

Assessing and managing animal and human bites

KEY WORDS

- » Acute setting
- » Bites
- » Common bite complications
- » Infection
- » Non-healing wounds

US studies (2001–2010) suggest that up to 1.82% of patients seen in Emergency Departments were hospitalised as a result of a “non-canine” bite, with the majority being insect or arachnids (Langley et al, 2014). In the UK, dog and human bites are the most common bites encountered in Emergency Departments, mammalian bites cause significant tissue damage and are most likely to be infected within a few hours of being inflicted. Most insect/arachnid bites will resolve within a few days but some people are more likely to experience complications including infection and non-healing wounds. Despite the wide variety of animals that bite, the general management of bites remains the same and consists of cleansing, debridement and repair of the skin and soft tissues. Specific infections such as rabies and tetanus need to be considered and appropriate prophylactic and therapeutic measures should be taken (Stevens et al, 2014). Early identification of the type of bite, decontamination and wound management is essential to reduce the risk of complications. Hospital admissions can be avoided or reduced with access to outpatient antibiotic therapy units and specialist wound management services.

In September 2018, eight UK schools in East London made the headlines when they were closed due to False Widow spider invasions, and there have been many scare stories in the tabloids regarding False Widow spider bites causing “massive wounds” and “life-threatening infection”. But in reality, most insect bites do not require hospital treatment; one UK emergency department turned away 25 patients per day in the summer of 2017 due to insect/spider bites that did not require treatment (Jordan, 2017). There have also been reported cases of skin and soft tissue infection being attributed to insect/arachnid bites without clear evidence of a bite (Dominguez, 2004).

Dog bites are the most common bites encountered in Emergency Departments (ED), accounting for 80% of all animal bites seen in hospital (Stevens et al, 2005). Mammalian bites cause significant tissue damage and are most likely to be infected within a few hours of being inflicted. However, most data available has been gleaned from hospital records and thus may be biased towards those that inflict significant tissue damage and require treatment — not

accounting for those bites that do not present at ED (Westgarth et al, 2018).

Some types of bites are more likely to become infected than others and some patients are at a higher risk of complications, such as open wounds and infection, particularly if they have reduced immunity or chronic conditions such as diabetes (Stevens et al, 2005). In 2018, our Trust treated 140 patients for cellulitis due to secondary skin infections due to insect/arachnid bites and trauma within our outpatient antibiotic therapy (OPAT) unit. This paper is limited to the common bite complications seen in one acute hospital in the East of England.

TYPE OF BITE

Mammalian — dog and human

A study by Westgarth et al (2018) demonstrated that 25% of people in one area of the UK were affected by a dog bite at some point in their life; similar statistics have been found in Germany (Rothe et al, 2015). Of these, a third had required medical treatment and 0.6% had required hospital admission. Both studies found that men were

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Figure 1. Serious injuries inflicted by a dog



Figure 2. Ensure that the injuries caused by a human bite are well documented and pictures are taken as evidence



Figure 3. Up to a quarter of human bites become infected

more likely to be bitten by a dog than females. Additionally, Westgarth et al (2018) identified children with mental health or Attention Deficit Hyperactivity Disorder (ADHD) disorders and those who were less shy around dogs were more likely to be bitten than more cautious children. Also of note was the finding that dog bites were just as likely to occur with a familiar dog as with an unknown dog.

Large dogs can inflict serious crushing and often disfiguring injuries (*Figure 1*), particularly in children with extensive, irregular tissue loss (Rothe et al, 2015). There is a high risk of contamination from the flora within the animal's mouth, streptococci, staphylococci, pasteurella species, diphtheroids and gram-negative organisms have all been cultured (Stevens et al, 2014).

Between 2–30% of dog bite wounds that need medical treatment will be infected (Boyle, 2017). Patients who present eight hours or more after the injury has occurred usually have established infection (Stevens et al, 2005).

Human

Like dog bites, human bites not only damage the soft tissue and skin (*Figure 2*) but may result in infection. Up to 25% of bites will become infected (Rothe et al, 2015) (*Figure 3*), with aerobic and anaerobic streptococci, *Staphylococcus aureus*, gram-negative rods and bacteroides having been found in the wounds (Stevens et al, 2014).

If a patient presents for treatment of any hand wound over the knuckle, consideration should be taken that it may be a human bite wound, even if the history given is otherwise. Bite wounds over knuckles are referred to as indirect or “clenched fist” bites due to a blow to the teeth by another person's fist. Whereas bite wounds caused by occlusion of the victim's skin by the biter's teeth are known as direct or occlusal bite wounds (National Institute of Health and Care Excellence [NICE], 2018).

Safeguarding or criminal concerns must always be considered — particularly if the victim is a child or vulnerable adult. Ensure all history given is well documented, if possible, take photographs of any bite wounds as these may be required as evidence later if there is a criminal or safeguarding concern (Rothe et al, 2015).

MANAGEMENT OF MAMMALIAN BITES

As with any wound assessment, a holistic approach is required (Stevens et al, 2014). Any past medical history that may affect wound healing or increase risk for infection will impact on management choices. Ideally, it is useful to understand the events that lead to the bite:

- ▶▶ Was there a provocation or was the bite accidental?
- ▶▶ How powerful was the bite?
- ▶▶ In the case of a dog bite, did the animal have a locking jaw that would increase the power of injury (Rothe et al, 2015)?
- ▶▶ Are there other injuries which need to be assessed and managed?
- ▶▶ Was there any loss of teeth to the biter, these may be embedded in the wound and will need removal.

The wound will require meticulous cleansing and probable irrigation with normal saline to remove any contamination, though high-pressure irrigation is not recommended as this may spread infection into the deeper tissues (Rothe et al, 2015). Any de-vitalised tissue will need debridement, depending on depth and location, this may need to be completed surgically. Hand wounds have the potential for joint or tendon involvement and, in some cases, will need formal surgical exploration by an appropriate speciality surgeon. Small puncture wounds may be deceiving and hide a deeper tissue injury not yet visible. Radiological investigation is recommended to exclude any underlying fracture or foreign body (tooth).

Closure of bite wounds is controversial (Stevens et al, 2005), particularly at an early stage, as there is a high risk of retained contaminants or devitalised tissue; most small wounds on extremities and genitals may be managed by secondary intention. Facial wounds, however, always require primary closure to avoid later cosmetic concerns (Stevens et al, 2014; Rothe et al, 2015). If the wound is extensive or complicated, discussion with a senior A&E physician or the on-call plastic surgeon regarding management is advisable.

Dressing choice will be dependent on local wound care formularies, but topical



Figure 4. Multiple mosquito bites



Figure 5. Cellulitis cause by scratching



Figure 6. A single puncture wound caused by horsefly

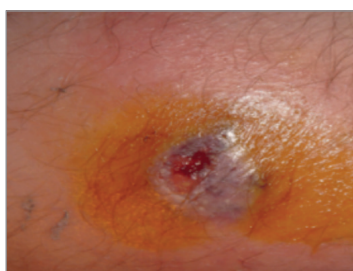


Figure 7. Infected horsefly bite



Figure 8. A False Widow's distinct double puncture wound

antimicrobial products should be considered given the high risk for infection, particularly in patients with underlying conditions, which increase the risk of infection.

Following cleaning and dressing the wound, antibiotic therapy should be commenced for all human bites that are less than 72 hours old with or without signs of infection, and any animal bite less than 48 hours old with a high risk of infection (National Institute of Health and Care Excellence [NICE], 2018). Tetanus and rabies prophylaxis should be given if necessary (Stevens et al, 2014), and consideration should also be taken for anyone bitten who may be at risk of blood borne diseases such as the human immunodeficiency virus (HIV) or hepatitis.

Patients who do not require hospital admission, should be encouraged to elevate any limb wounds to reduce oedema and informed of the early signs of infection and told to return.

INSECTS AND ARACHNIDS (SPIDERS)

Studies suggest that up to 94% of people are stung or bitten by insects or arachnids at least once in their lifetime (NICE, 2016), most stings and bites do not cause adverse reactions and resolve within a few days with localised management of itch and swelling only.

It is often very difficult to know exactly what did the biting/stinging, unless the predator has been seen or killed at the time. Mosquitoes and midges are very common during the summer months (Figure 4), particularly around damp and humid areas such as river banks, forestry and lakes (Medlock et al, 2012). Their bites cause single tiny itchy punctures, but can involve multiple bites that may not be noticed immediately (NICE, 2016). Complications such as cellulitis tends to be secondary as a result of wounds caused by scratching (Figure 5).

The horsefly is particularly common in rural damp areas around farming and areas of horse keeping and cause large painful bites, again a single puncture wound with localised swelling and noticeable immediately (NICE, 2016). Horsefly bites increase during heatwaves and are described as less sophisticated biters than mosquitoes as they are more used to biting the tough skin of horses and cattle, so cause a larger wound in humans

(Figure 6). There is a higher risk that these bites will develop adverse reactions and infection (Figure 7), developing blistering and oedema quickly (Davis, 2018)

The False Widow is the most common biting spider in the UK (Dunbar et al, 2017; Bauer et al, 2019), with a distinct double puncture wound (Figure 8) that delivers a neurotoxic venom which can cause steatodism (Dunbar et al, 2017). Although rare, it is considered a serious complication. This presents a set of symptoms, most notably intense pain radiating from the bite, cramps, fever, nausea, headache, malaise, lethargy and even chest pains or difficulties with breathing (Thomas et al, 2012; (Bauer et al, 2019). Despite the tabloid headlines, such severe reactions are apparently rare (Bauer et al, 2019). Wound breakdown following an insect or spider bite is not directly caused by the bite itself but by secondary bacterial infection entering the puncture site (Osterloff, 2017).

MANAGEMENT OF INSECT AND ARACHNID BITES

As with mammalian bite wounds, a holistic assessment is essential to understand the potential risks for the patient of secondary infection. It is helpful, but not essential to know what did the biting, so consideration can be made for wider systemic effects if there is a possibility of exposure to a neuro toxin, for example, or if the culprit was an insect or arachnid at all (Dominguez, 2004).

Good cleansing of the area to remove any contaminants or toxins is required and local debridement of devitalised tissues may be indicated to reduce risk of infection and improve the wound bed condition. Efforts to reduce oedema and localised inflammation can include cooling and elevation if a limb is affected or systemic antihistamines prescribed, recent evidence suggests that topical local antihistamines are ineffective (Morrisey, 2019).

Appropriate dressings for the wound bed conditions should be selected from local formularies to promote a healing environment and aid repair of the skin and soft tissues.

Routine prophylactic antibiotic therapy is not required unless there are signs of infection present (Stevens et al, 2014); at which point first line



Figure 9. Normal reactions to an insect bite include redness, oedema and itchiness



Figure 10. Infected insect bite

Table 1. List of symptoms of inflammation versus infection

| Inflammation/Reaction | Infection |
|-----------------------|---|
| Redness | Cellulitis |
| Oedema | Friable bleeding granulation tissue |
| Heat | Localised heat/pyrexia >37.2 |
| Itchy | Wound breakdown/increase in wound size/delayed healing/increased slough or necrosis |
| Pain | Unexplained pain/tenderness at site of bite |
| Rash | Abscesses, purulent drainage, odour |

antibiotic therapy should be chosen in accordance to local guidelines issued by microbiologists (Morrissey, 2019). Consideration should be taken for patients at high risk for infection such as diabetic or immune-suppressed; topical antimicrobial dressings may be useful. Anti-tetanus may be needed (Morrissey, 2019).

INFECTION

It is important to recognise the difference between normal reaction and localised inflammation (Table 1) due to an insect/arachnid bite (Figure 9) as opposed to bacterial infection (Figure 10).

Specific infections such as rabies and tetanus need to be considered and appropriate prophylactic and therapeutic measures taken (Morrissey, 2019). Osteomyelitis is a frequent and severe complication of bite wounds, consider this diagnosis if there is pain in a joint or when a wound fails to heal and has evidence of deeper tissue necrosis or breakdown.

Streptococcus is a more virulent bacterium in most of its strains and is found in many bite wounds from mammalian to insect. It is responsible for life-threatening infections such as necrotising fasciitis and extensive tissue loss (Dow et al, 1999). *Staphylococcus aureus* and *Pseudomonas aeruginosa* usually require >10⁵ colony forming units per gram of tissue to cause significant damage but are also frequently found in bite wounds.

OTHER SPECIFIC CONCERNS FOR ANY BITE WOUND

Any underlying conditions need to be taken into account during holistic assessment as some patients will be more at risk of wound breakdown

and infection than others (Morrissey, 2019). Patients with a pre-existing vascular insufficiency or lower limb oedema of any aetiology who experience a bite to a lower limb will be at increased risk of ulceration and delayed healing without management of the underlying condition. Immuno-compromised patients and those on steroid medication or chemotherapy will be more susceptible to infections, particular aerobic and non-bacterial pathogens (Morrissey, 2019) and may need prophylactic management both systemically and topically. Diabetic patients may not exhibit normal signs of infection, but sudden high glucose could be an indicator and should be monitored and acted on early.

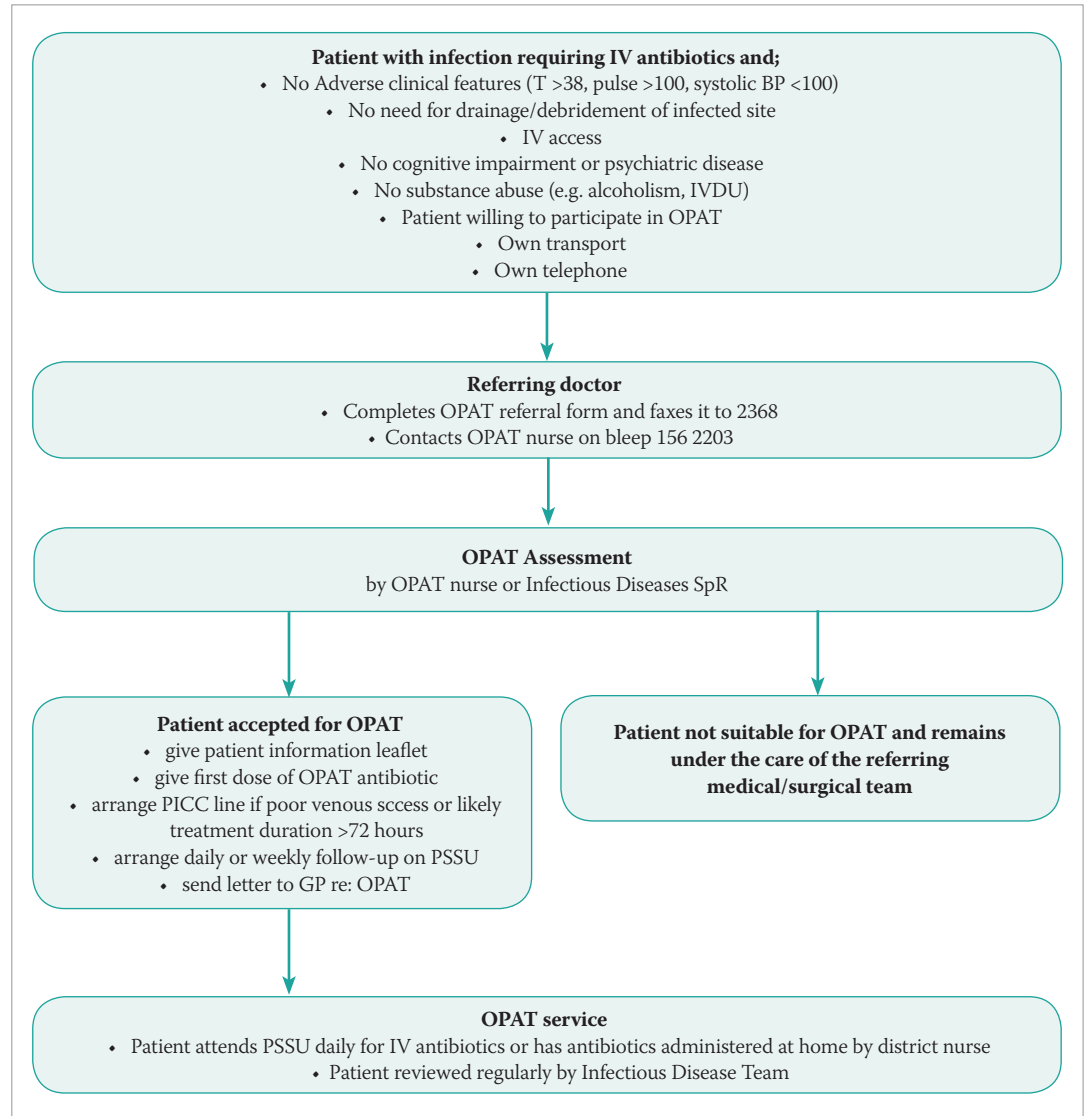
AVOIDING HOSPITAL ADMISSION

The management of soft tissue and skin infections is costly and traditionally has involved in-patient stays with intravenous antibiotics (Nathwani, 2001). However, in the last couple of decades, outpatient parenteral antibiotic therapy services have emerged across the UK (Durojaiye et al, 2018). These units have the advantage of reducing hospital length of stay, reducing costs and improve quality of life for patients (Hedley, 2013). All OPAT services are governed by the British Society for Antimicrobial Chemotherapy (BSAC) and most are exclusively medical team led (Durojaiye et al, 2018). Locally our service is led by an Infectious Diseases Consultant supported by a designated Specialist Registrar, alongside a nursing team consisting of a lead specialist registered nurse, two support specialist nurses, two staff nurses and a healthcare support worker (HCSW) with extended skills competencies, as well as a microbiologist and an antimicrobial specialist pharmacist (Whitehorn, 2018). Referrals are made via ED, wards or assessment units, with an initial assessment completed by the OPAT on call team and cases are reviewed at a weekly MDT meeting (Figure 11), this is in line with other services in the UK (Durojaiye et al, 2018).

CONCLUSION

In conclusion, despite the wide variety of animals that bite, the general management of bites remains the same. A holistic assessment is essential to establish history of the bite, underlying co-

Figure 11. Example of a local OPAT referral pathway



morbidities which may affect healing and potential for complications. Thorough cleansing is required as early as possible to remove contaminants and potential toxins. Reduction of inflammation will reduce pain and localised oedema, suggested options include cooling with ice packs, elevation if limb is affected and systemic anti-inflammatory medication.

Debridement may be necessary to remove devitalised tissue that poses a risk for bacterial or other pathogen infection and delayed healing. Extensive tissue loss may require surgical repair of the skin and/ or soft tissues, but the majority of bite wounds will be managed conservatively, using dressings to promote a healing environment and prevent infection. Any infection will

require systemic antibiotic therapy and topical antimicrobial products may be considered where a patient is more likely to develop complications. Admissions to hospital can be avoided or shortened with the availability of OPAT services, though not all patients will be suitable and a full triage and risk assessment needs to be undertaken by a specialist team.

Many bites can be avoided; campaigns to reduce animal attacks that include education of the public regarding the safe handling and approach towards dogs can reduce the risk of bites occurring. Preventative measures during the summer months, which include covering skin and the use of insect repellents, can reduce the risk of being bitten by insects and arachnids.

REFERENCES

- Bauer T, Feldmeier S, Krehenwinkel H et al (2019) *Steatoda nobilis*, a false widow on the rise: a synthesis of past and current distribution trends. *NeoBiota* 42:19–43
- Boyle A (2017) *Bites and Stings in the Emergency Department – Guideline*. Cambridge University Hospitals NHS Foundation Trust, Cambridge.
- Davis J (2018) *Are Horsefly Bites on the Rise?* Available at: <http://www.nhm.ac.uk/discover/news/2018/july/are-horsefly-bites-on-the-rise.html> (accessed 30 April 2019)
- Dominguez TJ (2004) *It's Not a Spider Bite, It's Community Acquired Methicillin-Resistant Staphylococcus*. Available at: <https://www.jabfm.org/content/17/3/220.full> (accessed 30 April 2019)
- Dow G, Browne A, Sibbald G (1999) Infection in chronic wounds: controversies in diagnosis and treatment. *Ostomy Wound Management*. 45(8):23–40
- Dunbar JP, Afoullous S, Sulpice R, Dugon MM (2017) Envenomation by the noble false widow spider *Steatoda nobilis* (Thorell, 1875) - five new cases of steatodism from Ireland and Great Britain. *Clinical Toxicology* 56(6): 433–5
- Durojaiye OC, Cartwright K, Ntziora F (2018) Outpatient parenteral antimicrobial therapy (OPAT) in the UK: a cross-sectional survey of acute hospital trusts and health boards. *Diagnostic Microbiology and Infectious Disease* 93(2019):58–62
- Hedley L (2013) *Cellulitis: What You Ought to Know*. Available at: https://www.pharmaceutical-journal.com/files/rps-pjonline/pdf/PJ240813_193-196.pdf (accessed 30 April 2019)
- Jordan B (2017) *Residents Warned Not To Go to A&E with Insect Bites*. Available at: <https://www.runcornandwidnesworld.co.uk/news/15391098.residents-warned-not-to-go-to-ae-with-insect-bites/> (accessed 30 April 2019)
- Langley R, Mack K, Haileyesus T et al (2014) National estimates of noncanine bite and sting injuries treated in US hospital emergency departments, 2001–2010. *Wilderness Environ Med* 25(1):14–23
- Medlock JM, Hansford KM, Anderson M et al (2012) Mosquito nuisance and control in the UK - a questionnaire-based survey of local authorities. *Journal of the European Mosquito Control Association* 30(2012):15–29
- Morrissey (2019) *Insect Bites and Stings*. Available at: <https://bestpractice.bmj.com/topics/en-gb/281> (accessed 30 April 2019)
- Nathwani D (2001) The management of skin and soft tissue infections: outpatient parenteral antibiotic therapy in the United Kingdom. *Chemotherapy* 47(suppl 1):17–23
- National Institute for Health and Care Excellence (2016) *Insect Bites and Stings – Clinical Knowledge Summary*. Available at: <https://cks.nice.org.uk/insect-bites-and-stings> (accessed 30 April 2019)
- National Institute for Health and Care Excellence (2018) *Bites - Human and Animal – Clinical Knowledge Summary*. Available at: <https://cks.nice.org.uk/bites-human-and-animal> (accessed 30 April 2019)
- Osterloff E (2017) *How Dangerous are False Widow Spiders?* Available at: <http://www.nhm.ac.uk/discover/news/2017/december/how-dangerous-are-false-widow-spiders.html> (accessed 30 April 2019)
- Rothe K, Tsokos M, Handrick W (2015) Animal and human bite wounds. *Deutsches Ärzteblatt International* 112(25):433–43
- Stevens DL, Bisno AL, Chambers HF et al (2005) Practice guidelines for the diagnosis and management of skin and soft tissue infections. *Clinical Infectious Diseases* 41(10):1373–406
- Stevens DL, Bisno AL, Chambers HF et al (2014) Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clinical Infectious Diseases* 59(2):e10–52
- Thomas E, Harbon S, Dyas J et al (2012) Immigrant Spiders - a cause for concern? *Clinical Toxicology* 50: 273–366 Abstracts of the 2012 international congress of the European Association of poisons centres and clinical toxicologists, 25 May–1 June 2012, London, UK
- Westgarth C, Brooke M, Christley RM (2018) How many people have been bitten by dogs? A cross sectional survey of prevalence, incidence and factors associated with dog bites in a UK community. *J Epidemiol Community Health* 72(4):331–36
- Whitehorn J (2018) *Skin and Soft tissue Infections – Guideline*. Cambridge University Hospitals NHS Foundation Trust, Cambridge.

