LOWER LIMB WOUNDS CAUSED BY DOG BITES

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Received for publication March 29, 2009

Abstract

Four patients, with an average age of 58 years, hospitalised in 2008 because of bite wounds to the lower leg, were analysed. The study was based on the analysis of medical records and the results of laboratory and microbiological tests. Precise wound cleansing and dressing, appropriate to each case, are principal elements of management in the treatment of dog bite wounds. Potential complications include limb infection, deformation, and amputation.

Key words: dog bites, wound infection, wound management.

The mutual relations between humans and dogs date back over ten thousand years. Wild aspects of the dog’s nature have, however, never been eliminated, and this poses an ongoing risk of attacks from domestic animals (1, 21). Fatal bites are rarely encountered, but bite wounds are frequent in clinical practice (20). Therefore, the appropriate treatment methods used in patients with bite wounds largely determine the therapeutic outcome.

The precise definition of the current incidence of dog bites is very difficult, as not all injured persons seek medical attention after the incident, particularly those bitten by their own dogs (1, 6, 8). It has been calculated that 50% of Americans will experience dog or human bites during their life (2, 16). According to estimates, the dog population increases four times faster than that of humans in the same time span (2). The calculations indicate that one out of 20 dogs will bite a human during its life (16). According to statistics held in the US, 2% of the American population is bitten by dogs annually, of which 17% require medical care, and 1%-4% hospitalisation (1, 2). Reports on mortality resulting from dog bites indicate 18-20 fatalities a year (6.7 persons/100 million) (1, 16, 21). In Belgium 1% of the population experience dog bites per year, of which 38% seek medical care (5). In the United Kingdom there are 200,000 cases of dog bites each year (17).

Dog bites more frequently involve men (especially those aged 20-40 years), and the risk of injury decreases with increasing victim age (1, 5, 6, 14, 21). Statistics report a high number of incidents in which women aged 60-70 years are involved (5). The incidence of bites is higher in spring and summer, and during weekends and afternoons (1, 5, 20, 21). Conducted studies indicate that over 50% of dog bites take place at home (8, 21). A dog attack is frequently provoked by humans (30%-90%), and the victim in the majority of cases (over 80%) is familiar with the attacker (1, 2, 8, 14, 16, 20). Incidents involving dog bites reflect the relationship between dogs and humans, and knowledge of the circumstances associated with these incidents is an important element in bite prevention (4). Bites to the hand and forearm often occur when humans attempt to help a wounded animal or separate two fighting animals (2, 8). Another type of bite occurs during work with dogs (e.g. police training), but their number, considering all incidents, does not exceed 12% (2).

The objective of this study was to describe the methods used at the Department of Trauma Surgery and Emergency Medicine, Medical University of Lublin, in the treatment of dog-bite wounds, to evaluate the efficacy of the management used, and to assess the medical problems associated with the delayed treatment of bite wounds to the lower limbs.

Material and Methods

One thousand, two hundred and thirty patients with injuries were treated in 2008 at the Department, including four injuries caused by dog bites (0.35%). A study was conducted of the course and outcome of the treatment of four patients (three women and one man), of ages from 35 to 73 years (average 58 years), hospitalised because of dog (mongrel) bites to the lower leg. The study was based on an analysis of the medical records of all the traumatised patients and a detailed analysis of the laboratory and microbiological test results.
Table 1

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Age</th>
<th>Time from injury to hospitalisation</th>
<th>Reason for treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>63</td>
<td>5 weeks</td>
<td>tissue necrosis, lack of wound healing</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>35</td>
<td>3 weeks</td>
<td>lack of wound healing</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>59</td>
<td>6 weeks</td>
<td>lack of wound healing</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>75</td>
<td>9 weeks</td>
<td>lack of wound healing</td>
</tr>
</tbody>
</table>

Results

In all cases, patients had injury to the posterior surface of the lower leg over the Achilles tendon. Preliminary wound dressing was conducted in the outpatients’ clinic, which involved cleaning and suturing of the skin flap. All patients received anti-tetanus prophylaxis and none of the patients required prophylaxis against rabies. Owing to complications like necrosis and/or soft tissue infection, patients were referred after some time to the Department and then, according to the treatment schedule, attended surgical treatment within 3-9 weeks of the injury, due to the complications. In the majority of cases prolonged local infection and lack of wound healing was an indication for hospitalisation.

All the hospitalised patients were treated according to antibiograms prepared from wound secretion. In two cases *Proteus mirabilis* was cultured from sampled material, which demonstrated growth within the first 48 h. The cultured bacteria were susceptible to piperacillin, ceftazidime, tazocin, gentamycin, and amikacin, but were resistant to amoxicillin and first and second-generation cephalosporins. In two other patients, *Streptococcus* and *Staphylococcus* were found. Hospitalised patients, who required treatment with antibiotics prior to microbiological analysis results, received a combination of amoxicillin and clavulanic acid 3 x 1.2 g/d i.v., and gentamycin or clindamycin alone in a dose of 3 x 300 mg. The hospitalisation target was to obtain granulation in previously necrotomised sites. The first step in surgical treatment was the removal of necrotic tissue. One patient required a double necrotomy before the administration of antibiotics, another had a single necrotomy, and two other patients required no surgical wound cleaning. In the pre-treating wound in all patients, a split-thickness mesh skin graft was used to cover the skin defect. In three cases, 100% graft healing within two weeks was obtained. In the oldest patient (a woman), who had coexisting diseases interfering with the healing process, the treatment was longer. Wound healing was complicated by partial graft rejection and infection at the graft recipient site. In this case, complete healing was achieved after 4 months. During the last year, four patients with this type of injury were treated at the Department.

Fig. 1. Skin defect caused by a bite wound in the 3rd week after a bite by a small mongrel dog. Complicated healing resulted from a diabetic angiopathy and atherosclerosis.

Fig. 2. The same wound 14 d after split-thickness mesh graft application.
Figs 3 and 4. Surgically dressed wound 3 d after a bite by a large dog (mongrel).

Discussion

Dog breeds more likely to attack humans include the Pit Bull Terrier, German Shepherd, Rottweiler, Doberman Pinscher, Husky, Jack Russell Terrier, Chow Chow, and Alaskan Malamute (1, 2, 16, 19). Doberman Pinschers, German Shepherds, Rottweilers, and Pit Bull Terriers are responsible for the most serious injuries, occasionally with fatal consequences (Pit Bull Terrier) (16). However, it should be emphasised that the frequency of incidents is not associated with the breed alone (4). Dog behaviour is determined, apart from genetic predisposition, by training, care quality, bite circumstances, and the victim's behaviour, and these should also be considered in the dog bite prophylaxis plan (1). In the discussed material, injuries were caused by surprise attack by mongrels. In three cases, the dogs belonged to the victims' neighbours and attacked on the margins of their territory, and in the fourth case the victim was a veterinarian providing medical assistance to another dog on the territory owned by the attacking dog's keeper.

The location of wounds caused by dog bites largely depends on the victim's height: children mainly suffer from injuries to the face, head, and neck, while adults suffer from injuries to the upper limbs, less frequently to the lower limbs, and only occasionally to the abdomen or sexual organs (1, 5, 7, 16). Anatomically, dog bites to lower limbs concern most frequently the lower leg, upper leg, knee joint, and its areas; rarely the foot (5). Wounds located within the distal 1/3 part of the lower leg are particularly problematic. Owing to insufficient perfusion of this area, the percentage of complicated healing cases is significantly higher than in injuries to other parts of the body. In all the analysed cases the bite wounds were located on the lower leg.

Typical injuries caused by dog bites include lacerated wounds, minor abrasions, and more complicated abruptions, crushing, and even open fractures (2, 5, 9, 16, 18). Differences in wounds mainly result from the adaptation of teeth arranged specially in the jaw for tearing and ripping food. Injuries are often lengthwise and open and their nature promotes structural damage to adjacent nerves, tendons, vessels and joints (2). Crushed wounds are a considerable problem. They can be very complicated and require careful management to restore the complete functionality of the injured limb. In many cases, crushed wounds are complicated by necrosis and infection of the injured area, as well as coexisting fractures and interruption of nerve continuity (3). None of the above-described injuries were observed in the analysed patients.

The vast majority of bacteria found in damaged tissues originates from animal saliva and easily crosses the damaged protective barrier of the human skin (1, 3, 14, 16, 19). There are different species forming bacterial flora (12). Aerobic bacteria found most frequently in the wound include Pasteurella multocida (50%), Streptococcus (46%), and Staphylococcus (46%) (1, 12, 16, 19). Anaerobic bacteria are most frequently represented by Fusobacterium (32%), Bacteroides fragilis (30%), and Porphyromonas (28%) (1, 16, 19). In the studied material Streptococcus, Staphylococcus (in two cases) and Proteus mirabilis (in two cases) were found.

The likelihood of infection in the wound caused by the dog (2%-20%) is relatively low in comparison to other animals (1, 2, 16), but increases to 36% in the case of bite wounds on the upper limbs (11). The presence and severity of infectious symptoms is mainly determined by the time elapsed from the dog bite (17). Usually, infection develops within 12-48 h and is manifested by redness, pain in adjacent tissue, swelling, and suppurative or serosanguinous oozing (11, 20). The infection develops more frequently in wounds older than 12 h, in wounds of the hand and foot, or those located in the proximity of large joints, stab wounds or crushing. Persons aged over 50 years, alcoholics, diabetic patients, immunodeficient or splenectomised patients, and those with coexisting vascular disease or primary swelling of the injured limb are more predisposed to infections (13, 16). Factors predisposing patients to the infection, such as age over 50 years (75%), diabetes (25%), or atherosclerosis (25%) were found in the analysed group of patients.

Clinical treatment of dog bite wounds includes thorough wound cleansing, surgical debridement (if recommended), staged wound closure, and limb elevation or immobilisation (1, 13, 15, 16, 20). Surgical removal of necrotic tissue around the wound should
always be reduced to a minimum for successful healing and the prevention of the risk of scar formation (1). It is assumed that crush and stab wounds, wounds younger than 24 h, and infected wounds, should be left open to heal by granulation (1, 9, 10, 19). Plastic surgery should be considered in order to recover the initial limb appearance and function, particularly in the case of hand or leg bites (3). Additional diagnostic procedures such as X-ray imaging are recommended if there is a suspected foreign body, fracture or osteomyelitis (17, 19). Pharmacological treatment of bite wounds is based on immediate pain control, treatment with antibiotics, and tetanus and rabies prophylaxis. Indications for hospital treatment include fever, sepsis symptoms, rapid development of connective tissue inflammation, septic arthritis, osteomyelitis, and former ineffective treatment (13, 15, 19). Patients in this study were hospitalised owing to the lack of skin healing after treatment in an outpatient clinic and indication for surgical treatment by skin graft.

Atherosclerotic lesions, varices, and diabetes are frequent diseases, particularly in elderly patients. Sometimes even a minor injury in these patients is associated with serious consequences and intensive treatment, often lasting many months. Limb amputation is required in extreme cases. Bite wounds, which are primarily infected, usually with an irregular margin, numerous pockets, and a large amount of necrotic tissue, create therapeutic problems. Injuries to the lower 1/3 of the leg, particularly in patients with the above-described coexisting diseases, are truly challenging surgical cases. Ongoing progress in medicine, both in pharmacological and surgical techniques, increases the chance of good functional and cosmetic treatment outcome. Most frequently, tissue loss is successfully treated by skin grafts. Other cases require more advanced techniques such as tissue flaps or free flaps, often with the need for microsurgical reconstruction. The majority of patients suffering from bite wounds receive medical attention in outpatient clinics. Minor wounds in well perfused parts of the body, despite a high risk of infection, heal with no need for hospital treatment if the correct management is applied. However, the depth, extent or location of a bite wound may sometimes confine treatment to the implementation of specialised surgical procedures that require hospitalisation.

It should be concluded that dog bites result in bite wounds, which are characterised by a significantly higher risk of infection and secondary damage to skin and soft tissues, often leading to skin loss and cosmetic defects, especially if treatment is delayed. The establishment of a uniform model for the management of patients suffering from injuries caused by dog bites is difficult due to the specificity of bite wounds and, on the other hand, because of patients who trivialise their injury and delay visiting a doctor. The risk of infection or disfigurement is very substantial and directly associated with inadequate treatment and wound dressing. Even minor injuries resulting from dog bites should be considered potentially serious. Professional and immediate first aid provided to a patient, and a well-planned treatment procedure eliminates the risk of serious infectious complications and minimises scar formation.

References