

review article

# Dog bite injuries: up to date.

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**Abstract:** Dog bite wounds represent a global health problem, being the most frequent in the population. Despite their importance and seriousness, their management and treatment is still controversial. The objective of this paper is to carry out a systematic review on the subject and a summary of the theoretical approach.

**Keywords:** dog bite wounds; trauma emergencies.

## 1. Pathogens

All dog bite wounds are always considered contaminated.

The pathogens involved are derived in part from the microbial flora of the dog's oral cavity and in part from the microbial flora of the human skin.

Wound contamination is considered polymicrobial as both aerobic and anaerobic bacteria are involved. In a schematic and simplified way, wounds can be divided into two groups: purulent and non-purulent.

A wound is defined as purulent by the presence of abscesses, while it is defined as non-purulent when it does not present them, but can manifest with cellulitis or lymphangitis.

The pathogens observed in non-purulent infections are generally aerobic, and the most frequent is *Pasturella* spp., a Gram-negative bacterium responsible for 50% of infections; secondly, there are *Streptococci* spp. and *Staphylococcus* spp. with a percentage of 46%.

In purulent wounds the bacteria are anaerobic, the most frequent are *Fuso* bacteria 32% and *Porfiromonas* 28%.

In a small percentage of cases an infection by *Capnocytop* *haga* *Canimorsus* can be observed, a Gram negative bacterium, saprophyte of the microbial flora of the dog's oral cavity that in normal situations only participates in the contamination of the wound, without giving signs or symptoms. In the categories of immunocompromised or multipathological patients, this bacterium can be very aggressive and the infectious picture can go as far as septic shock. The main problem is recognizing the infection since the symptoms are non-specific: fever, nausea, vomiting, diarrhea. The septic picture is the result of microcirculation alteration, with damage to the capillary endothelium that ends with disseminated intravascular coagulation.

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When an infection by this bacterium is suspected, hydrosaline fluids must be administered early to prevent shock and adapt antibiotic therapy, as will be explained later.

## 2. Location of the wound

The location of the wound is very important when deciding management and treatment.

The most frequent locations are the face, head and upper limbs.

Head and face injuries are more common in children, while hand injuries and forearms are more common in adults.

In dog bite wounds located on the face and head of children, fractures of the skull bones must always be ruled out by performing an imaging study with simple radiology. In case of doubt, a head CT should also be performed.



The wounds located in the forearm may present loss of substance, having to rule out vascular, tendon and nerve injuries. The most common injuries are rupture of the extensor tendons of the fingers, of the motor or sensory branches of the ulnar and radial nerves, and in more serious cases, injury to the radial artery.

Probably the most wounds complicated to handle are those located at the level of the hand.



The hand is highly vascularized and has a high risk of infection. In addition, it is frequent that a coverage defect remains and that flaps or skin grafts are needed. All these factors determine that patients with these categories of wounds need closer follow-up of the evolution.

Location in the lower limbs is less frequent, but can be more serious.

Of great importance are the wounds in the groin, which can cause vascular damage in the femoral artery or damage the entire vascular-nervous package, which would imply a surgical emergency.

Similarly to what happens in the upper limbs, tendon and nerve injuries can occur in the legs, especially at the level of the popliteal bundle and the EPC.



At the ankle level, the tibial nerve and artery can be damaged. In this case, vascularization is precarious and the risk of skin necrosis increases.

### 3. Handling

Management of dog bites begins at the ER door. it's fun  
It is essential that the medical team caring for the patient knows how to act.  
Schematically, management can be summarized in 5 points.

#### 1. Clinical history.

Both the patient and the dog. It is essential to know if the patient has pathologies of interest. In particular if you are a smoker, diabetic, if you have vascular pathologies and if you have been correctly vaccinated against tetanus.

As for the dog, it is necessary to know if it is stray or not and its situation with respect to anti-rabies vaccination.

#### 2. Inspection under anesthesia.

As previously stated, the location of the wound can give a lot of information when it comes to suspecting underlying injuries, but a good inspection must always be carried out to confirm or rule out suspicions. Due to the pain it is essential to use local anesthesia.

#### 3. Lavage with saline solution.

A lavage is performed with physiological saline and syringes with 19G needles. The volume of serum varies between 50 and 500 ml.

#### 4. Debridement

Every dog bite wound, in addition to having a laceration component, also has a compression component that determines, in most cases, necrosis of the edges.

Debridement of the necrotic edges significantly reduces the percentage of infection.

##### 5. Primary wound closure

It is the most controversial point of this topic. Until now it was thought that suturing dog bite wounds increased the risk of infection. However, in the most recent scientific literature there are many studies that compare treatment with primary closure of the wound with treatment without primary closure, without finding statistically significant differences between both groups.

In 2014 Nikolaos K. Paschos published in *Injury, Int. J. Care Injured*, a randomized clinical trial with 168 patients, 82 of whom were treated with primary closure of the wound and 86 without primary closure<sup>2</sup>.

The outcome variables used in the study were two: the infection rate and the aesthetics of the scar.

The first was evaluated with the appearance of fever, abscesses, cellulitis and lymphangitis.

The second variable was evaluated through the Vancouver scale, a scale from 0 to 14 points where the lowest values correspond to better aesthetic results and the highest values to worse results. Four elements are considered on the scale: pigmentation, vascularity, elasticity and thickness of the scar.

All study patients received medical attention in the hospital emergency department within 48 hours of the bite. The protocol used for both groups was the same. A correct anamnesis was carried out, emphasizing the diseases of interest such as diabetes, vascular pathologies, immunosuppression; the wound was inspected under 0.2% lidocaine; the wound was washed with 0.9% saline using syringes with 19G needles with a volume between 200 and 500 ml; debridement of the edges was performed in the cases that presented necrosis of these edges.

The 86 patients belonging to the primary closure group were sutured with 3.0 monofilament threads. The removal of the points occurred after 7 days on the face, after 10 days on the upper limbs and trunks, and after 14 days on the lower limbs.

The overall infection rate was 8.3% and no significant differences were found compared to the other group ( $p=0.5$ ).

Most interesting was the discovery that in patients treated before 8 hours, with or without primary closure, the infection rate was only 4.5%, while the infection rate in patients treated after this time was of 22.2% and that the results were significant ( $p=0.0025$ ).

Analyzing the second variable, patients treated with primary closure had a score of 1.8 on the Vancouver scale, while patients without primary closure had a score of 3.1 ( $p=0.001$ ), determining a statistically and clinically significant result.

After analyzing the results, it can be concluded that there are no significant differences between the two groups, but it is essential to treat patients within eight hours to significantly reduce the risk of infection. It is also evident that suturing the wound improves the aesthetic results of the scar, demonstrating that wounds located on the face, head, and neck can be considered optimal candidates for primary closure.

Also in 2014, Hsu-Tang Cheng published in the Journal of Plastic, Reconstructive & Aesthetic Surgery<sup>1</sup> a meta-analysis including four clinical trials, one of which is the study by Nikolaos K. Paschos. The included patients were 1071: 542 treated with primary closure of the wound and 529 treated without closure. The meta-analysis shows that there are no significant differences in the incidence of infection in the two groups (38/542, 7.0% versus 40/529, 7.6%; RR Z 0.93, 95% CI, 0.60 to 1.42; PZ 0.72) and it is evident low heterogeneity (I<sup>2</sup> Z 0%; PZ 0.74). The large sample size and low heterogeneity allow us to hypothesize that the results are correct.

#### 4. Treatment

Treatment is based on antibiotic therapy and tetanus and rabies vaccination.

All dog bite wounds are considered contaminated and therefore antibiotic prophylaxis with Amoxicillin-Clavulanic acid is always administered for 3 days.

In the event that a high risk of infection is suspected (diabetic patient, smoker or vascular pathology), the first dose of intravenous antibiotic is administered and then the oral regimen is followed until completing the 3 days.

If there are signs of established infection, treatment can be oral with Metronidazole for 14 days or intravenous with Cefuroxime, Ceftriaxone or Piperacillin-Tazobactam for 14 days.

In the case of suspected infection by Capnocytophaga Canimorsus, intravenous penicillin associated with a  $\beta$ -lactamase inhibitor can be used, or choose between Linezolid, Clindamycin, Tetracyclines or Carbapenems, for 10 days.

All patients who have received more than three doses are considered correctly vaccinated against tetanus, the last one being administered no more than five times ago. In this case it is only necessary to administer the tetanus toxoid.

In cases in which there are less than three doses or more than five years have passed since the last one, tetanus toxoid should be administered together with the specific immunoglobulins and a booster dose of the vaccine. Patients who do not remember the number of doses or the time between them should also be considered incorrectly vaccinated.

If the dog has not been vaccinated against rabies or is a stray dog, a dose of the rabies vaccine must be administered together with the specific immunoglobulins.

## 5. Comparison with other bites

Dog bites are the most frequent, but there are also bites from other animals that are equally present in the population and difficult to handle.

Cat bites are the second most frequent. They share the same pathogens as those of dogs and for this reason they are treated with the same antibiotic therapy. Unlike dog bite wounds, the complication rate is higher, especially osteomyelitis and septic shock, because patients underestimate the severity of the injury and seek medical attention later.

In third place are human bites. The percentage of these injuries is probably wrong because not all cases are recorded.

The microbial flora of the human oral cavity is different from that of animals and antibiotic therapy must be adapted; Four antibiotics are combined to cover Streptococcus, Staphylococcus Aureus, Eikenella, Fusobacterium: First generation cephalosporin (cephalexin) + erythromycin + clindamycin + aminoglycoside.

## 6. Conclusion

In the event of a bite wound, it is necessary to identify whether it is produced by a human or by animals, especially dogs or cats, in order to adjust the antibiotic therapy from the outset.

The first step to follow is a correct anamnesis, emphasizing the patient's risk factors.

Subsequently, an inspection of the wound is carried out under local anesthesia, cultures are taken and the edges are washed and debrided if necessary.

Once the lesions are located, it is decided where it is most appropriate to monitor the patient.

If there is tendinous, nervous or vascular involvement, the wound will have to be checked in the operating room and the patient will be monitored on the hospital ward.

If the wound can be treated in the Emergency box, it can be closed primary and the patient discharged with adequate antibiotic therapy at home, carrying out follow-up in the outpatient clinic.

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