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Epidemiology of head injury in the United Arab Emirates

Birleşik Arap Emirlikleri'ndeki kafa yaralanması epidemiyolojisi

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BACKGROUND

Head injury increases mortality in trauma patients. We aimed to study the epidemiological and clinical features of head injury in Al-Ain city, United Arab Emirates (UAE).

METHODS

Trauma patients with head injury who were admitted to Al-Ain Hospital for more than 24 hours and those who died in the hospital were included in the study. Data were prospectively collected from March 2003 - March 2006.

RESULTS

589 patients were studied, and 521 were males (88.3%). The median (range) age was 30 (1-89) years. The most common mechanism of injury was road traffic collision (67.1%) followed by fall from height (11.9%). Head injury was mild in 82.2% of patients, moderate in 5.7%, and severe in 12.1%. 20.9% of patients were admitted to the intensive care unit. 35 patients died (overall mortality 5.9%). Patients who died had significantly higher Injury Severity Score ($p<0.0001$), lower Glasgow Coma Scale ($p<0.0001$), and higher Abbreviated Injury Scale of the head ($p<0.0001$).

CONCLUSION

Motor vehicle collision was the main mechanism of head injury in the UAE followed by fall from height. Legislation for compulsory seatbelt usage and helmet usage by bicyclists and motorcyclists should be adopted. A safe work environment and preventive measures at work should be introduced.

Key Words: Head; trauma; motor vehicle collision; United Arab Emirates; seatbelt usage.

AMAÇ

Kafa yaralanması travma hastalarında mortaliteyi artırmaktadır. Bu yazıda, Birleşik Arap Emirlikleri (BAE) Al-Ain kentindeki kafa yaralanmalarının epidemiyolojik ve klinik özellikleri değerlendirildi.

GEREÇ VE YÖNTEM

Al-Ain Hastanesi'ne 24 saatten daha uzun süreyle yatırılan ve hastanede ölen kafa yaralanması hastaları çalışmaya dahil edildi. Veri, Mart 2003 ile Mart 2006 tarihleri arasında prospektif olarak derlendi.

BULGULAR

589 hasta çalışıldı [521 erkek (%88,3)]. Mediyan (aralık) yaş, 30 (1-89) yıldı. En sık yaralanma mekanizması, karayolu trafik kazası (%67,1) ve daha sonra da yüksekten düşme (%11,9) idi. Kafa yaralanması, hastaların %82,2'sinde hafif, %5,7'sinde orta derece ve %12,1'inde ciddi idi. Hastaların %20,9'u yoğun bakım ünitesine yatırıldı. Otuz beş hasta öldü (genel mortalite %5,9). Ölen hastalar, anlamlı şekilde yüksek yaralanma şiddet skoruna ($p<0,0001$), daha düşük Glasgow koma skoruna ($p<0,0001$) ve daha yüksek kısaltılmış yaralanma ölçeğine ($p<0,0001$) sahipti.

SONUÇ

Motorlu araç kazası, BAE'deki kafa yaralanması ile ilgili başlıca mekanizma idi ve bunu yüksekten düşme izliyordu. Zorunlu emniyet kemeri kullanımı, bisiklet ve motorsiklet sürücüleri tarafından kask kullanımı ile ilgili mevzuat yasalaştırılmalıdır. İşyerinde güvenli iş ortamı ve koruyucu önlemler sağlanmalıdır.

Anahtar Sözcükler: Kafa; travma; trafik kazası; Birleşik Arap Emirlikleri; emniyet kemeri kullanımı.

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Trauma is a leading cause of death worldwide. Trauma patients with head injury (HI) have a 10-fold higher mortality than in those with no HI.[1] Furthermore, HI accounts for two-thirds of in-hospital trauma deaths.[2] Disability following traumatic brain injury may require a lengthy rehabilitation, which places a great burden on national medical resources.[3,4]

The rapid industrialization and tremendous increase in motorized vehicles in developing countries have led to an increase in the incidence of HI. Epidemiological studies are essential for strategic planning for health resources and prevention.[5]

We aimed to study the incidence, mechanisms, types, and outcome of HI in Al-Ain city, United Arab Emirates (UAE) in order to give recommendations on preventive priorities.

MATERIALS AND METHODS

All HI trauma patients who were admitted to Al-Ain Hospital for more than 24 hours or who died in the hospital after arrival were studied. Data of the patients were retrieved from Al-Ain Hospital Trauma Registry. The Local Ethics Committee of Al-Ain Health District area approved data collection for all trauma patients who were admitted to Al-Ain Hospital or who died in the Emergency Department (Ethical approval No: RECA/02/44). Data were prospectively collected over a period of three years (March 2003 - March 2006). The percentages of the population by nationality and gender were retrieved from the general census of the UAE for population, 2005.[6] Demographics, mechanism and types of injury, Glasgow Coma Scale (GCS) on arrival, the need for ventilation, Injury Severity Score (ISS), Abbreviated Injury Scale (AIS) for the head, hospital stay, and mortality were analyzed.

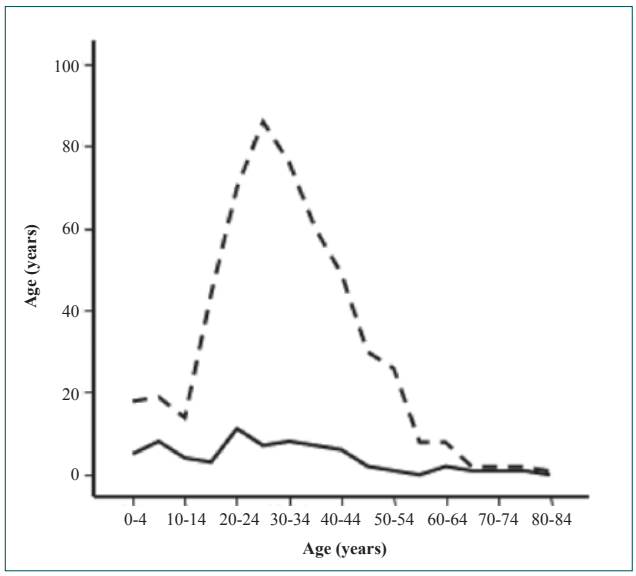

Fig. 1. Hospitalized head injury patients, by age and gender: males (broken line, n=521), females (solid line, n=68), Al-Ain, United Arab Emirates 2003-2006 (n=589).

Table 1. Nationality of hospitalized head-injured patients, Al-Ain, United Arab Emirates 2003-2006 (n=579)*

Nationality	Number	%
UAE	140	24.2
Other Arab	122	21.1
Pakistani	129	22.3
Indian	72	12.4
Bangladesh	72	12.4
Other Asia	38	6.6
Others	6	1
Total	579	100

UAE: United Arab Emirates; * missing data (10).

Table 2. Mechanism of injury of hospitalized head-injured patients, Al-Ain, United Arab Emirates 2003-2006 (n=589)

Mechanism	Number	%
Road traffic collision	395	67.1
Fall from height	70	11.9
Fall	43	7.3
Heavy object	28	4.8
Assault	28	4.8
Animal-related	13	2.2
Others	12	2.2
Total	589	100

Statistical analysis included Mann-Whitney U test for continuous or ordinal data to compare two independent groups and Spearman's rank correlation test to study correlations between two variables. A p value of ≤ 0.05 was considered significant. Data were analyzed with PASW Statistics 18, SPSS Inc, USA.

RESULTS

There were 2573 patients included in the Trauma Registry of Al-Ain Hospital, and 589 (22.9%) patients had HI. There were more male patients (521, 88.3%) than female patients (68, 11.5%), with a male: female ratio of 7.7: 1. The median (range) age was 30 (1-89) years (Fig. 1). One hundred and forty patients (24.2%) were UAE nationals (Table 1).

The majority of HI took place on the street (65.1%), followed by the work place (14.1%) and home (12.7%). The most common mechanism of injury was road traffic collision (RTC) (67.1%) followed by fall from height (11.9%) (Table 2). The majority of patients (330, 56.1%) arrived to the hospital by ambulance, while 233 (39.6%) arrived by private cars. The most frequent time for HI was midnight. There was no difference in the occurrence of HI between the days of the week or months of the year (Fig. 2).

On admission, the median (range) GCS was 15 (3-15). HI was mild (GCS 13-15) in 474 (82.2%) patients, moderate (GCS 9-12) in 33 (5.7%) patients, and severe (GCS 3-8) in 70 (12.1%) patients. The median (range) ISS was 4 (1-43). Intubation and mechanical ventilation was needed in 82 (13.9%) patients. One hundred and seventy-five (29.7%) patients had an isolated HI. The most common HI was concussion (77.4%) (Table 3). The most commonly injured body region in association with HI was the upper limbs (28.4%) (Table 4).

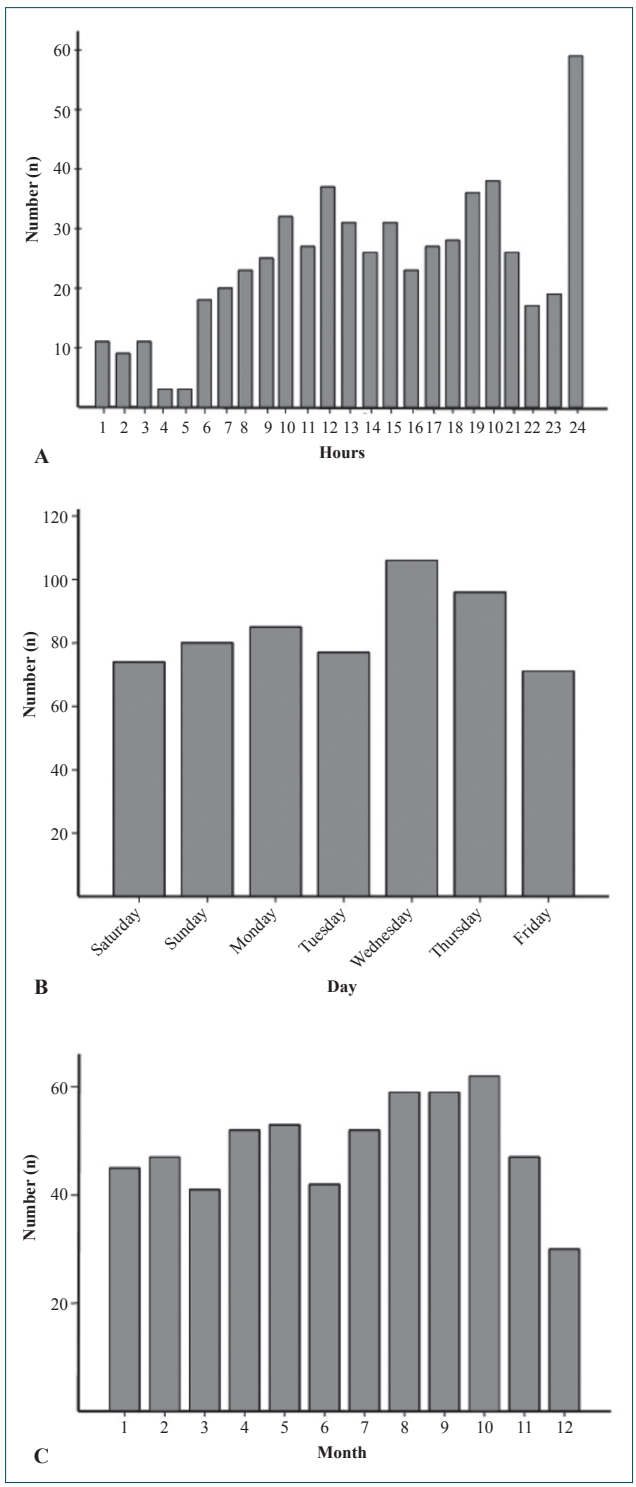

Fig 2. Distribution of hospitalized head-injured patients by time (A), day (B) and month (C), Al-Ain, United Arab Emirates 2003-2006 (n=589).

Table 3. Types of head injury of hospitalized head-injured patients, Al-Ain, United Arab Emirates 2003-2006 (n=589)

Type of head injury	Number	%
Concussion	456	77.4
Fractured skull	198	33.6
Subdural hematoma	44	7.5
Epidural hematoma	33	5.6
Subarachnoid bleeding	33	5.6
Intracerebral hemorrhage	13	2.2
Brain contusion	32	5.4
Others	26	4.4

Table 4. Associated injured body regions of hospitalized head-injured patients, Al-Ain, United Arab Emirates 2003-2006 (n=589)

Region	Number	%
Neck	18	3.1
Chest	128	21.7
Abdomen	28	4.8
Spine	32	5.4
Upper limbs	167	28.4
Lower limbs	130	22.1

One hundred twenty-three (20.9%) patients were admitted to the intensive care unit (ICU), with a median (range) ICU stay of 2.5 (1-35) days. The mean (range) hospital stay was 8.31 (1-130) days. Two hundred and ten patients (36%) were discharged within 48 hours. Thirty-five patients died (overall mortality 5.9%), while the overall mortality of our Trauma Registry in the same period was 2.2% (56 patients). Twenty-nine (82.9%) patients who died were involved in RTC. 15 died in the Emergency Department, 2 in the Operating Theater, and 18 in the ICU. Patients who died had significantly higher ISS, lower GCS, and higher AIS of the head compared with those who survived ($p<0.0001$, $p<0.0001$ and $p<0.0001$, respectively, Mann-Whitney U-test) (Table 5). GCS was significantly correlated with AIS of the HI (-0.59, $p<0.0001$, Spearman's rank correlation).

DISCUSSION

Reports of HI vary widely between different epidemiological studies due to the lack of a common clear definition of head trauma, different study samples, and methodology issues.[4,7] For these reasons, comparison between different studies is difficult. In our study, HI was defined according to the anatomical lesions and

Table 5. Comparison between patients who died and those who survived after head injury, Al-Ain, United Arab Emirates 2003-2006 (n=589)

	Survived (n=554)	Died (n=35)	p*
ISS	3 (1-41)	25 (13-43)	<0.0001
GCS	15 (3-15)	4 (3-15)	<0.0001
Highest head AIS	1 (1-5)	3 (1-5)	<0.0001

ISS: Injury Severity Score; GCS: Glasgow Coma Scale; AIS: Abbreviated Injury Scale.
* p value Mann-Whitney test.

level of consciousness in accordance with the AIS manual.[8] Several factors increase rates of HI in developing countries, including increased population numbers and density and increased vehicular traffic.[9] The UAE is a rapidly developing country. Al-Ain Hospital is one of the two major hospitals in Al-Ain city, which is the largest city in the eastern district of Abu Dhabi, with 463,000 inhabitants.[10] It is a modern city that extends horizontally over a wide area with modern well-designed roads and short buildings (less than 4 floors in height). This makes the density of the population less compared with other cities in the country. This study has shown that the annual incidence of hospitalized head trauma patients in Al-Ain city was 42 per 100,000 population. If we consider that only 20% of patients presenting to the Emergency Unit were admitted to the hospital,[11] this makes the annual incidence of head trauma patients treated in the hospitals in Al-Ain city to be 210 per 100,000 inhabitants, which is similar to other studies.[4,9] This incidence is less than that reported by studies including on-scene deaths.[7] Trauma patients having HI constituted more than 20% of all trauma patients admitted to our hospital, which is consistent with other studies.[7]

The HI rate for males was higher than for females in all age groups, which is comparable with other studies.[4,12] The male: female ratio in our study was 7.7: 1, which is much higher than in other studies from other regions,[4,7,9,13] but was similar to a study from Qatar, which is located in the same region.[14] This may be explained by the fast economic growth of the Gulf Cooperation Council (GCC) countries requiring the employment of many male foreign workers. In the UAE, there are workers representing 202 different nationalities.[15] Most are male manual laborers working in major infrastructure construction projects and constituting 78% of the population.[6] This can also explain the incidence of HI among the UAE nationals (24%), which is comparable to their percentage in the population.

The highest peak of incidence of HI according to age was in young adults (15-34 years). The second peak was below the age of 5 years. This is different from other studies from developed countries, where a third peak occurs at the age of 75 years.[4,7,13] This might be attributed to the fact that only 0.3% of the population in the UAE are over 75 years of age, as many expatriates return to their home country after the age of retirement of 60 years.[6]

Similar to other studies, the main mechanism of injury was RTC,[4,5,7,16,17] in contrast to other reports from developed countries, in which fall or assault was the main mechanism.[9,11,18] In Sweden, the incidence of HI due to RTC has changed over time to be replaced by falls as the main mechanism of HI. This was attributed to the success of public safety measures and preventive strategies for RTC.[9]

Fall from height was the second cause of HI followed by fall from the same level. Fall from height is the main cause for hospital admission of occupational injuries in the UAE due to lack of proper safety measures in the workplace, especially at construction sites.[19] This can explain the occurrence of the majority of injuries on the street followed by the workplace. RTC is the most common mechanism of injury in young adults, while fall from the same level is common in old ages.[17,20]

Our present study has shown that the predominant time for the occurrence of HI was midnight. This may be caused by RTCs involving expatriate laborers returning home after a hard working day, either while walking or using cheap transportation methods like bicycles.[21] In comparison with other studies, our study has shown no increase in the incidence of HI during the weekend days. This was attributed to alcohol consumption in the other studies, which is uncommon in the UAE.[4,22]

The GCS was significantly correlated to HI. It is classified according to GCS on arrival at the hospital as severe (GCS <8), moderate (GCS 9-12), or mild (GCS 13-15).[11] Mild HI was recorded in more than 80% of the patients followed by severe HI, which is comparable to other studies.[2,11]

Also similar to other studies, only 30% of patients had isolated HI.[7] Concussion was the most common HI, followed by fractured skull and intracranial hema-

toma.[9] Delayed evacuation of the hematoma is the main cause of preventable deaths in patients with head trauma.[3]

The majority of patients had multiple injuries. The most commonly injured body region was the upper limbs.[7] More than one-third of our patients were discharged within 48 hours, which is much less than in other reports.[9,11] This can be attributed to different management protocols and to the fact that most of our injured patients are expatriate laborers living in camps, with no relatives to care for them after discharge.

The overall mortality in our study was about 6%, which is similar to other studies.[4] As expected, patients who died had severe HI and had significantly higher ISS than those who survived. HI severity is the most important predictor for mortality in hospitalized trauma patients.[23] Our study has shown that patients with HI account for about two-thirds of hospital trauma deaths, which is consistent with other reports.[2] The severity of HI is related to the mechanism and cause of injury.[11] In our study, RTC was the main mechanism of serious HI, causing more than 80% of deaths, which is higher when compared with other reports.[7,18] This can be attributed to the fact that RTC mortality in the UAE is one of the highest in the world, which has been estimated at 37 per 100,000 population annually.[21,24,25]

Patients who survive HI may suffer severe residual disability including epilepsy, speech impairment, personality disturbance, and other irreversible neurologic damages.[4] Residual disability was found in survivors of moderate (54%) and mild (51%) HI.[26] Apparently mild or moderate HI can alter the patient's life by causing persistent headache or memory problems, even leading to unemployment.[11] Treatment and lengthy rehabilitation of HI patients place a heavy burden on health services.[2] Follow-up of our patients is lacking, and it is difficult to study the long-term effects of HI in our study because many of our injured expatriate laborers return to their home countries.

Head injury is preventable.[3] Protective equipment that includes seatbelt usage and helmets for motorcyclists and bicyclists can reduce the incidence of HI and must be applied strictly in our community.[27-30] Appropriate safety measures at the workplace should be implemented to safeguard against falls and decrease the incidence of HI at the workplace.[19] One of the success stories of HI prevention in the UAE was the replacement of the camel jockey during camel races by robots. This has led to tremendous decrease in the incidence of HI among those jockeys, who were mostly in the pediatric age group.[31]

Motor vehicle collision was determined to be the main mechanism of HI in the UAE followed by fall from height. Legislation for compulsory seatbelt usage and helmet usage by bicyclists and motorcyclists should be adopted. Ensuring a safe work environment and other preventive measures including educational programs and the use of protective equipment should be introduced to reduce the morbidity and mortality of HI.

Competing interests

The authors declare that they have no competing interests.

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REFERENCES

1. Patel HC, Bouamra O, Woodford M, King AT, Yates DW, Lecky FE; Trauma Audit and Research Network. Trends in head injury outcome from 1989 to 2003 and the effect of neurosurgical care: an observational study. Lancet 2005;366:1538-44.
2. Jennett B. Epidemiology of head injury. Arch Dis Child 1998;78:403-6.
3. Jennett B, Carlin J. Preventable mortality and morbidity after head injury. Injury 1978;10:31-9.
4. Jagger J, Levine JI, Jane JA, Rimel RW. Epidemiologic features of head injury in a predominantly rural population. J Trauma 1984;24:40-4.
5. Chiu WT, Hung CC, Shih CJ. Epidemiology of head injury in rural Taiwan -a four year survey. J Clin Neurosci 1995;2:210-5.
6. United Arab Emirates Census. Population Preliminary results 2005 by age and nationality. Adapted from: Preliminary Results of the General Census for Population, Housing and Establishments, 2005, United Arab Emirates. Available from URL: http://www.zu.ac.ae/library/html/UAEInfo/documents/CensusResults2005. pdf [Accessed May 27, 2011].
7. Tiret L, Hausherr E, Thicoipe M, Garros B, Maurette P, Castel JP, et al. The epidemiology of head trauma in Aquitaine (France), 1986: a community-based study of hospital admissions and deaths. Int J Epidemiol 1990;19:133-40.
8. Committee on Injury Scaling: The Abbreviated Injury Scale (AIS), 1980 revision. American Association for Automtive Medicine, Motrton Grove, IL, 1980.
9. Kleiven S, Peloso PM, von Holst H. The epidemiology of head injuries in Sweden from 1987 to 2000. Inj Control Saf Promot 2003;10:173-80.
10. Annual report 2006, Preventive Medicine Sector, Ministry of Health, United Arab Emirates, published on November 2007.
11. Kay A, Teasdale G. Head injury in the United Kingdom. World J Surg 2001;25:1210-20.
12. Klauber MR, Barrett-Connor E, Marshall LF, Bowers SA. The epidemiology of head injury: a prospective study of an entire community-San Diego County, California, 1978. Am J Epidemiol 1981;113:500-9.
13. Whitman S, Coonley-Hoganson R, Desai BT. Comparative head trauma experiences in two socioeconomically different Chicago-area communities: a population study. Am J Epidemiol 1984;119:570-80.

14. Bener A, Omar AO, Ahmad AE, Al-Mulla FH, Abdul Rahman YS. The pattern of traumatic brain injuries: a country undergoing rapid development. Brain Inj 2010;24:74-80.
15. Staff reporter: 202 nationalities in labour market. khaleej times 2006. Website: http://www.khaleejtimes.com/DisplayArticleNew.asp?section=theuae&xfile=data/theuae/2006/august/theuae_august735.xml.
16. Cadotte DW, Vachhrajani S, Pirouzmand F. The epidemiological trends of head injury in the largest Canadian adult trauma center from 1986 to 2007. J Neurosurg 2011;114:1502-9.
17. Abelson-Mitchell N. Epidemiology and prevention of head injuries: literature review. J Clin Nurs 2008;17:46-57.
18. Swann IJ, MacMillan R, Strong I. Head injuries at an inner city accident and emergency department. Injury 1981;12:274-8.
19. Barss P, Addley K, Grivna M, Stanculescu C, Abu-Zidan F. Occupational injury in the United Arab Emirates: epidemiology and prevention. Occup Med (Lond) 2009;59:493-8.
20. Adam SH, Eid HO, Barss P, Lunsjo K, Grivna M, Torab FC, et al. Epidemiology of geriatric trauma in United Arab Emirates. Arch Gerontol Geriatr 2008;47:377-82.
21. World Health Organization, Global status report on road safety: time for action. Geneva, 2009 Available at: htpp://www.who.int/violence_injury_prevention/road_safety_status/2009 [Accessed on 6 May 2011].
22. Wilson PJ. The prevention and prognosis of head injury. Practitioner 1983;227:390-7.
23. Lefering R, Paffrath T, Linker R, Bouillon B, Neugebauer EA; Deutsche Gesellschaft für Unfallchirurgie/German Society for Trauma Surgery. Head injury and outcome--what influence do concomitant injuries have? J Trauma 2008;65:1036-44.
24. Eid HO, Barss P, Adam SH, Torab FC, Lunsjo K, Grivna M, et al. Factors affecting anatomical region of injury, severity, and mortality for road trauma in a high-income developing country: lessons for prevention. Injury 2009;40:703-7.
25. Eid HO, Abu-Zidan FM. Biomechanics of road traffic collision injuries: a clinician's perspective. Singapore Med J 2007;48:693-700.
26. Thornhill S, Teasdale GM, Murray GD, McEwen J, Roy CW, Penny KI. Disability in young people and adults one year after head injury: prospective cohort study. BMJ 2000;320:1631-5.
27. Chiu WT, Hung CC, Le LS, Lin LS, Shih CJ, LaPorte RE. Head and Spinal Cord Injury Research Group ROC (Taiwan). Head injury in urban and rural populations in a developing country. J Clin Neurosci 1997;4:469-72.
28. Hefny AF, Eid HO, Grivna M, Abu-Zidan FM. Bicycle-related injuries requiring hospitalization in the United Arab Emirates. Injury 2011 Jun 9. [Epub ahead of print]
29. Abbas AK, Hefny AF, Abu-Zidan FM. Seatbelts and road traffic collision injuries. World J Emerg Surg 2011;6:18.
30. HefnyAF, Barss P, HaniO.Eid HO, Abu-Zidan FM. Motorcycle-related injuries in the United Arab Emirates. Accid Anal Prev 2011.
31. Nawaz A, Matta H, Hamchou M, Jacobsz A, Al Salem AH. Camel-related injuries in the pediatric age group. J Pediatr Surg 2005;40:1248-51.