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Epidemiology of traumatic spinal cord injury: The substantial role of imaging methods

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ABSTRACT

Background and aims: One of the most common injuries around the world is the traumatic injury of the spine and spinal cord with unknown worldwide situation of traumatic spinal cord injury (TSCI) affecting on the effectiveness of preventive policy programs. In addition, because of possibility of making paralysis, the potential injury to the spine could be one of the most important traumas and a major cause of disability.
Methods: This research is a review study. Initial studies had focused on the descriptive epidemiology, considering incidence rates, age, gender, race, etiology and level and completeness of injury, but the recent researches are focusing on identifying of the high-risk groups, making awareness, establishing trends, predicting the needs, and thus contributing to effective health care planning of this condition.
Results: An important part of the prognosis, diagnosis and management of acute and chronic spinal trauma could be diagnostic medical imaging. While spinal cord and soft-tissue injuries could be evaluated better by magnetic resonance imaging (MRI); spine fractures could be characterized better by computed tomography (CT).
Conclusion: Imaging using CT and MRI is essential in the management of acute/chronic spinal cord injuries. The problem could be that due to fear of clinicians from missing occult spine injuries, they ask radiographs for almost all injured patients. It is recommended that a National Registry for spinal cord injuries be established by the national Ministry of Health, so that the etiological pattern of spinal cord injuries in the world can be known.

Keywords: Epidemiology; Trauma; CT scan; Spinal cord injury; Diagnosis.

Review article

INTRODUCTION

Spine and spinal cord is one of the key areas in the human body. More than half of neurological function through the control system and set the percentage of errors (erroneous) and errors in diagnostic and therapeutic clinical issues and intervention in this area is high.[1] Moreover, one of the most common injuries around the world is the traumatic injury of the spine and spinal cord. However, the worldwide situation of

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traumatic spinal cord injury (TSCI) is not well understood affecting on the effectiveness of preventive policy programs.[2,3] TSCI, as a condition with suffering of neural elements from acute trauma which can be prevented, may result in short-term or long-term sensory and motor problems. In addition, because of possibility of making paralysis, the potential injury to the spine could be one of the most important traumas and a major cause of disability.[4] In the USA about 10,000 traumatic cervical spines fractures and 4000 traumatic thoraco-lumbar fractures are identified each year, with less paralysis than moderate or severe brain injury, but with huge socioeconomic costs.[4] In addition, TSCI could be one of the main causes of death especially among injuries from traffic accidents, with potential possibility of causing other related neurological conditions such as paraplegia and quadriplegia.[5,6] It has been found that the most frequent etiology of TSCI could be traffic accidents, followed by falls, violence and sports/leisure activity incidents.[7] TSCI could result in potential important changes in a patient's life such as risk of serious complications both in the acute phase and several years after the trauma.[8] The potential costs could be direct and indirect costs. Direct costs could be death, hospitalization, rehabilitation, medications, diagnostic tests (CT scan and MRI), but indirect costs may be increasing chance of disability among younger people, loss of production, absence from work, psychiatric effects on families, and establishing more specialized centers for injured TSCI patients. It is obvious that a substantial improvement in the acute medical management as well as rehabilitation may have a contribution well into changes in morbidity and mortality patterns in TSCI patients. However, there is still necessity for obtaining more knowledge about outcomes in people surviving more than 20 years after the injury.[8] It is also important to know that spinal cord injury may account for a significant proportion of musculoskeletal injuries worldwide.[9] Finally, to categorize the spine trauma injuries, there are different methods such as dividing to fractures and dislocations, traumatic disc injuries, ligamentous injuries, whiplash injuries and spinal cord injuries.[4]

TSCI epidemiology has been studied since 40 years ago. While initial studies had focused on the descriptive epidemiology, considering incidence rates, age, gender, race, etiology and level and completeness of injury, the recent researches are focusing on identifying of the high-risk groups, making awareness, establishing trends, predicting the needs, and thus contributing to effective health care planning of this condition.[10] It should be noted that large geographical differences in reported incidence, prevalence and lethality exist mainly due to differences in definition, inclusion criteria, classification and patient identification procedures in the various studies, as well as geographical and cultural differences and differences in pre-hospital and hospital treatment.[7] Most of the studies on TSCI have been conducted in the developed countries, in only a limited section of the world's population. In fact, more than 80% of the world's population are living in more than 100 developing countries with no established national spinal trauma or SCI.[11] Moreover, epidemiologic TSCI data are available for 41 countries, mostly European and high-income countries; therefore, the efforts should be gathering information in developing and low-income countries to make it possible to plan appropriate cost-effective preventive strategies for TSCI.[3] There is a controversy on the findings of different studies; for example, while the annual incidence of TSCI varies from 2.3 to 83 patients per million in some studies around the world. In a different study, the figures ranged from 3.6 to 195.4 patients per million in Canada and Ireland,

respectively.[3,7,12,13] Furthermore, the prevalence ranged from 236 to 1800 per million in India and USA, respectively. Finally, the average age at the time of injury varies from 26.8 years in Turkey to 55.5 years in the USA; the ratio of males to females also varies from 0.9 in Taiwan to 12.0 in Nigeria.[7]

An important part of the prognosis, diagnosis and management of acute and chronic spinal trauma could be diagnostic medical imaging, while spinal cord and soft-tissue injuries could be evaluated better by magnetic resonance imaging (MRI). Spine fractures could be characterized better by computed tomography (CT). Therefore, imaging using CT and MRI is essential in the management of acute/chronic spinal cord injuries. Moreover, conventional angiography in diagnosis of vascular injuries may have a limited role because of high radiation absorbed dose and low differential contrast compared to CT- or MRI-angiography.[14] In addition, CT scan is indeed a gold standard for diagnosis (confirmation of TSCI is done by imaging), determination of natural history of disease (staging), estimation of length of disease, prognosis (severity of disease) and the quality of response to treatment procedures. Multi-detector (or multi-slice) computed tomography (MDCT) is the preferred primary imaging modality in TSCI patients who do need imaging. Comparing CT and MRI, CT not only is more accurate in diagnosing spinal injury, it also reduces imaging time and patient manipulation.

Moreover, nowadays with the advancement of information technology (IT) and medical engineering techniques (Techniques) including many magnetic resonance spectroscopy (MRS), Diffusion weighted imaging (DWI), Perfusion weighted imaging (PWI) and Diffusion tensor imaging (DTI) on the MRI machine is designed for using these techniques, particularly DTI and MRS of the spinal cord, vertebral canal structure (structural) and functional (functional) at a molecular and cellular imaging.[15]

CONCLUSION

There is no doubt regarding the need for accurate and emergent imaging assessment of the traumatized spine for evaluation of spinal stability and integrity of neural elements. However, the problem is that due to fear of clinicians from missing occult spine injuries, they ask radiographs for almost all injured patients. It should be tried to use experienced personnel in order to decline the number of repeated images for diagnostic interpretation as well as received x-ray by patient. In this case, the patient receives less radiation, and less movement. In addition, there is no need for extra graph and the lesion and the affected area can be identified much earlier.[1,16] Thus, providing a set of clinical and/or anamnestic criteria can be very helpful in identifying patients with low probability of injury and with no need for imaging. Studies have reported that car accident is the main cause of injury among TSCI patients. Therefore, establishing a database could help policy makers in Traffic Police to plan organized efforts to improve the management of TSCI patients. It is recommended that a National Registry for spinal cord injuries be established by the national Ministry of Health, so that the etiological pattern of spinal cord injuries in the world can be known.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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