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Head, face and neck camel-related injuries: Biomechanics and severity

Mohamed A. Al-Ali[a,b], Ashraf F. Hefny[a,c,*], Fikri M. Abu-Zidan[a,c]

[a] Department of Surgery, College of Medicine and Health Sciences, UAE University, Al Ain, Abu Dhabi, United Arab Emirates
[b] Department of Otolaryngology, Al Ain Hospital, Al Ain, Abu Dhabi, United Arab Emirates
[c] Department of Surgery, Al Ain Hospital, Al Ain, Abu Dhabi, United Arab Emirates

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ABSTRACT

Introduction: Large animal-related human injuries are associated with high morbidity and mortality. There are no studies on biomechanics of the camel-related head, face, and neck (HFN) injuries. We aimed to study the mechanism, anatomical distribution and severity of camel-related HFN injuries.
Methods: We analyzed our prospectively collected data of patients who were admitted to Al Ain Hospital with camel-related HFN injury during the period of October 2001 to January 2010.
Results: Seventy-three patients were studied; all were males having a median (range) age of 28 (5–89) years. Camel kick was the most common mechanism of injury (45%) followed by falling from a camel (22%). Facial fractures were significantly more common in patients who were kicked by a camel. Severe head injuries were significantly more in patients who fell from a camel or who had a car collision with a camel. Car collision with a camel was significantly associated with lower cervical spine fractures ($p = 0.017$) and severe cervical spine injuries ($p = 0.004$). Two patients died (overall mortality 3%)
Conclusions: Our study provides an insight into the complex biomechanics and severity of camel-related HFN injuries. It is essential to adopt protective measures in our community so as to reduce camel-related HFN injuries.

Introduction

Large animal-related human injuries are associated with high morbidity and mortality. They are caused by various mechanisms including kicks, bites, falls, and road traffic collisions [1].

Camels are a dependable source of transport, milk, and food, in many areas of Asia and Africa. Camel racing attracts a huge number of spectators in United Arab Emirates (UAE). There are more than 300,000 registed camels in Dubai [2]. The camel weighs up to 600 kg having its shoulders at 2 m high [3]. Male camels become more aggressive during their rutting season and tend to bite [4]. Injured patients are usually camel caregivers. Nevertheless, camel riders and bystanders can also be injured. More than 80% of animal-related injuries in the UAE are caused by camels with kicks being the most common mechanism of injury [5]. Horse-related injuries have been extensively studied compared with few studies on camel-related injuries [6–8]. Although the head, face, and neck (HFN) are small body regions, yet they sustain more frequent and severe injuries [1,8]. We are not aware of any study investigating the biomechanics of camel-related HFN injuries. We aimed to study the mechanism, anatomical distribution and severity of camel-related HFN injuries.

Patients and methods

Ethical approval for this study was obtained from the local ethics committee of the Al Ain Health District Area, Al Ain, UAE (UAE RECA/02/44). Specific written informed consents were taken from the two patients who agreed to publish their clincial images in this manuscript.

We retrospectively analyzed our prospectively collected data of all patients who were admitted to Al Ain Hospital with a camel-related HFN injury during the period of October 2001 to January 2010. Al-Ain Hospital is a university-affiliated hospital having trauma and acute care facilities. It is located in Al Ain City which has a population of 738,000 inhabitants [9].

This study is a post hoc analysis of a subgroup of 73 patients who were part of a prospective cohort study of 212 camel-related injuried patients [1]. It includes an in-depth analysis of the biomechanics of camel-related HFN injuries. The overlap with the other paper is minor. Studied variables included demography, vital signs and Glasgow Coma Score (GCS) on admission, mechanism of injury, anatomical location and severity of injury, associated injuries, hospital stay, and patient outcome. A special protocol was designed to study the details of HNF injuries. Head injuries were

* Corresponding author at: Department of Surgery, College of Medicine and Health Sciences, UAE University, P O Box 18532, Al-Ain, United Arab Emirates.
E-mail address: ahefny@uaeu.ac.ae (A.F. Hefny).

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classified into soft tissue injury, concussion, skull fracture, and intracranial injury (intracranial hemorrhage, brain contusion, and laceration). Face injuires were classified into soft tissue and facial bone fracture. Neck injuries were classified into skin and subcutaneous tissue, neurovascular, and cervical spine injury.

The severity of the injury of an anatomical region was assessed by the Abbreviated Injury Severity Score (AIS). Injury severity was assessed using the New Injury Severity Score (NISS). Both were calculated manually using the AIS 2008 handbook [10]. Collected data were entered into a Microsoft Excel spreadsheet (Microsoft Corporation, Seattle, WA) and analyzed using the PASW Statistics 24 software (SPSS Inc, Chicago, IL, USA). The nonparametric statistical methods which were used for comparison between independent groups included Kruskal-Wallis test for continuous/ordinal data and Fisher's exact test for categorical data. A p value of less than 0.05 was accepted as significant.

Results

Seventy-three patients were studied; all were males. Their median (range) age was 28 (5–89) years. 79% of them were from the Indian subcontinent (Table 1). Kick by a camel was the most common mechanism of injury (45%) (Table 2). The median (range) NISS was 5 (1–35), and the median (range) GCS was 14 (3–15). The upper limb was the most common injured region (15%) followed by the chest (11%) (Table 3). Facial bone fractures were significantly more in patients who were kicked by camels (Table 4, Fig. 1). Mid-facial fractures were 49% of all facial bone fractures (Table 5). Four patients had bilateral mandibular fractures (4/9) (Fig. 2). Severe head injury and head concussions were significantly more in falls from camels and road traffic collisions (Table 6). Camel bites had significantly more frequent and severe cervical soft tissue and neurovascular injuries (Tables 4 and 6). Motor vehicle collisions with camels were significantly associated with more frequent and severe cervical spine fractures (Tables 4 and 6). All cervical spine fractures (in six patients) were low (C5-C7).

Patients stayed for a median (range) of 11 (1–103) days in the hospital. Nine patients (12%) were admitted to the Intensive Care Unit (ICU). One patient had quadriplegia following a camel bite to the neck. Two patients died (overall mortality 3%), the first patient had a carotid artery injury which was complicated by a massive brain infarction following a camel bite to his neck. The second patient was involved in a motor vehicle collision with a camel. He had severe head and cervical spine injuries.

Discussion

Our study has shown that camel kick was the most common mechanism of camel-related human HFN injuries. Severe head injuries were more common in those who fell from camels while road traffic collisions with camels were associated with severe lower cervical spine injuries. Majority of our patients were males from the Indian subcontinent who work as camel caregivers [11]. The small number of children in our study was due to the fact that children in the UAE were banned from riding as camel jockeys and were replaced by robotic jockeys [12].

The incidence of facial bone fractures was significantly higher for camel kicks compared with other mechanisms [7,8,13]. Most facial bone fractures involved the mid-facial bones (49%), including the zygomatic bone. Mandibular fractures were common and 44% were bilateral. The large surface of the camel hooves can cause these injuries.

Head injury is a major cause of death following large animal-related injuries [6,8,13]. They were more common in our patients who fell from a camel or who had a motor vehicle collision with a camel. When hit by a motor vehicle, the camel may fall on the vehicle roof injuring the head and neck of the vehicle occupants [14].

During the breeding season (December to March) male camels become aggressive and tend to bite [11]. Using their sharp canine teeth and strong jaws, camels can efficiently grip their victims, lift them up, and shake them with a jerky movement. Although the wounds of camel bites look superficial, they are penetrating and can injure deep structures [4,11]. Cervical neurovascular injuries were severe in patients who were bitten in their neck incluing carotid artery and spinal cord injuries. Flexion/axial compression cervical spine fractures of vehicle occupants may occur if a vehicle collides with a camel [15]. The high incidence of lower cervical spine injuries in our adult patients was reported by others [14]. The fulcrum of movement is at C5-C6 in adults compared with C2-C3 in young children [16].

Injury prevention of camel-related injuries should be promoted. Helmets and face guards can reduce the severity of head and face injuries. Educating non expert camel caregivers and bystanders about the aggressive camel behavior during rutting and covering its mouth with a muzzle can prevent camel bites [1,4].

Table 1
Nationalities of 73 patients who had head, face, and neck camel-related injuries, and were admitted to Al Ain Hospital during the period of October 2001 to January 2010.

Nationality	Number (%)
Pakistani	33 (45 %)
Bangladeshi	16 (22 %)
Indian	9 (12 %)
Emirati	6 (8 %)
Sudanese	3 (4 %)
Mauritanian	3 (4 %)

Table 2
Primary mechanism of injury of 73 patients who had head, face, and neck camel-related injuries, and were admitted to Al Ain Hospital during the period of October 2001 to January 2010.

Mechanism	Number (%)
Camel kick	33 (45 %)
Fall from a camel	16 (22 %)
Camel bite	11 (15 %)
Camel-car collision	7 (10 %)
Others	6 (8 %)

Table 3
Anatomical distribution of other injuries of 73 patients who had head, face, and neck camel-related injuries, and were admitted to Al Ain Hospital during the period of October 2001 to January 2010.

Anatomical region	Number	%
Face	46	63
Head	36	49
Neck	9	12
Upper Limb	11	15
Chest	8	11
Abdomen	3	4
Pelvis	1	1
Spine	6	8
Lower Limb	4	5

Table 4
Comparison of anatomical region of injury by mechanism of injury of 73 patients who had head, face, and neck camel-related injuries, and were admitted to Al Ain Hospital during the period of October 2001 to January 2010.

Injury	Kick (n = 33)	Fall (n = 16)	Bite (n = 11)	Car collision (n = 7)	Others (n = 6)	p value
Facial soft tissue	17 (52 %)	8 (50 %)	6 (55 %)	3 (43 %)	1 (17 %)	0.62
Facial fracture	18 (55 %)	2 (13 %)	3 (27 %)	1 (14 %)	1 (17 %)	0.021
Scalp injury	5 (15 %)	2 (13 %)	1 (9 %)	3 (43 %)	2 (33 %)	0.28
Concussion	5 (15 %)	7 (44 %)	0 (0 %)	5 (71 %)	2 (33 %)	0.002
Skull fracture	8 (42 %)	1 (6 %)	0 (0 %)	2 (29 %)	0 (0%)	0.14
Intracranial	2 (6 %)	3 (19 %)	0 (0 %)	1 (14 %)	0 (0 %)	0.37
Neck soft tissue	2 (6 %)	0 (0 %)	5 (45 %)	0 (0 %)	0 (0 %)	0.005
Neck neurovascular	0 (0 %)	0 (0 %)	2 (18 %)	0 (0 %)	2 (33)	0.004
C-spine fracture	0 (0 %)	1 (6 %)	2 (18 %)	2 (29 %)	1 (17 %)	0.017

Data are presented as number (%), p value = Fisher's Exact test.

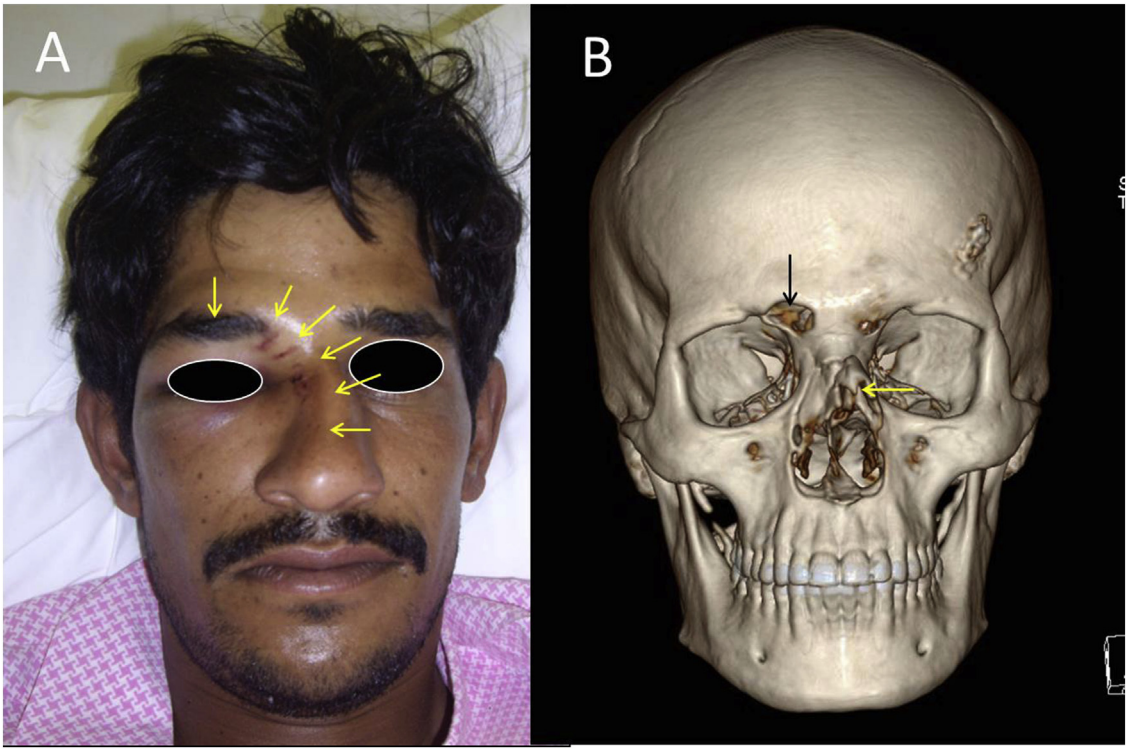

Fig. 1. A 25-year old camel caregiver was kicked by the knee of a camel into his right eye (A). The nose was deviated to the left side. The margins of the knee of the camel (yellow arrows) have imprinted the right orbit. CT scan of the skull (B) showed a fracture of the right frontal sinus (black arrow) and multiple nasal fractures (yellow arrow) associated with nasal deviation. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

Table 5
Number (%) of facial bone fracture sites (35) caused by camel kicks among patients who had head, face, and neck camel-related injuries, and were admitted to Al Ain Hospital during the period of October 2001 to January 2010.

Fracture site	Number (n = 35)	%
Mandible	7	20
Zygoma	6	17
Maxilla	5	14
Nasal bone	3	9
Orbital floor	3	9
Orbital roof	1	3

encing highways and putting road warnings can reduce road traffic collisions with camels [17].

Although our study provides useful information on the biomechanics of camel-related HFN injuries, it has certain limitations. Our study group is not representative of all camel-related HFN injuries in our community. Patients who died in the field and those who were treated at the Emergency Department were not included. Our patients were from a single hospital and our sample size was relatively small. Accordingly, our results may not be generalizable to all UAE. Despite these limitations, we think that our study has provided useful information that can be used for injury prevention.

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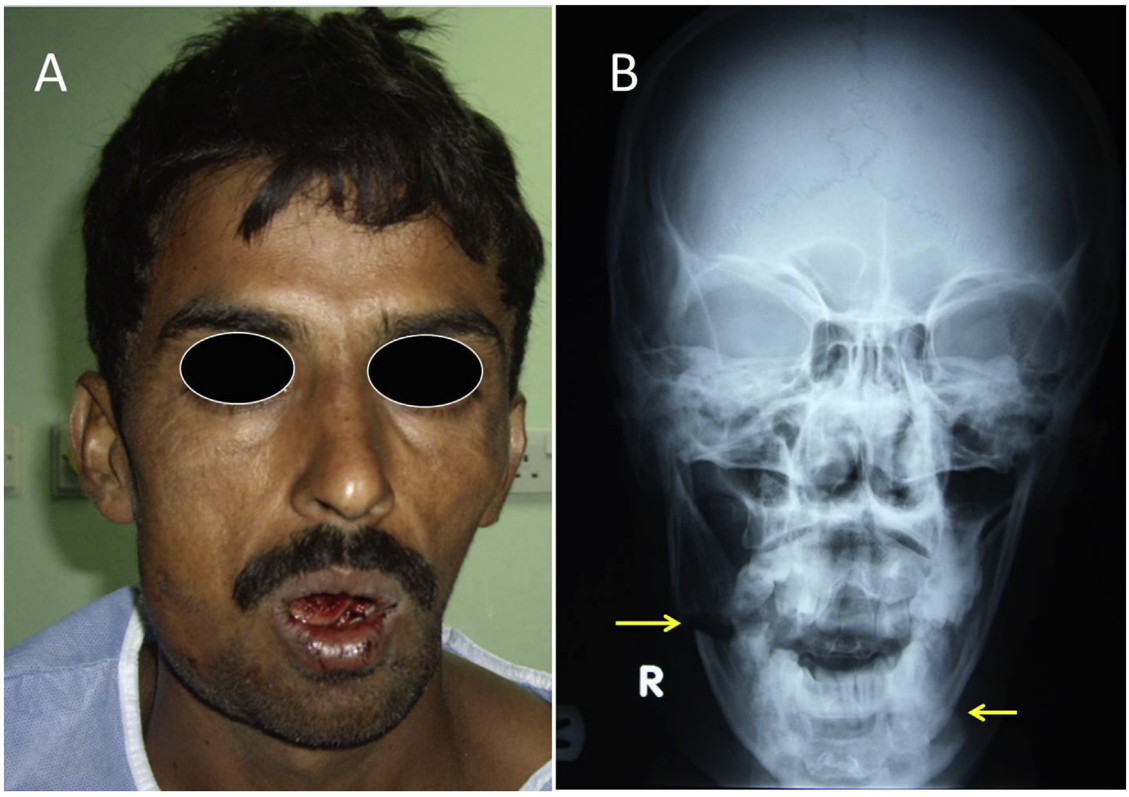

Fig. 2. A 22-year old camel caregiver was kicked by a camel into his lower face (A). The lower face was swollen with restricted mouth opening and intraoral bleeding. Anterior-posterior skull radiograph (B) demonstrating bilateral displaced mandibular fractures (arrows).

Table 6
Comparison of Injury severity by mechanism of injury of camel-related injuries of different anatomical regions of 73 patients who had head, face, and neck camel-related injuries, and were admitted to Al Ain Hospital during the period of October 2001 to January 2010.

AIS	Kick (n = 33)	Fall (n = 16)	Bite (n = 11)	Car collision (n = 7)	Others (n = 6)	p value
Face	1 (0-2)	1 (0-2)	1 (0-2)	0 (0-2)	0 (0-1)	0.09
Median (range)	1.1 (0.8)	0.6 (0.6)	0.6 (0.7)	0.6 (0.8)	0.3 (0.5)	
Mean (SD)						
Head	0 (0-3)	1 (0-3)	0 (0-1)	2 (1-4)	1 (0-2)	0.003
Median (range)	0.8 (1)	1.1 (1.2)	0.1 (0.3)	2.1 (1.2)	0.8 (0.8)	
Mean (SD)						
Neck	0 (0-1)	0 (0-0)	0 (0-3)	0 (0-0)	0 (0-0)	0.006
Median (range)	0.1 (0.2)	0 (0)	0.6 (0.9)	0 (0)	0 (0)	
Mean (SD)						
Spine	0 (0-0)	0 (0-2)	0 (0-3)	0 (0-4)	0 (0-5)	0.004
Median (range)	0 (0)	0.1 (0.5)	0.6 (1.2)	1.1 (1.6)	1.3 (2.2)	
Mean (SD)						

AIS: abbreviated injury scale.
Data are presented as median (range), mean (SD), p value = Kruskal-Wallis test.

Conclusions

Our study highlights the complex biomechanics of camel-related HFN injuries. It is essential to adopt protective measures in our community so as to reduce camel-related HFN injuries.

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