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Original Research

Environmental factors associated with the prevalence of animal bites or stings in patients admitted to an emergency department

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Abstract

Background: Environmental factors may affect the prevalence of different animal bites; however, this area has not been well studied. The aim of this study was to report in detail on the categories of animals involved in causing bites or stings, patient characteristics, outcomes, and associated environmental factors.
Methods: This prospective study involved patients visiting an emergency department for animal bites or stings from January 2007 to December 2008. Patient demographics, type and severity of injuries, outcomes, and types of offensive animals were recorded on a predefined database. Environmental factors, including season, temperature, precipitation, and relative humidity, were collected. Analyses were undertaken to check the relationship between animal bite/sting injuries and environmental factors.
Results: Mammalian bites (65.2%) were the most common, followed by insect stings (24.9%) and reptile bites (7.2%). Dogs (54.3%), bees (12.9%), and snakes (7.0%) were the three most common animals to attack. Most of the injuries were mild, superficial, and located on limbs. Only 5.3% of patients had moderate effects and 1.5% of patients had major effects in outcomes. Poor outcome-related factors included large size of wound (maximum length of wound >3 cm; $p = 0.000$), wound type (skin defect; $p = 0.000$), and animal type (reptile bite; $p = 0.000$). The season in which the most injuries occurred was summer for insects and autumn for reptiles. No significant trend was found for mammals and other animals. We found the highest precipitation and insect bites/stings in June ($r = 0.93$, $p < 0.001$), and increased incidence of insect bites/stings in the hot months ($r = 0.83$, $p = 0.001$). We also found increased reptile bites in May to June and September to October, which may be associated with a significant change in precipitation ($r = 0.78$, $p = 0.005$).
Conclusions: The most common animal bites seen in our emergency department are from mammals, especially dogs. Although most animal bites/stings were superficial and minor, there are risks of major effects on outcome in cases with large wounds or reptile bites. Environmental factors, including the season, temperature, and precipitation, were related to insect and reptile stings/bites.
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Keywords: Animal bites; Emergency department; Environmental factors; Mammalian; Outcomes; Taiwan

1. Introduction

Animal bites may result in an adverse outcome and treatment of such bites can be a challenge for emergency department (ED) physicians due to patient complications and systemic problems, including infection, allergy, and even anaphylactic shock.[1–9] Previous studies have reported that about 2% of people are affected each year and an animal (or human) will bite one in two Australians or Americans in their lifetime; overall, almost 1% of all emergency admissions involve an animal bite.[8,10,11] The diagnosis and treatment of animal bites are usually based on taking a detailed history and

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on animal recognition. Therefore, knowledge of how animal bites vary, including wound care and resulting complications, will help primary physicians perform an appropriate clinical assessment and predict the outcome of a given bite.

Epidemiological studies of animal bites have demonstrated that household pets (dogs and cats in particular) cause the majority of all bites.[12] Since the proportion of households having such pets varies greatly between countries (64% in Australia and up to 58% in England), it seems likely that the prevalence of pet bites might differ across the world.[11,13] In Taiwan, the percentage of families that have such pets is not high. Government reports have mentioned that only 14.5 % and 2.1% of households in central Taiwan have a dog and a cat as a pet, respectively. Therefore, it is reasonable that regional data regarding animal bites might differ. Region-specific events associated with wild animals are also likely to differ greatly between global locations, and it is clear that bites by different species of animal are likely to result in different outcomes. For example, rattlesnake bites are more common in America and *Vipera berus* bites are more common in Poland.[14–16] In this context, information regarding bites by specific species of animals is lacking in central Taiwan.

Environmental factors are also likely to affect the prevalence of animal bites; in America and Europe, snake bites are more frequent in the summer.[14,15] In fact, climate generally varies greatly between regions and yet local data are not available for central Taiwan. In the present study, therefore, we aim to prospectively present the region-specific demographics of animal bites in central Taiwan. Furthermore, we explore the detailed categories of animal involved in these bites, together with the factors associated with outcome as well as the environmental factors that might be associated with differences in the prevalence of animal bites.

2. Materials and methods

2.1. Study population and study design

From January 1, 2007, to December 31, 2008, 587 patients at the ED of a 2500-bed medical center/hospital covering a population of 1,600,000 individuals in central Taiwan, were diagnosed as having an animal bite. In this prospective study, information relating to patients with animal bites was recorded by the triage personnel and the staff (physicians and senior nurses) of the ED once the patients were admitted and presented with an animal bite or sting (according to the patient's statements). All information concerning the patients was eventually imported into the database of the hospital poison center and these patients were traced to evaluate follow-up treatment and outcome after discharge from the hospital. Patients where the wounds were caused by plants or a mechanical device, where the injury was a non-bite- or non-sting-related wound (scratching injury), and where the major category of animal involved could not be identified were excluded from the study. Patient characteristics, clinical features and environmental factors that might be associated with patient outcome with respect to the animal bite were analyzed in this study. The study protocol was approved by the Institutional Review Board of this hospital.

To improve accuracy and to minimize inconsistencies in recording, the recorders were trained using a practice recording before the study started. Recorders used a standardized abstraction form to guide data collection. Once a diagnosis of an animal bite had been made, photographs of the wound were taken. The quality of the data collected was discussed at regular meetings and the performance of the recorders was also monitored.

2.2. Data collection and definitions

Patients treated for an animal bite and presenting with clinical symptoms were required to remain at the ED for observation or were hospitalized until their vital signs stabilized and major symptoms had subsided. Surgical intervention was indicated when there was active bleeding and a need for debridement. Wound management, including sutures and anesthesia, was carried out using appropriate and sterile procedures. We followed the Advanced Trauma Life Support guidelines to treat traumatic injuries,[17] the Advanced Cardiac Life Support guidelines to treat complications such as anaphylaxis,[18] and the American Association of Poison Control Centers (AAPCC) categories to classify patients' outcomes.[19]

Patients in this study could generally be divided into four major groups based on the category of animal causing the bite. These were:

- mammals (dog, cat, mouse, human being, etc.);
- insects (bee, centipede, ant, etc.);
- reptiles (snake and lizard); and
- others.

Information relating to the animal bite was obtained from the hospital poison center database. Demographic data included sex, age, occupation, major clinical presentations, condition of the wound, treatments, and outcome. The major clinical presentations were categorized into six groups of constitutional symptoms:

(1) skin only problems (localized and well defined pain, swelling and redness);
(2) respiratory tract symptoms (cough, rhinorrhea, sore throat, or shortness of breath);
(3) cardiovascular symptoms (chest pain, new onset of cardiac dysrhythmia, or unstable blood pressure);
(4) neurological symptoms (dizziness, vertigo, convulsion, headache, or change in consciousness);
(5) gastrointestinal symptoms (nausea, vomiting, diarrhea, or abdominal pain); and
(6) multiple symptoms (two or more symptoms).

The conditions associated with the wound were also collected, including the main site of wound – head and neck, trunk, upper or lower limbs, and multiple (two or more) main

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