# Animal-related injuries in hospitalized patients

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**Abstract**

**Introduction:** Injury from animal attacks is an important public health problem with high morbidity and mortality. As we cannot neglect or underestimate these hazardous conditions, we aimed to assess animal-related injuries in Iranian patients and compare the results.

**Methods:** In this cross-sectional study conducted on data from the National Trauma Registry of Iran, trauma patients admitted to the hospital due to animal attacks from January 15, 2018, to November 1, 2021, were assessed. A checklist gathered data consisting of baseline characteristics such as sex, age, activity, place at the time of the attack, and injury site. In addition, we extracted the clinical features of these patients, including injury severity score, Glasgow coma scale, intensive care unit (ICU) admission, hospital length of stay, surgery, and discharge status.

**Results:** One hundred thirty-one patients were registered in the study. Most of the patients were male (80.9%), aged 16 to 44 years (59.5%), and encountered animal attacks when they were in agricultural areas (45%). Ninety-six patients (73.3%) underwent surgery, and three were hospitalized in ICUs. We recorded 172 injuries, consisting of 92 (53.5%) injuries in the upper extremities as the most common region of the body. The males were aged 16-44 years (66%), and the females were aged 45-65 (52%) (P=0.005). Fifty percent of males and 24% of females were injured in the agricultural areas. Moreover, 24% of females and 6.6% of males were injured at home.

**Conclusion:** This study showed a high incidence animal attacks in Iran. Most injuries were in middle aged males and in the agricultural area.

**Keywords:** Animals, Trauma Centers, Wounds, Injuries.

## Introduction

Injuries from animal attacks are a considerable public health problem with high morbidity and mortality rates[1]. Both domestic and wild animals may threaten peoples' lives; it is noteworthy that the injuries caused by wild animals are often severe and lead to higher morbidity and mortality rate [2]. Urbanization [3] and ecosystem change, and humans' encroachment into previously wildlife territory [4] exposed them to the risk of being injured by wild animals [3]. Snakes, dogs, cats, and monkeys are among the most common animals causing animal injuries [5]. Moreover, bull, horse, or large dog attacks induce high-energy trauma resulting in severe morbidity or mortality, especially in humans whose job or place of inhabitant involves large animals [6]. They cause significant hazards of animal-related morbidity

and mortality in men and the elderly who live in urban areas [5]. Besides, it is estimated that the non-fatal injury rate was highest in ≥ 18-year-old adults (1820.6 in 100,000 population) [7].

Diverse mechanisms such as bite, sting, crush, gore, stomp, buck off, fall on, peck, or scratch can cause animal-related injuries [8]. Most injuries are minor and can be managed by ambulatory treatment, and there is no need for medical help. However, various undocumented injuries lead to death before receiving appropriate medical care [9]. Management of both fatal and non-fatal animal injuries can be costly and have a considerable impact on public health [10]. Although clinicians manage minor wounds conservatively through cleaning and debriding, administering prophylactic antibiotics, rapid treatment of developed infections, tetanus vaccination [11], and extensive injuries commonly need surgeries. As a result, clinicians cannot neglect or underestimate these hazardous conditions [9].

Trauma registries are systems that record the characteristics of patients hospitalized with injuries [12-14]. Based on our knowledge, there is a shortage of comprehensive evidence regarding animal attacks in our country [5, 15-17]. Also, there is no previous publication on this issue using the Iranian registries. Therefore, due to the importance of these valuable data from different trauma centers in our country, we aimed to assess the baseline and clinical characteristics of trauma patients admitted to hospitals due to animal attacks and compared the results regarding sex.

## Methods

### Study protocol

In this cross-sectional study conducted on data from the National Trauma Registry of Iran (NTRI), trauma patients admitted to the hospital due to animal attacks were assessed. We included patients hospitalized for ≥24 hours or those who died in the emergency room in <24 hours. Patients transferred from the intensive care unit (ICU) of another hospital to ours and discharged in <24 hours were included as well.

For the current study, we extracted collected data from eight trauma centers in different cities that attended this registry from January 15, 2018, to November 1, 2021. They were Sina (in Tehran), Imam Khomeini (in Urumia), Al-Zahra (in Isfahan), Shahid Rahnamoon (in Yazd), Imam-Hussein (in Shahroud), Taleghani (in Kermanshah), Shohada (in Tabriz) and Beheshti (in Kashan). In the NTRI, trauma patients were considered based on the International Classification of Diseases, 10th Revision (ICD-10) definition. Two trained nurses completed the checklist and entered data in the web-based patient registry software. Three experienced general practitioners assessed the quality of the data as the supervisors.

Data were gathered by a checklist consisting of baseline characteristics, including sex, age, years of school, activity at the time of injury (During exercise, Having fun, At work, Others (e.g., education, cleaning, walking, and physical training), and Unknown), place at the time of the attack (At home, At work or school, In the street, Construction areas, Agricultural areas, and others (e.g., gym, malls, dormitory, prison, sanatorium, and unknown place)), and types of transportation (Ambulance, Private car, Unknown). Additionally, we extracted the following clinical characteristics of these patients: injury severity score (ISS), Glasgow Coma Scale (GCS), intensive care unit (ICU) hospitalization, length of stay (LOS), surgery, and discharge status (Complete/ partial remission, Voluntary Discharge, Leaving the hospital without notification). We defined surgery as attending the operating room and having surgery (including any sutures). As patients might have had single or multiple body region attacks, the injured region was classified into the head, face, neck, thorax, abdomen, spine, upper extremities, and lower extremities. The abbreviated injury scale (AIS) on a six-point scale ranged from one to six and indicated minor, moderate, serious, severe, critical, maximal, and unknown, respectively. Considering this ordinal method, trauma with AIS of equal or more than three indicated severe injuries. The ISS was measured based on AIS and ranged from 1 to 75. It was calculated by the squared value of maximum AIS scores in the three most severely injured regions of the six predefined regions ($ISS = A^2 + B^2 + C^2$ where A, B, and C are the AIS scores of the three most injured ISS body regions) (13). Three trained nurses converted ICD-10 patient codes to AIS codes during the registry.

### Statistical analysis

Normally distributed variables were described by mean ± standard deviation. In the quantitative variables with non-normal distributions, the data were described as the median and interquartile range (IQR). Also, frequency and percent were reported for qualitative variables. The

Mann-Whitney U test was used to compare LOS between males and females. Also, Chi-square and Fisher exact tests were used to compare the nominal and categorical variables between males and females. P<0.05 was considered statistically significant. The analyses were performed using STATA 14.0 (StataCorp LLC, College Station, Texas, USA).

## Results

Results showed that most of the patients were male (80.9%), aged 16 to 44 years of age (59.5%), encountered animal attacks when they were in agricultural areas (45%,) and were transferred by private cars (86.3%). The following results were obtained regarding the frequency of assessed patients in eight centers, including 7 (4.9%) Sina, 8 (5.6%) Imam Khomeini, 1 (0.7%) Al-Zahra, 3 (2.1%) Shahid Rahnamoon, 18 (12.5%) Imam-Hussein, 8 (5.6%) Taleghani, 70 (48.6%) Shohada, and 29 (20.1%) Beheshti. The baseline characteristics of patients were shown in Table 1.

Table 1: Baseline characteristics of trauma patients admitted to hospital due to animal attack, N (%), N=131

|  | N (%) |
|---|---|
| **Sex** | |
| Female | 25 (19.1) |
| Male | 106 (80.9) |
| **Age** | |
| ≤15 | 16 (12.2) |
| 16 to 44 | 78 (59.5) |
| 45 to 65 | 37 (28.2) |
| **Years of school, mean ± SD** | 6.6 ± 5.2 |
| **Activity at the time of injury** | |
| During exercise | 1 (0.8) |
| Having fun | 15 (11.5) |
| At work | 32 (24.4) |
| Others* | 77 (58.8) |
| Unknown | 6 (4.6) |
| **Place at the time of the attack** | |
| At home | 13 (9.9) |
| At work or school | 3 (2.3) |
| In the street | 29 (22.1) |
| Construction areas | 4 (3.1) |
| Agricultural areas | 59 (45.0) |
| Others** | 23 (17.6) |
| **Types of Transportation** | |
| Ambulance | 17 (13.0) |
| Private car | 113 (86.3) |
| Unknown | 1 (0.8) |

*Others: Activities such as education, cleaning, walking, and physical training, **Others: Places such as gym, mall, dormitory, prison, sanatorium, and unknown place

Table 2 demonstrated that the median of ISS and GCS were 1 and 15, respectively. In this study, 3 (2.3%) patients were hospitalized in ICUs. Besides, 96 (73.3%) attended the operating room and underwent surgery (including any sutures). The mean LOS was 5.3 (SD=10.9). The discharged patients had mostly complete/ partial remission (93.1%).

Table 2: Clinical characteristics of trauma patients admitted to the hospital due to animal attack

| | Animal Attack (N=131) |
|---|---|
| **ISS (median ± IQR)** | 1 ± 0 |
| **ISS score N (%)** | |
| 1.00 | 109 (78.4%) |
| 2.00 | 1 (0.7%) |
| 4.00 | 15 (10.8%) |
| 5.00 | 7 (5.0%) |
| 6.00 | 1 (0.7%) |
| 9.00 | 5 (3.6%) |
| 75.00 | 1 (0.7%) |
| **Total** | 139 (100%) |
| **GCS (median ± IQR)** | 15 ± 0 |
| **ICU admission N (%)** | |
| Yes | 3 (2.3) |
| No | 128 (97.7) |
| **LOS (mean ± SD), day** | 5.3 ± 10.9 |
| **Surgery N (%)** | |
| Yes | 96 (73.3) |
| No | 35 (26.7) |
| **Discharge status N (%)** | |
| Complete remission | 122 (93.1) |
| Voluntary Discharge | 8 (4.6) |
| Leaving the hospital without permission | 2 (1.5) |

Results indicated that 172 injuries were recorded from 131 assessed patients. Considering the body region attacked by animals, 92 (53.5%) were in the upper extremities. The severity of AIS in 133 (77.3%) patients was minor (Table 3).

Table 3: Body region and the severity of AIS of trauma patients admitted to hospital due to animal attack

| | Total injuries (N=172) |
|---|---|
| **Body region N (%)** | |
| Head | 3 (1.7) |
| Face | 7 (4.1) |
| Neck | 1 (0.6) |
| Thorax | 5 (2.9) |
| Abdomen | 9 (5.2) |
| Spine | 1 (0.6) |
| Upper extremities | 92 (53.5) |
| Lower extremities | 54 (31.4) |
| **The severity of AIS N (%)** | |
| Minor | 133 (77.3) |
| Moderate | 26 (15.1) |
| Serious | 5 (2.9) |
| Severe | 0 (0.0) |
| Critical | 0 (0.0) |
| Maximal | 1 (0.6) |
| Unknown | 7 (4.1) |

Comparing variables in Table 4 indicated that despite no statistically significant difference between males and females in terms of hospital length of stay, ICU admission, activity at the time of injury, and surgery, there was a statistically significant association between age group and place at the time of the attack with sex. Most male patients were aged 16-44, and females were mostly aged 45-65 (P=0.005). There was a significant statistical association between patterns for the place at the time of attack and sex (P=0.042). Fifty percent of males and 24% of females were injured in the agricultural areas. Moreover, 24% of females and 6.6% of males were injured at home.

Table 4: Comparing variables of trauma patients admitted to hospital due to animal attack by sex, N (%).

| | Male (N= 106) | Female (N=25) | p-value |
|---|---|---|---|
| **LOS, median (IQR), day** | 4.0 (4.0) | 3.5 (4.0) | 0.591[a] |
| **ICU admission** | | | 0.093[b] |
| Yes | 1 (0.9) | 2 (8.0) | |
| No | 105 (99.1) | 23 (92.0) | |
| **Age groups** | | | 0.005[b] |
| ≤15 | 12 (11.3) | 4 (16.0) | |
| 16 to 44 | 70 (66.0)[c] | 8 (32.0) | |
| 45 to 65 | 24 (22.6) | 13 (52.0) | |
| **Activity at the time of injury** | | | 0.074[b] |
| During exercise | 0 (0.0) | 1 (4.0) | |
| Having fun | 12 (11.3) | 3 (12.0) | |
| At work | 30 (28.3) | 2 (8.0) | |
| Others | 59 (55.7) | 18 (72.0) | |
| Unknown | 5 (4.7) | 1 (4.0) | |
| **Place at the time of the attack** | | | 0.042[b] |
| At home | 7 (6.6) | 6 (24.0) | |
| At work or school | 3 (2.8) | 0 (0.0) | |
| In the street | 22 (20.8) | 7 (28.0) | |
| Construction areas | 4 (3.8) | 0 (0.0) | |
| Agricultural areas | 53 (50.0) | 6 (24.0) | |
| others | 17 (16.0) | 6 (24.0) | |
| **Surgery** | | | 0.873[d] |
| Yes | 78 (73.6) | 18 (72.0) | |
| No | 28 (24.4) | 7 (28.0) | |
| a: Mann-Whitney U test | | | |
| b: Fischer's exact test | | | |
| c: Bolds indicate proportions that were significantly different between the two groups at the 0.05 level. | | | |
| d: Chi-square test | | | |

## Discussion

Using the data registry, which compiles numerous data with significant precision [18-20], we aimed to assess the baseline and clinical characteristics of trauma patients admitted to hospitals due to animal attacks. Among 131 admitted patients due to animal attacks, most were male, aged 16 to 44 years, encountered animal attacks in agricultural areas, transferred by private cars, and had upper extremities attacks. Although most patients did not hospitalize in ICUs and had complete/ partial remission, approximately 74 % attended the operating room and underwent surgery (including any sutures). Our results indicated significant statistical differences in age patterns and place of attack regarding sex.

Chalya et al. [11] performed a five-year retrospective investigation on patients admitted to Bugando Medical Centre due to biting injurie. They recruited 98 patients, 55 (56.1%) of them were males. Also, Moini et al. [5] assessed animal-related injuries in 40 subjects (0.2%) among 17753 traumatic patients admitted to eight cities. They found that 25 (62.5%) of the participants were male.  Similar to previous studies [5, 11], the higher rate in males occurred due to their higher outdoor activities, which may expose them to higher animal-related attacks and consequences. Furthermore, a previous study mentioned that most patients were middle-aged males [9]. Eid et al. indicated that among 89 (2.3%) patients from those admitted to Al-Ain Hospital with animal-related injuries, 99% were males, and the median age of the patients was 30 (range= 5-89) [21].

Like our results, Schwab and Powers, who assessed puncture wounds and mammalian bites, noted animals as one of the main reasons for injuries in the farming industry [22]. It can be expected because agricultural areas are common in rural areas. As a result, we can expose to more wild or domestic animals in nature, and it is essential to improve farmers' knowledge regarding this probable threat on farms to abstain from its occurrence. Besides, Lindsay et al., who performed a cross-sectional study on injuries to Scottish farmers, reported that large animals commonly injure farming communities, and approximately 24% of farmers reported livestock-related injuries [23]. Moini et al. assessed the pattern of animal-related injuries in Iran and reported that housewives (n=11) and farmers (n=10) were the most affected groups [5].

Our results demonstrated that the upper and lower extremities were the main body regions affected by injuries.  Similar results obtained by previous descriptive studies [24-25] emphasized the vital role of these regions for animal bites or injuries, which exposed them to the higher rate of animal attack and the probable tendency of animals to traumatize moving body regions, especially feet and hands. Furthermore, Shahan et al. reported the effect of a patient's age on the injury pattern of extensive animal-related injuries requiring hospital admission. They found that very young and short patients had more head injuries [26]. Therefore, it seems that classifying the pattern of injuries based on patients' age and demographic characteristics can add valuable information to the current knowledge.

LOS is another critical variable in trauma patients because long-term hospitalization can be related to an undesirable burden on health resources. In our study, the mean LOS was 5.3 days (Median: 4, IQR: 4), and we had no reported mortality. In line with our results, Eid et al., who performed a similar descriptive investigation in the United Arab Emirates, showed that the median LOS was six days (range= 1-53) with no mortality report [21]. However, Gilyoma et al., who performed their descriptive investigation in Tanzania, a low-income country, noted higher LOS for patients with trauma-related injuries (median: 16 days) [9], which was higher than Moini et al. [5]. They related the higher LOS to the socioeconomic circumstances in Tanzania [8]. They also reported the median ISS as four (range= 1-13) [9], which was certainly higher than ours.

As we mentioned, attending the operating room and undergoing surgery (including any sutures) was required in most of our patients. It was consistent with the previous study, which indicated a high surgery rate in patients hospitalized due to animal attacks. They found that 102 (72.9%) were admitted to the surgical wards, and the remaining 38 (27.1%) were admitted to the intensive care unit (ICU) [9]. These consistent results might be obtained because we both studied hospitalized patients who may require surgical procedures instead of conservative (non-surgical) treatment. Moreover, similar to our results, Moini et al. noted that most patients had remission and were discharged. They found that all patients, except two, had 15/15 GCS [5]. Although Gilyoma et al. reported an excellent overall outcome and the patients were discharged without long-lasting

complications, they detected a 10.2% mortality rate due to severe injuries, tetanus, and shock on admissions [5], contrary to ours with no death. We also mentioned that only three patients were admitted to ICUs, similar to EID et al., who reported ICU admission in three (4.3%) out of 81 patients [21].

## Strengths and limitations

Based on our knowledge, no previous study assessed multicenter and registry data on animal attacks in our country; however, our study had two limitations. We did not have available data on the animal species causing injuries. Injuries differ by geographical region depending on animal type, size, and performance. For instance, the Iranian investigation noticed dog bites and cow-related injuries as the main types [5]. However, Eid et al. mentioned animal kicks, especially by camels, as the principal cause of animal-related injuries [21]. Moreover, despite our promising results on discharge, death, and ICU admission, we cannot neglect our hospital-based data, causing missing data about outpatients.

## Conclusion

Although the results indicated a few ICU admissions in patients confronted with animal attacks, the high number of surgeries emphasized its importance. Moreover, males aged 16 to 44 years working in agricultural areas should consider the related precautions. It is highly recommended to train at-risk populations about these injuries.

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## Conflict of Interest Disclosures

There is no conflict of interest to be declared.

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## Authors' Contributions

All authors met four criteria for authorship contribution based on recommendations of the International Committee of Medical Journal Editors.

## Ethical Statement

Informed consent was obtained from all participants or their guardians. The ethics committee approved this study at the Tehran University of Medical Sciences (Code: IR.TUMS.SINAHOSPITAL.REC.1399.090).

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