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ANIMAL RELATED INJURIES TREATED AT THE DEPARTMENT OF TRAUMA AND EMERGENCY MEDICINE, MEDICAL UNIVERSITY OF LUBLIN

Adam Nogalski[1], Leszek Jankiewicz[1], Grzegorz Ćwik[2], Jerzy Karski[1], Łukasz Matuszewski[1]

[1]Chair of Trauma and Emergency Medicine, Medical University of Lublin, Poland
[2]II Chair and Department of General Surgery, Medical University of Lublin, Poland

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Abstract: Despite urbanization of contemporary society and limitation on the environmental areas, the threat of animal attacks on people is still an important social and medical problem. Although they usually do not have serious consequences, they are nevertheless disturbing and alarming enough to make people seek professional, medical help. The aim of this study was to estimate the epidemiology and the risk rate of animal related injuries in the urban and rural population, as well as to select the characteristics of such injuries, which are distinguishable from injuries caused by other factors. The work presents a retrospective analysis of the medical records of 1,872 patients treated at the Department of Trauma and Emergency Department between 2001-2004, who suffered from animal related injuries. Our analysis led to the following conclusions: Most animal related injuries, reported to doctors, are mild injuries. The threat of animal attack is similar in urban and in rural areas, and concerns mostly men between the ages of 22-40. Injuries caused by large animals, such as a horse or a cow, require hospitalization and should be considered as high-energy injuries. The vast majority were patients who after the treatment could return to their social and occupational activities; the mortality rate in hospitalized patients with animal related injuries was higher then in other injuries, but the difference was statistically irrelevant.

Address for correspondence: Adam Nogalski, Chair of Trauma and Emergency Medicine, Medical University of Lublin, ul. Staszica 16, 20-081 Lublin. E-mail: noad@tlen.pl

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INTRODUCTION

Despite the urbanization of contemporary society and the limitation on environmental areas, the threat of animal attacks is still an important social and medical problem. Various species of domestic animals, and less often wild animals, may still pose a threat to people's health and life. Serious injuries of the body are usually caused by attacks of large animals such as horses, cows, pigs or big dogs. Attacks by small animals usually do not cause injuries requiring hospitalization, but may pose a serious threat because of toxins in their venom or because of transmitting infectious diseases. People living in the country are more exposed to attacks by large animals because of their work in agriculture, but also those living in the city may be attacked by animals, mostly kept as pets, such as dogs, cats, hamsters or guinea pigs, as well as exotic ones such as parrots, turtles, scorpions or iguanas. In recent years, there has been observed an increase in the interest in horsemanship which resulted in a number of accidents caused by horses among city dwellers. A common problem in the city as well as in the country is insect stings. Although they usually do not have serious consequences they are disturbing and alarming enough to make people seek professional medical help. During the summer months, when insects are most active, every day there are a few such cases reported in the

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Emergency Department. Also at this time, people returning from abroad report injuries caused by exotic animals, such as jellyfish burns or sea urchin wounds. People suffering from animal related injuries are a very low percentage of all patients with injuries, but the specific character of these injuries takes a lot of experience and an individual approach to each patient. Every type of injury results in characteristic consequences and causes specific problems for the therapy. Falling off a horse or being battered by a horse or a cow are considered as high-energy injuries, which is connected with the probability of serious injuries, even if there are no obvious symptoms in the beginning. It is only observation and extended diagnostics that can exclude serious injuries in this group of patients. Bite wounds caused by different species of animals are responsible for a much bigger number of bacterial complications and the possibility of transmitting infectious diseases such as rabies, borreliosis or tick fever. Bee and wasp stings may lead to anaphylaxis, which can clinically differ depending on a patient and even pose a threat to the patient's life. The aim of this study was to estimate the epidemiology and the risk rate of animal related injuries in the urban and rural population, as well as to select the characteristics of such injuries, which are distinguishable from injuries caused by other factors.

MATERIAL AND METHODS

The Department of Trauma and Emergency Medicine, Medical University in Lublin, operates in one of six hospitals which provide medical services to 800,000 people in Lublin and several neighbouring villages. 59% of the population are city dwellers, whereas the average in Poland is 61.9%. These departments admit patients over 16 years of age, while the younger ones are treated at the Clinical Children's Hospital in Lublin. Between 2001 and 2004 at the Emergency Department there were treated 67,200 patients with injuries. At the same time, at the Trauma Department there were treated 4,678 patients with injuries who needed hospitalization over 24 hours. In this study, we made a retrospective analysis of the medical records of 1,872 patients with animal related injuries treated at these departments between 2001-2004. The statistics presented in this work deal with injuries caused directly by animals, while those caused indirectly, e.g. road accidents, are not included. The result of the treatment was evaluated at the time of discharge, dividing the patients into 4 categories: I – good treatment results: up to 2 weeks after the patient leaves the hospital they can fully perform all social and occupational activities, II – temporary disability: the patient will be able to perform social and occupational activities between the

Table 1. Structure of patients with injuries treated at the Department of Trauma and at the Emergency Department between 2001-2004.

	Trauma Dpt.	Emergency Dpt.	Total
Number of patients with injuries	4,678	67,200	71,878
Number of patients with animal related injuries (% of all injuries)	51 (1.09%)	1,821 (2.71%)	1,872 (2.60%)

Table 2. Structure of gender and age of patients who suffered from animal related injuries treated in both departments.

Gender/age in years	16-21	22-40	41-64	>65	Total	Statistical analysis	Median age
	n (%)	n (%)	n (%)	n (%)	n (%)		years
Men (% of men)	255 (21.97)	431 (37.12)	348 (29.97)	127 (10.94)	1,161 (62.02)	χ^2=72.2	39.7
Women (% of women)	170 (23.91)	208 (29.26)	156 (21.94)	177 (24.89)	711 (37.98)	p<0.00000001	43.86
Total (% of animal related injuries)	425 (22.70)	639 (34.14)	504 (26.92)	304 (16.24)	1,872 (100)		41.78
	p=0.32	p=0.0004	p=0.0002	p<0.0001	p<0.0001		

Table 3. Treatment of animal related injuries according to animal species and mechanism of injury, including patient's place of residence.

Animal	Mechanism of injury	Hospitalization*	Ambulatory treatment**	All animal related injuries	Rural area	Urban area	Statistical analysis rural to urban area
		n (%)	n (%)	n (%)	n (%)	n (%)	
Dog	Biting, knocking over	11 (21.57)	273 (14.99)	284 (15.17)	110 (38.73)	174 (61.27)	p=0.0004
Horse	Falling,Kicking, biting	9 (17.65)	36 (1.98)	45 (2.40)	22 (48.89)	23 (51.11)	p=0.98
Cat	Biting or scratching	–	254 (13.95)	254 (13.57)	83 (32.68)	171 (67.32)	p<0.0001
Cattle	Attacking with horns, battering	28 (54.90)	70 (3.84)	98 (5.24)	92 (93.88)	6 (6.12)	p<0.0001
Pig	Biting, battering	3 (5.88)	93 (5.11)	96 (5.13)	85 (88.54)	11 (11.46)	p<0.0001
Insects	Stinging	–	894 (49.09)	894 (49.09)	420 (46.98)	474 (53.02)	p=0.07
Other***	Biting, beak prodding	–	201 (11.04)	201 (10.74)	67 (33.33)	134 (66.67)	p<0.0001
Total	–	51 (100)	1,821 (100)	1,872 (100)	879 (46.96)	993 (53.04)	p=0.01

* hospitalization – patients with injuries who needed at least a 24-hour treatment at the Trauma Department. ** ambulatory treatment – patients who after diagnostics and treatment at the Emergency Department were discharged. *** Other animals reported as the cause of injury: rodents (rats, mice, hamsters, rabbits) – 171, foxes – 2, parrots – 3, turkeys – 7, squirrels – 2, fish – 1, iguanas – 2, turtles – 4, sea urchins – 6, jellyfish – 3.

second week and the sixth month after discharge, III – permanent disability: consequences of the injury are permanent and necessitate some limitations or changes in social and occupational activities, IV – patient's death. In this study, there were applied test of homogeneity chi square and coefficient structure test.

RESULTS

The total number of patients with animal related injuries treated at the Department of Trauma and at the Emergency Department, Medical University in Lublin was 1,872, which constitutes 2.6% of all patients with injuries treated.

Between 1 January 2001 – 31 December 2004 at the Trauma Department there were treated 51 patients with animal related injuries 1.09% of all patients with injuries treated. Hospitalization took from 2-68 days, and averaged at 12 days. In the Emergency Department at this time, there were treated 1,821 ambulatory patients with mild animal related injuries – 2.71% of all patients with injuries treated (Tab. 1).

Analysis of the injury rate in each age group (except group 16-21 years of age) showed statistically important differences according to age, gender and persons who suffered from animal related injuries. 62% of all analyzed patients were men. Both men and woman between 22-40 years of age are at higher risk of animal related injury than any other age group. The median age for injured women and men was 43.8 years and 39.7 years, respectively with a range of 17-90 and 16-84, respectively. The median age of all analyzed patients was 41.8 years of age (Tab. 2).

Hospitalization at the Trauma Department was necessary only in 2.7% of all animal related injuries, and concerned only injuries caused by horses (20% of patients) cattle 28.57% of patients) and pigs (3.13% of patients) dogs (3.78% of patients). The total number of hospitalized patients was 51. The majority of injuries caused by animals (97.3% of all animal related injuries) were so mild that after ambulatory treatment at the emergency department the patients were discharged (n=1,821 patients). Insect stings – mainly wasps, bees and ticks – are the vast majority of animal related injuries treated at the Emergency Department. Allergic reactions caused by bee and wasp stings were under control within 24 hours at the Emergency Department. Statistically important differences in animal related injuries between the rural and urban population were as follows: dogs (38.73% vs. 61.27% respectively), cats (32.68% vs. 67.32% respectively), cattle (93.88% vs. 6.12% respectively), pigs (88.54% vs. 11.64% respectively), other animals (33.33% vs. 66.64% respectively). Only horses and insects caused a similar number of injuries in rural and urban populations (Tab. 3).

Analysis of number of body regions and severity of animal related injury in hospitalized patients showed that among 51 patients requiring hospitalization at the Department of Trauma, 39 had isolated injuries and 12 had multiple injuries, which is 23.53% of the patients, whereas only 11.3% of the remaining patients with other injuries had multiple injuries. Multiple injuries percentage in the animal related injuries group is higher than in other injury patients, and the differences are statistically significant (Tab. 4).

In the majority of hospitalized patients, a surgical procedure was necessary; 21 of these patients needed more than one surgical procedure and the total number of surgeries was 135. The most common injuries were caused by horses and cattle, and in this group the percentage of surgical procedures was 92% in those species related injury. The most common surgical procedures were surgical fracture stabilizing and surgical debridement with ablation of necrotic tissue (28.15% and 23.70% respectively) (Tab. 5).

Table 4. Multiple injuries among patients with animal related injuries treated at the Trauma Department, in comparison with those with other injuries.

Type of injury	Isolated injuries of the body n (%)	Multiple injuries of the body n (%)	Total n (%)	Statistical analysis
Animal related injuries	39 (76.47)	12 (23.53)	51 (100)	χ^2=7.4
Other injuries	4,104 (88.70)	523 (11.30)	4,627 (100)	p=0.006
Total	4,143 (88.57)	535 (11.43)	4,678 (100)	

Table 5. Types of surgical procedures applied to patients with animal related injuries.

Type of surgical procedure	Number of surgical procedures	Percentage of the total number of surgeries
Craniotomy	4	2.96
Pleural cavity drainage	18	13.34
Thoracotomy	2	1.48
Laparotomy	25	18.52
Surgical fracture stabilizing	38	28.15
Reconstructing and plastic surgeries of the body integument	16	11.85
Surgical debridement and ablation of necrotic tissue	32	23.70
Total	135	100

Table 6. Treatment results in the analyzed group of patients.

Treatment result	Number of patients	Percentage of patients
Good treatment result	25	49.02
Temporary disability	18	35.29
Permanent disability	5	9.81
Death	3	5.88
Total	51	100

The outcome of treatment estimated at the time of discharge from hospital indicated that the vast majority were these patients who after the treatment could return to their social and occupational activities – 84.31%. Only 5 patients (9.81% of the group) after their discharge had to reduce their everyday activities as their disability was permanent. Three patients died, therefore the death rate was at the level of 5.88% in the analyzed group (Tab. 6), while the death rate among all patients with injuries treated at the Trauma Department was 3.98%, but this difference was statistically irrelevant (p=0.47).

Medical records of hospitalized patients showed also that 14 patients (27.45% of the analyzed group), had infectious complications caused by animal related injuries. These complications were limphangitis, limphadenitis, pyosis of the injury, and in 2 cases general complications (sepsis) developed. All the patients with infectious complications suffered from primary open injuries, while those whose injuries had not been open did not have such complications.

DISCUSSION

Animal attacks on people all over the world result in millions of injuries and hundreds of deaths [1, 5, 7]. These attacks affect both rural and urban dwellers. Many people with less serious injuries do not contact their doctors and these cases are therefore not recorded in the statistics. It is estimated that about 60% of animal attacks result in such mild injuries that the ambulatory treatment is sufficient, or the injured do not call for medical help at all [10]. In this study (Tab. 3), it is stated that 97.3% of animal related injuries are mild injuries which need only ambulatory treatment, and only 2.7% are so serious that they need longer hospitalization. The difference probably comes from great number of insects bites reported in our Department.

Although the animals are usually regarded as "perpetrators" of these attacks on people, it must be noted that in most cases it is the people themselves who are responsible for these accidents because of their inappropriate behaviour, lack of suitable control over the animal, or over their children. The threat to life and health of the patient posed by animal attacks may be a consequence of direct injuries (bites, kicks, battering), or it may be a result of developing wound infections or transmitting infectious zoonoses. Animals may also cause injuries in an indirect way, e.g. by causing road accidents. As there are no relevant statistics concerning such cases, in this study we concentrated only on injuries caused directly by animals.

Epidemiological researches dealing with large populations [7, 10] show a considerably higher risk of receiving animal related injuries, and even of death, among men and the elderly. In our study 62.02% of patients with animal related injuries were men, and only in the age group of over 65 years of ages which indicates the majority of woman which is understandable as women at this age are 72.03% of the age group in Lublin population.

It was also shown that both men and woman between 22-40 years of age form the largest group of patients who had a statistically higher risk of receiving animal related injuries (Tab. 2).

All activities connected with keeping animals may be potentially dangerous, and mostly concerns people whose occupation is connected with animals. The largest group are farmers, but it also includes veterinary surgeons, butchers, zoo and circus workers [16]. Researches conducted by American authors reveal that animals are one of the main causes of injuries in the farming industry, and every year in the USA animal related injuries cause about 40 deaths [2, 10].

Most serious injuries are caused by large animals, such as horses, cows or pigs [2,3]. Our work confirms considerably higher percentage of injuries requiring hospitalization only in cases of horse and cow attacks. Pig attacks, which is in contrast to American research, did not cause more serious injuries than any other animal species.

Horse related injuries often lead to serious injuries of internal organs or serious head, spine and limbs injuries [8]. The analyzed material (Tab. 3) shows that 20% of patients with horse related injuries needed hospitalization. An increase in horsemanship observed in recent years resulted in a bigger number of horse related injuries among city dwellers.

Animal attacks also affect those who through their sport or hobby have contact with animals. In this group (including hunters and anglers) the largest number are injuries caused by bites by dogs, cats or small rodents (kept as pets). Similar observations come from the analysis of the epidemiology of relevant material of our Trauma and Emergency Departments. Detailed statistics concerning injuries carried out in the USA allow estimation of the scale of this occurrence and the threat of dog bites [11, 13, 15]. It is estimated that dog bites constitute about 80% of all animal bites that affect people, about 10% are cat bites, while the remaining 10% are caused by other animals, such as horses, bats, rats, foxes, and others. Animal bites, except for direct injuries, also pose a threat of transmitting zoonoses; every year there are recorded about 50 cases of various zoonoses which cause a few deaths a year [14].

According to American authors, about 20% of injuries caused by dogs lead to the development of wound infections, whereas other injuries do not develop more than 4%. A higher percentage of wound infections, reaching 30%, is characteristic only for cat bites. The authors own observations, confirmed by the data from the literature [4, 6], reveal that there are 2 main factors responsible for such a high percentage of infectious complications. The first is specific flora in the animal saliva, which at the moment of biting infects human tissue. The second factor is tissue ischaemia in the region of the wound, caused by the compressive force of the dog's jaws crushing the soft tissue. In the ischaemic tissue it is more difficult for antibodies carried in the bloodstream to protect the organism against bacteria. It is

also more difficult for antibiotics to reach their therapeutic concentration in the crushed, ischaemic tissue. Another factor which largely contributes to the healing of tear wounds is the patient's general and immunological condition. Elderly people, undernourished, suffering from AIDS, or other forms of immunodeficiency, are much more susceptible to wound infections of clinical importance as well as to generalized infections [9]. Apart from direct injuries, dog bites are connected with the possibility of passing on rabies and also a higher risk of developing tetanus. Insect stings form another group of threats. In the summer months, all people are threatened with insect stings, especially those in the open. Insect stings constitute 49.09% of all animal related injuries treated at the Casualty Department but, although they do not usually have any serious consequences, they are alarming enough for the patients for them to seek medical help. Bee and wasp stings may lead to an anaphylactic reaction, which can develop in various ways and even pose a threat to the patient's life. It is estimated that 0.3-3% of the population may experience an anaphylactic reaction after an insect sting [12]. Any individual with a history of severe reactions to insect stings should be evaluated by an allergist and consider desensitization therapy. Also, such individuals should always carry an insect sting anaphylaxis treatment kit. The allergic reactions caused by bee or wasp stings in the analyzed group of the patients were brought under control within 24 hours at the Casualty Department. Tick bites may lead to borreliosis or tick fever, and therefore these trivial primary injuries need specific treatment in the isolation ward.

Limitations. The basic limitations in this study were that the analyzed group of patients were treated at a single medical centre, which deals with both city and country dwellers, and also due to the lack of information on animal related injuries among children. Therefore, the obtained results are not adequate for the whole population of the Lublin Region and do not reflect the full scale of the problem. Another limitation was the small number of those with serious injuries requiring hospitalization. A detailed estimation of the seriousness of injuries, their complications and consequences, needs research involving several medical centres. The third limitation was the fact that the results of treatment which were remote in time, were estimated on the basis of the examination at the time of discharge from hospital. This could have resulted in some inaccuracies in the number of patients in the III and IV categories of treatment results. Moreover, infectious diseases transmitted by ticks, which could develop later and so influence the final treatment results, were not taken into consideration.

CONCLUSIONS

1. Most animal related injuries are of a minor degree and only need ambulatory treatment and affect mostly men especially in age group between 22-40 years of age.
2. There is a similar risk of animal related injury in the urban and rural areas, and some important differences are connected with the species of animals.
3. Injuries caused by large animals, such as a horse or a cow, are treated as high-energy injuries this is confirmed by a statistically significant higher percentage of hospitalizations, compared with the consequences of other animal attacks.
4. The great majority were patients who after the treatment could return to their social and occupational activities; the mortality rate in hospitalized patients with animal related injuries was higher then in other injuries, but the difference is statistically irrelevant.

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