by age of bite victim and anatomic location of the bite wounds, a distinct trend was observed. The mean age of patients bitten on the foot was 33 years of age; on the leg, 26 years; abdomen, 22 years; chest, 13 years; and head or neck, 8 years.

When the species of biting animal was analyzed by sex of the bite victim, only cat, centipede, and spider bites were found to be more frequent in females than in males.

In contrast to island residents, visitors were most likely to be the victims of misadventures with marine life, with sea urchin

Table 1. Animal bites and stings by species of biting animal and year treated, Guam, 1988 - 1994

Species	1988	1989	1990	1991	1992	1993	1994	TOTAL
Dog	122	146	151	183	242	207	240	1291
Tree snake	11	32	31	34	43	32	19	202
Jellyfish	15	20	24	25	24	26	48	182
Stonefish	11	24	15	30	23	29	48	180
Sea urchin	20	15	15	14	22	21	17	124
Bee	14	29	22	23	18	9	8	123
Insect	5	13	12	10	20	21	30	111
Cat	6	8	3	10	10	8	13	58
Human	5	5	2	3	6	9	11	41
Rat	2	2	1	7	7	5	2	26
Centipede	0	1	2	3	3	1	2	12
Pig	1	0	1	0	3	1	2	8
Ant	0	0	0	3	1	2	1	7
Shark	0	3	0	1	0	0	0	4
Spider	0	0	2	0	0	2	0	4
Stingray	0	1	2	0	1	0	0	4
Turkeyfish	1	1	0	0	2	0	0	4

stings, stonefish stings and jellyfish stings, in order of frequency, the most common causes of injury for this group.

Snake bite victims were the youngest patients (median age 10, mean age 19.16 ± 20.95 S.D.) while pig bite victims were the oldest (median age 48, mean age 40.75 ± 23.55 S.D.) (Table 2).

When bite and sting rates were analyzed on the basis of geographic location of the patient's residence (Table 3), dog bites, tree snake bites, sea urchin stings, cat bites, and human bites did not show a statistically significant variation between regions ($p > .05$). In contrast, jellyfish and insect stings were most common among residents of the northern region ($p < .05$) while stonefish stings were most commonly reported by residents of the south ($p < .01$). While the number of bites recorded was not adequate for valid statistical analysis, it is interesting to note that the incidence of centipede bites in the south was nearly 3.5 times that of the central area and more than 5 times that of the northern region (see Table 3).

“ The highest average annual rate for dog bites as well as the largest number of dog bites occurred in the northern region of Guam. The largest number of snake bites were also reported in the northern region ... ”

The highest average annual rate for dog bites as well as the largest number of dog bites occurred in the northern region of Guam. The largest number of snake bites were also reported in the northern region but the highest average annual incidence of snake bite occurred in the central region. In contrast, the village with the highest incidence of dog bites (Umatac) and the village with the highest incidence of snake bites (Talofofo) are both in the southern region (Table 4).

Only two of the more common types of bites or stings were distinctly seasonal, both snake bites and jellyfish stings were more likely to occur during Guam's July-November wet season. This seasonality was much more pronounced with respect to jellyfish stings (25.8% of recorded stings occurring in the peak month of July), compared to snake bites (only 12.9% of all snake bites were recorded in the peak month of September).

Table 2. Animal bites and stings by age of patient and species of biting animal, Guam, 1988 - 1994

Species	Mean age	Std Deviation	Median age
Dog	23.47	±19.69	17
Tree snake	19.16	±20.95	10
Jellyfish	25.06	±12.34	24
Stonefish	26.10	±14.44	24
Sea urchin	26.24	±12.15	25
Bee	24.91	±15.90	24
Insect	15.69	±14.77	13
Cat	35.63	±24.36	36
Human	27.59	±15.34	29
Rat	19.80	±20.10	17
Centipede	22.75	±12.91	28
Pig	40.75	±23.55	48
Ant	24.23	±25.71	31
Moray eel	29.00	± 7.75	31
Shark	27.50	±11.59	26
Spider	20.75	±23.23	14
Stingray	45.25	± 5.19	47
Turkeyfish	35.00	±13.09	36

Discussion

Guam's dog bite rate of 184/100,000 population appears to be lower than reported for other areas including Baltimore, 800/100,000¹ and St. Louis, 450/100,000^{1, 2}. The Indiana Department of Health reports a dog bite rate of 172/100,000 for the state of Indiana as a whole and a rate of 258/100,000 for the county in which the city of Indianapolis is located suggesting that dog bites rates may be higher in urban areas than in rural³. Guam's rate is, however, in line with other rabies-free areas where the monitoring of dog bites may be considered less critical. For example, the reported a dog bite rate is 175/100,000 for New Zealand and 184/100,000 for Australia^{4, 5}. Guam experienced a rabies epizootic in 1967, the first outbreak of rabies ever to occur in Micronesia or Polynesia. Rabies has since been eradicated from Guam and as long as the island remains rabies-free, rabies prophylactic treatment is not required for animal bite patients except in unusual circumstances^{6, 7}.

The correlation observed between the body location of dog bites and patient age may be the result of the head region being less accessible in older persons because of their greater stature and perhaps a greater ability to ward off attacks with arms or legs as well. This study undoubtedly represent only

some fraction of the total bites and stings that occur on Guam since only those persons with the most serious wounds or complications are likely to seek medical assistance. Other factors that may affect the decision of victims to seek medical attention may be whether or not they have health insurance and the accessibility of medical care.

Bites and stings constituted only 1.2% of all GMH-ED patients seen during the period of this study. The percent of the total patients seen for conditions that constituted true emergencies has not been determined but may be as low as 50% as the GMH-ED serves not only to treat patients with true emergencies, but also patients with other conditions who do not have health insurance or who do not wish to take time off from daytime jobs to seek medical care, etc..

Guam is frequently divided into three regions for analytical purposes. The northern and central regions have the greatest population density, most rapid growth, and are essentially urban or suburban in character while the south has a lower population density, less population growth and retains a

Table 3. Incidence (1) of animal bites and stings suffered by Guam residents by region of residence and species of biting animal, Guam, 1988 - 1994.(2)

Species	North	Central	South
Dog	171.58	119.51	152.55
Tree snake	22.16	25.42	24.02
Jellyfish	20.87	14.42	11.04
Stonefish	17.52	16.31	31.16
Sea urchin	9.79	9.48	11.68
Bee	15.97	9.11	14.2
Insect	16.23	8.73	5.19
Cat	9.53	4.93	5.19
Human	5.41	4.55	5.19
Rat	2.83	3.79	1.30
Centipede	0.77	1.14	3.89
Pig	0.52	1.14	0.65
Ant	0.26	0.38	2.60
Shark	0.00	0.38	1.95
Spider	0.52	0.00	1.30
Stingray	0.00	0.38	1.95
Turkeyfish	0.52	0.38	0.65

(1) Cases per 100,000 population.

(2) Excludes data for visitors to Guam.

more rural and traditional character. Despite these differences there was little variation in bite and sting rates between regions.

Two types of bites or stings showed statistically significant variation by region were due to sea life; since other demographic characteristics of jellyfish and stonefish sting victims were remarkably similar (Tables 2 - 4), it seems probable that ecological preferences, in the case of stonefish, or the influence of prevalent winds and currents, in the case of jellyfish, may contribute to increased populations of these species in the waters most used by the people living in their respective areas⁸.

The only snake endemic to the island of Guam, *Ramphotyphlops braminus*, is a small, blind, worm snake that is incapable of inflicting a serious bite to humans. Following World War II, however, *Boiga irregularis*, a tree snake native to Australia and Melanesia, appeared on the island, presumably introduced in shipments of military equipment. Little note was taken of this new island resident except when some brave soul caught a particularly large specimen, occasionally exceeding 8 feet. By the 1970's, a precipitous decline in the population of virtually all of Guam's native birds occurred, and studies have shown this to be the result of predation by the tree snake⁹. In the 1980's, presumably as a result of depletion of their usual prey species, many of which were now extinct in the wild, an increase of human snake bite reports was noted. An unusual aspect of this 'epidemic' was that in many instances it appeared that human infants were a special target of these snakes, often being attacked while sleeping between their parents¹⁰.

The tree snake is a rear-fanged poisonous snake whose venom contains a myotoxic fraction of moderate lethal potency¹¹. Although no deaths due to snake bite have been recorded on Guam, large specimens of the tree snake may inject sufficient venom to cause serious complications in small children.

Most insect stings on Guam attributed to 'bees' are probably due to the wasp, *Icaria marginata*, frequently referred to as the 'boonie bee' by island residents. This insect is particularly aggressive in protecting its small paper nests which are typically built on the underside of leaves in dense foliage¹². For this reason gardeners and hikers frequently fall victim to its stings. It is also the habit of this wasp to attack its target about the face and immediately return to its nest, frequently leaving the victim in some doubt as to the

Table 4. Mean annual incidence rates of dog and snake bites by patient's residence village, Guam, 1988 - 1994.(1)

Village	Population 1991	Dog bites	Rate (2)	Snake bites	Rate (2)
NORTHERN REGION					
Dededo	29801	315	151.00	56	26.84
Tamuning	17,024	208	174.54	6	5.03
Yigo	8,626	117	193.76	23	38.09
SUBTOTAL	55,451	640	164.88	85	21.89
CENTRAL REGION					
Agana	1,166	17	208.28	1	12.25
Agana Hts	3,387	19	80.13	0	0.00
Asan-Maina	1,631	11	96.34	1	8.75
Barrigada	7,160	72	143.65	24	47.88
CP-Ordot	4,609	42	130.18	12	37.19
Mangilao	10,079	96	136.06	24	34.01
M-T-M	5,345	64	171.05	7	18.70
Piti	1,602	18	160.51	2	17.83
Sinajana	2,676	29	154.81	3	16.01
SUBTOTAL	7,655	368	139.61	74	28.07
SOUTHERN REGION					
Agat	5,067	64	180.43	4	11.27
Inarajan	2,514	32	181.83	5	28.41
Merizo'	1,750	16	130.61	4	32.65
Santa Rita	3,955	24	86.68	1	3.61
Talofofu	2,343	19	115.84	9	54.87
Umatac	915	17	265.41	1	15.6
Yona	5,463	58	151.66	13	33.99
SUBTOTAL	22,007	230	149.33	37	24.01
Residence unknown		7		2	
TOTAL	115,113	1,245	154.50	198	24.57

(1) Excludes data for visitors to Guam.
 (2) Bites per 100,000 village residents.

source of their sudden pain. Perhaps this is one reason that although the annual number of reported 'bee' bites has decreased over the period of this study, bites attributed to unidentified 'insects' have increased.

Stepping on a stonefish, *Syanceia verrucosa*, or on a sea urchin could ruin a vacation, and visitors to Guam should be warned about these hazards to their health and comfort.

Guam residents routinely use some type of footwear when engaging in ocean water activities other than swimming in posted areas.

One of the most dread biting animals man is likely to encounter is the shark. Fortunately, shark bites treated in the GMH-ED are generally the result of fishing misadventures rather than shark attacks *per se*. The data reviewed in this study, however, may actually underestimate the risk of shark attacks on Guam. Although no deaths due to shark attack in Guam waters have been documented in recent years, several swimmers, divers, surfers or boaters disappear each year under circumstances that suggest that sharks may be involved.

Injuries due to misadventures with animals not only represent a threat to the health of individuals, but also a drain on limited community resources dedicated to health care. Some types of injuries, such as dog bites, may be minimized by government activities including stray animal control and other animal control regulations. Injuries due to contact with wild animals, on the other hand, may best be controlled through health education efforts.

Acknowledgments

The authors gratefully acknowledge the assistance of Dr. R. Muniappan, Agricultural Experiment Station, University of Guam, in providing scientific names for animals mentioned in this study, and C. L. Naval, Office of Planning and Evaluation, Guam Department of Public Health and Social Services, in providing the Guam population statistics used in calculating rates.

References

1. Berzon, DR. The animal bite epidemic in Baltimore, Maryland: review and update. *American Journal of Public Health*, 1978; 68: 593-595.
2. Beck, AM, Loring H, Lockwood, R. The ecology of dog bite injury in St. Louis, Missouri. *Public Health Reports*, 1975; 90: 262-267.
3. Indiana State Department of Health. *Annual Report*, 1993
4. Langley, J. The incidence of dog bites in New Zealand. *New Zealand Medical Journal*, 1992, 105: 33-35.
5. Nixon, J, Pearn, J, & McGarn F. (1980). Dog bite injuries to children: potential rabies threat to Australia. *Medical Journal of Australia*, 1994, 1: 175-176.
6. Haddock, R.L. Progress for rabies-free status for the Territory of Guam. In, *Rabies - Proceedings of a Working Conference on Rabies*, 1942. Y Nagano & F.M Davenport (Editors), University of Tokyo Press; 1971.
7. Haddock, RL (1980). Guam rabies conference. *South Pacific Bulletin*, 1971; 31:14-15
8. Barcinas, PR, Levin MJ, Naval CL. In, *Guam's people: a continuing heritage*, Inter-agency Committee on Population, Government of Guam; 1988
9. Savidge JA. Extinction of an island forest avifauna by an introduced snake. *Ecology*, 1987; 68: 660-668.
10. Fritts, TH, McCoid MJ, Haddock RL. Risks to infants on Guam from bites of the brown tree snake (*Boiga irregularis*). *American Journal of Tropical Medicine and Hygiene*, 1990; 42: 607-611
11. Weinstein SA, Chiszar D, Bell RC, Smith LA. Lethal potency and fractionation of Duvernoy's secretion from the brown tree snake, *Boiga irregularis*. *Toxicol*, 1991; 29: 401-407
12. Swezey, O.H. Wasps of Guam. *Insects of Guam - I. Bernice P. Bishop Museum Bulletin*, 1942; 172:184-187. □

“ Although no deaths due to shark attack in Guam waters have been documented in recent years, several swimmers, divers, surfers or boaters disappear each year under circumstances that suggest that sharks may be involved. ”

**God put me on this Earth to accomplish a number of things.
Right now I am so far behind that I will never die!**

From an office wall in the Pacific