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Horse-Related Injuries in Children: A Review

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ABSTRACT

Horseback riding is an increasingly popular activity among today's youth, providing them with the opportunity to learn responsibility and respect for animals. However, it can also be associated with severe injury, of which many physicians are unaware. In 2002, there were an estimated 13,400 emergency department visits nationwide for horse-related injuries among children younger than 15 years. When using a severity score to compare it with other childhood injuries, equestrian-related injury ranked second only to pedestrians being struck by a car, and had a higher score than all terrain vehicle, bicycle, and passenger motor vehicle crash injuries.

Most serious injuries occur when a rider is thrown from a horse, which is often accompanied by being dragged or crushed by the horse. However, hoof kick injuries to an unmounted child represent about 30% of horse-related injuries and may result in more severe injury. Head injury is the injury most likely to result in hospitalization or death. The effectiveness of helmets in preventing serious head injury in horse-related accidents has been very well established.

Recommendations for the prevention of horse-related injury include requiring helmet use on and near a horse, use of safety stirrups to prevent drag injury, matching rider skill with the appropriate horse, and providing close adult supervision.

INTRODUCTION

In the United States, an estimated 30 million Americans participate in horse-related activities.[1] In fact, many families consider horses not just a hobby but a lifestyle. Children ride horses for recreational, occupational, and competitive purposes. Raising, caring, and riding a horse can provide a child with exercise, self-esteem, and education.

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However, activities with horses have the potential to be quite dangerous. Actor and activist Christopher Reeve's recent death from complications following a spinal cord injury due to falling from a horse brought public awareness to the risk associated with equestrian events.

The inherent danger in these activities is illustrated in the Mexican proverb "It is not enough for a man to know how to ride; he must know how to fall." Children, in particular, are susceptible to injury from riding and even just being near a horse. This is not surprising when one considers that horses can weigh up to 1100 pounds and reach speeds of 40 miles per hour.[2] Horses have their own temperament and can change speed and direction in less than a second. This article will review the known epidemiology and mechanisms of injuries associated with child-horse interactions and discuss strategies for preventing such injuries.

EPIDEMIOLOGY OF INJURY

Multiple studies have attempted to quantify the relative frequency of horse-related injuries. This has been difficult, as many injuries are treated at home and are not brought to medical attention. However, the Centers for Disease Control and Prevention has reported that the rate of injury secondary to equestrian activities is 18.7 per 100,000 people.[3]

In 2002, there were an estimated 13,400 emergency department (ED) visits nationwide for horse-related injuries among children younger than 15 years. This age group accounted for 19% of the ED visits for horse-related injuries.[4] If the 15-24 year age group is included, the percentage of total visits increases to nearly 40%.[5] A study of horseback riders in rural Virginia found the rate of injury in children nearly twice that found in adults, demonstrating 5.6 injuries per 10,000 person-years for children under age 16 compared to 3.9 per 10,000 for those older than 16 years.[2]

Equine-related injuries are more common among female riders. In fact, female riders accounted for 62% of injuries cared for in EDs in 2002.[6] Furthermore, a survey of horseback riders under age 25 found that being

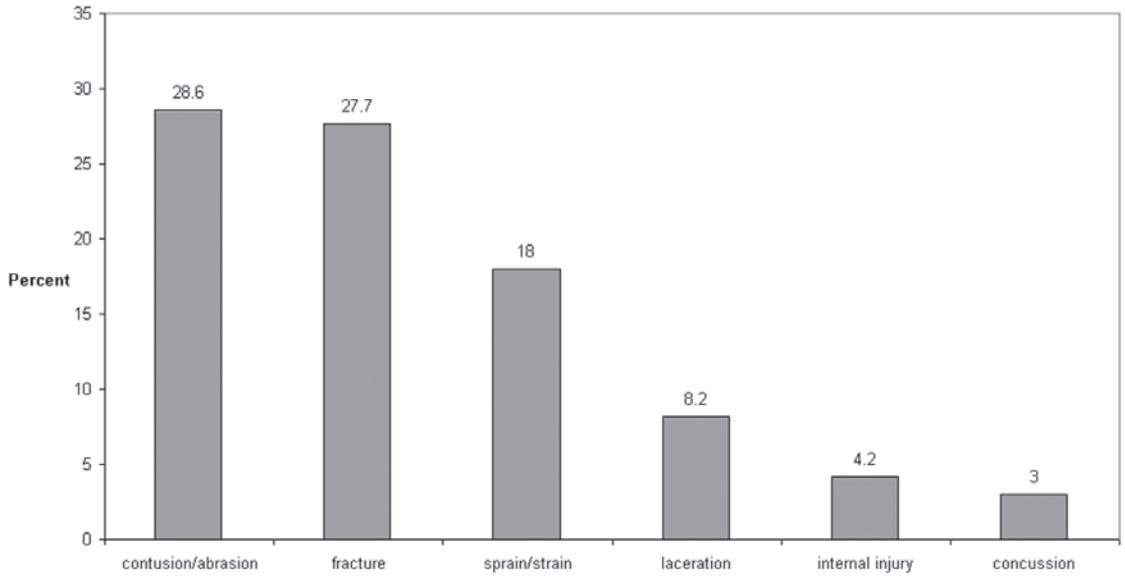

Figure 1. Type of Injury[5]

female is an independent risk factor for injury with an odds ratio (OR) of 1.81. This predilection likely reflects disproportionate participation by girls and women in the sport. The only age group in which males had more injuries than females was <4 years.[7] In this group, the predominance of males may reflect early exploratory behavior that places boys at risk rather than actual participation in the sport. Other risk factors for injury included riding English style (OR=1.77) and riding 15-24 hours per month (OR=2.04).[8]

The most common places horse-related injuries occur are sporting venues, followed by the home, in a public place, and on a farm.[5] The sporting venue provides a valuable opportunity for child advocates and members of the horse riding community to revise regulations to improve safety around horses.

Horse-related injuries can be quite severe. When compared with other childhood injuries using the Modified Injury Severity Scale, equestrian-related injury ranked second only to pedestrians being struck by a car, and scored higher than injuries from all terrain vehicles, bicycles, and passenger motor vehicle crashes.[9]

MECHANISMS OF INJURY

Numerous studies have examined risk factors and mechanisms for equestrian injuries. Ghosh et al examined the records of 315 children hospitalized for horse-related injuries.[7] The majority of serious injuries occur when a rider is thrown from a horse, often accompanied by being dragged or crushed by the horse. It is important to note that more than a third of these severe injuries occurred while the rider was dismounted (Table 1). Activities such as grooming or leading the horse occur while alongside the horse, which may give the rider a lessened sense of danger. However, an individual in this position remains vulnerable to serious injury. Exadaktylos et al note that a hoof kick can deliver over 10,000 Newtons of force to its victim. Over 50% of

Table 1. Mechanism of Injury[7]

	Percent
Rider Initially Mounted	
Fell off	52
Fell off and kicked	4
Fell off and stepped on	4
Fell off and dragged, entrapped or other	5
Rider Dismounted	
Kicked by horse	29
Stepped on by horse	4
Crushed or dragged by horse	2

Table 2. Body Site of Injury[7,13,11,12]

	Percent
Head and face	38
Upper extremity	24
Lower extremity	20
Chest	9
Abdomin	8
Pelvis	4
Neck/cervical spine	4
Back/thoracolumbar spine	8

Percentages exceed 100% due to injuries at multiple locations.

Figure 2. All riders should wear a SEI approved helmet that fits snuggly.

kick injuries involve the head, neck, or face.[10] Kicks often occur when the rider is behind or aside the horse, a time when many riders may not think of the necessity of wearing a helmet. Abu-Zidan et al showed that kick injuries resulted in average hospital stays that were nearly 3 times longer than those from injuries due to a fall.

The most common horse-related injuries among children and young adults seeking care in EDs are contusion/abrasion, fractures, sprain/strain, lacerations, internal injury, and concussion (Figure 1).[5]

The body site involved in injuries related to horses has been delineated in several studies (Table 2). The upper extremity is mainly involved in falls with an outstretched hand and injuries where the hand is entrapped in rope lines, reins, or other horse tack. The lower extremity, particularly the ankle, may become caught in a stirrup after a fall, resulting in ankle injury as well as causing further injury when the rider is dragged behind the horse.

Overall, a majority of serious injuries occur at the head and face, which has important implications for prevention. Head injury is the injury most likely to result in hospitalization or death of a horseback rider. A retrospective chart review of equestrian-related injuries presenting to a Temple, Tex ED found head injury in 12% of the patients admitted to the hospital. Interestingly, this study was done in a population in which most of the riding was done in a work setting or as a non-organized leisure activity. Notably, none of the patients with head injuries were wearing protective headgear.[13]

Head injuries can result in long-term disability. The Oklahoma State Department of Health and the Centers for Disease Control and Prevention analyzed horseback-related traumatic brain injuries (TBI) in Oklahoma from 1992-1994.[14] Only riders who were hospitalized with TBIs were identified by the surveillance system. The study found that of 106 survivors of riding-associated TBIs, 63% experienced loss of consciousness, 46% had post-traumatic amnesia, and 13% had persistent neurologic sequelae upon discharge from the hospital.

Children are at particular risk for head injury given their large head size compared to body mass. The 1997 National Electronic Injury Surveillance System (NEISS) data illustrate this well. Children 0-4 years made up 2.1% of the total horse-related injuries, but had 5.1% of the head injuries. Children 5-14 years also had a greater percent of head injuries than their percent of total injuries would predict (31.1% vs 20.6 %).[5]

The effectiveness of helmets in preventing serious head injury in horse-related accidents has been very well established. Abu-Zidan showed that in patients who had head involvement during a fall, only 5% of helmeted—as opposed to 60% of unhelmeted riders—had brain injury.[15] A study done at the University of Virginia found that riders who wore a helmet were less likely to be hospitalized, had a lower Modified Injury Severity Scale score, and were less likely to have a Glascow Coma Score below 15.[9] In the study of hoof-kick injuries in Switzerland, the head was the most frequent site of injury. All 9 patients who had been kicked in the head had worn helmets and none suffered brain injury.[10] Many of these patients did have maxillofacial injuries, however, and the authors recommended the use of face shields like those used by polo players.

PREVENTION STRATEGIES

Given the growing popularity of horseback riding, physicians should be familiar with strategies to prevent equestrian-related injuries. Anticipatory guidance should be geared toward young riders and their parents at health supervision visits and at visits for acute injuries.

Helmets should be universally recommended for all activities on or near a horse (Figure 2). While many organized riding clubs such as the United States Pony Club require helmets for all activities, this is not universal. According to the National High School Rodeo Association 2003-2004 Rules, Bylaws, and Constitution, helmets may be worn in lieu of western hats in competi-

tion.[16] However, there is no requirement for helmets despite the inherent risks of rodeo events. A 1998 survey of farm households estimated that 2382 youth younger than 20 years experienced horse-related injuries on a farm.[17] Importantly, three-fourths of the injured youth were not wearing a helmet. Specifically, males wore a helmet 9% of the time compared to 16% for females.[17] This population should be targeted for education about the importance of wearing helmets.

Horseback riders should also wear appropriate footwear, consisting of boots or shoes that completely cover the ankle and have a heel. A heel is important in preventing the rider's foot from slipping through the stirrup. Such an incident can result in the rider being dragged behind a horse. Safety stirrup irons should also be universally recommended for all riders (Figure 3). One side of the safety stirrup irons is comprised of a thick rubber band. This quickly releases when pressure is applied to it, allowing a rider's foot to be freed during a fall, preventing entanglement and dragging.

All riders should be instructed never to tie themselves to their horse. The practice of wrapping ropes and reins around the hand can result in many injuries including amputation of fingers and shoulder dislocations, which can occur when a horse pulls or flees from the handler. Horse handlers are generally instructed to keep ropes and reins bunched in a figure 8 pattern and held so that they may be immediately released should the horse pull.

Adequate parental supervision is a must when children are on or near horses. Children should be allowed to mount a horse only when they have the developmental ability to stay firmly seated and adequately control the horse. A rider's skill level and expertise should be matched to the appropriate horse. Children should be warned of horse "danger zones": directly in front and in back where a hoof kick is most likely to land.

There are many valuable resources available for professionals and families of those involved in equestrian activities. The National Children's Center for Rural and Agricultural Health and Safety has a resource packet on horse safety that can be downloaded at http://research.marshfieldclinic.org/children/Resources/Equestrian/FactSheet.htm.

The American Academy of Pediatrics (AAP) recommends several strategies to reduce horseback riding-associated injuries (see Table 3). However, we feel that the evidence supports extending the AAP recommendation for helmet use to all activities on or near a horse, even when not mounted. This includes handling, grooming, and tacking of horses (Figure 4).

The primary care physician can play an important role in preventing serious injury to children involved in equestrian activities by recommending simple, effective measures that allow children to enjoy horses and remain safe.

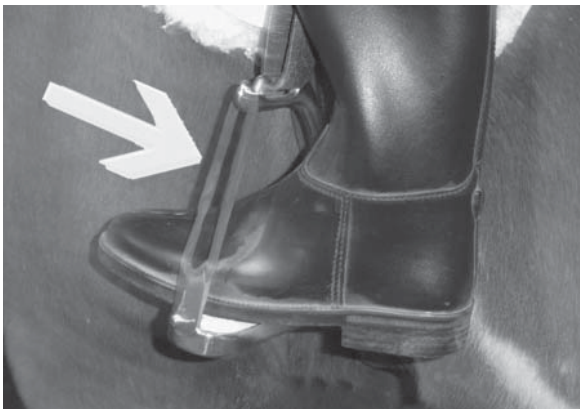

Figure 3. Breakaway stirrups prevent drag injuries. The stirrup has a rubber band (arrow) that will allow the rider's foot to release in the event of a fall.

Table 3. American Academy of Pediatrics recommendations

1. Education programs, such as those offered by the US Pony Club, should be presented to parents, riding instructors, horse show organizers, and managers. Programs should emphasize risks involved in horseback riding and should present methods to minimize them.
2. Parents should be urged to verify that their children are matched with horses based on each child's riding capabilities.
3. Riding activities should be supervised commensurate with the skill level of the rider.
4. Young riders, when mounted, should wear helmets that meet 1988 American Society for Testing and Materials standards and are certified by the Safety Equipment Institute. The helmets should be secured by appropriate chin straps. All organizations and activities (riding schools, horse shows, rodeos, etc.) that promote or sanction horseback riding events should require entrants to use Safety Equipment Institute-certified helmets.

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Figure 4. Helmets should also be worn on the ground during activities such as grooming or handling a horse.

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