EM ADVANCES

Factors associated with delay to emergency department presentation, antibiotic usage and admission for human bite injuries

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ABSTRACT

Objectives: Evidence and consensus on best practices on the management of human bite injuries is lacking. Our objective was to identify factors that are associated with delay to emergency department (ED) presentation, antibiotic usage and patient admission.

Methods: We present a retrospective chart review of adults treated for human bites. Multivariable logistic regression models used demographic characteristics and bite circumstances and characteristics as factors associated with ED presentation more than 24 hours after the bite, antibiotic usage and hospital admission.

Results: Of the 388 patients evaluated for a human bite, 66.5% were bitten during an altercation; 23.8% presented more than 24 hours after the bite; 50.3% were bitten on the hands or fingers, 23.5% on an extremity and 17.8% on the head or neck. Only 7.7% of all patients sustained closed-fist injuries; the majority had occlusional or other kinds of bites. The majority of patients (77.3%) received antibiotics and 11.1% were admitted to hospital. Patients who had greater odds of presenting more than 24 hours after the bite were black (odds ratio [OR] 1.79, 95% confidence interval [CI] 1.02–3.13), Hispanic (OR 2.68, 95% CI 1.22–5.89) and those who had a non-occupational bite (OR 3.87, 95% CI, 1.68–8.90). Patients had a greater chance of receiving antibiotics if they were bitten during an altercation (OR 1.87, 95% CI, 1.09–3.20) and were bitten on the hands or fingers (OR 2.23, 95% CI 1.31–3.80). Patients had a greater chance of being admitted to the hospital if they were bitten during an altercation (OR 4.91, 95% CI 1.65–14.64), bitten on the hands or fingers (OR 5.26, 95% CI, 1.74–15.87) and if they presented ≥ 24 hours after the bite.

Conclusion: Most patients presented to the ED within 24 hours of their injury and received antibiotics. The circumstances surrounding the bite appeared to be associated with delay to ED presentation, receipt of antibiotics and admission to the hospital. There are ethnic background differences in delay to ED presentation. ED clinicians in our study favour antibiotic usage and admission based on the body location of the bite, despite little evidence to support these practices.

Key words: human bites, prophylaxis, antibiotics, emergency medicine, wound infection

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This study was presented at the 10th Annual New England Regional Society for Academic Emergency Medicine Research Conference, Shrewsbury, Mass., on March 30, 2006.

Received: Jan. 18, 2007; revised: Apr. 30, 2007; accepted: July 30, 2007

This article has been peer reviewed.

Can J Emerg Med 2007;9(6):441-8

RÉSUMÉ

Objectifs : Vu le manque de données probantes et de consensus sur les pratiques exemplaires en matière de gestion des plaies par morsure humaine, nous avons voulu mettre en lumière les facteurs associés au retard de consultation à l'urgence, à l'utilisation d'antibiotiques et à l'hospitalisation des patients.

Méthodes : Nous présentons une étude rétrospective de dossiers de patients traités pour morsure humaine. Les caractéristiques démographiques ainsi que les caractéristiques de la morsure et les circonstances l'entourant ont été considérées, dans des analyses de régression logistique multivariées, comme facteurs associés à la présentation à l'urgence plus de 24 heures après l'incident, l'utilisation d'antibiotiques et l'hospitalisation.

Résultats : Des 388 patients examinés pour morsure humaine, 66,5 % ont été mordus lors d'une altercation; 23,8 % se sont présentés à l'urgence plus de 24 heures après l'incident; 50,3 % ont été mordus sur la main ou les doigts; 23,5 % à une extrémité et 17,8 % à la tête ou au cou. Dans seulement 7,7 % des cas, la plaie était consécutive à un coup de poing. La majeure partie avait des morsures directes ou d'autres types de morsures. La majorité des patients (77,3 %) ont reçu une antibiothérapie et 11,1 % d'entre eux ont été hospitalisés. Les patients qui étaient plus susceptibles de se présenter plus de 24 heures après la morsure étaient les Noirs (rapport de cotes [RC] 1,79; intervalle de confiance [IC] à 95 %, 1,02 à 3,13), les Hispaniques (RC 2,68; IC à 95 %, 1,22 à 5,89) et ceux qui avaient une morsure non liée au travail (RC 3,87; IC à 95 %, 1,68 à 8,90). Les patients avaient plus de chance de recevoir des antibiotiques s'ils avaient été mordus lors d'une altercation (RC 1,87; IC à 95 %, 1,09 à 3,20) et mordus à la main ou aux doigts (RC 2,23; IC à 95 %, 1,31 à 3,80). Les patients avaient plus de chance d'être hospitalisés s'ils avaient été mordus lors d'une altercation (RC 4,91; IC à 95 %, 1,65 à 14,64), mordus à la main ou aux doigts (RC 5,26; IC à 95 %, 1,74 à 15,87) et s'ils se présentaient à l'urgence 24 heures ou plus après la morsure.

Conclusion : La majorité des patients se sont présentés à l'urgence dans les 24 heures suivant la morsure et ont reçu des antibiotiques. Les circonstances entourant la morsure semblent déterminantes dans le retard de consultation à l'urgence, l'administration d'une antibiothérapie et l'hospitalisation. La présentation à l'urgence varie en fonction de l'origine ethnique. Les médecins d'urgence faisant partie de notre étude préconisent l'antibiothérapie et l'hospitalisation, selon l'emplacement de la morsure sur le corps, bien qu'il y ait très peu de données probantes à l'appui de ces pratiques.

Introduction

Recommendations regarding prophylactic antibiotics for human bite injuries are conflicting so that there is no consensus on best practices[1–4] (Box 1). Some authors believe that all human bite injuries are at high risk for infection and recommend prophylactic antibiotic treatment after all such injuries.[5–7] Others recommend reserving prophylaxis for closed-fist injuries.[8–11] A recent Cochrane Collaboration review found scant evidence that antibiotic prophylaxis for human bite wounds in general reduces infection rates.[12] A study by Broder and colleagues challenged the routine use of prophylactic antibiotics in selected emergency department (ED) patients.[13]

Factors that influence the emergency physician's (EP's) decision to prescribe antibiotics or admit these patients to the hospital are unknown. Identification of these factors could direct future research. The utility of these factors in providing appropriate treatment could be evaluated and eventually permit the development of best practice guidelines.

In this study, we sought to describe the bite characteristics and the demography of adult patients with a human bite presenting for medical care to the ED. Our main objective was to identify demographic and clinical factors that were associated with a delay to ED presentation of more than 24 hours. We also aimed to document current antibiotic usage and hospital admission for these injuries in our community.

Methods

Study design

We conducted a retrospective chart review of all adult patients with human bites presenting to a US, urban, level I trauma centre ED (with more than 75 000 annual visits). Our institutional review board approved the study.

Study population and case identification

We searched the hospital and emergency medicine (EM) clinician billing databases to identify all ED visits by those over 18 years old who sustained human bites between

https://doi.org/10.1017/S1481803500015475 Published online by Cambridge University Press

January 1, 1995, and December 31, 2001, using *International Classification of Disease, Ninth Revision, Clinical Modification* (US Department of Health and Human Services, 6th Edition, 2001) (ICD-9) codes. We identified all visits coded with E968.7 ("human bite") and E968.8 ("other means specified"). The ICD-9 code E968.8 was employed before October 2000 for human bites and other unrelated conditions.

The hospital and the EPs for this ED maintain separate billing databases. We searched each of these 2 computerized billing databases independently using both ICD-9 codes to maximize capture of all visits for human bites. By this method, if either billing record database used one of the 2 ICD-9 codes for any patient encounter, or if the human bite occurred with another injury or with an unrelated diagnosis, the visit was captured.

The following medical record data were recorded onto a standardized form: the patients' demographic characteristics, the dates of their bites and presentation for medical care, the circumstances surrounding the bites, the location of the bites, and whether or not they were prescribed antibiotics and were admitted to the hospital.

We purposely included all patients presenting with human bites, regardless of signs or symptoms of infection or if they sustained the classically described "fight bite" (or closed-fist injury), an occlusional bite or if the bite occurred by another mechanism. We chose these broader inclusion criteria to allow study and analysis of a wider spectrum of bite injuries evaluated by ED clinicians.

Data analysis

Two research assistants independently entered the data into an Epi Info 2002 (Centers for Disease Control and Prevention, 2002) database, performed a data comparison analysis to verify the accuracy of data entry and then corrected any errors. Subsequent analyses were performed on this verified database. The data were analyzed using Stata 9.2 (Stata Corporation, College Station, Tex.). Pearson's chi-squared test, 2-sample tests of binomial proportions and risk ratios (RRs) with corresponding 95% confidence intervals (CIs) were used to compare:

1. differences in the time elapsed from the bite to ED presentation (< 24 h v. ≥ 24 h);
2. usage of antibiotics; and
3. admission to hospital by body location of the bite and by whether or not the patient sustained a closed-fist

Box 1. Recommendations regarding prophylactic antibiotics for human bite injuries

The Clinical Practice of Emergency Medicine, 4th ed. A. Harwood-Nuss, 2005.[4]
"Human bites are thought to be the third most frequent (mammalian bite) after dog and cat bites. Although "prophylactic" antibiotics are often prescribed, there are no prospective controlled studies with sufficient numbers of patients to demonstrate their effectiveness definitively or the superiority of a particular regimen. It seems, however, that antibiotics significantly decrease the incidence of infection in high-risk situations."

Emergency Medicine: A Comprehensive Study Guide, 6th ed. J. Tintinalli, 2004.[2]
"The low incidence of (human bite) injuries has hampered prospective study, but experience suggests that they have a high rate of complication. All should be treated as contaminated puncture wounds; many will present late due to the circumstances leading to the injury. Amoxicillin-clavulanate is recommended for treatment and prophylaxis following all but the most trivial human bites."

Rosen's Emergency Medicine: Concepts and Clinical Practice, 6th ed. J. Marx, 2006.[1]
"Antibiotic prophylaxis is recommended for all human bites of the hand…Antibiotics are indicated for high-risk human bite wounds elsewhere on the body, including deep punctures, severe crush injuries, contaminated wounds, older wounds, and wounds in patients with underlying illnesses. The antibiotics selected should offer coverage for gram-positive organisms and *E. Corrodens*, such as a second-generation cephalosporin or amoxicillin-clavulanate, and should be given for five days…All patients with infected human bites of the hand should be hospitalized…Reliable, otherwise healthy patients who present within 24 hours without infection and have no tendon, joint, or bone damage can be treated at home with close follow-up, preferably within 1 to 2 days…High-risk patients, such as those with delayed presentation or deep structure involvement, require prophylactic parenteral antibiotics and close evaluation. Hospitalization is generally recommended…Ordinary bites, such as those exchanged among children, are not high risk for infections or complications and do not require prophylaxis.

Up To Date v 14.3. http://www.uptodate.com/ Soft tissue infections due to human bites. 2006.[3]
"Some patients present early after being bitten and before there is evidence of infection. It is not clear that such patients require antibiotics. A prospective, double-blind, placebo-controlled trial found that infection rates were low, with or without antibiotics (combination of cephalexin and penicillin), in 127 immunocompetent adults with low-risk wounds who presented within 24 hours of sustaining a human bite. Low-risk wounds were those that only involved the epidermis and did not involve the hands, feet, or skin overlying joints or cartilaginous structures. In comparison, antibiotic prophylaxis was beneficial in a small randomized trial of human bites involving the hand. This finding is consistent with a meta-analysis from the Cochrane database. Using data from the above trial of human bites and three trials of dog bites involving the hand, antibiotic prophylaxis significantly reduced the rate of infection (2 versus 28 percent with placebo, odds ratio 0.10, 95% CI 0.01 to 0.86). A limitation to these observations is that most of the studies were small and/or methodologically deficient."

https://doi.org/10.1017/S1481803500015475 Published online by Cambridge University Press

injury. Differences were considered significant at the α 0.05 level.

We formed multivariable logistic regression models for 3 outcomes. The first model's outcome was presentation to the ED more than 24 hours after the bite; the second model's outcome was the receipt of antibiotics; and the third model's outcome was admission to hospital. Patient demographic characteristics, circumstances of the bite, characteristics of the bite, and elapsed time from the bite to ED presentation were examined in univariable logistic regression analyses as potential variables for each of these outcomes. We created multivariable models using covariates from the univariable analyses that were significant at the α 0.05 level. For each outcome, all variables significant in the univariable analyses were included in the multivariable model that was specific to that outcome. We estimated odds ratios (ORs) with corresponding 95% CIs. We conducted sensitivity analyses of the impact of closed-fist injuries on the multivariable model.

Results

Study population

The ICD-9 code search revealed 413 ED visits. Ninety-nine percent of the medical records for these visits were available for review. From the review of these records, 388 visits were for adults who sustained human bites. The remainder constituted ICD-9 coding errors. For the 6.5-year period of this study, these visits for human bites represented 0.1% of the number of all visits to the ED.

Demographics, bite characteristics and circumstances

The majority of patients were male, white, bitten during an altercation, bitten on only one body location, were not bitten while at work and presented for medical care within 24 hours of their bite (Table 1). The patients' median age was 28 years (range 18–78 yr). One-half of the patients were bitten on the hands or fingers (50.3%). Of those bitten at work, most were health care workers. Overall, 7.7% of wounds resulted from closed-fist injuries, which represented 15.4% of the hand or finger bites. The remaining were occlusional or other bites (e.g., "strikes" or abrasions that were not to the metacarpophalangeal joint). It was not possible to determine from the medical records which patients had definite signs of infection at the time of their ED visit.

Time elapsed from bite to ED presentation

The percentage of patients presenting within 24 hours of their injury was essentially independent of body location (Table 2). More patients presented within 24 hours than after, irrespective of the body location of the bite ($p < 0.001$ for all comparisons). When isolating closed-fist injuries from other bites, patients with closed-fist injuries were more likely to present more than 24 hours following their injury than patients with other hand or finger bites (44.8% v. 22.5%; $p \leq 0.01$) and all other bites (44.8% v. 21.5%; $p \leq 0.01$).

Table 3 provides the results of the logistic regression analysis evaluating demographic and bite characteristic factors associated with presenting more than 24 hours after a human bite injury. Patients of black (OR 1.79, 95% CI 1.02–3.13) and Hispanic (OR 2.68, 95% CI 1.22–5.89) ethnic background as well as those with a non-occupational bite (OR 3.87, 95% CI 1.68–8.90) had greater odds of presenting more than 24 hours after their bite. The findings were robust when patients with a closed-fist injury were removed from the analysis.

Table 1. Demographics and bite characteristics, *n* = 388

Variable	% of patients*
Median age (and range), yr	28 (18–78)
Sex	
Female	35.6
Male	64.4
Race	
Black	28.9
Hispanic	8.0
White	53.6
Other	9.5
Bite characteristics	
Bite circumstances	
Altercation	66.5
Playing with a child	0.5
"Love bite"	1.0
Other	17.8
Not stated	14.2
Nonoccupational bite	77.8
Occupational bite	22.2
Health care worker	9.0
Police officer	6.2
Group home worker	3.1
Restaurant worker	2.6
Janitorial worker	1.3
Body location	
Hands or fingers	50.3
Head or neck	17.8
Extremities	23.5
Other	8.4
Multiple bites	12.9
ED presentation > 24 h†	23.8

ED = emergency department.
*Unless otherwise indicated.
†*n* = 370 (time of bite missing for 18 patients).

https://doi.org/10.1017/S1481803500015475 Published online by Cambridge University Press

Antibiotic usage

The majority of patients received some form of antibiotics as part of their medical care and received these antibiotics while in the ED (Table 2). The percentages were the highest for those bitten on the hands or fingers and for those bitten on the head or neck. Compared with patients who sustained a hand or finger bite, the probability of receiving any antibiotics was the same as for those with a head or neck bite (RR 1.00, 95% CI 0.83–1.21), was greater than those with an extremity bite (RR 1.45, 95% CI 1.13–1.86) and was the same for those bitten on other body locations (RR 1.10, 95% CI 0.93–1.30). The majority of patients (86.7%) with closed-fist injuries received some form of antibiotics but were just as likely to receive them as all other patients (86.7% v. 72.0%, $p \leq 0.09$) and just as likely to receive them as patients with other hand or finger bite injuries (86.7% v. 81.8%, $p \leq 0.52$).

Table 2 also provides a comparison of antibiotic usage by form of antibiotic delivery and by bite location. Of the 388 patients, 36.6% were given intravenous (IV) antibiotics and 64.7% received oral antibiotics, either in the ED, at discharge or both. The majority (73.3%) of patients with closed-fist injuries received IV antibiotics, which was more than patients with all other bites (73.3% v. 21.8%, $p \leq 0.0001$) and those with other hand or finger bites (73.3% v. 47.3%, $p \leq 0.01$). The most commonly prescribed IV antibiotic was ampicillin–sulbactam (71.1%). The most commonly prescribed oral antibiotic in the ED (69.3%) and for discharge (72.2%) was ampicillin–clavulanate.

Table 3 shows the results of the logistic regression analyses using patient demography and bite characteristics as potential predictors of antibiotic usage. In the multivariable analyses, patients bitten during an altercation and those bitten on the hands or fingers had a greater chance of receiving antibiotics. The findings were robust when patients with a closed-fist injury were removed from the analysis. Age, sex, ethnic background and presence of multiple bites were not associated with the receipt of antibiotics.

Hospital admission

Of all 388 patients, 11.0% were admitted to the hospital. Table 2 depicts the percentage of patients admitted by body

Table 2. Time elapsed to emergency department presentation, antibiotic usage and hospital admission

	% of patients							
	Specific bite location comparison					Closed-fist injury comparison		
Variable	Hands or fingers, *n* = 195	Head or neck, *n* = 69	Extremities, *n* = 91	Other, *n* = 33	Total, *n* = 388	Closed-fist injuries, *n* = 30	Other hand or finger bites, *n* = 165	All other bites, *n* = 193
Time elapsed from bite to ED presentation								
< 24 h	74.1	78.3	79.8	75.0	76.2	55.2	77.5	78.5
≥ 24 h	25.9	21.7	20.2	25.0	23.8	44.8	22.5	21.5
Antibiotic usage								
Any antibiotics received	82.6	82.6	63.7	72.7	77.3	86.7	81.8	72.0
Antibiotics received in ED	67.2	69.6	42.9	45.5	60.1	83.3	64.2	52.9
Form of antibiotic delivered								
Any intravenous antibiotic usage	51.3	43.5	8.8	12.1	36.6	73.3	47.3	21.8
Any oral antibiotic usage	63.1	71.0	60.4	72.7	64.7	46.7	64.8	57.4
Intravenous in ED only	19.5	11.6	3.3	0.0	12.6	33.3	17.0	5.7
Oral in ED only	1.5	1.4	5.5	0.0	2.3	6.7	0.6	3.1
Oral at discharge only	15.4	13.0	20.9	27.3	17.3	3.3	17.6	19.2
Intravenous and oral in ED	0.5	0.0	0.0	0.0	0.3	0.0	0.6	0.0
Intravenous and oral in ED and oral at discharge	2.6	4.3	1.1	0.0	2.3	0.0	3.0	2.0
Oral in ED and at discharge	14.4	24.7	28.6	33.3	21.1	3.3	16.3	28.0
Intravenous in ED and oral at discharge	28.7	27.6	4.4	12.1	21.4	40.0	26.7	14.0
No antibiotics	17.4	17.4	36.2	27.3	22.7	13.4	18.2	28.0
Admission to hospital	16.9	8.7	3.3	3.0	11.0	36.7	13.3	5.2

ED = emergency department.

https://doi.org/10.1017/S1481803500015475 Published online by Cambridge University Press

location of their bite. The highest percentage was those who had been bitten on the hands or fingers. The majority of patients with closed-fist injuries (63.3%) were not admitted to the hospital. However, patients with a closed-fist injury were more likely than patients with all other bites (36.7% v. 5.2%, $p < 0.001$) and those with other hand or finger bites (36.7% v. 13.3%, $p \leq 0.002$) to be admitted.

As shown in the multivariable logistic regression analyses (Table 3), patients bitten during an altercation, those bitten on the hands or fingers, and those presenting to the ED more than 24 hours after their bite had a greater chance of being admitted to the hospital. The findings were robust when patients with a closed-fist injury were removed from the analysis. Age, sex, ethnic background and presence of multiple bites were not associated with admission to the hospital.

Discussion

Our findings suggest that EPs are not relying on the limited data and (sometimes) conflicting information available to them to make clinical decisions. Decision making may instead be based on this lack of consensus and a desire to avoid poor outcomes. Research and consensus guidelines about when, what and how to prescribe antibiotics are clearly needed, particularly with regard to prophylaxis.

Most of the patients presenting for medical care were bitten during an altercation. However, despite the fact that the "fight bite," or closed-fist injury is classically taught as the hallmark of human bite injuries, patients bitten during an altercation were bitten on many different parts of the body. Therefore, EPs should be reminded that patients who have been in an assault or altercation can be bitten anywhere on the body and careful inspection of the entire skin surface may reveal bites that were not a part of the patient's chief complaint.

Most patients presented within 24 hours of receiving the bite, again despite classic teaching that patients with human bite injuries have a delayed presentation. When controlling for other factors, "fight bite" closed-fist injury

Table 3. Factors associated with time elapsed to emergency department presentation, antibiotic usage and hospital admission

	Presentation ≥ 24 h of bite		Antibiotics usage		Admission to hospital	
Factors	Univariable OR (95% CI)	Multivariable OR (95% CI)	Univariable OR (95% CI)	Multivariable OR (95% CI)	Univariable OR (95% CI)	Multivariable OR (95% CI)
Age	0.98 (0.96–1.01)	—	0.99 (0.97–1.01)	—	1.00 (0.97–1.03)	—
Female v. male	1.26 (0.77–2.06)	—	1.16 (0.70–1.92)	—	0.67 (0.33–1.36)	—
Ethnic background						
White	Ref	Ref	Ref	—	Ref	—
Black	2.22 (1.29–3.84)	1.79 (1.02–3.13)	1.36 (0.78–2.39)	—	1.76 (0.86–3.60)	—
Hispanic	3.18 (1.47–6.87)	2.68 (1.22–5.89)	2.25 (0.75–6.73)	—	1.56 (0.49–4.97)	—
Other	0.99 (0.34–2.79)	0.76 (0.27–2.15)	0.90 (0.41–1.98)	—	1.65 (0.57–4.76)	—
Nonoccupational v. occupational bite	4.42 (1.96–9.99)	3.87 (1.68–8.90)	2.10 (1.23–3.56)	1.50 (0.83–2.71)	1.86 (0.76–4.57)	—
Altercation v. other circumstance	1.14 (0.68–1.90)	—	2.34 (1.44–3.81)	1.87 (1.09–3.20)	5.61 (1.96–16.10)	4.91 (1.65–14.64)
Multiple v. single bites	1.22 (0.62–2.43)	—	1.05 (0.51–2.14)	—	0.67 (0.23–1.95)	—
Bite locations						
Head or neck	1.01 (0.48–2.14)	—	2.43 (1.18–5.02)	1.87 (0.88–3.97)	2.86 (0.78–10.50)	1.70 (0.39–7.37)
Hands or fingers	1.28 (0.74–2.20)	—	2.42 (1.44–4.10)	2.23 (1.31–3.80)	6.11 (2.11–17.70)	5.26 (1.74–15.87)
All other locations	Ref	—	Ref	Ref	Ref	Ref
Presentation ≥ 24 h v. < 24 h	NA	NA	0.96 (1.63–1.46)	—	2.58 (1.60–4.14)	2.75 (1.64–4.62)

OR = odds ratio; CI = confidence interval; Ref = reference category; NA = not applicable.

https://doi.org/10.1017/S1481803500015475 Published online by Cambridge University Press

patients were not more likely to present later than other patients. It is concerning that patients of black and Hispanic ethnic background were more likely to present later than white patients. This delay might reflect a problem with access to medical care or culturally-related beliefs about the need for medical care for these injuries. Patients bitten at work were more apt to present earlier for medical care. This finding also likely reflects the ability of health care and public service workers to seek ED care faster than other patients owing to their occupations.

Despite the lack of clear guidance on when to use antibiotics for human bite injuries, more than three-quarters of patients received antibiotics, and most received them in the ED. Antibiotics were likely given primarily as a prophylactic measure, given that most patients presented within 24 hours of their bite, that few patients were admitted and because presentation within, compared with beyond, 24 hours was not a predictor of prescribing antibiotics. Our findings suggest that EPs are generalizing the admonition for antibiotic usage for "fight bites" to other hand or finger (predominately occlusional) bites, particularly in the presence of a history of an altercation. It is unclear whether or not such a practice is justified.

Clinicians favoured giving antibiotics to patients bitten on the head or neck, or hands or fingers, compared with those bitten elsewhere on the body even though it has not been established that the former are more likely to become infected. Ampicillin–sulbactam and ampicillin–clavulanate were the popular choice for antibiotics, which is in concordance with most, but not all recommendations for either prophylaxis or treatment of human bite wounds.[1–3,14–16] Some EPs apparently favour providing a first dose of IV antibiotics to patients being discharged, although there is no evidence to support or refute that this is better practice than oral antibiotics alone.

A minority of patients were admitted to the hospital. From Talan and colleagues' study of ED patients with infected human bite wounds, the median time from a human bite to the appearance of the first symptoms of infection was 22 hours.[17] It is therefore highly probable that most of the patients admitted in this study had signs or symptoms of infection. These results suggest that patients bitten during a fight on the hands or fingers and who present late for medical care form a group that is at higher risk of having an infection. However, these features are not absolute predictors of an infection since it is difficult to determine the natural history of a human bite injury given the frequent use of prophylactic antibiotics by EPs. Nevertheless, controversy remains over which patients require admission for these injuries.

Limitations

There are several limitations to this study. First, ICD-9 code billing searches rely on the accuracy of the coding and billing process, so cases might have been missed. However, we believe that this number is small, given our search methods. Moreover, it is unlikely that missing cases confounded the relation between our factors of interest and our selected outcomes. Second, studies involving medical record reviews depend on data completeness. Antibiotic and admission decision-making rely on specifics of the exposure circumstances that could not be reliably obtained from all medical records. This study instead focused on a few selected potential factors related to antibiotic usage and admission. Third, the study was from a single ED. The patient population might not be similar to other EDs so the results might not be generalized to all other populations. However, given the diversity of our sample, our attempts to collect all patients presenting with human bite injuries, and the type of analysis we conducted, we believe that our primary findings are of use to other EDs. Fourth, patient behaviours and clinician actions might have changed since these data were collected, so the results might not reflect current practice. However, antibiotic formulations, standards for admission and advice to clinicians regarding these injuries has changed little over the years; therefore, we expect that the results are nevertheless applicable to current practice. Fifth, a "delay" to ED presentation is not well defined. Although we used a 24-hour cut-off that is widely cited, the true time needed to present after a human bite injury has not been well established.

Conclusion

Most of the patients who sustained a human bite injury had been involved in an altercation; however, most had occlusional bites. Approximately one-half of the human bites were on the hands and fingers, yet only 15.4% of these were closed-fist injuries. Although few patients required admission, over 75% of ED patients were prescribed antibiotics, presumably as a prophylactic measure. Given the high rate of antibiotic usage identified in our study, the disparate advice available to clinicians on the management of human bite injuries and variations in clinician practice patterns, consensus evidence-based guidelines on antibiotic usage and admission for these patients are needed.

Acknowledgements: Dr. Merchant was supported by a National Institutes of Health training grant through the Division of Infectious Diseases, Warren Alpert Medical School of Brown University, The

Miriam Hospital, from the National Institute on Drug Abuse, 5 T32 DA13911. This study was supported in part by grants from the National Institutes of Health to the Brown/Lifespan/Tufts Centers for AIDS Research (P30 AI42853), the Rhode Island Foundation, and the Elizabeth Glaser Pediatric AIDS Foundation.

Competing interests: None declared.

References

1. Weber EJ. Mammalian bites. In: Marx J, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 6th ed. Philadelphia (PA): Elsevier; 2006. p. 882-92.
2. Schwab RA, Powers RD. Puncture wounds and mammalian bites. In: Tintinalli JE, ed. Tintinalli's emergency medicine: a comprehensive study guide. 6th ed. New York (NY): McGraw-Hill; 2004. p. 324-8.
3. Baddour LM. Soft tissue infections due to human bites: up to date; 2006. Available: www.uptodate.com.
4. Wolfson AB, ed. Harwood-Nuss' clinical practice of emergency medicine. 4th ed. Philadelphia (PA): Lippincott Williams and Wilkins; 2005. p. 1644-7.
5. Martin LT. Human bites. Guidelines for prompt evaluation and treatment. Postgrad Med 1987;81:221-4.
6. Douglas LG. Bite wounds. Am Fam Physician 1975;11:93-9.
7. Kelleher AT, Gordon SM. Management of bite wounds and infection in primary care. Cleve Clin J Med 1997;64:137-41.
8. Bunzli WF, Wright DH, Hoang AT, et al. Current management of human bites. Pharmacotherapy 1998;18:227-34.
9. Demetriades D. Human and animal bites. S Afr J Surg 1989;27: 185-7.
10. Griego RD, Rosen T, Orengo IF, et al. Dog, cat, and human bites: a review. J Am Acad Dermatol 1995;33:1019-29.
11. Goldstein EJ. Bite wounds and infection. Clin Infect Dis 1992; 14:633-8.
12. Medeiros I, Saconato H. Antibiotic prophylaxis for mammlian bites. Cochrane Database Syst Rev 2001;CD001738.
13. Broder J, Jerrard D, Olshaker J, et al. Low risk of infection in selected human bites treated without antibiotics. Am J Emerg Med 2004;22:10-3.
14. Gilbert DN, Moellering RC, Eliopoulos G, et al., editors. The Sanford guide to antimicrobial therapy, 36th edition. Sperryville, (VA): Antimicrobial therapy; 2006.
15. Callaham M. Controversies in antibiotic choices for bite wounds. Ann Emerg Med 1988;17:1321-30.
16. Morgan M. Hospital management of animal and human bites. J Hosp Infect 2005;61:1-10.
17. Talan DA, Abrahamian FM, Moran GJ, et al. Clinical presentation and bacteriologic analysis of infected human bites in patients presenting to emergency departments. Clin Infect Dis 2003;37:1481-9.

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