

# Hospitalization due to Horse-Related Injuries: Has Anything Changed? A 25 Year Survey

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**ABSTRACT:** **Background:** Horse riding and horse handling are dangerous. There is a lack of knowledge concerning the incidence of hospitalization due to horse-related injuries and types of injuries in Israel. During the last two decades we have observed an increasing incidence of hospitalizations due to horse-related injuries at our medical center as well as the frequent involvement of pediatric patients.

**Objectives:** To investigate these injuries with respect to type, incidence and modes of prevention.

**Methods:** We conducted a retrospective study of medical records for all patients admitted to Assaf Harofeh Medical Center due to horse-related injury between January 1984 and December 2008. A telephone questionnaire was used to complete the data.

**Results:** Eighty-nine subjects (267 injuries) were included in the study. Most of them were not professional horse riders or horse handlers. Helmet use was reported in only 28% of the participants. The number of subjects with horse-related injuries and the percentage of pediatric involvement increased during the study period. Falling from a horse was the most frequent cause of injury (60.67%), followed by being kicked (13.4%). Head and extremities were the most affected areas. On admission, 33.7% had a potential severe injury score. Forty-two participants (47%) had underlying fractures, mostly in the upper extremities. In the pediatric population, 16.2% (vs. 0% adults) rode horses for therapeutic reasons. Seventeen subjects reported having long-term consequences.

**Conclusions:** The findings are similar to those described in other parts of the world. Horseback riding-related injuries are increasing, which emphasizes the need for safety education programs in Israel.

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**KEY WORDS:** equestrian, injury, horse, helmet, fracture

**H**orse-related activities, both recreational and work-related, are common worldwide. In the United States, an estimated 30 million Americans participate in horse-related activities [1]. Despite the dangers involved [2], it is expected that the

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number of horseback riders will continue to rise. During their riding career, approximately one in five horseback riders will suffer a serious injury requiring medical care and, potentially, hospitalization [3]. The hospital admission rate associated with equestrian activity is estimated to be 3.5-fold higher than the admission rate for motorcycle-related injuries [4,5]. In Israel, the precise number of horseback riders or people who deal with horses as part of their job is unclear, but animal-related injuries have increased in the last decade according to a report from the Gertner Institute (Israel National Center for Trauma and Emergency Medicine Research). A 2001 survey of sport injuries among a convenience sample of Israeli athletes did not mention any cases of horse-related injuries [6]. Another work, recently published, examined the clinical significance of ventricular arrhythmias during an exercise test in non-competitive and competitive athletes and found that only 4 of 192 participants were horseback riders [7].

In Israel, there is no formal law requiring that horse riders wear a helmet. According to the National Association for Horseback Riding, which oversees horseback riding sports in Israel, it is obligatory to wear a helmet only in English-style jumping competitions. It is probable that helmets are used on most official farms, as stipulated by insurance companies.

Assaf Harofeh Medical Center, situated in central Israel, treats a heterogenic population that lives in both urban and rural regions. During the last two decades we have observed an increasing incidence of hospitalizations due to horse-related injuries at our medical center and noticed the frequent involvement of pediatric patients. The objective of this study was to investigate these injuries with regard to type, incidence and modes of prevention.

## PATIENTS AND METHODS

A retrospective study of medical records was performed for all patients admitted to Assaf Harofeh Medical Center for horse-related injuries between January 1984 and December 2008. This study was approved by the Institutional Review Board.

Patients were identified using the hospital computerized database. The inclusion injury codes (of the ICD9-CM code system) were as follows: run over by animal, stepped on by an

animal, fallen on by a horse (E906.8), and accident involving an animal (E828.0, E828.2, E828.4, E828.8, E828.9). Patients whose work involved dealing with horses were considered professional and those dealing with them as a hobby were considered non-professional. Pediatric patients were defined as under age 17 and adult patients as 17 or older. Patients injured by a fall, crash, kick or bite while riding horses were included in the study. Injured patients with motor vehicle involvement while riding a horse or a horse-drawn wagon were excluded. Patients who visited the emergency room and were discharged home were also not included. Collected and analyzed data comprised patient details, mode and time of injury, use of protective devices, injury mechanism, clinical features, and investigations on admission, as well as inpatient management and follow-up.

A telephone questionnaire was used to complete data on rider experience, use of protective helmets and presence of a horseback riding guide during the accident. Recognizing long-term effects was another purpose of the telephone call. Protective devices other than helmets were not examined in the current study. The severity of the injury according to the symptoms on admission was measured by the Revised Trauma Score. A score of  $\leq 11$  indicated potentially severe trauma.

Descriptive statistics were used to describe the study population. Fisher's exact test or Pearson's chi-square test were used for categorical variables and Student's *t*-test or the Mann-Whitney test (as appropriate) were used for continuous variables. The level of significance for all analyses was set at  $P < 0.05$ .

## RESULTS

We identified 92 patients over the 25 year study period. Three patients were excluded due to motor vehicle involvement. The remaining 89 patients (71 males, 18 females) comprised the study population. The mean age of the patients was  $20.89 \pm 12.09$  years and they sustained 267 injuries that affected 181 areas of the body. About half the patients were non-professional (53%) and 70% of them reported that an expert guide had not been present at the time of the accident. Helmet use was reported in only 28% of the participants (66% of them were non-professionals), and 80% lived in or near cities. No significant correlations were found between the epidemiological variables (age, gender, residential area). Falling from a horse was the most common cause of injury (60.67%), followed by being kicked (13.4%), trampled on (8.9%), bitten (8.9%), crushed (4.49%), and combined (3.63%). Head and extremities were the area mainly affected, followed by the back, abdomen and chest.

The characteristics of the participants are summarized in Table 1. On admission, the patients had a mean Revised Trauma Score of 11.16 and 33.7% of them had a potentially severe Injury Severity Score. The mean Revised Trauma Score was higher among non-professionals and non-helmet users [Table

**Table 1.** Demographic data of study participants (n=89)

|   |                                       |
|---|---------------------------------------|
| Age (yr) (mean $\pm$ SD)  | 20.89 (12.09)                         |
| <b>Gender</b>   |                                       |
| Male  | 71 (79.8%)                            |
| Female  | 18 (20.2%)                            |
| <b>Residence</b>  |                                       |
| Urban   | 70 (78.7%)                            |
| Rural   | 19 (20.2%)                            |
| <b>Injury mechanism</b>   |                                       |
| Fall  | 60.67%                                |
| Kick  | 13.4%                                 |
| Other   | 25.9%                                 |
| Revised Trauma Score $\leq 11$  | 30 (33.7%)                            |
| Duration of hospitalization (mean $\pm$ SD days)                      | 3.1 (3.3)                             |
| <b>Type of injury:</b> % of patients (% of positive imaging findings) |                                       |
| Soft tissue   | 77.3% (68.1%)                         |
| Head  | 53.9% (15.9%)                         |
| Neck  | 7.9% (14.28%)                         |
| Chest   | 15.7% (57.1%)                         |
| Abdomen   | 19.1% (35.29%)                        |
| Pelvis  | 11.2% (30%)                           |
| Back  | 24.7% (18.1%)                         |
| Upper limb  | 53.9 (22.9%)                          |
| Lower limb  | 37.1 (18.1%)                          |
| Surgical intervention   | 16.85% (93% orthopedic interventions) |
| Readmission   | 11.2%                                 |

**Table 2.** Comparison between severity of trauma, rider experience and helmet use

|                           | All participants | Non-professional | Professional |
|---------------------------|------------------|------------------|--------------|
| Mean Revised Trauma Score | 11.1             | 11.6             | 10.77        |
| Helmet use (%)            | 28               | 33               | 66           |

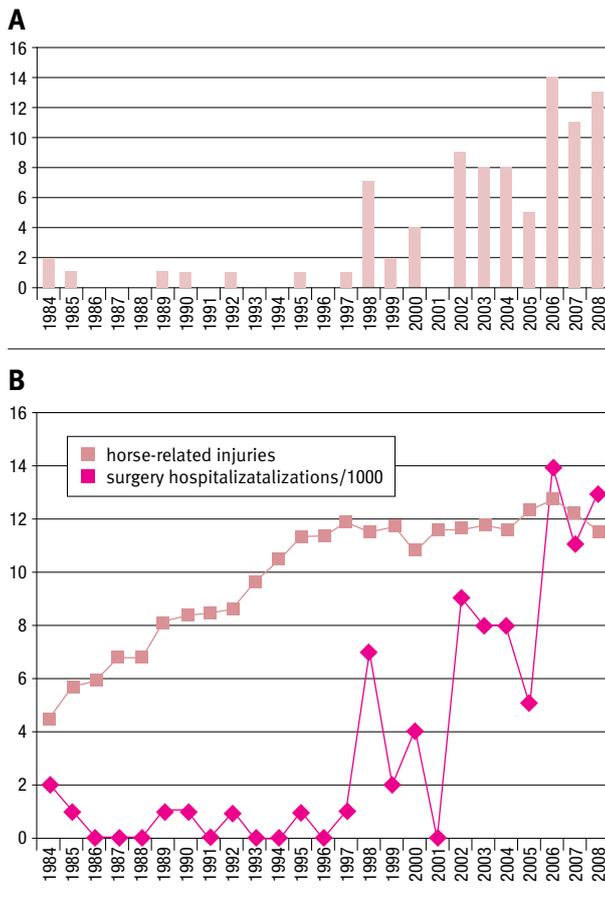
**Table 3.** Distribution of the underlying fractures (n=42)

| Upper limbs | Ribs  | Lower limbs | Skull | Spine | Pelvis | Combined fractures                             |
|-------------|-------|-------------|-------|-------|--------|--|
| 28.6%       | 16.7% | 14.3%       | 12%   | 11.9% | 7.1%   | Skull + upper limbs 7.1%<br>Skull + spine 2.3% |

2]. Forty-two patients (47%) had underlying fractures, mostly in the upper extremities. Table 3 illustrates the distribution of skeletal fractures. Four patients had multiple fractures. No significant change was observed regarding head trauma during the study period ( $P = 0.34$ ).

The yearly distribution of injuries, shown in Figure 1A, demonstrates that the number of patients with horse-related injuries increased. It should be noted that the hospital used the same record-keeping system throughout the indicated period and the geographic area served by the hospital did not change. The trend of hospitalization due to horse-related inju-

**Figure 1. [A]** Yearly distribution of injuries. **[B]** Trend of horse-related injury hospitalizations compared to general surgery hospitalization



ries increased as compared to general surgery and orthopedic hospitalizations [Figure 1B].

Dividing the study period into two (1984–1996 and 1997–2008) reveals an increase in the percentage of pediatric involvement (from 25% to 44%) and a decrease in adult involvement, but no statistical significance was found.

The mean duration of hospitalization was 3.1 days, and the incidence of hospitalization for more than 3 days increased significantly during the study period (25% vs. 39.5% respectively,  $P = 0.032$ ).

Two significant correlations were found between type of injury and patient age. Adult patients were more likely to suffer from fractures and neck trauma than pediatric patients ( $P = 0.034$  and  $P = 0.019$  respectively). No significant correlation was found between genders, but females were more likely to have intracranial injury (50% females vs. 28.6% males) ( $P = 0.098$ ).

Comparing purpose of horseback riding and age, among the pediatric population 16.2% (vs. 0% adults) rode horses for therapeutic reasons due to attention deficit disorder ( $P = 0.004$ ).

The majority of data were taken from the medical files. No mortality rate was recorded for the short-term follow-up. Only 17 subjects agreed to respond to a telephone questionnaire relating to long-term effects of horse-related injuries. Thirteen of them reported long-term sequelae. Statistical analysis of this sample proved to be reliably representative of the entire group. The average period from the injury to the phone call questionnaire ranged from 1 to 4 years. One of the subjects suffered from nasal fractures that subsequently caused respiratory difficulties requiring turbinectomy, one pediatric subject still suffers from anxiety, and another 11 patients reported recurrent pain in the injured body areas. The fact that only 17 (from a total of 89) agreed to respond to a telephone questionnaire relating to the long-term effects of horse-related injuries can be explained by reluctance to remember the accident and the immediate and long-term consequences involved. Nonetheless, this negative attitude had only a minor effect on the final results, as most of the average and long-term effects from our subjects' injuries were actively evaluated during a close ambulatory follow-up.

## DISCUSSION

This survey demonstrates an increase in the incidence and total number of admissions due to horse-related injuries during the period of the study. The rate of hospitalization for more than 3 days due to horse-related injury increased during the study period and the percentage of pediatric involvement was higher. Young patients were more likely to ride horses for therapeutic reasons. Most of the injured patients were non-professional and lived in urban areas. Contrary to what is described in the literature around the world, in our region males were more frequently involved than females and adults suffered more severe injuries than young patients. The majority of study participants did not use protective devices and reported the lack of expert adult care at the accident scene. Falling from the horse was the most common mechanism of injury. One-third of the patients had a severe trauma score and almost half of them suffered from bone fractures. The head and extremities were the most commonly involved body areas. Long-term sequelae were non-specific.

It is important to realize that the incidence reports vary widely among countries, regions, and type of equestrian activities. A recent review of equestrian injuries in the pediatric population puts horse-related injuries as high as 21% of young riders in a given year [8]. The increasing incidence of injured children can be explained partially by the increasing use of riding horses as a therapeutic tool for a variety of indications [9]. Age is also believed to be a relative risk factor, with multiple studies identifying 10–29 years of age as the peak age for injury [10]. In the literature, the female gender has been identified as an independent risk factor for equestrian-related injury, but that may

be biased by the predominance of female riders, particularly at the recreational and amateur levels [11]. In Israel, there are no known statistics on gender differences in equestrian activities, but the current study demonstrated a male predominance. In the future, with expected increasing horse-related activities, we may see a rise in the number of female riders, and consequently a higher incidence of injuries in this specific group.

Falling from a horse was the most common cause of injury in the present study followed by being kicked, trampled, and bitten. A similar incidence of mechanism of injury was reported in the literature, with falling ranging from 60% to 80% of all equestrian injuries [12,10]. The injuries in the present study were relatively severe as could be expected due to the physical characteristics of horses: they are large and fast, often weighing 450 kg or more, and their speed can reach 48 km/hour. When sitting on the horse the rider's head is up to 3 m above the ground. However, even when not mounted on a horse, a person can be seriously injured by a horse kick, which can generate a force of up to 1.8 times its body weight [13].

While the use of protective riding helmets has been associated with a fivefold reduction in head injuries, most studies report that fewer than 40% of riders wore helmets at the time of injury, with numbers as low as 9% [12,14]. Although approved helmet use is becoming more common in the competitive setting, enforcing its use in the recreational and free-style riding setting is still difficult. In addition to headgear, protective equipment needs to focus on the high frequency of injuries involving the upper extremities as well as the torso and abdomen. As demonstrated by the injury patterns reviewed, these sites are injured frequently. Compared with other injury sites, there is a relatively infrequent occurrence of lower extremity injuries [12,15-17]. Another protective measure is the wearing of boots with appropriate heels and often a hard toe, which provide protection while on the ground as well as in the saddle and prevent the rider's foot from slipping through the stirrup, thereby reducing the risk of being dragged in the event of a fall.

Professional riders should set the example and be role models to non-professional riders, providing educational courses on the dangers of horse riding and stressing ways to prevent them. A law mandating the compulsory use of protective helmets, braces and vests when riding a horse should also be passed, since legislation is widely regarded as one of the most powerful tools in injury prevention, when properly enforced.

The long-term outcome of equestrian injuries can be serious and often includes disabilities and handicaps [18]. One study reported that 55% of the injured participants still experienced ongoing physical difficulties as a result of the trauma [14]. Even minor or moderate injuries can cause long-term disabilities, especially in pediatric patients [19].

The limitations of this study include its retrospective nature, the small number of participants, and the lack of some data due to individuals' refusal to collaborate. Another

limitation was the lack of evaluation of protective devices other than helmets.

In conclusion, despite the similarity of our results to those described in the literature, this study is important. As far as we know, this is the first study on horse-related injuries in Israel. Moreover, our findings show that this kind of injury is increasing and that protective measures are rarely used. Studies in the future should focus on safety education and injury prevention to improve the safety of horseback riders.

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