



Pattern of skull fracture in Iran: report of the Iran National Trauma Project

İran'da kafatası kırığı paterni: İran Ulusal Travma Projesi raporu

Soheil SAADAT,¹ Neda RASHIDI-RANJBAR,¹ Mohammad R. RASOULI,²
Vafa RAHIMI-MOVAGHAR,^{1,3}

BACKGROUND

We characterize in this report the mechanism and type of skull fracture in urban populations of Iran.

METHODS

Data including the general characteristics, mechanism of trauma, abbreviated injury scale, Glasgow coma scale, duration of hospitalization, and outcome of trauma patients registered from 1999 to 2004 were extracted from the Iranian National Trauma Registry database.

RESULTS

Of 16,321 registered trauma patients, 1704 cases with skull fracture were found. The most common mechanism of trauma was motor-vehicle crash (MVC) (62.5%) followed by fall (23.8%). The majority of traffic victims were pedestrians (41.6%). Skull fracture was more likely to be seen in men (78.6%), with a mean age of 27.2 ± 17.7 years. In MVCs, skull base fracture was observed in 51.2% and vault fracture in 48.8% of patients. A significant difference was found in sex distribution between skull base and vault fracture ($p=0.002$). MVC was the mechanism of injury in 67.4% of skull base fracture cases compared to 58.1% of vault fracture cases ($p<0.001$).

CONCLUSION

Safety legislations and risk-specific intervention programs should be improved considerably in Iran.

Key Words: Crashes; head injury; skull fracture; skull base; vault.

AMAÇ

Bu yazıda, İran'ın kentsel nüfusundaki kafatası kırık tipi oluş mekanizması tanımlandı.

GEREÇ VE YÖNTEM

Genel özellikler, travma mekanizması, kısaltılmış travma skalası, Glasgow koma skalası, hastanede kalış süresi ve 1999 yılından 2004 yılına kadar kaydedilen travma hastalarının sonucunu içeren verilere, İran Ulusal Travma Kayıtları veritabanından ulaşıldı.

BULGULAR

Kayıtlı 16,321 travma hastası arasında, kafatası kırığı olan 1704 olgu saptandı. En yaygın travma özelliği motorlu araç kazası (MAK) (%62,5) ile düşme (%23,8) idi. Trafik kazası mağdurları çoğunlukta yayalardı (%41,6). Kafatası kırığının ortalama $27,2 \pm 17,7$ düzeyinde bir yaşla birlikte erkeklerde (%78,6) görülmesi daha sıktı. MAK'lerde, kafa tabanı kırığı hastaların %51,2'sinde ve kafa tavanı kırığı da hastaların %48,8'inde gözlemlendi. Kafa tabanı kırığı ve kafa tavanı kırığı arasında, cinsiyet dağılımı bakımından anlamlı bir farklılık vardı ($p=0,002$). Kafa tabanı kırığı olgularının %67,4'üne karşı kafa tavanı olgularının %58,1'inde, MAK, travma mekanizması idi ($p<0,001$).

SONUÇ

İran'da, güvenlik yasaları ve risk-spesifik müdahale programları önemli ölçüde geliştirilmelidir.

Anahtar Sözcükler: Kazalar; kafa travması; kafatası kırığı; kafa tabanı; kafa tavanı.

¹Sina Trauma and Surgery Research Center, Tehran University Medical Sciences, Tehran, Iran; ²Department of Orthopaedics and Neurosurgery, Thomas Jefferson University and the Rothman Institute, PA, USA; ³Research Centre for Neural Repair, University of Tehran, Tehran, Iran.

¹Tehran Tıp Bilimleri Üniversitesi, Sina Travma ve Cerrahi Araştırma Merkezi, Tahran, İran; ²Thomas Jefferson Üniversitesi ve Rothman Enstitüsü, Ortopedi ve Nöroşirürji Bölümleri, PA, ABD; ³Tahran Üniversitesi, Nöral Onarım Araştırma Merkezi, Tahran, İran.

Head injury is a considerable public health issue, with high rates of mortality and morbidity.^[1-3] Approximately 30% of head injuries result in skull fractures.^[4] About two-thirds of skull fractures are accompanied by injury to the brain.^[5,6] Linear vault fracture is seen more frequently than skull base, but fractures may be present at both sites.^[7] There are only a few reports from developing countries about the patterns of skull fracture.^[7,8] The present study aimed to describe skull fractures according to sex, age, injury mechanism, and outcome among patients in Iran.

MATERIALS AND METHODS

This is a cross-sectional study that was performed using the data from the Iran National Trauma Registry database from August 1999 to February 2004. The database includes data collected from the University hospitals in eight major cities of Iran. The data of every patient admitted in these hospitals due to trauma with a hospital stay of more than 24 hours were registered in the database and included the patients' general characteristics, mechanism of trauma, abbreviated injury scale (AIS), duration of hospital stay, and final outcome. The type of skull fracture and mechanism of accidents were coded according to the International Classification of Diseases, 9th revision (ICD-9). Skull fracture was considered as skull base fracture or vault fracture. In this report, Glasgow coma scale (GCS) and AIS scores were used to classify injury severity and were assigned to all injuries noted in the diagnostic record of hospitalized patients with skull fractures. Injury severity score (ISS) was computed from the sum of squares of the highest AIS score in the three most severely injured body regions. ISS was categorized into three groups of <7, 7-12 and >12.^[9] Statistical analysis included Student's t test, chi-square testing of frequency data and chi-square test for trend, where

appropriate. The level of significance was set at 0.05. Statistical analyses of data were done using SPSS 13.0 (SPSS Inc, Illinois, USA).

RESULTS

Of 16,321 registered trauma patients, 1704 cases (1339 (78.6%) males) had a skull fracture. The mean age of patients with skull fractures was 27.2±17.7 years. In motor-vehicle crashes (MVCs), skull base and vault fracture were seen in 546 (51.2%) and 520 (48.8%) patients, respectively. Although there was no significant difference in the mean age of patients between the skull base and vault fracture groups (27±19 vs. 26±18), a significant difference was seen in sex distribution according to fracture type ($p=0.002$), i.e., vault fractures were more frequent than base fractures in males (729 vs. 610), while base fractures were more frequent than vault fractures in females (200 vs. 165). There was no significant difference in mean GCS between skull base and vault fractures (12.8 vs. 12.6). The mean ISS was 15.6 and 14.9 in skull base and vault fractures, respectively (Table 1).

Motor-vehicle crash (MVC) was the most common mechanism of skull fractures (62.5%), followed by fall (23.8%) (Table 1). MVC was the mechanism of injury in 67.4% of skull base fracture cases compared to 58.1% of vault fracture cases ($p<0.001$). Figure 1 demonstrates the mean age of both sexes according to the different mechanisms of skull base and vault fractures. 41.6% of traffic victims were pedestrians ($n=443$), and motorcycle riders were the second most common traffic victims (34.5%, $n=368$) (Table 1).

There were no significant differences between skull base and vault fractures with respect to the mean duration of hospitalization (5.4 vs. 5.6) and mortality (86 (10.7%) and 99 (11.1%) deaths, respectively; $p=0.752$).

Table 1. Comparison of injury severity score (ISS), mechanism of trauma and various subtypes of motor-vehicle crash (MVC) in skull base and vault fractures

	Skull fracture		Skull base fracture		Vault fracture	
	n	%	n	%	n	%
ISS						
<7	229	14%	58	7.2%	171	20.5%
7-12	596	36.5%	350	43.6%	246	29.6%
>12	810	49.5%	395	49.2%	415	49.9%
Mechanism						
MVC	1066	62.5%	546	67.4%	520	58.1%
Fall	405	23.8%	174	21.5%	231	25.8%
Hit by a blunt object	190	11.1%	74	9.1%	116	13%
Other	44	5.2%	16	2%	28	3.2%
Subtypes of MVC						
Pedestrian	443	41.6%	233	42.7%	210	40.4%
Motorcycle rider	368	34.5%	182	33.3%	186	35.8%
Car passenger or driver	217	20.4%	117	21.4%	100	19.2%
Other	38	3.6%	14	2.5%	24	4.6%

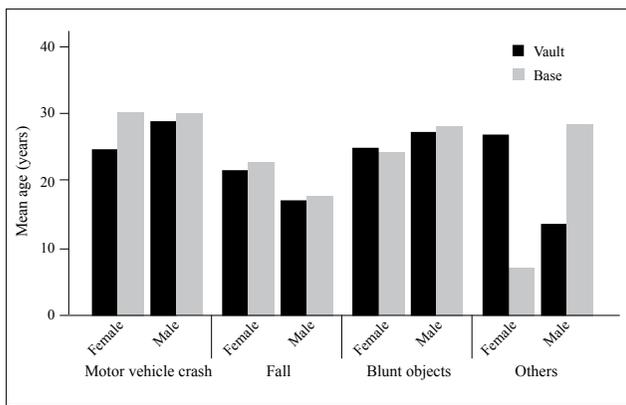


Fig 1. The mean age of both sexes in different mechanisms of skull base and vault fractures.

DISCUSSION

In the present study, the majority of skull fracture cases were male (78.6%). The male to female ratio in the study was 3.6:1. Our result is consistent with previous studies that showed skull fractures as being more frequent in males.^[4] The reason for the male majority might be that men everywhere generally have greater exposure to outdoor activities, rendering them more prone to trauma.

Approximately 30% of head injuries result in skull fractures, which are usually caused by a severe blow to the head, MVCs, falls, physical assault, and contact sports.^[4] Some studies reported that vault fracture is seen three times more often than skull base fracture.^[7] Our results showed a 2.4% higher incidence in vault fracture compared to skull base fracture, which was similar to some previous studies.^[10]

In the present study, vault fractures were more frequent than base fractures among males, but skull base fractures were more common than vault fractures in females. As fall was one of the main mechanisms for skull fracture, the male dominance may be explained by the social culture in Iran, in which females are unlikely to work in high-risk occupations such as building construction.

Motor-vehicle crash (MVC) was the most common mechanism of skull fracture, which is in accordance with other studies.^[11,12] In our population, most of the victims were pedestrians, which was also similar to previous reports.^[13,14]

This study has some limitations that should be kept in mind. The study is a part of the national trauma project that mainly focuses on epidemiologic aspects of all types of traumas. No accurate data on the type of the fracture (linear or depressed), special treatment and long-term follow-up of the patients are available.

In conclusion, skull fracture is commonly seen in MVC. Most of the victims were pedestrians. The

young male population is more prone to skull fracture due to a traumatic injury. Some road traffic policies such as pedestrian-friendly paths, separate lanes for light trucks/vans and heavy motor vehicles, and strict implementation of traffic rules and regulations are recommended; in this regard, this study may improve the planning and delivery of preventive and management services.

Acknowledgement

The database was provided by the Sina Trauma and Surgery Research Center. The project was approved by the Institutional Review Board of the Research Council in the Sina Trauma and Surgery Research Center of Tehran University of Medical Sciences.

Disclaimer

The authors received no funding for this clinical research.

REFERENCES

- Gurdjian ES, Webster JE, Lissner HR. Studies on skull fracture with particular reference to engineering factors. *Am J Surg* 1949;78:736-51.
- Yates PJ, Williams WH, Harris A, Round A, Jenkins R. An epidemiological study of head injuries in a UK population attending an emergency department. *J Neurol Neurosurg Psychiatry* 2006;77:699-701.
- Marik PE, Varon J, Trask T. Management of head trauma. *Chest* 2002;122:699-711.
- Nelson EL, Melton LJ 3rd, Annegers JF, Laws ER, Offord KP. Incidence of skull fractures in Olmsted County, Minnesota. *Neurosurgery* 1984;15:318-24.
- Carson HJ. Brain trauma in head injuries presenting with and without concurrent skull fractures. *J Forensic Leg Med* 2009;16:115-20.
- Solomon S. Post-traumatic headache: commentary: an overview. *Headache* 2009;49:1112-5.
- Menon A, Pai VK, Rajeev A. Pattern of fatal head injuries due to vehicular accidents in Mangalore. *J Forensic Leg Med* 2008;15:75-7.
- Jiang JY, Feng H, Fu Z, Guo-yi G, Wei-ping L, Wei-guo L, et al. Violent head trauma in China: report of 2254 cases. *Surg Neurol* 2007;68:2-5.
- Zargar M, Modaghegh MH, Rezaishiraz H. Urban injuries in Tehran: demography of trauma patients and evaluation of trauma care. *Injury* 2001;32:613-7.
- Fimate L, Chandra S, Dikshit PC. Survival time in relation to consciousness and severity of head injury. *J Fors Med Toxicol* 1992;8:15-9.
- Banerjee KK, Agarwal BB, Kohli A, Aggarwal NK. Study of head injury victims in fatal road traffic accidents in Delhi. *Indian J Med Sci* 1998;52:395-8.
- Johnson RM, McCarthy MC, Miller SF, Peoples JB. Craniofacial trauma in injured motorcyclists: the impact of helmet usage. *J Trauma* 1995;38:876-8.
- de Sousa RM, Regis FC, Koizumi MS. Traumatic brain injury: differences among pedestrians and motor vehicle occupants. *Rev Saude Publica* 1999;33:85-94.
- Chandra J, Dogra TD, Dikshit PC. Pattern of cranio-intracranial injuries in fatal vehicular accidents in Delhi, 1966-76. *Med Sci Law* 1979;19:186-94.