Original Article

Elderly patients in Japan are susceptible to cervical spine injury: a database search study

Keita Nakayama, Tomofumi Nishino, Kengo Fujii, Tetsuya Abe, Masataka Sakane, Masao Koda, Toru Funayama, Hiroshi Noguchi, Kosei Miura, Katsuya Nagashima, Hiroshi Kumagai, Kentaro Mataki, Masashi Yamazaki

Department of Orthopedic Surgery, University of Tsukuba, Tsukuba, Ibaraki, Japan

Contributions: (I) Conception and design: T Nishino, M Yamazaki; (II) Administrative support: K Fujii, M Sakane; (III) Provision of study materials or patients: K Nakayama, T Abe, M Koda, T Funayama; (IV) Collection and assembly of data: H Noguchi, K Miura, K Nagashima; (V) Data analysis and interpretation: M Koda, H Kumagai, K Mataki; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Masao Koda. Department of Orthopedic Surgery, University of Tsukuba, Tsukuba, Ibaraki, Japan. Email: masaokod@gmail.com.

Background: The aim of the present study was to elucidate the prevalence of cervical spine injury and its age distribution, and the causes and mortality rate in Japan using the Japan Trauma Data Bank.

Methods: Patients coded as having a cervical spine injury were extracted from the Japan Trauma Data Bank from 2004 to 2013, which consisted of a total of 152,722 patients. The number of patients, their age distribution and causes of injury were analyzed amongst the patients with Abbreviated Injury Score (AIS) coding associated with cervical spine injuries. Next, we extracted data for patients with an AIS coding of cervical spine injuries as a main disease, excluding patients with multiple trauma. We compared the mortality rate between aged and non-aged patients.

Results: The total number of patients with an AIS code of cervical spine injuries was 12,116. The peak age range for cervical injury was 60–69 years. The most common causes of cervical spine injuries were falls from a height and traffic accidents. The number of patients with an AIS code of cervical spine injuries as a main disease was 8982. The total number of patients who died from a cervical spine injury was 668. Mortality rate tended to be higher in the older patients.

Conclusions: The present results showed that the peak age range for cervical injury was 60–69 years. The mortality rate tended to be higher in patients over 70 years old.

Keywords: Spine injuries; cervical vertebrae; databases; factual

Received: 07 June 2018; Accepted: 28 June 2018; Published: 02 July 2018.

doi: 10.21037/amj.2018.06.03

View this article at: http://dx.doi.org/10.21037/amj.2018.06.03

Introduction

Cervical spine injury, which consists of cervical spine fracture, dislocation, dislocation-fracture and cervical spinal cord injury with or without cervical spine injury, is severe trauma that can be fatal. Its prevalence has been reported to be 19–88 patients per 100,000 (1), accounting for 19–51% of all spinal injuries. Its major causes are falls from heights and traffic accidents (2-5).

Two nationwide surveys for spinal cord injury have been conducted in Japan (6,7); however, the survey was subsequently suspended. Therefore, updated information about cervical spine injuries was unavailable. To accelerate trauma research, the Japan Trauma Data Bank was founded in 2000 as the very first nationwide database of various kinds of trauma. Its registration is based on the Abbreviated Injury Score (AIS), which is an anatomically based, consensus derived, global severity scoring system that classifies an individual injury by body region according to its relative severity on a 6-point scale (1= minor and 6= maximal) (8). The AIS provides standardized terminology to describe injuries, and it ranks injuries by

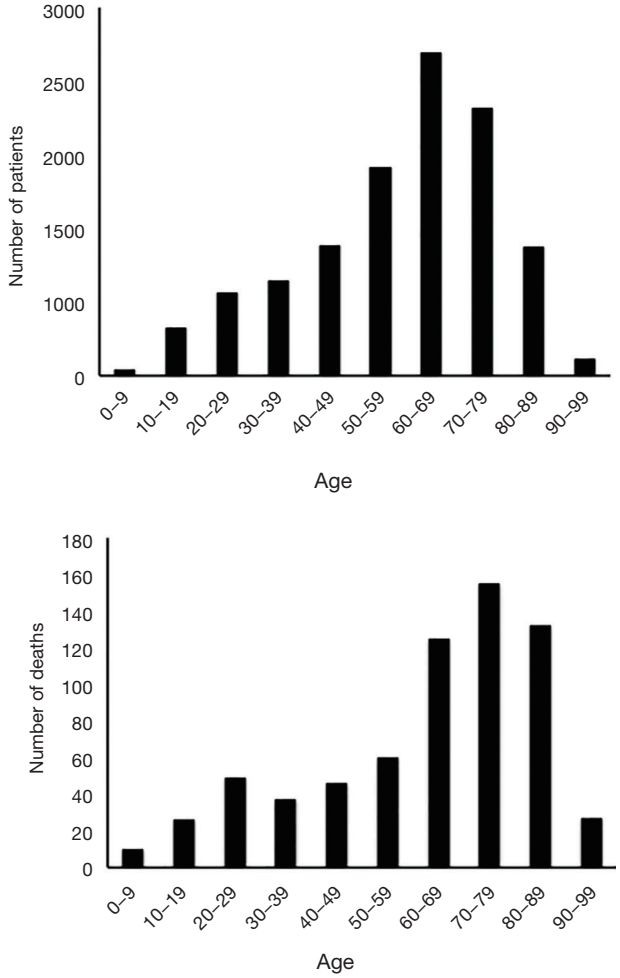

Figure 1 Age distribution of the patients with cervical spine injuries as a main disease and the number of death related to cervical spine injuries.

severity. The current AIS users, all of which may influence public policy, include the following: health organizations for clinical trauma management, outcome evaluation and case mix adjustment purposes; motor vehicle crash investigators for identifying the mechanism of injury and improving vehicle design; and researchers performing epidemiological studies and systems development. The Japan Trauma Data Bank includes all types of cervical spine injuries.

The aim of the present study was to provide an update on cervical spine injury in Japan, the prevalence of cervical spine injury and its age distribution, and the causes and mortality rate in Japan using the Japan Trauma Data Bank.

Methods

Patients coded as having a cervical spine injury included those with a fracture, dislocation, or fracture-dislocation of the cervical spine and cervical spinal cord injury; their data were extracted from the Japan Trauma Data Bank from 2004 to 2013, which consisted of a total of 152,722 patients. The number of patients, their age distribution and causes of injury were analyzed amongst the patients with AIS coding associated with cervical spine injuries.

Next, we extracted data for patients with an AIS coding of cervical spine injuries as a main disease, excluding patients with multiple trauma, to do a calculation of the mortality rate of cervical spine injuries. The mortality rate caused by cervical spine injuries was calculated as follows: the number of dead patients with an AIS code of cervical spine injury as a main disease was divided by the number of patients with an AIS code of cervical spine injuries. The age distribution of the dead patients with an AIS code of cervical spine injuries as a main disease and the mortality rate were analyzed.

To compare the mortality rate of cervical spine injury between aged patients and non-aged patients, we first calculated the cut-off value of the receiver-operator coefficient analysis for the mortality rate and age distribution. Next, we compared the mortality rate between patients who were over and under the cut-off age.

Results

The total number of patients with an AIS code of cervical spine injuries was 12,116. The age distribution of patients with cervical spine injuries in descending order of frequency was as follows: 60–69 years (n=2,736), 70–79 years (n=2,314), and 50–59 years (n=1,821) (*Figure 1*). The most common causes of cervical spine injuries were falls from a height (51% of all patients) and traffic accidents (42% of all patients).

The number of patients with an AIS code of cervical spine injuries as a main disease was 8,982, and most of those patients were in their 60's. The total number of patients who died from a cervical spine injury was 668. The peak age range for the largest number of patients who died from a cervical spine injury was 70–79 years (*Figure 1*). The ROC analysis revealed that the cut-off value for the mortality rate was 70 years of age. Therefore, we compared the mortality rate between patients under 70 years old and those over 70

Table 1 Mortality rate of patients with cervical spine injuries as a main disease

Variables	Age	
	0–69	70–99
Number of deaths	354	314
Number of patients	6,062	2,805
Mortality rate (%)	5.84	11.19

years old. The number of deaths was 354 out of 6,062 in patients under 70 years old compared with 314 out of 2,805 in patients over 70 years old, showing a tendency to be higher in the older patients (*Table 1*, P=0.09).

Discussion

The present study is the first to show the age distribution for cervical injuries in Japan. The present data showed that the peak age range for cervical injury was 60–69 years. This observation is in line with previous reports describing that the number of cervical injuries in elderly people, in whom injury could be caused by relatively low energy trauma, is larger than in the younger population (9,10).

As for the etiology of cervical spine injuries, previous reports described the main causes as falls from a height and traffic accidents (4,5). Similar to the previous reports, the present data also showed that falls from a height (51%) and traffic accidents (42%) were the main causes of cervical spine injuries.

To calculate the mortality rate in the present study, patients classified as having a cervical injury as a main lesion were assessed; this approach was used because cervical injury often occurs concomitantly with multiple injuries, which could possibly interfere with the results of a mortality calculation (11). The age distribution of patients classified as having a cervical injury as a main lesion was similar to that of the entire patient population, and peak age for these lesions occurred in the 60's. This observation repeatedly indicated that cervical injury in elderly people can be induced by relatively low energy trauma compared with a younger population, because cervical spine injury in a younger population often occurred concomitantly with multiple trauma.

The mortality rate tended to be higher in patients older than 70 years in the present study. There is controversy about the mortality rate of cervical spine injuries in elderly patients. Golob *et al.* reported that isolated cervical spine fracture with or without spinal cord injury in the elderly showed significant unfavorable outcomes and a high mortality rate (12). In contrast, Harris *et al.* reported that there was no significant difference in the 1-year mortality rate between patients in their 60s and those over 79 years old (13). Xing *et al.* described in their systematic review that pre-existing comorbidities, age and spinal cord injury are strong predictors for mortality after cervical spine injuries in the elderly (14). In this systematic review, there is a significant dispersion of patient populations in the papers analyzed, in which the mortality rate varies from 6% to 38.5%. Therefore, the discrepancy between the present results and the previous ones can possibly be attributed to the difference in patient populations included in the data.

There are several limitations in the present study. Firstly, we could not detect the cause of death from the datasets. Next, the possible influence of comorbidities on outcomes could not be precisely assessed in the datasets. Finally, neurological impairment concomitant with cervical spine injuries, which is one of the main determinants of the mortality rate of cervical spine injury in the elderly, could not be detected by the database search. Those limitations are attributed to the nature of the database, severely limiting the implications of the present results for clinical practice.

Conclusions

The present results showed that the peak age range for cervical injury was 60–69 years. The data also showed that falls from a height (51%) and traffic accidents (42%) were the main causes of cervical spine injury. The mortality rate tended to be higher in patients over 79 years old. More precise data collection should be performed in the near future for a more precise investigation of cervical spine injuries.

Acknowledgements

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/amj.2018.06.03). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all

aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Hasler RM, Exadaktylos AK, Bouamra O, et al. Epidemiology and predictors of cervical spine injury in adult major trauma patients: A multicenter cohort study. J Trauma Acute Care Surg 2012;72:975-81.
2. Lenehan B, Boran S, Street J, et al. Demographics of acute admissions to a National Spinal Injuries Unit. Eur Spine J 2009;18:938-42.
3. Chu D, Lee YH, Lin CH, et al. Prevalence of associated injuries of spinal trauma and their effect on medical utilization among hospitalized adult subjects--a nationwide data-based study. BMC Health Serv Res 2009;9:137.
4. Holly LT, Kelly DF, Counelis GJ, et al. Cervical spine trauma associated with moderate and severe head injury: incidence, risk factors, and injury characteristics. J Neurosurg 2002;96:285-91.
5. Fancher TT, Krol E, Rasmussen RW, et al. Cervical spine injuries; an outcome analysis. Pol Przegl Chir 2011;83:583-7.
6. Shingu H, Ohama M, Ikata T, et al. A nationwide epidemiological survey of spinal cord injuries in Japan from January 1990 to December 1992. Paraplegia 1995;33:183-8.
7. Shibasaki K. Nationwide survey for spinal cord injuries in Japan. Jpn J Spinal Cord Lesions 2005;18:271-4.
8. Rating the severity of tissue damage: The abbreviated scale. JAMA 1971;215:277-280.
9. Lieberman IH, Webb JK. Cervical spine injuries in the elderly .J Bone Joint Surg Br 1994;76:877-81.
10. Watanabe M, Sakai D, Yamamoto Y, et al. Analysis of predisposing factors in elderly people with Type II odontoid fracture. Spine J 2014;14:861-6.
11. Takahashi I, Kitahara T, Endo M, et al. Clinical analysis of multiple spine injured patients. J Jpn Ass Acute Med 2001;12:396-400.
12. Golob JF Jr, Claridge JA, Yowler CJ, et al. Isolated cervical spine fracture in the elderly: a deadly injury. J Trauma 2008;64:311-5.
13. Harris MB, Reichmann WM, Bono CM, et al. Mortality in elderly patients after cervical fractures. J Bone Joint Surg Am 2010;92:567-74.
14. Xing D, Wang J, Song DH, et al. Predictors for mortality in elderly patients with cervical spine injury. Spine 2014;38:770-7.

doi: 10.21037/amj.2018.06.03
Cite this article as: Nakayama K, Nishino T, Fujii K, Abe T, Sakane M, Koda M, Funayama T, Noguchi H, Miura K, Nagashima K, Kumagai H, Mataki K, Yamazaki M. Elderly patients in Japan are susceptible to cervical spine injury: a database search study. AME Med J 2018;3:72.