Mini Review Article

Horse kick injury mimicking a handle bar injury or a hidden speared injury

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A 16-year-old male was transported to our emergency department after he was kicked in the abdomen by a horse. He was diagnosed with injury of the liver and abdominal rectus muscle, and was cured by observational treatment. An Ichushi search was undertaken to identify articles published from 1983 to 2013 using the key words “horse” and “trauma”. We found 13 cases that described horse-related injuries and summarized these cases, including our case. There were 10 males, three females and one patient of an undescribed sex. The patients ranged in age from 16 to 58 years old, with an average age of 33 years. The injured sites were predominantly the face (mandible) and upper abdomen, indicating that a projecting part of the body may be more likely to be injured. Cardiac rupture, aortic head injury, or lethality induced by a horse kick have not been reported in Japan, but such injuries have been reported in other countries. Ten of 15 cases (67%) required surgical treatment for severe injuries. Horse kick injuries tend to be severe, because the transfer of energy from the end of the hoof, with a small cross-sectional area, to a small field, leads to internal organic injuries that are more severe than predicted, similar to a handlebar injury. Accordingly, we advocate the close observation of patients with horse kick injuries, which may be regarded as being similar to blunt stab wounds or hidden speared injuries.

Key words: Handle bar injury, hidden speared injury, horse kick injury, liver injury, observation

INTRODUCTION

INJURIES CAUSED BY horses are rare.^{1,2} Most cases are injuries due to a fall from a running horse, which is equivalent to a high energy accident. The other mechanisms of injuries include those due to a kick or bite, or being dragged.^{1–5} We herein present a rare case of injury induced by a horse kick and a review of published reports.

CASE

A 16-YEAR-OLD MALE WAS kicked in the abdomen by a horse when he performed warm-up exercises prior to participating in an equestrian event. He was transported to Numazu City Hospital by a helicopter emergency medical service due to severe abdominal pain. He had asthma and was being treated with fluticasone/salmeterol. On arrival, he was alert with a blood pressure of 150/94 mmHg, a heart rate

of 72 b.p.m., a 99% SpO₂ under room air, and a body temperature of 37.4°C. He had right hypochondrial pain, a scabbing wound induced by the horse kick (Fig. 1), and tenderness without peritoneal irritation signs.

Other findings were: white blood cell count, 16,500/μL; hemoglobin, 11.5 g/dL; platelets, 43.0 × 10⁴/μL; total protein, 7.2 g/dL; aspartate aminotransferase, 181 IU/L; alanine aminotransferase, 144 IU/L; glucose, 98 mg/dL; blood urea nitrogen, 14.7 mg/dL; creatinine, 0.75 mg/dL; sodium, 143 mEq/L; potassium, 4.5 mEq/L; chloride, 103 mEq/L; creatine phosphokinase, 343 IU/L; C-reactive protein, <0.1 mg/dL; and troponin T, negative. A urinary occult blood examination was negative. An electrocardiogram was also negative for abnormalities.

An abdominal echo revealed a highly echoic area at segments 5 and 8 of the liver, with fluid retention at the rectovesical pouch (Fig. 2). His hepatic lesion corresponded to a type IIIa hepatic injury according to the classification of the Japanese Association for the Surgery of Trauma. A plain trunk computed tomography scan also showed the same lesion. He was diagnosed with injury of the liver and abdominal rectus muscle, and was admitted to the hospital for observation and fasting because his vital signs were stable. His symptoms and signs improved day by day, and a

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repeated abdominal echo showed decreasing fluid at the rectovesical pouch. After confirming decreases in the aspartate aminotransferase and alanine aminotransferase levels, he was discharged to home.

DISCUSSION

AN ICHUSHI SEARCH (Japana Centra Revuo Medicina), which collects summaries of Japanese medical articles, was undertaken to identify articles published between 1983 and 2013 using the key words “horse” and

Fig. 1. Abdominal appearance on arrival of a 16-year-old male patient who was kicked in the abdomen by a horse. The patient had a scabbing wound induced by the horse kick.

“trauma”. We found eight articles and two abstracts, including 13 cases that described horse-related injuries.^{5–15} We summarized these cases, including our present case, in Table 1. The patients included 10 males, three females, and one of undescribed sex. They ranged in age from 16 to 58 years, with an average age of 33 years. The injured sites were predominantly the face (mandible) and upper abdomen. One case was injured by a front hoof,⁸ but most cases were induced by kicks from the rear legs. A projecting part of the body may be more likely to be injured, because the rear legs of a horse kick upward.

Our search of published work using the key words “horse” and “kick” on PubMed identified 48 reports; of these, 34 reported treatment of humans and 14 reported treatment of horse injuries. Of the 34 reports of humans, one treated a patient with an ovarian tumor who had a past history of a horse kick injury that was not related to the ovarian tumor. Among the 33 human reports of a horse kick injury, 20 were case reports, while the other 13 included one prospective study, seven retrospective studies, three surveys using questionnaires, and two reviews.^{4,16–47} The case reports are summarized in Table 2,^{16–35} and all reports other than case reports are summarized in Table 3.^{4,36–47} Cardiac rupture and/or lethal head injuries induced by horse kicks have not been previously reported in Japan, although these injuries have been documented in other countries.^{18,37}

In a case report concerning hepatic injury, Horwitz *et al.* reported the successful treatment of an 8-year-old male with a devitalized right lobe of the liver and avulsion of the right hepatic vein using venovenous bypass to obtain a stabilized circulation and bloodless operative field.³⁵ Balakrishnan *et al.* reported 20 cases of hepatic injury induced by horse kicks or falls from horses.³⁶ All patients had right-sided rib

Fig. 2. Results of abdominal ultrasound on arrival of a 16-year-old male patient who was kicked in the abdomen by a horse. The scan revealed a high-echoic area at segments 5 and 8 of the liver (the left side, arrowed), with fluid retention at the rectovesical pouch (the right side, arrowed).

Table 1. Summary of horse kick injuries reported in Japan

Ref.	Age, years	Sex	Injured site	Treatment
6	20s	M	Rupture of the small intestine	Surgical repair
6	60s	F	Liver injury	Observation
6	30s	M	Rupture of the small intestine	Surgical repair
7	20	M	Mandibular fracture	Internal fixation
7	ND	ND	Maxillary fracture	ND
8	37	F	Mandibular fracture, neck sprain	Intermaxillary anchorage
9	29	M	Pancreatic injury	Letton–Wilson procedure
10	54	M	Pancreatic injury	Necrotomy and drainage
11	28	M	Rupture of the duodenum	Surgical repair
12	37	M	Rupture of the duodenum	Surgical repair
13	23	M	Ascending colon injury	Surgical repair
14	20	F	Mandibular and cervical fractures	Internal fixation
15	58	M	Paniculitis	Surgical removal
Present	16	M	Liver injury	Observation

F, female; M, male; ND, not described; Ref., reference number.

Table 2. Published case reports of horse kick injuries

No.	Lead Reporter	Patient age, years	Sex	Diagnosis	Outcome
1	Sarin	43	M	Blunt aortic rupture	Survived
2	Gorman	43	F	Right ventricular rupture	Survived
3	Ebert	13	F	Left ventricular rupture	Death
4	Alami	35	M	Right atrial rupture	Survived
5	Skene	47	F	Pericardial effusion	Survived
6	Byrne	63	M	Tricuspid regurgitation and right-to-left intra-atrial shunt	Survived
7	Tatabe	22	M	Tricuspid insufficiency	Survived
8	Knobloch	29	F	Tricuspid insufficiency	Survived
9	Benitez	47	M	Complete heart block	Survived
10	Pérez de Juan Romero	21	M	Myocardial infarction	Survived
11	Ogawa	56	M	Cranial penetration injury	Survived
12	Downar	49	F	Streptococcal meningitis after head trauma	Survived
13	Martins	45	M	Dentoalveolar and mandibular body fractures	Survived
14	Kannan	42	M	Facial injury	Survived
15	Andratschke	ND	ND	Arteriovenous fistula of the orbit	Survived
16	Freitas	6	M	Multiple avulsions of deciduous teeth	Survived
17	Steinhorst	12	F	Orbital fractures and blunt eye trauma	Survived
18	Lodder	34	F	Rupture of the thyroid gland	Survived
19	Méndez-Gallart	8	M	Duodenal rupture	Survived
20	Horwitz	8	M	Major hepatic injury	Survived

F, female; M, male; ND, not described in abstract.

Table 3. Published reports of horse-related injuries including kicks, excluding case reports

No.	Lead Reporter	Design	Total no. of patients	Average patient age, years	Range of patients' ages, years	Sex (%male)	Mortality, n (%)	Subject	Main results
1	Balakrishnan	Retrospective	20	22	5–48	2 (10)	0 (0.0)	Liver trauma after falling from or being kicked; treated in the regional hepatopancreatobiliary unit at a tertiary referral center	Only 2 patients required laparotomy and liver resection, remaining 18 were successfully managed conservatively, early CT imaging is advised
2	Carmichael	Retrospective	284	37.2	ND	145 (51)	3 (1.0)	Horse-related injuries in a single Level I trauma center	Most injuries occurred due to falling off while riding (54%) or kick (22%) Extremity fracture (33%) and head injury (27%) Mounted equestrians more commonly incurred injury to the chest and lower extremity Unmounted equestrians incurred injury to the face and abdomen Head trauma frequency was equal between mounted and unmounted equestrians
3	Zhang	Retrospective	149	ND	5–65	91 (61.0)	ND	Cranio-facial injuries caused by animals in southern-central part of China	3 deaths, 2 of which were due to severe head injury from a kick Bite was the predominant mechanism of injury, followed by kick, fall, trample, knock, and scratch
4	Eckert	Prospective	24	22.6	7–34	2 (8.3)	0 (0.0)	Equestrian injuries caused by horse kicks; multicenter study including 9 trauma centers in Hamburg, Germany	All accidents (100%) occurred while the equestrians were handling or grooming the horse 16 riders (66.7%) suffered orbital, midface, or mandible fractures; 8 riders (33.3%) had injuries on other parts of the body
5	Kiuru	Retrospective	46	30	16–55	3 (6.5)	1 (2.1)	Horse-riding accidents treated in a single Level I trauma center	Falling off a horse (72%), horse kick (11%), and crushing injury caused by a falling horse (13%) 5 head, 3 facial, 13 spine, 5 body, 2 pelvic, and 3 lower extremity trauma. Multiple injuries were seen in 5 (11%) patients. In 21 patients (46%) multi-slice CT examination was normal In 1 patient the injuries were lethal (head trauma)
6	Exadaktylos	Retrospective	17	36	16–74	6 (35.2)	0 (0.0)	Horse kick injury in Switzerland	8 of 17 patients sustained contusions of the extremities, the back, and the trunk. In 9 patients an isolated facial injury was diagnosed The equestrian community may underestimate the risk of severe injuries attributable to hoof kicks, especially while handling the horse

Table 3. *continued*

No.	Reporter	Design	Total no. of patients	Average patient age, years	Range of patients' ages, years	Sex (%male)	Mortality, n (%)	Subject	Main results
7	Costa	Retrospective	1 (13)	<3	ND	ND	ND	Ventricular assist devices in pediatric cardiac surgery	Cardiac trauma induced by horse kick
8	Busch	Retrospective	11(134)	ND	ND	ND	0	Blunt bovine and equine trauma treated in a single Level II trauma center	Fall from horse in 45 patients, animal assault in 42, animal kick in 39, and animal-drawn vehicle in 8
9	Meredith	Questionnaire	ND	ND	ND	ND	ND	Horse-related facial injuries in riding school	Falls were perceived to be the most common cause of facial injury (41%), ahead of horse kicks (9%)
10	Jäggin	Questionnaire	ND	ND	ND	ND	ND	Questionnaires to 700 veterinary practitioners concerning horse kick injury	Severe injuries incurred by veterinarians in recent years were few
11	Giebel	Questionnaire	155	ND	ND	ND	1 (0.6)	Equestrian accidents in children younger than 16 years in Germany	The typical patient profile was that of young female equestrian with little experience and little weekly riding practice, without practicing falling exercises and warming up, often using different horses
12	Bury	Review	ND	ND	ND	ND	ND	Animal-related fatalities	Falling of the horse (64.9%) and falling with the horse (5.7%) were accidents of special significance. Kick by horse's hoof (11.8%), being stepped by horse (3.8%), horsebite (7.3%) and injuries of the horse's bridle had their own patterns of injuries. Injuries of the distal parts of the upper extremity are preeminent in falling of the horse, whilst in falling with the horse head injuries and shoulder injuries are preeminent. Remarkably often horse-kicks were causing dangerous head injuries (41.6%). One fatal accident happened in handling a horse
13	Jagodziniski	Review	ND	ND	ND	ND	ND	Horse-related injuries in children	Blunt force injuries characteristically involve larger animals such as cattle or horses that may kick, crush, or trample a victim causing head and facial injuries
ND, not described.									

fractures, and computed tomography indicated laceration of the liver in 12 patients, contusion in three patients, and subcapsular hematoma in two patients. Only two patients required laparotomy and liver resection; the remaining 18 were successfully managed conservatively, similar to the present case.

Carmichael *et al.* reported the largest series (284 cases) of horse-related injuries to date.³⁷ In that report, most injuries occurred due to falling off while riding (54%) or sustaining a kick from the horse (22%), resulting in extremity fractures (33%) and head injury (27%). Mounted equestrians more commonly incurred injury to the chest and lower extremities, whereas unmounted equestrians received injuries to the face and abdomen, primarily due to horse kicks, similar to the above Japanese series. There were three deaths, two of which were the result of severe head injuries from kicks.

One of the reasons for this is that horse kick injuries tend to be severe, because the transfer of energy from the end of the hoof, with a small cross-sectional area, to a small field, leads to internal organ injuries that are more severe than predicted, similar to a handlebar injury.^{48,49} Accordingly, we advocate the close observation of patients with horse kick injuries, which may be regarded as being similar to blunt stab wounds or hidden speared injuries.

CONFLICT OF INTEREST

NONE.

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