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Clinical Study

Fatal cervical spine injuries: a Finnish nationwide register-based epidemiologic study on data from 1987 to 2010

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Abstract

BACKGROUND CONTEXT: The number of cervical spine injuries (CSIs) is increasing. Cervical spine injuries are associated with high morbidity and mortality. Identifying those who are at risk for CSI-related death can help develop national and international interventions and policies to reduce mortality.

PURPOSE: This study aimed to determine the trends in the incidence and the characteristics of fatal CSIs in Finland over a 24-year study period from 1987 to 2010.

STUDY DESIGN/SETTING: A large nationwide, retrospective, register-based study was carried out.

PATIENT SAMPLE: The population-based sample was collected from death certificates issued in Finland between 1987 and 2010. The death certificates were obtained from the official Cause-of-Death Register, coordinated by Statistics Finland, which covers all deaths occurring in Finland.

OUTCOME MEASURES: Sociodemographics and injury- and death-related data were used for outcome measures.

METHODS: All death certificates issued in Finland (1987–2010) containing a CSI as the cause of death were carefully reviewed.

RESULTS: A total of 2,041 fatal CSIs were identified. These constituted 0.17% of all deaths in Finland within the study period. The average annual incidence of fatal CSIs was 16.5 per million (range: 12.5–21.2). The majority of the victims were male (72.9%) and had concurrent spinal cord injury (83.0%). Traffic accidents (40.1%) and falls (45.0%) were the most common injury mechanisms. Almost one-third (29.8%) of the deaths were alcohol-related. Among the young victims (<60 years) with upper CSI (C0–C2), the majority (91.8%) died within 24 hours post-injury. One-third of elderly victims' (≥60 years) CSI-related deaths occurred after 1 week post-injury and were mostly (74.2%) caused by respiratory and circulatory system diseases. Within the 24-year period, the incidence of fatal CSIs (+2/million), as well as the average age of sustaining a fatal CSI (+13.5 years), increased markedly. Fall-induced accidents among elderly males were the most prominently increasing subpopulation of fatal CSI victims.

CONCLUSIONS: In recent decades, fatal CSI incidence (death certificate-based) has increased, being 18.6 per million in Finland in 2010. Victims of fatal CSIs tend to be older than in the past, and for a substantial number of males, low-energy falls lead to cervical trauma and death.

Keywords: Autopsy; Epidemiology; Mortality; Registries; Spinal injuries; Spinal cord injuries

FDA device/drug status: Not applicable.

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Introduction

Globally, traumatic injuries are the leading cause of death among people aged between 5 and 44 years [1]. Cervical spine injuries (CSIs) constitute a considerable number of these fatal injuries. Cervical spine injuries are most often caused by motor vehicle accidents and falls, and they are associated with significant morbidity and mortality [2,3]. The overall prevalence of CSIs among all trauma patients is estimated to be about 3.7% [4], and the annual incidence of CSIs in the general population is reported to be 12 per 100,000 [5,6]. The overall incidence of fatal CSIs in developed countries is not well known. The majority of epidemiologic CSI studies focus on hospital-admitted patients [5–7]. However, it has been noted that a substantial number of all injury-related (including CSI-related) deaths occur outside hospitals [8–10]. Therefore, many CSIs go unrecorded unless postmortem examinations are conducted.

Medicolegal autopsies are crucial for the accuracy of death certification. The number of medicolegal autopsies performed in Finland is considerably higher than in many other developed countries [11]. In Finland, the indications for medicolegal autopsies are strictly controlled by legislation [11]. Medicolegal autopsies are performed in up to 87.2% of all unintentional injury-related deaths, 98.3% of homicides, and 99.5% of suicides [11]. This results in highly controlled and comprehensive national mortality statistics.

Acknowledging the fatal nature of CSIs and the relatively high incidence of concurrent mortality, there is a need for preventive measures for CSIs. Identifying those who are at risk for CSI-related death can help develop national and international interventions and policies to reduce mortality. We aimed to determine the trends in CSI incidence and the characteristics of patients with fatal CSIs over two decades by exploiting the inclusive population-based mortality statistics of Finland. Our data were drawn from the entire population of Finland; therefore, the absolute numbers and incidences of CSIs in this study represent complete population-based results, not cohort-based estimates. We hypothesized that the number of fall-related fatal CSIs among elderly people (60 years and older) had increased over the last two decades.

EVIDENCE & METHODS

Context

The authors present results of an epidemiological investigation regarding the incidence and clinical characteristics of fatal cervical spine injuries in Finland between 1987 and 2010.

Contribution

A total of 2,041 fatal cervical injuries were identified. Fatal cervical injuries have increased over the course of the time-period studied, particularly among older males. Nearly one-third of deaths were alcohol related.

Implications

The results presented here dovetail to some extent with material published from the United States and elsewhere, particularly with respect to an increasing incidence of fatal cervical injury among elderly males. Nonetheless, there is little evidence that the information in this analysis can be generalized beyond the Finnish population and the findings are likely not translatable to other socio-ethnic and demographic contexts, particularly with regard to factors associated with cervical spine injury. While presenting interesting information from the perspective of clinical epidemiology, the evidence associated with this work must be considered no higher than Level IV.

—The Editors

Materials and methods

Study frame and ethics

This population-based sample was collected from death certificates issued in Finland between 1987 and 2010. The death certificates were obtained from the official Cause-of-Death Register, coordinated by Statistics Finland, which covers all deaths occurring in Finland. The Finnish official cause-of-death statistics are, in practice, 100% complete [12]. According to Finnish legislation, a medicolegal autopsy should be performed in the following circumstances: when death is caused or suspected to be caused by (i) a crime, (ii) a suicide, (iii) an accident, (iv) poisoning, (v) an occupational disease, or (vi) medical treatment, or when death has (vii) not been caused by a disease, or when (viii) during the last illness, the deceased had not been treated by a doctor within 3 months, or when (ix) the death was otherwise unexpected. The study was approved by the Ethics Committee of Pirkanmaa Hospital District, Tampere, Finland.

Data collection

All death certificates containing CSI as an immediate, intermediate, main, or related cause of death were carefully reviewed by the first author (T.T.). During this period, both the International Classification of Diseases (ICD)-9 and the ICD-10 codes were in use. In our study, CSI was defined as an injury to the cervical spine, including (i) fractures, (ii) dislocations, (iii) fractures with spinal cord injury, (iv) isolated spinal cord injury, or (v) a combination of the aforementioned. The corresponding ICD-10 diagnosis codes were S12.0, S12.1, S12.7, S12.9, S13.0, S13.1, S13.2, S13.3, S14.0, and S14.1, and the ICD-9 diagnosis codes were 805.0–805.18, 806.0–806.19, 839.0–839.18, and 952.0–952.09. Combined skull and cervical fractures (T01.1–T06.0), whiplash, nerve root injuries, and non-traumatic spinal cord lesions were not used for the screening of the death certificates. The collected variables included diagnosis (ICD codes), gender, age, time of injury, place of injury, time between injury and death, cause