

CME Article

Bites to the hand: are they more than we can chew?

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ABSTRACT

Animal bites to the hand caused by dogs, cats and humans are common conditions that general practitioners, emergency physicians and hand surgeons encounter in their practice. These bites are prone to infection and represent great cost to the patient in terms of time, money and disability, if not treated optimally from the outset. Other than lacerations to the skin, injuries to the tendons, nerves, bone and joints are commonplace given their proximity to the skin surface in the hand. Optimal treatment of acute animal bites to the hand should include clearance of contamination by surgical debridement, prophylactic antibiotics and tetanus toxoid, as well as staged reconstruction of all damaged tissue, including the skin, once the wound is deemed clean.

Keywords: cat bites, dog bites, human bites, treatment

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INTRODUCTION

Bites from pets are becoming increasingly common,⁽¹⁾ as Singapore's rising affluence allows more people to keep animals such as dogs and cats. The other less common but equally serious 'fight bite' is a human bite injury to the dorsum of the metacarpophalangeal joint, which is usually sustained when a clenched fist meets an adversary's incisors. A good number of these two types of bites either present for treatment in the acute setting or with delayed presentation after initial sub-optimal treatment.

EPIDEMIOLOGY

Dog and cat bites

There are approximately 55,000 dogs in Singapore and about 70 reports of dog attacks in 2009,⁽¹⁾ although the actual figure could be higher, as many pet owners may not report bites from their own dogs. While there are no local figures, a recent report estimates that dog bites affect 1.5% of the population in the USA annually.⁽²⁾ There is less information on the pet cat population, but it would



Fig. 1 Clinical photograph shows a fight bite over the dorsum of the right second metacarpophalangeal joint.



Fig. 2 Clinical photograph shows fresh dog bites to the right forearm sustained by a dog handler.

not be unreasonable to say that it may be close to that of the dog population. Bites from dogs and cats are not a trivial problem in terms of patient numbers, especially considering our department treats approximately five animal bites a week. Equally important, the cost of dog and cat bites managed optimally in the initial setting was far lower than the cost of managing complications such as osteomyelitis and septic arthritis after the inadequate initial treatment (US\$17,000 vs. US\$77,000).⁽³⁾ As such, it would make good clinical as well as economic sense to provide the best treatment from the outset.

Human bites

Human bites usually take the form of fight bites (Fig. 1), which is not only sustained during fist fights but also accidentally during contact in field sports. A New York study reported an incidence of 11.8 per 100,000 population per year,⁽⁴⁾ although under-reporting is the norm, as many who are involved in altercations may not admit to the mechanism of injury due to a combination of embarrassment and fear of legal consequences.

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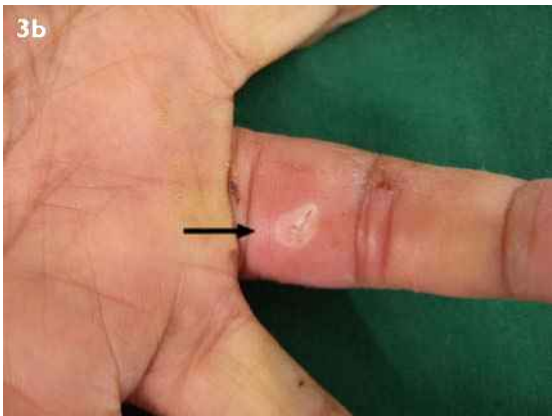
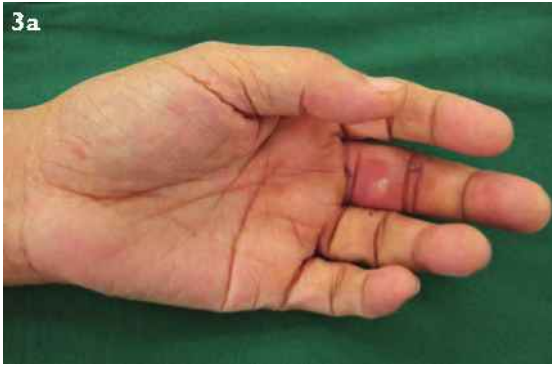


Fig. 3 (a) Clinical photograph shows the left middle finger of an elderly woman who sustained a bite from her pet cat. (b) Close-up photograph shows the infected puncture wound (arrow) inflicted by the cat.



Fig. 4 Intraoperative photograph shows suppurative flexor tenosynovitis of the left middle finger caused by a cat bite.

CLINICAL MANIFESTATIONS

Tissue injury

Crush injury, lacerations and abrasions are common in dog bites (Fig. 2), as dogs' teeth and jaws are designed to crush and tear their prey. These wounds, on top of being inoculated with bacteria, will have devitalised tissue that requires surgical excision. Cats, in contrast, usually inflict puncture wounds (Fig. 3), as they have long, slender incisors that can penetrate deeply into tendon, bone and joints (Fig.



Fig. 5 Intraoperative photograph shows osteochondral fracture (black arrow) and extensor tendon laceration (white arrow) as a result of a fight bite.



Fig. 6 Radiograph shows a loss of cortical continuity over the head of the second metacarpal (arrow).

4). These wounds tend to be underestimated because they are small and seal off early. In fact, deep abscesses and osteomyelitis are more common in cat than dog bites, as is infection.⁽⁵⁾ Significantly, human bites have higher complication and infection rates than animal bites. This is especially so in fight bites due to several reasons:⁽⁶⁾

1. These injuries occur over the dorsal aspect of the metacarpophalangeal joint, where teeth can easily penetrate the skin, tendon, joint capsule, articular cartilage and even bone (Fig. 5).
2. The contamination sustained when the fist is clenched then gets spread proximally into the dorsum of the hand when the fist is opened, thereby spreading the bacteria over a wider area.
3. Extensor tendon and articular cartilage are relatively avascular structures that have limited ability to fight infection.

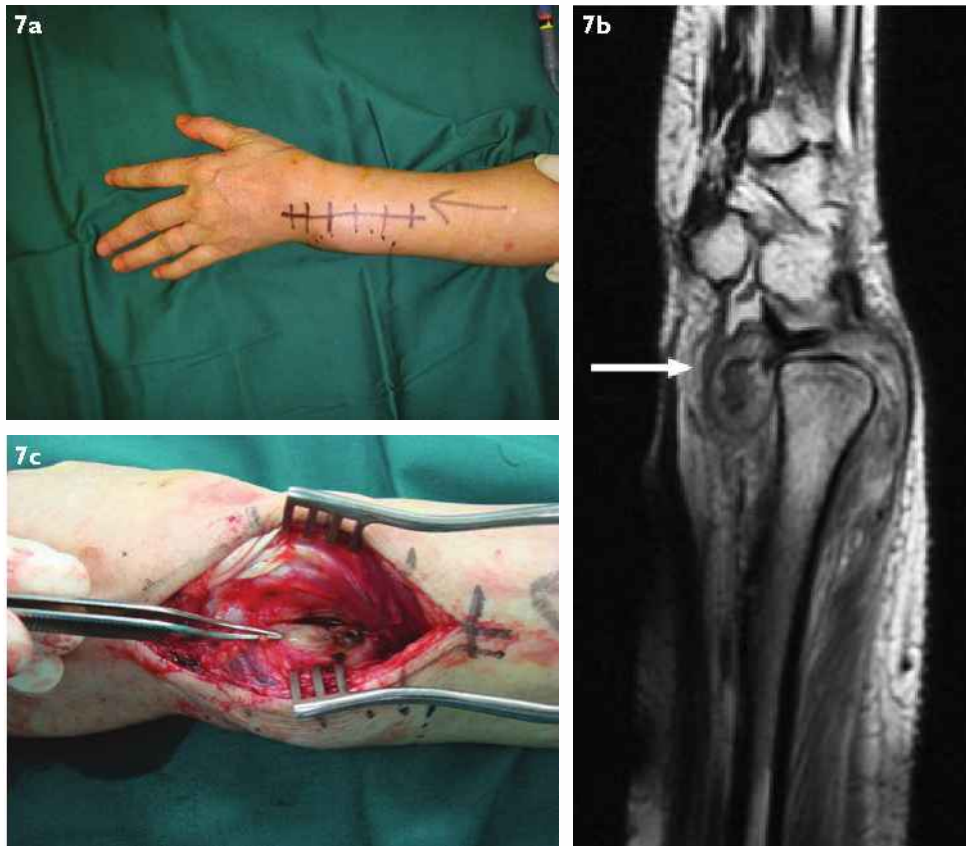


Fig. 7 (a) Clinical photograph shows swelling and erythema over the ulnar side of the left wrist of a woman who was bitten by her dog five weeks prior to presentation. (b) MR image of the patient's wrist shows septic arthritis of the distal radioulnar joint and osteomyelitis of the ulnar head (arrow). (c) Intraoperative photograph of the same patient shows pus in the distal radioulnar joint and erosion of the ulnar head.

4. There is a high concentration of pathogenic organisms in human saliva.
5. Patients tend to present later, as they underestimate the injury and are uncomfortable with the potentially law-breaking circumstances surrounding their injury.

Radiographs (Fig. 6) are necessary to detect foreign bodies in the form of animal teeth parts, as well as to assess the integrity of bone cortices, the loss of which may indicate penetration to the bone. Dog and human bites are usually polymicrobial, with a mixture of anaerobes and aerobes such as *Pasteurella* spp., *Eikenella corrodens*, *Staphylococcus* spp. and *Streptococcus* spp., whereas *Pasteurella multocida* is the main isolate in cat bites.⁽⁷⁾

MANAGEMENT

Bites with established infection (Fig. 7) should be treated with surgical debridement and intravenous antibiotics. We advocate a similar approach for acute bites to ensure a better and more predictable outcome using surgical debridement. However, while parenteral antibiotics (i.e. intravenous or intramuscular) are preferable, oral antibiotics may suffice in minimally contaminated wounds.

Clearance of contamination

“There are two kinds of bites. The ones you debride and the ones you wish you had debrided.” This adage, drummed into us by doyens of the community, sums up the first and arguably most important principle in the management of bites. This is especially true in the hand, where 30%–40% of bites become infected.⁽⁸⁾ The reason for this is the many tight and enclosed spaces that exist to allow inoculated bacteria to fester, as well as the proximity of the bone and joints to the skin, making them more susceptible to penetration by teeth. Timely and crucial surgical treatment involves excision of all tissue that is devitalised and most tissue that has been inoculated by the animal's teeth, including curettage of affected bone and lavage of joints that have been breached. For effective debridement, good lighting and the use of a tourniquet to prevent bleeding is essential. Thorough irrigation or lavage of the wounds to dilute the bacterial load is necessary. Effective anaesthesia, either local, regional or general, is important. It is also important to note that local anaesthesia must be given remote from the bite site so as not to spread the infection.

Antibiotic and tetanus prophylaxis

Amoxicillin-clavulanic acid is the mainstay of

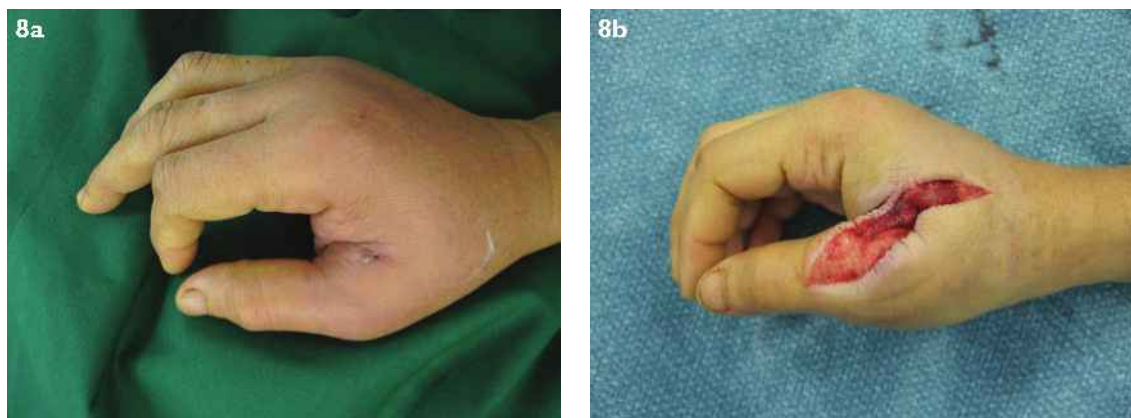


Fig. 8 Photographs show (a) an infected dog bite of the right hand leading to first web space abscess; and (b) the wound 48 hours after debridement, which is clean and ready for secondary suture.

prophylaxis, as it provides excellent coverage against the usual organisms that are inoculated.⁽⁹⁾ Doxycycline with metronidazole is a good alternative in individuals who are allergic to penicillin.⁽⁹⁾ While the oral route has been recommended as sufficient, intravenous antibiotics is the rule for patients managed in our department due to their increased bioavailability and non-interference with patients fasting for general anaesthesia. Tetanus booster is a must if the original three-dose series has been given but none in the year prior to the bite.⁽⁹⁾

Repair of damaged tissue

Structures, including skin injured by the bite, will need to be repaired. However, in the face of the high infection risk linked to bites, internal fixation of fractures and tendon, nerves and skin repair should be deferred until the wound is deemed to be clean, after at least one adequate surgical debridement (Fig. 8). In uncomplicated acute bites, after adequate debridement and lavage, and if the doctor deems it to be safe, the wounds may be stitched. However, if there is any doubt, wound closure should be delayed.

How about rabies?

Rabies virus is present in the saliva of the biting animal and has to be taken up by the nerve synapses to travel to the brain, where it can cause fatal encephalitis. The hand, along with the face, has a large number of nerve endings and is hence considered a higher risk exposure when the biting animal is infected with rabies. Fortunately, the latest data in 2005 from the Centers of Disease Control and Prevention places Singapore on the list of countries that report no indigenous cases.⁽¹⁰⁾ As such, it is reasonable to omit rabies prophylaxis if the patient has been bitten by an animal in Singapore.

Have we gotten away with doing less?

While we definitely do not advocate anything less than prophylactic antibiotics, tetanus prophylaxis and surgical debridement, anecdotes of less optimal treatment being carried out without subsequent serious infection taking place have been told. Nonetheless, such a strategy is unpredictable at the very least, and in fact, potentially disastrous.

CONCLUSION

Bites to the hand are serious injuries that have significant infection risk. Adequate treatment includes surgical debridement, antibiotic prophylaxis and staged repair of damaged tissue.

REFERENCES

1. Wong T. Dog attacks on the rise. *The Straits Times* 2009, November 19.
2. Gilchrist J, Sacks JJ, White D, Kresnow MJ. Dog bites: still a problem? *Inj Prev* 2008; 14:296-301.
3. Benson LS, Edwards SL, Schiff AP, Williams CS, Visotsky JL. Dog and cat bites to the hand: treatment and cost assessment. *J Hand Surg Am* 2006; 31:468-73.
4. Marr JS, Beck AM, Lugo JA Jr. An epidemiologic study of the human bite. *Public Health Rep* 1979; 94:514-21.
5. Fleischer GR. The management of bite wounds. *N Engl J Med* 1999; 340:138-40.
6. Perron AD, Miller MD, Brady WJ. Orthopedic pitfalls in the ED: fight bite. *Am J Emerg Med* 2002; 20:114-7.
7. Dendle C, Looke D. Review article: Animal bites: an update for management with a focus on infections. *Emerg Med Australas* 2008; 20:458-67.
8. Morgan M, Palmer J. Dog bites. *BMJ* 2007; 334:413-7.
9. Oehler RL, Velez AP, Mizrahi M, Lamarche J, Gompf S. Bite-related and septic syndromes caused by cats and dogs. *Lancet Infect Dis* 2009; 9:439-47.
10. Travelers' health yellow book on Rabies. In: Center for Disease Control and Prevention (CDC) [online]. Available at: www.nc.cdc.gov/travel/yellowbook/2010/chapter-2/rabies.aspx. Accessed September 12, 2010.

SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 20110B)

	True	False
Question 1. Regarding dog bites:		
(a) Inadequately treated dog bites can lead to osteomyelitis.	<input type="checkbox"/>	<input type="checkbox"/>
(b) They are caused by long, slender teeth that can penetrate deeply.	<input type="checkbox"/>	<input type="checkbox"/>
(c) They usually involve contamination with <i>Pasteurella multocida</i> .	<input type="checkbox"/>	<input type="checkbox"/>
(d) They usually do not require rabies vaccination.	<input type="checkbox"/>	<input type="checkbox"/>
Question 2. Regarding human bites:		
(a) They are sometimes not reported as such by patients.	<input type="checkbox"/>	<input type="checkbox"/>
(b) They are not associated with significantly higher rates of infection.	<input type="checkbox"/>	<input type="checkbox"/>
(c) 'Fight bites' usually result in injury for the dorsum of the metacarpophalangeal joint.	<input type="checkbox"/>	<input type="checkbox"/>
(d) They have polymicrobial isolates.	<input type="checkbox"/>	<input type="checkbox"/>
Question 3. Regarding assessment of bites:		
(a) Radiographs are completely unnecessary.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Extensor tendons must be carefully evaluated for injury.	<input type="checkbox"/>	<input type="checkbox"/>
(c) It requires good lighting in the operating room and tourniquet control.	<input type="checkbox"/>	<input type="checkbox"/>
(d) It does not require careful visual examination of all involved tissues during debridement.	<input type="checkbox"/>	<input type="checkbox"/>
Question 4. Regarding management of bites:		
(a) Oral antibiotics are adequate in all cases.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Debridement of the wound is necessary.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Adequate anaesthesia is important for good debridement.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Amoxicillin-clavulanic acid is not the first line of antibiotic prophylaxis.	<input type="checkbox"/>	<input type="checkbox"/>
Question 5. Regarding reconstruction of bite wounds:		
(a) All wounds can be closed primarily.	<input type="checkbox"/>	<input type="checkbox"/>
(b) All reconstruction should be staged if there is any doubt of the post-debridement cleanliness of the wound.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Local anaesthesia must be given remotely to minimise spread of the infection.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Uncomplicated wounds that involve only skin can be closed primarily after satisfactory debridement.	<input type="checkbox"/>	<input type="checkbox"/>

Doctor's particulars:

Name in full: _____

MCR number: _____ Specialty: _____

Email address: _____

SUBMISSION INSTRUCTIONS:(1) Log on at the SMJ website: <http://www.sma.org.sg/cmc/smj> and select the appropriate set of questions. (2) Select your answers and provide your name, email address and MCR number. Click on "Submit answers" to submit.**RESULTS:**(1) Answers will be published in the SMJ December 2011 issue. (2) The MCR numbers of successful candidates will be posted online at www.sma.org.sg/cmc/smj by 18 November 2011. (3) All online submissions will receive an automatic email acknowledgment. (4) Passing mark is 60%. No mark will be deducted for incorrect answers. (5) The SMJ editorial office will submit the list of successful candidates to the Singapore Medical Council.**Deadline for submission: (October 2011 SMJ 3B CME programme): 12 noon, 11 November 2011.**