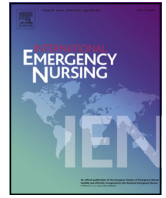




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## Bite wounds and antibiotic prescription among patients presenting to an Australian emergency department

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## ABSTRACT

**Introduction:** Emergency department presentations after mammalian bites may be associated with injection of bacteria into broken skin and may require prophylactic antibiotics to prevent subsequent infection. We aim to describe the epidemiology of patients presenting with a mammalian bite injury and antibiotic choice to an Australian adult tertiary centre.

**Methods:** A retrospective cohort study was performed capturing all presentations after mammalian bite wounds between 01 Jan 2014 and 31 Dec 2014. An explicit chart review was conducted to determine management of each case. Cases were subgrouped into high- and low-risk groups as defined by the Australian Therapeutic Guidelines for animal bites.

**Results:** There were 160 cases of mammalian bite wounds included, with 143 (89.4%) patients grouped as high-risk and 17 (10.6%) patients identified as low-risk. High-risk features were delayed presentation > 8 hours (57 patients, 35.6%), bites to the head, hand or face (113 patients, 70.6%), and puncture wounds unable to be adequately debrided (74 patients, 46.3%). There was a significant association with delayed presentation of more than eight hours and clinically established infection [OR 36.2; 95% CI: 12.6–103.6;  $P < 0.001$ ]. Prescriptions for antibiotics that adhered to current guidelines occurred in 99 (61.9%) cases.

**Conclusions:** This study highlights variability in antibiotic prescription practice among clinicians and the need for ongoing education on antibiotic stewardship. Intervention strategies, including ongoing education, are indicated to improve adherence to antibiotic guidelines.

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### 1. Introduction

Mammalian bite wounds account for approximately 1–2% of all emergency department (ED) presentations in Australia and the United Kingdom (Evengiou et al., 2013; MacBean et al., 2007). In Australian EDs, 80% of bites are from dogs, 9% from humans, and 7% from cats (MacBean et al., 2007), with the remaining from other mammals, marine animals and reptiles (Dendle and Looke, 2008). Human and animal bite wounds can cause substantial tissue damage (including tendon damage, fractures and neurovascular damage),

psychological distress or infection (Dendle and Looke, 2009). An estimated 3–18% of dog bites and 28–80% of cat bites become infected, which complicates the initial skin and tissue damage (MacBean et al., 2007). Causative organisms vary depending on the source of the bite. Human bites are associated with *Staphylococcus aureus*, *Eikenella corrodens*, *Streptococcus* species and beta-lactamase-producing anaerobic bacteria. Animal bites are associated with *Pasteurella* species, *Staphylococcus aureus*, *Capnocytophaga canimorsus*, *Streptococcus* species and anaerobic bacteria (Dendle and Looke, 2008).

Local skin and soft tissue infections are the most common causes of morbidity associated with bite wounds. Sepsis, fractures, osteomyelitis, meningitis and endocarditis are reported features in high-risk patients (Smith et al., 2000). Mortality in animal bites is usually associated with small children receiving bites to the head and neck (Dendle and Looke, 2009). However, there have been case reports of overwhelming sepsis from untreated bites (Iyidobi et al., 2012).

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**Box 1.** High-risk features of bite wounds requiring antibiotic therapy (eTG Complete, 2015).

High-risk features:

- Wounds with delayed presentation (8 hours or more).
- Puncture wounds that cannot be debrided adequately.
- Wounds on the hand, feet or face.
- Wounds involving deeper tissues.
- Wounds in immunocompromised patients.

This highlights the importance of early and appropriate treatment directed at preventing infective complications of bite wounds.

Management of bite wounds in the ED generally comprises wound washout, debridement, tetanus immunisation, and if appropriate rabies vaccination (Broom and Woods, 2006). In more severe bites, surgical evaluation may be required (Smith et al., 2000). It is recommended that prophylactic empiric antibiotics should be considered in cases where there is a high risk of subsequent infection (Box 1) (Campbell et al., 2009). Therapeutic Guidelines Australia provides peer-reviewed guidelines to assist clinicians in prescribing (eTG Complete, 2015). Oral amoxicillin with clavulanic acid 875/125 mg 12-hourly is considered to be the most appropriate first-line therapy in high-risk wounds as a defence against beta-lactamase-producing anaerobic bacteria (Raval et al., 2014). In patients with a penicillin allergy, oral ciprofloxacin 500 mg 12-hourly plus oral clindamycin 450 mg 8-hourly is indicated. In bite wounds with an established moderate to severe infection, admission to hospital is recommended, including an antibiotic regime of intravenous (IV) piperacillin with tazobactam 4/0.5g 8-hourly (eTG Complete, 2015).

The primary aim of this study was to describe the epidemiology of presentations after a mammalian bite injury to the ED of an adult tertiary referral centre. Secondary aims investigated the prescription of antibiotics and adherence to current clinical guidelines outlining the treatment for bites from human and animals.

## 2. Methods

### 2.1. Setting

The Alfred Hospital in Melbourne, Australia, is a major adult referral centre. The Alfred Hospital is the state of Victoria's adult primary referral centre for burns, haemophilia, acute haematological emergencies, hyperbaric therapy, HIV, bone marrow transplantation, heart-lung transplantation, cystic fibrosis and one of two centres for adult major trauma. The ED receives over 60,000 presentations per year, with an admission rate of around 50%. The ED is serviced by a fast-track service, staffed primarily by nurse practitioners and an 18-bay short stay unit. During the study period, there were no hospital-specific guidelines outlining time for administration of antibiotics or antibiotic prescribing for bite wounds.

### 2.2. Data source

Data were extracted from The Alfred Hospital database on eligible patients presenting to the ED, between 01 Jan 2014 and 31 Dec 2014. To maximise cases, the search criteria included cases where "bite" was noted in the discharge diagnosis, as a presenting complaint, or in the triage descriptor text. These data included date of presentation, age, sex and discharge destination. An explicit chart review was conducted and each case was examined to further extract the following variables: Australasian Triage Scale (ATS) category (Australasian College of Emergency Medicine, 2013), bite source, bite location, type of bite (superficial vs. penetrating), involvement of

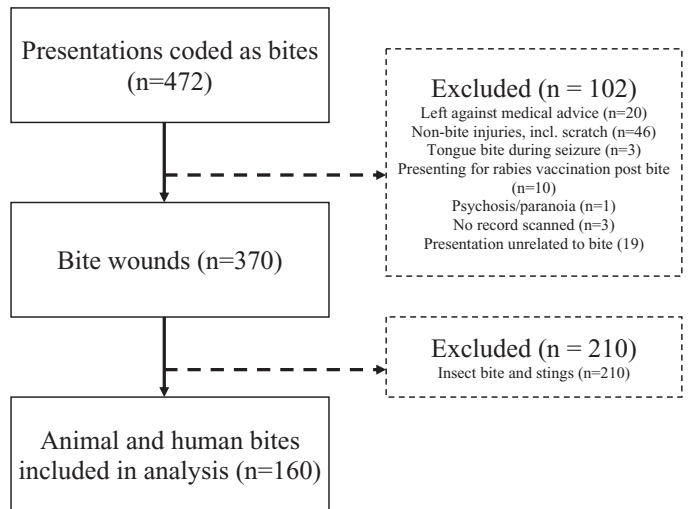


Fig. 1. Inclusion and exclusion criteria.

deeper tissues, time elapsed since bite occurred, smoking status, co-morbidities such as diabetes, immunosuppression, clinical presence of infection, admission to hospital and treating unit, antibiotic used for treatment, and route of administration. The secondary outcome variable, adherence, was noted as prescriber observance of the suggested antibiotics in Therapeutic Guidelines Australia. Therapeutic Guidelines Australia is based on the latest international literature, interpreted by experts, with input from an extensive network of general practitioners and other users. The information is an independent and unbiased distillation of current evidence and opinion. Each expert group comprises approximately 14 people, including a chairman, an editor, and experts in relevant medical specialties, a clinical pharmacology trainee, a general practitioner, a pharmacist and a nurse. Depending on the subject matter, the group may also include a consumer or experts from other areas, such as physiotherapy and nutrition (eTG Complete, 2015).

### 2.3. Data analysis

Descriptive statistics were performed for frequency analysis to identify initial trend and incidence. Unpaired t-tests were used to determine differences between continuous variables. A Pearson chi-squared test was performed to determine differences between ordinal variables, and if value in a cell was less than five the Fisher exact test was used. A P-value of <0.05 was considered statistically significant. This study was approved by The Alfred Hospital Research & Ethics Committee.

## 3. Results

Over the study period, there were 62,316 presentations to the ED and 472 cases who satisfied the search criteria, with 160 (33.9%) cases resulting from a mammalian source and included in the analysis (Fig. 1). Sex distribution among the included patients was equal (M:F = 79:81) with a mean age (SD) of 41.9 (1.4) years. Of the study population, 143 (89.4%) had features of high risk of infection, 113 (70.6%) had a bite to the head, hand or face, 57 (35.6%) had a delayed presentation, and 74 (46.3%) had a puncture wound unable to be debrided adequately. There were 25 (15.6%) patients who had wounds involving deeper tissues and one patient (0.6%) was immunocompromised. There were 17 (10.6%) patients who had none of these features and were classified as low risk. There was no significant age or sex difference between the low- and high-risk groups (Table 1).

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