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The Saudi Public's Knowledge Level of Spinal Injury: A Novel Risk Prediction Scoring System

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ABSTRACT

Objective: *The aims of this study are to assess the Saudi public's knowledge of the spinal cord injuries (SCI) and to establish a knowledge-based risk prediction scoring system.* ***Methods:*** *This cross-sectional survey was conducted between October 2016 and February 2017 using a self-administered questionnaire that was distributed electronically through social media. The questionnaire was designed to assess the Saudi public's knowledge of different aspects of SCI.* ***Results:*** *A total of 501 participants completed the survey. Most of the participants were knowledgeable about the basic structures of the spine; however, less than half (45.9%) knew about the clinical features of SCI. Males were significantly at a higher risk for SCI (odds ratio [OR] 1.98, 95% confidence interval [CI] 1.15-3.39, p=0.012). Additionally, males were more likely to provide incorrect answers to the question that assessed participants' knowledge of the loss of motor and sensory functions (OR 3.54, 95% CI 1.86-6.73, p=0.001). The respondents' level of education was significantly associated with their knowledge of the anatomy of the spine. Participants who had completed only primary and secondary school were less likely to know the basic structure of the spine (p=0.019), the causes of SCI (p<0.001), and the symptoms of SCI (p=0.010). a knowledge-based spine injury risk prediction scoring system was developed.* ***Conclusion:*** *Younger males lacked knowledge of spinal cord structure and injury. The spinal injury risk prediction scoring system may be used and needs further evaluations.*

Keywords: Knowledge, Scoring, Spine, Injury, Risk

INTRODUCTION

Spinal cord injuries (SCI) are common worldwide. The incidence of traumatic SCI is reported between 2.5 and 57.8 per million annually. Worldwide, the most common cause of SCI is road traffic accidents (RTAs) (40%), followed by falls (28%), acts of violence (15%), and sports injuries (8%) [1]. Saudi Arabia has one of the world's highest rates of SCI as per the Saudi Ministry of Health (MOH). These injuries are mostly due to RTAs [2]. However, the information available is too limited to estimate the exact incidence of traumatic SCIs in the kingdom [2,3]. The young age group is most commonly affected, with most being car drivers [3].

A study on Saudi male SCI patients reported that 43.9% of the patients had a cervical injury, followed by 40.4% with thoracic injury, and 3.5% with lumbar injury [4]. Furthermore, most cases of cervical injury occurred in patients aged 21-40 years. A recent study reported that the cervical cord was the most common site of injury, accounting for 34% of cases of traumatic SCI among males. In females, the most frequent level of injury was the thoracic vertebrae (82%), followed by the cervical (12%) and lumbar spine (6%) [5].

In patients who have had an SCI, complications due to the injury are the main causes of physical and psychological distress [6]. Early management and rehabilitation aim to decrease long-term complications of SCI, including hospital stay duration. Prevention should be the mainstay of care [7].

Although medical and surgical treatment is the main ways to restore function after SCI, rehabilitation is a mandatory lifelong process that should be started in the critical care setting and continued into primary care [8]. The aims of rehabilitation for SCI patients are to improve all physical, social, emotional, recreational, vocational, and functional recoveries [9].

Some investigators have suggested that educating SCI patients about the pathophysiology of SCI and its medical consequences can help accelerate the rehabilitation process and increase the fitness levels of the patients [10-12]. However, there is a paucity of data on whether knowledge of SCI can lead to the prevention of these injuries. Additionally, previous studies have identified risk factors for SCI [13,14], but the investigators did not explore a possible association between knowledge levels and the likelihood of being at high risk for these injuries. The aim of this study is to assess the Saudi public's knowledge of the spinal cord and SCI and to develop a prediction model for identification of the risk group based on the knowledge.

MATERIALS AND METHODS

This cross-sectional survey was conducted between October 2016 and February 2017 at King Abdulaziz University using a self-administered questionnaire that was distributed electronically through social media (Twitter, WhatsApp, etc.). The questionnaire was designed to assess the Saudi public's knowledge regarding different aspects of SCI (anatomy, function, causes of injury, diagnosis, and treatment) and was created using Google forms; the Arabic version of this questionnaire is available online [15].

The first part of the questionnaire included questions on the respondents' gender, age, and level of education. These were followed by questions that assessed the respondents' knowledge of anatomy and physiology of the spinal cord, causes of SCI, clinical features of SCI, as well as investigations and treatment of SCI.

The results were tabulated in an Excel sheet and expressed as central tendencies (mode) for non-parametric values. Spearman correlation was used to investigate the relationship between variables.

The odds ratio (OD) was calculated to assess respondents' risk of exposure and different outcomes when significant differences were found between variables. The scoring system was designed based on the significant OD and the correlation of the different variables.

The analyses were performed using the SPSS software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). A p-value<0.05 was considered significant.

This study was approved by the Biomedical Ethics Research Committee of King Abdulaziz University (reference No. 341-16).

RESULTS

Descriptive Statistics

A total of 501 members of the public completed the survey. Females comprised the majority of the sample (n=347, 69.3%). The most represented age group was 21-30 years old (Figure 1).

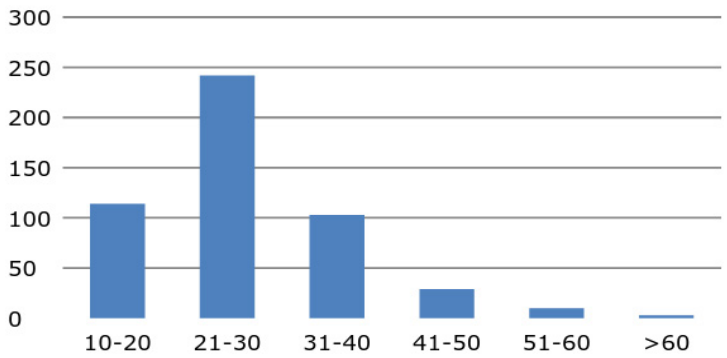

Figure 1 Age distribution of the respondents in years

Based on the educational level, those with a bachelor's degree were heavily represented in the sample (Figure 2).

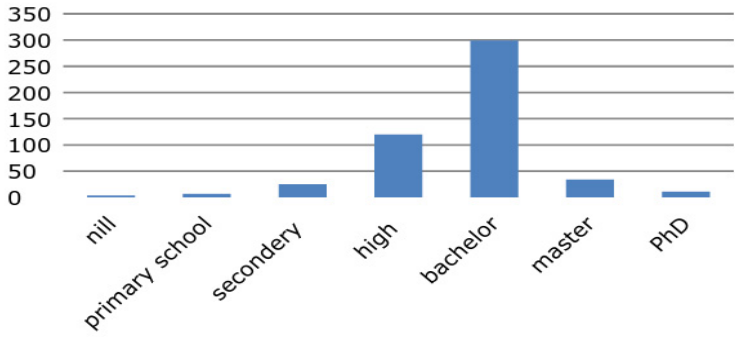

Figure 2 Distribution of the educational level of the participants

Total 63 participants (12.6%) including 28 men (18.2%) reported a history of spine injury.

Assessment of Participants' Basic Knowledge of the Spinal Cord Structure

Most of the participants (n=469, 93.6%) knew that the spinal cord is a bundle of fibers that passed in the vertebral column. A slightly higher proportion of participants (n=484, 96.6%) knew that the spinal cord is part of the central nervous system that extends from the brain. However, a smaller proportion of respondents (n=447, 89.2%) knew that the spinal cord is responsible for the transmission of signals to and from the brain.

Assessment of Participants' General Knowledge about SCI

Causes of SCI: A total of 312 participants (62.3%) knew that the main cause of spine injury is a motor vehicle collision. Respondents reported the following as the main cause of SCI: performing the wrong daily habits (n=96, 19.2%), falls (n=47, 9.4%), medical errors (n=20, 4%), and sports injuries.

Clinical features of SCI: Of the 501 respondents, 230 (45.9%) thought that loss of consciousness is a symptom of SCI injury. The majority of the participants (n=465, 92.8%) knew that loss of sensory and motor functions could be a feature of SCI. Close to half of the participants (n=263, 52.5%) agreed that vital signs (heart rate, blood pressure, respiratory rate, and temperature) could change in patients with SCI.

Investigations in SCI: More than four-fifths of the participants (n=420, 83.8%) thought that magnetic resonance imaging (MRI) is an important investigational tool in SCI patients; 81 (16.2%) thought otherwise. Approximately 82.8% of the participants (n=415) thought that a CT scan is an important tool in the investigation of SCI.

Care of patients with SCI: Most of the participants (n=483, 96.4%) thought the best initial course of action is to immobilize the patient with SCI. Close to one quarter (n=120, 24%) thought that surgery is important for all spine injury victims; 443 (88.4%) thought that physiotherapy is important in the care of patients with SCI.

Potential Risks for Spine Injury Misconceptions

Males had a significantly higher risk for SCI than females (OR 1.98, 95% confidence interval [CI] 1.15-3.39, p=0.012). Additionally, males were more likely to provide incorrect answers to the question that assessed participants' knowledge about the loss of motor and sensory functions (OR 3.54, 95% CI 1.86-6.73, p=0.001). Participants who did not know the basic histology of the spinal cord did not know the importance of MRI in SCI (OR 3.47, 95% CI 1.62-7.43, p=0.001) and the importance of computed tomography (CT) (OR 2.75, 95% CI 0.99-7.66, p=0.044). Participants who knew the basic anatomy of the spinal cord were significantly more likely to know its basic function (OR 8.45, 95% CI 3.11-23.0, p=0.001). People who lacked knowledge of the function of the spinal cord were significantly more likely to lack knowledge of the symptoms of SCI (OR 4.31, 95% CI 1.98-9.37, p=0.001) (Table 1).

Table 1 Association between the knowledge variables and respondents at risk for misconception

Knowledge Field	People at Risk for Misconception	p-value
Motor and sensory function of the SC	Male gender	0.001
Investigation of SCI	People who did not know the basic structure of the SC	0.001
Symptoms of SCI	People who lacked the knowledge of the function of the SC	0.001

Symptoms of SCI	People who lacked the knowledge of the function of the SC	0.001
Knowledge of initial immobilization in SCI	People who had a history of SCI	0.007
	People who thought the loss of consciousness was part of SCI	0.023
Vital signs changes in SCI	People who thought the loss of consciousness was part of SCI	0.001
Physiotherapy knowledge	People who lacked knowledge of MRI	0.033
	People that have a misconception about the surgery for SCI	0.046
The basic structure of the SC	Primary and secondary school level of education	0.019
SC: Spinal Cord; SCI: Spinal Cord Injury		

Participants who reported a positive history of spine injury incorrectly respond to the question about spine immobilization in SCI patients (OR 3.47, 95% CI 1.35-8.93, p=0.007). However, they were more knowledgeable about the surgical care of SCI (OR 2.02, 95% CI 1.15-3.54, p=0.013). Participants who lacked knowledge of the immobilization of SCI patients believed that loss of consciousness was part of SCI (OR 1.98, 95% CI 0.93-4.19, p=0.023). Conversely, participants who knew the importance of immobilization also knew the importance of CT scans in the diagnosis of SCI (OR 3.25, 95% CI 1.22-8.65, p =0.038).

People who had misconceptions about the loss of consciousness in SCI were significantly more likely to lack knowledge of vital sign changes in patients with SCI (OR 2.8, 95% CI 1.95-4.04, p=0.001). Not knowing the importance of MRI was associated with a risk of not knowing the importance of physiotherapy in SCI (OR 2.0, 95% CI 1.04-3.80, p=0.033). Similarly, participants who lacked knowledge of the role of surgery in SCI were more likely not to know the importance of physiotherapy (OR 1.67, 95% CI 1.01-2.75, p=0.046).

Participants' level of education was significantly associated with their knowledge of the anatomy of the spine. Furthermore, those who had completed only primary and secondary school were less likely to know the basic structure of the spine (p=0.019), the causes of SCI (p<0.001), and the symptoms of SCI (p=0.010).

Based on these results, a questionnaire that stratifies participants' risk of spine injury can be suggested to include the following items to cover other aspects that were tested (Table 2). The scores in this system are based on the odd ratio of each item.

Table 2 The suggested knowledge-based spinal injury risk prediction scoring system

Item	Score
Gender	Male: 3
	Female: 0
The function of the spinal cord	Correct: 0
	Incorrect: 4
Immobilization is important in spine injured victim	Yes: 0
	No: 3
Loss of consciousness is essential in spinal cord injury	Yes: 2
	No: 0
Physiotherapy has a role in the treatment of spinal cord injured patient	Yes: 0
	No: 2
Maximum score	14
Minimum score	0
Accordingly, the spinal injury risk prediction will be as follows: 0-4: Low risk for spinal injury; 5-7: Moderate risk for spinal injury; >7: High risk for spinal injury; This scoring system correlated significantly with the patients' history of spine injury (p=0.002)	

DISCUSSION

The aim of this study was to assess the Saudi public's injuries locally and worldwide. Additionally, the focus of this study was on the general population to measure their knowledge level and attitude regarding spinal cord structure and injury. Robert and Zamzami conducted a similar study; however, they targeted patients with spinal cord injury and studied psychological factors and their relationship with patients' level of education [2]. In the current study, we found a significant awareness of one of the most common associations between the respondents' level of education and the likelihood of misconception. Indeed, it is conceivable that people with a lower level of education lacked fundamental knowledge about spinal cord injury.

Several tools have been developed to assess whether an injured person had the potential for spinal injury [16]. However, none has been developed to determine the risk for uninjured individuals in potentially at-risk occupations. The findings of this study can be used to develop a questionnaire that stratifies people's risk of SCI with the aim of decreasing the incidence of SCI. The instrument can be potentially useful in assessing the knowledge of persons with a high risk of injury in order to identify those with a low knowledge level and educate them accordingly. Although the instrument can be relevant, several steps would be needed to test its validity and applicability in uninjured individuals in high-risk occupations for complex injuries.

Bellon, et al., reported that the best way to deal with SCI is to actively identify the weak points regarding SCI (awareness level, driving safety measures as RTA is the leading cause, providing first aid, etc.) and work on continuously reducing SCI effectively [17]. The main issues that should be emphasized in this study include:

- A better understanding of the spinal cord anatomy/histology leads to a better understanding of the symptoms associated with SCI
- The management of a patient with SCI starts from the moment the patient had an accident until when the essential modalities of diagnosis are done, including imaging studies (CT and MRI)
- The treatment plan (rehabilitation versus surgery or both) depends on the extent of SCI and the associated complications

Our findings support the benefit of developing a national program to raise awareness among the public about SCI, especially in younger males. Primary prevention of SCIs may be achieved by teaching the public, with a focus placed on teaching behavior modification and parenting strategies [17]. According to these investigators, SCI may be avoided by increasing awareness of etiology-driven evidence-based primary prevention methods. For example, evidence shows that gadgets such as airbags, modern car seats, and improved seat belts have decreased the occurrence of SCI due to road traffic accidents [18]. The American Trauma Society also supports the active and passive prevention of SCI, which can be done by working to change people's behaviors [19]. A change in behavior to improve safety may help reduce the likelihood of having an SCI.

The limitations of this study warrant discussion. First, it is limited by its small sample, making it difficult to draw relevant conclusions. Thus, further studies including a larger sample size are required to confirm these findings. Another limitation of this study is the lack of active interventions to assess the value of our questionnaire in improving the community's understanding of SCI. Nevertheless, the results reflect the lack of some important information regarding the manifestations of SCI, especially in men, who are more likely to experience this type of injury [2].

CONCLUSION

This study shows that younger males lack knowledge about spinal cord structure and injury. The suggested spinal injury risk prediction scoring system may help in the identification of at-risk individuals. An educational program is needed for this group in order to reduce the frequency of SCI.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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