

Dog bites – barking up the right treatment tree

H Parkar,¹ SS Mlambo,¹ L Naude,² AD Cromarty¹

¹Department of Pharmacology, Faculty of Health Sciences, University of Pretoria, South Africa

²Eloquent Health and Wellness, South Africa

Corresponding author, email: hafiza.parkar@up.ac.za

Injuries from dog bites vary in severity and complexity, ranging from puncture wounds from the dog's teeth to lacerations and tissue removal from ripping and skin tearing. As dog bites are trauma wounds, they are most likely to be encountered by general practitioners in emergency centres. Therefore, proper assessment and management of these wounds requires knowledge of the treatment guidelines recommended by the World Health Organization (WHO) and the National Institute for Communicable Diseases (NICD). In this article, we discuss the consequences of dog bites, highlight the recommended treatment guidelines and present a case study of typical dog bite treatment.

Keywords: dog bite, dog bite complications, rabies, wound management, post-exposure prophylaxis, rabies immunoglobulin

Introduction

Dog bites and their consequences

Dog bites are reported to be the most frequently encountered animal bites managed in emergency centres in South Africa.¹ Although anyone can be a victim of a violent dog attack, dog bites are a common occurrence in children due to their height being at the same level as that of dogs, and the likelihood of them provoking the dogs while playing. Injuries are likely to be sustained on the head, face and neck in children below the age of six, and to lower limbs, arms and hands in older children and adults.¹⁻⁴ Numerous South African and international studies have shown that the incidence of dog bites is higher in children under the age of 10.^{1,3,4}

Injuries from dog bites vary in severity and complexity, ranging from puncture wounds from the dog's teeth, to lacerations and tissue removal from ripping and skin tearing.¹ Although the injuries may not appear severe on the external surface, especially if the superficial tissue remains intact, underlying tissue may be devitalised as a result of injury to deep structures such as nerves and blood vessels.^{1,5} Where tissue has been removed, reconstructive surgery may be required and is often costly.⁴ While rabies is the most feared complication arising from dog bites, the most common complication is skin infections.³ Severe bites can result in serious complications such as osteomyelitis and septic arthritis, and these are especially seen in bites on the hands.³

In instances where severe dog bite injuries are sustained, infection commonly complicates these wounds due to the exposed tissue being in contact with pathogens from human skin flora and the oral flora of the dog.⁶ Bacterial infections associated with dog bites include tetanus and capnocytophaga. Patients infected with tetanus present with symptoms such as cramping in the jaw, muscle spasms (usually in the stomach) and muscle stiffness, while capnocytophaga infection may

cause blistering, oozing from the wound, fever and joint pain.^{7,8} If left untreated, infection may result in further complications such as kidney failure, myocardial infarction and severe sepsis. In immunocompromised patients, there is a possibility for the infection to cause gangrene to the limbs.^{1,8}

The major viral complication arising from dog bites is rabies. Rabies infection does not occur in every dog bite victim, but only in those bitten by rabid dogs. These dogs transmit the virus through their saliva, which then affects the central nervous system (CNS) of the infected patient. The virus can cause CNS complications, which ultimately lead to death and this is mostly seen in immunocompromised patients, where the development of rabies may go unnoticed or wrongly treated as HIV-associated encephalitis or meningitis.⁹

In addition to a compromised physical status, dog bite victims may suffer severe emotional stress associated with memories of violent dog attacks, and wounds particularly to the face, since these wounds may go through a longer inflammatory phase of healing which may increase the risk of pathological scarring.^{2,5,10}

As dog bites are trauma wounds, they are most likely to be encountered in emergency centres and, as such, a general practitioner would most likely deal with a post-hospitalised dog bite patient, but it is not unlikely that they may be presented with a fresh wound. Proper assessment and management of these wounds would require knowledge of the necessary treatment guidelines recommended by World Health Organization (WHO) and the National Institute for Communicable Diseases (NICD).

Treatment

Post-exposure prophylaxis

Post-exposure prophylaxis (PEP) involves the prompt administration of a rabies vaccine followed by rabies immunoglobulin (RIG) if necessary. At present, there are three WHO prequalified human rabies vaccines available on the market: Rabavert® and

Rabipur® produced by GSK and Verorab® (cell culture vaccine) produced by Sanofi Pasteur.¹¹ The one currently available in South Africa is Verorab® and should be administered intramuscularly in four doses on days 0, 3, 7 and then any day between day 14 and 28.¹² Verorab® comes in a 0.5 ml vial and the entire vial is used per dose for both adults and children.¹²

Rabies immunoglobulin is recommended by the WHO and is used to neutralise the virus at the bite site.^{11,12} The maximum calculated dose should be infiltrated directly into and around the wound at volumes that are anatomically feasible. There are two variants of RIG available in South Africa which are human-derived rabies immunoglobulin (HRIG) and equine-derived rabies immunoglobulin (ERIG). Two types of HRIG are available under the tradenames Rabigam® and KamRAB® (available with special permit) and the maximum dosage for both formulations is 20 IU/kg bodyweight.¹² The ERIG is available under the tradename Equirab® and the maximum dosage for this formulation is 40 IU/kg bodyweight. ERIG, however, is only recommended for use in facilities where anaphylaxis and adverse reactions can be managed, even though the incidence of anaphylaxis following ERIG administration is low.¹² Timely administration of the rabies vaccine and RIG (where required), in addition to good wound management is the most effective way to prevent rabies, even after a high-risk exposure.^{11,12}

Treatment according to dog bite categories

According to the WHO, bites from dogs can be divided into three categories based on the level of exposure to an animal and need for PEP.¹¹ A Category I exposure requires no treatment or PEP, as it is not technically exposure, but an interaction without incident, where an animal may lick a person on intact skin while they are feeding or touching them.¹¹ In this case, the person should wash their hands with soap and water after the interaction but is at no risk for disease. For an exposure to be classified as Category II, there must be direct contact with open skin, the dog may nibble or lick broken skin or cause minor scratches or abrasions without bleeding. In this instance, the exposed person should immediately clean the superficial wound by washing with soap and water, followed by disinfection with an antiseptic agent, prior to seeking medical care, where they should receive a full course of rabies vaccines^{9,11,13} as detailed in Table I.

Category III exposures are severe cases where the interaction has resulted in deep transdermal penetration through bites, scratches, skin tearing or where the mucous membranes/broken skin have been contaminated by saliva from the dog licking the wound.¹¹ When a Category III exposure has occurred (Table I), the wound should be thoroughly flushed immediately with copious amounts of water, a topical antiseptic or virucidal agent should be applied and the patient should be taken to an

Table I: Dog bite and rabies exposure classifications according to the WHO^{1,11-14}

Classification	Characteristics	Treatment strategy
Category I: <ul style="list-style-type: none"> Touching or feeding an animal or licks on intact skin 	<ul style="list-style-type: none"> No penetration of the skin 	<ul style="list-style-type: none"> No exposure PEP not indicated Wash hands with soap and water
Category II: <ul style="list-style-type: none"> Animal nibbles uncovered skin Minor scratches or abrasions without bleeding 	<ul style="list-style-type: none"> Superficial wounds Irritation Inflammation Infection caused by animal saliva or teeth Rabies Tetanus 	<ul style="list-style-type: none"> Wound should be immediately and thoroughly flushed and washed with soap and water Application of virucidal agent such as povidone iodine or similar Immediate rabies vaccination Tetanus vaccine and antibiotic treatment administered for contaminated wounds Antimicrobial dressings, if required: <ul style="list-style-type: none"> Cadexomer iodine, honey, silver, PHMB, hydrophobic dressings, hypochlorous acid solution (HOCL), copper Application of local remedies is discouraged
Category III: <ul style="list-style-type: none"> Single/multiple transdermal bites or scratches Contamination of mucous membranes with saliva from licks Licks on broken skin 	<ul style="list-style-type: none"> Severe bite wounds Deep wounds Puncture Pain Bleeding Inflammation Infection caused by animal saliva or teeth <ul style="list-style-type: none"> Osteomyelitis Septic arthritis Rabies Tetanus Odour 	<ul style="list-style-type: none"> Bleeding can be slowed/stopped by compression with a clean towel or gauze Thorough cleaning and deep irrigation of wound Application of a potent antiseptic agent RIG should be administered with the rabies vaccine into and around the wound site Most severe bite wounds are best treated by a daily dressing, followed by secondary suturing when necessary Recommended dressings: <ul style="list-style-type: none"> Antimicrobial: Cadexomer iodine, honey, silver, PHMB, hydrophobic dressings, HOCL, copper Other: <ul style="list-style-type: none"> If sutures are required, it is advised to delay the closing of the wound for several hours to allow adequate diffusion of the RIG into the tissues The use of local anaesthetic during suturing is contra-indicated since the use of local anaesthetic agents may cause infection to spread locally Tetanus vaccine and antibiotic treatment administered for contaminated wounds Pain management with anti-inflammatories and opioids

emergency centre. RIG should be administered into and around the bite wound which should be given in conjunction with the first dose of the rabies vaccine.^{11,12} Thereafter, the wound should not be sutured (if possible), but left to heal by secondary intent. If sutures are required, wound closure should be delayed for various reasons as detailed in Table I. After primary treatment has been administered and the patient has been stabilised, it is advised that patients with Category III wounds be referred to an advanced wound care practitioner for further care.

Case report

A 39-year-old female (vaccinated against rabies), who was bitten at home by her own dog (vaccinated against rabies) was referred to an advanced wound care specialist after receiving a tetanus injection and one suture (Figure 1) from her GP. She presented with bruising and several lacerations 24 hours after the incident (Figure 1). The wounds showed signs of inflammation, bruising and oedema typical of a Category III dog bite. The wounds were very painful, and the patient was struggling to walk.

The wound was cleaned with a HOCL antiseptic solution, and a single suture (Figure 1) was already placed in situ to approximate the edges of the deepest part of the wound. The patient underwent light therapy using a red light and near-infrared light therapy (Figure 2) as well as intermittent vacuum therapy (IVT) in



Figure 3: Patient undergoing intermittent vacuum therapy (IVT)



Figure 4: Patient wound 72 hours after treatment



Figure 1: Patient wound 24 h after being bitten, showing lacerations, bruising, inflammation and oedema

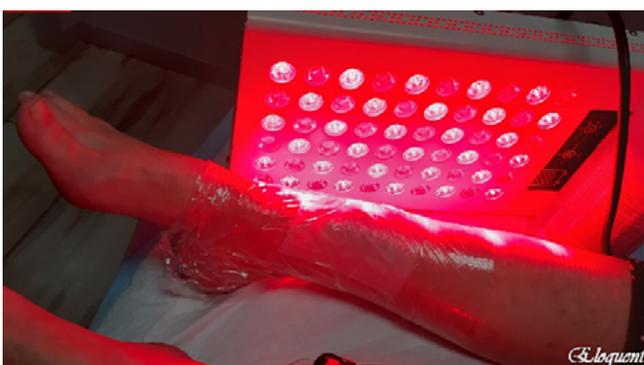


Figure 2: Red light treatment of dog bite wound

a Vacumed® device (Figure 3), to decrease oedema and promote vascular and lymphatic drainage. The wound was then treated with an antimicrobial honey ointment and closed with a silicone foam dressing in conjunction with light compression bandages and the patient was placed on a broad-spectrum antibiotic.

The wound was treated using the abovementioned advanced wound care strategy for 3 days. The antimicrobial dressings were changed daily and the compression bandage reapplied, the patient also underwent IVT on each day. After 72 hours, a noticeable decrease in oedema and bruising was observed and no clinical signs of infection were noted (Figure 4). Thereafter the patient continued with iodine impregnated dressings in conjunction with a silicone foam dressing until fully healed.

The use of advanced technology enables faster healing, pain relief and better lymphatic drainage which is often a complication of Category II and III dog bites due to the crushing injury. It is also important to not only treat the wound but the underlying contributing aetiologies such as venous hypertension and lymph drainage. If advanced technologies are not available, basic compression bandaging can assist in decreasing the oedema of the lower limb and promote improved healing.

Conclusion

Proper first-line treatment is essential in dealing with dog bites, as there is a likelihood that a small puncture wound can become

a severely infected, hard-to-heal wound if not treated correctly. Following the guidelines recommended by the WHO and the NICD will reduce the incidence of human rabies and other serious complications. It is therefore imperative that first-line healthcare providers continuously educate themselves on the changes in these protocols. If the wound is not healing, or the patient has comorbidities such as diabetes or vasculopathies, it is best to refer the patient to an advanced wound care specialist for further care.

Conflict of interest

Authors have no conflict of interest to declare.

Funding source

National Research Foundation – Blue Skies Grant

ORCID

H Parkar  <https://orcid.org/0000-0003-3732-1409>

SS Mlambo  <https://orcid.org/0000-0002-5622-2046>

L Naude  <https://orcid.org/0000-0002-6414-5802>

AD Cromarty  <https://orcid.org/0000-0002-9512-6081>

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