REVIEW

Interdisciplinary aspects of possible negative effects of dogs on humans in Bosnia and Herzegovina

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ABSTRACT

The coexistence of humans and dogs, in addition to all positive effects, can result in negative effects on human health. A particular risk is posed by a population of stray dogs, that is, dogs without owners and veterinary supervision. A contact with dogs in addition to bites, carries the risk of viral, bacterial and parasitic zoonoses, and can also cause psychological trauma. Children, the elderly and pregnant women are the categories most susceptible to the negative effects of dogs. The aim of the paper was to make an interdisciplinary analysis of the negative effects of dogs on humans. Dog bites cause wounds and dysfunction of damaged tissue, and often lead to various infections. The risks of rabies and tetanus are particularly significant if proper and timely treatment is not performed. Ongoing training for dog owners can significantly reduce the number of bites inflicted by owned dogs, but stray dogs remain a serious social problem and pose potential health risks of some zoonosis. Timely and adequate management of bite wounds and the use of rabies-post-exposure prophylaxis as well as psycho-therapy, where indicated, significantly reduce possible adverse health effects for patients who have been bitten by dogs.

Key words: canids, bites, risks, epidemiology, zoonosis

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Original submission:
27 April 2020;
Revised submission:
04 May 2020;
Accepted:
08 June 2020
doi: 10.17392/1187-20

Med Glas (Zenica) 2020; 17(2): 246-251

INTRODUCTION

A dog is an animal most commonly found with humans; it is used to such a lifestyle, and it is imperative that people take care of them and their health. In developed countries of the West dogs are common pets that live in flats with their tenants, and they are given full care and attention. In developing and underdeveloped countries, and especially in areas with an armed conflict, dogs are often abandoned by their caregivers. They are known by the name "stray dogs", and they are unwanted, often unhealthy and unvaccinated (1-3). In contact with humans, when looking for food, they often attack in self-defence or defence of their pups. Most often children, the elderly and pregnant women are attacked (4-6).

People are attacked and injured by dogs with owners, as well as by non-owner dogs, in relatively equal measure (3,7,8). In certain cantons of Bosnia and Herzegovina (B&H), between 1996 and 2005, there were as many as 6.9% more dog bites by dogs with owners than by stray dogs (9). Almost half of all registered dog bites occur within the family in which the dog resides (10). Fewer owned dogs attack people in public areas, and most often because of the owners' irresponsible behaviour (11). However, dogs of known owners are more or less under the veterinary control; they are most often vaccinated against rabies, which is not the case with dogs without owners. Owned dogs are fed with adequate dog food, and non-owner dogs tend to seek food among the waste, assuming that stray dogs have a higher quantitative and qualitative representation of microorganisms in the mouth. Because of this, they are considered to be significantly greater carriers of zoonoses to humans and some other diseases to domestic and wild animals, compared to owned dogs (12). Dog bites introduce different microorganisms into the tissue of a bitten person, which in turn can lead to infection (3). The situation is especially serious if there is a risk of tetanus or rabies (13). This is especially important in countries where these diseases are endemic (14,15).

In countries where there is a high population density of stray dogs in big cities, such

as in India, rabies poses a huge problem (15,16). The risk of bites in urban areas from aggressive dogs is high (17).

In addition to the risks of infection, dog bites also cause psychological trauma (18). Dogs without owners do not have secure alimentation, and so are constantly on the lookout for food. They are often infected by the food they eat, as is the case with the consumption of raw meat at slaughterhouses and other places of slaughter of animals (19). Because of that, *Taenia echinococcus* can be introduced into the dogs' bodies and through excretion of its eggs through the faeces, contaminate the environment and be introduced into the human body and cause *Echinococcosis* (20,21). Different types of microorganisms are excreted through dog faeces, which, if not properly disposed of, contaminate the surfaces, posing a risk of them being introduced into the human body and of a set of diseases (22,23). Dogs are reservoirs of leishmaniasis that can be transmitted to humans by phlebotomus causing leishmaniasis (24). Dogs can transmit a range of diseases (e.g. parvovirus, distemper, leptospirosis, rabies etc.) to other dogs, domestic and wild animals (15, 25-28).

The aim of this paper is to point out the negative effects of dogs on humans by analysing interdisciplinary aspects: public health, emergency and forensic medicine, paediatrics, psychiatry and infectiology, and to emphasize the importance of timely treatment in the prevention of particular zoonoses.

EPIDEMIOLOGICAL ASPECT OF CONTAMINATION OF PUBLIC AND ARABLE LAND BY CANINE FAECES AND URINE

Contamination of public areas by dog faeces, urine and hair pose a risk to human health (22,23). The basic parameter for assessing human health risk is the amount of faeces excreted in an area (8,29). The average daily amount of excreted faeces of an adult dog ranges from 340-1000 grams, while the average daily amount of excreted urine is about 40 mL per kilogram of body weight (8,30). Dogs, weighing 15 kg, for example, excrete about 0.6 litres of urine a day (8,30). The estimates correspond to the study of Ma et al. (2020) (31), which states that the daily excretion of faeces in dogs ranges from 21 g to 1074 g, depending on the body weight and breed. The body weight range of the tested dogs was from about 1.72 kg (miniature poodles) to up to 90.7 kg of body weight in large breeds (shepherd dogs) (31).

According to Katica et al. (8), in four cantons of

Bosnia and Herzegovina, a population of 21.800 stray dogs was recorded, meaning that they contaminated public areas daily with about 10.900 kilograms of faeces and 13.080 litres of urine.

In the four cantons surveyed in Bosnia and Herzegovina, there is no reliable information on registered dogs with known owners, and approximate estimates are that there are around 23.000 dogs (8). There are serious assumptions that this number is much higher than estimated and that a significant number of these registered dogs have irregular veterinary health surveillance, or have never had one. Therefore, 23.000 registered dogs daily contaminate with about 11.500 kilograms of faeces and 13.800 litres of urine (8).

Since eggs of *Taenia echinococcus* may be found in the excreted faeces of humans, soil contamination caused by dog excrement is directly related to the occurrence of human echinococcosis (32). Human *echinococcosis* is usually a consequence of soil contamination, contamination of low-growing vegetables and fruits eaten raw, or direct contact with dogs (20). To humans, *echinococcus* eggs are introduced through mouth, contaminated food or contaminated hands, but due to a long incubation period, health effects of this zoonosis can be expected only after a few years (33).

PSYCHOLOGICAL TRAUMA IN BITTEN PERSONS

Dog bites can also include phenomena such as the appearance of intense fear, helplessness or horror, which ultimately often leads to many symptoms of post-traumatic stress disorder (PTSD) (34-36). In paediatric care, this risk to child health is underestimated, since they are the most vulnerable group in this respect (37). The reason of PTSD occurring in some children is unknown. It is evident that it is closely related to the intensity, character and aggressiveness of the animal attack (36). Children who are victims of dog bites often require medical attention, but psychological support is rarely offered (37). In such circumstances, rapid intervention is recommended in order to prevent PTSD. Children who have had violent and/or multiple dog bites often have a heterogeneous developmental disorder characterized by distraction, impulsiveness, irritability and hyperactivity, Attention Deficit Hyperactivity Disorder (ADHD), and they are the patients with particular priority for engagement in appropriate psychotherapy (38,39).

Pregnant women can also become victims of dog bites and suffer considerable emotional trauma, reliving for years the memories of fear and pain caused by an aggressive dog attack (40,41). Although there is no reliable scientific evidence, it is believed that a dog bite trauma can endanger pregnancy and assist in the onset of miscarriage or preterm birth (4). A number of legal norms regulate these issues (42,43). It is known that environmental factors affect emotional, behavioural and cognitive components of foetal development, and that pregnancy stress can have long-lasting effects on offspring neurodevelopment (44). These consequences include a wide range of disorders ranging from emotional distress to cognitive impairment (45). Even the foetal fingerprint pattern is known to change under the influence of prenatal stress resulting from changes in foetal brain development (46). Undoubtedly, the stress hormone cortisol plays an important role in the development of these changes (47).

SURGICAL THERAPEUTIC TREATMENT OF A BITTEN PREGNANT WOMAN

Surgical treatment of a bitten pregnant woman does not deviate significantly from the classic treatment. With additional psychological support, special attention should be paid to the possible development of local and systemic infection from the bite wound due to the specific immune status of the pregnant woman (48). In addition to classic, well-known pathogens, various exotic infections originating from canine oral cavity from visceral leishmaniasis (49), trypanosomiasis (50), to toxoplasmosis (51) have been demonstrated in pregnant women.

A special therapeutic dilemma for many physicians who do not have clinical experience with this issue is the use of post-exposure antiretroviral prophylaxis in pregnant women, in fear of possible adverse effects of the vaccine and immunoglobulin on the foetus (52). Numerous papers have been cited in the literature on the outcome of pregnancies in pregnant women bitten by infected dogs, with and without subsequent anti-rabic prophylaxis (53-55). Evidence-based medicine today takes the view that this concern is unwarranted and that any pregnant woman bitten by a stray dog, whose vaccination status cannot be confirmed, should be treated with an anti-rabies vaccine according to the prescribed protocol (56).

FORENSIC MEDICAL ASPECTS OF DOG BITES

Dog attacks on humans can sometimes result in death (57). Over ten deaths a year in the US are related to dog bites (10,58). Bite wounds (*vulnus morsum*) in humans by dogs are phenomena encountered by forensic experts as well. The forensic importance of bite wounds is that they can easily be mistaken for some mechanical injuries, especially puncture and contusion wounds (59). Dog bites can cause a variety of injuries, ranging from individual injuries to body dismemberment and death, which is extremely rare. Death occurs more often from complications and infections that develop after the bite than from a direct bite (60).

Neck bites represent a particular risk, that is, a possible interruption of the continuity of the carotid artery, which will cause an inevitable death (61). About 78% of dog bites in children occur on the head and neck, which is particularly risky due to the localization of the bite (62,63).

Forensic experts often carry out expert assessments of injuries inflicted on people from bite wounds. The occurrence of the injury and the circumstances of the attacks and bites of dogs are proved in court, using medical records, and the examination of witnesses, eyewitnesses and possibly a police record, if it exists.

In conclusion, dogs and humans live in direct contact. Differently developed countries are dominated by different types of dogs; in developed countries these are pets, and in underdeveloped and developing countries, stray dogs. Dogs pose a potential health risk due to the transmission of zoonoses, especially stray dogs. In preventing the onset of the risk of zoonoses originating from dogs, it is important to adequately remove the faeces and urine of dogs to prevent contamination of public areas. In case of bites, timely and adequate management of *vulnus morsum* by physicians of appropriate specialties, the implementation of rabies-post-exposure prophylaxis, and, if necessary, the inclusion of psycho-therapy are important. This can significantly reduce the adverse health risks for patients who have suffered dog bites.

ACKNOWLEDGMENT

The authors thank dr. Nirves Bulaja, Director of the Cantonal Veterinary Stations of Sarajevo Canton, for technical support and collecting information for registered dogs. The authors are grateful to MA iur. Lejla Suljević for the help provided to perform this work.

FUNDING

No specific funding was received for this study.

TRANSPARENCY DECLARATION

Competing interests: None to declare.

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