

## Original Article

# Awareness of Spinal Cord Injury Among Medical Students at Umm Al-Qura University in Makkah City, Saudi Arabia: A Cross-Sectional Study

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## Abstract

**Background:** spinal cord injuries (scis) are known for their significant impact, often associated with high morbidity and mortality rates. Effective first aid plays a pivotal role in mitigating the severity of scis and enhancing patient outcomes. This study aimed to evaluate the understanding and awareness of first-aid measures for scis among medical students in Saudi Arabia.

**Methods:** a prospective cross-sectional study was conducted in July 2022 utilizing an online questionnaire survey developed through Google Forms. The study participants consisted of second- to sixth-year medical students enrolled at Umm Al-Qura University in Makkah City, Saudi Arabia. The questionnaire was designed to assess participants' awareness levels, knowledge of first aid measures, and identification of risk factors associated with scis.

**Results:** a total of 302 participants were included in the study, with a mean age of  $22.1 \pm 4.9$  years (range: 18–28 years), of which 76.5% (n = 231) were male. Findings revealed that 70.2% (212) of the students demonstrated commendable awareness levels regarding scis, while 29.8% (90) exhibited lower awareness. Notably, 44% believed immediate contact with emergency services constituted primary treatment for cervical spine injuries, while 80% acknowledged the importance of early detection in minimizing complications. Participants identified various risk factors linked to scis, including road traffic accidents (88.7%), falls (75.5%), sports-related injuries (70.2%), tumors (64.6%), inflammation (55%), and incorrect sitting posture (54%).

**Conclusions:** scis require urgent and comprehensive care, encompassing prevention strategies and proper management. We found a commendable awareness level (70.2%) among participants regarding the initial aid required for scis.

**Keywords:** awareness, first aid, sci, medical student, Saudi Arabia

## Introduction

A spinal cord injury (SCI) is a serious condition that affects not only individuals but also their families and communities because of the high morbidity and mortality rates associated with it, leading to conditions such as tetraplegia, paraplegia, and hemiplegia (1). The definition of an SCI by the World Health Organization encompasses any harm to the spinal cord caused by external factors, including motor vehicle collisions, falls, or instances of violence (2). SCI affects more than half a million people worldwide annually (3).

In accordance with the International Perspectives on SCI, the majority of patients with traumatic SCIs (TSCIs) are young men aged 20–30 years, and traffic accidents are the predominant cause of such injuries globally. Road traffic accidents (RTAs) have been identified as the primary cause of spinal injuries, accounting for approximately half of all SCI cases (4).

Saudi Arabia is one of the largest countries in the Middle East, and its population is over 27.5 million (2). It also has one of the highest rates of SCIs worldwide (5). In Saudi Arabia, RTAs are frequent and represent the foremost contributors to SCIs. This observation was reinforced by the findings of a study conducted in a hospital setting, which reported that RTA accounted for 79.2% of cases of SCIs among admitted individuals (6).

SCI can be classified into two stages: primary and secondary. The primary stage is caused by direct physical SCIs, whereas a secondary injury results from a cascade of physiological, biochemical, and intracellular events (7). The complications of traumatic SCI include loss of both motor and sensory functions, bowel and urinary incontinence, and neuropathic pain (8).

First aid is a pivotal measure that significantly contributes to reducing mortality related to various diseases and injuries, such as fractures and paralysis, which can result from SCIs (9). When an individual has an injury that can lead to an SCI, it is crucial to promptly administer first aid until comprehensive medical treatment becomes

available (9). The provision of first aid for SCI requires a judicious and swift approach within a limited timeframe to optimize outcomes and mitigate the risk of severe harm, or even fatality in certain cases (10). Addressing first aid for SCI requires a structured approach. Therefore, ensuring airway integrity takes precedence. Subsequently, maintaining the patient's hemodynamic stability is of paramount importance. Finally, it is imperative that the patient's head or neck not be moved to avoid further potential damage (4).

In the realm of medical education, fostering a comprehensive understanding among students regarding immediate assistance for SCIs remains pivotal. However, scant investigations have delved into evaluating the awareness, knowledge, and attitudes of medical students concerning urgent care for SCIs. Hence, this study undertakes the essential task of exploring the depth of awareness, knowledge, and attitudes among medical students at Umm Al-Qura University in Saudi Arabia regarding immediate assistance for SCIs.

The significance of this investigation lies in addressing a critical gap in understanding the preparedness and perceptions of future healthcare professionals in managing emergency situations related to SCIs. By evaluating the awareness and knowledge levels among medical students, this study aims to contribute substantially to the enhancement of educational strategies, potentially impacting future healthcare practices and outcomes in dealing with SCI emergencies.

## Materials and methods

### *Ethical Statement*

Prior to the study initiation, ethical approval was obtained from the “Biomedical Ethics Committee” at Umm Al-Qura University, Makkah, Saudi Arabia. The ethical approval reference number for this study is HAPO-02-K-012-2022-06-1122. Overall, 302 participants were included, all of whom provided informed consent.

### *Study sampling and population*

In this prospective cross-sectional study, all second- to sixth-year medical students at Umm Al-Qura

University were included. The study survey was administered in July 2022 through an online questionnaire developed using Google Forms. Exclusion criteria include non-medical students, first-year medical students, medical students from other universities, graduate students or residents, students not providing informed consent, and participants who submitted incomplete questionnaire responses.

### Data Collection

The questionnaire employed in the study was structured into three main sections: the initial section gathered sociodemographic information about the participants; the second section was dedicated to assessing their awareness of SCIs; and the final section concentrated on the participants' reactions and approaches to handling patients with SCIs. This questionnaire was adapted based on a previous cross-sectional study that evaluated the level of public awareness regarding SCIs among adult residents of the Kingdom of Saudi Arabia (11).

### Statistical analysis

Data collected were evaluated and entered into the Statistical Package for the Social Sciences version 21 (IBM Corporation NY, USA, Armonk). Statistical methods employed were two-tailed with a significance level of 0.05. A scoring system assigned one point for each accurate response, culminating in an overall awareness score. Scores below 60% were categorized as poor awareness, while scores at or above 60% indicated good awareness.

Descriptive analysis involved frequency distributions and percentages to assess variables including student demographics, academic details, and grade point averages (GPAs). Additionally, awareness items and self-reported practices associated with observed SCI cases were tabulated. The overall awareness level was graphically represented. Cross-tabulation techniques were used to illustrate the distribution of participants' awareness levels based on various factors, and Pearson's chi-square test was applied to determine the significance of relationships, utilizing exact probability tests for small frequency distributions.

## Results

### Participant's personal data

The study engaged 302 undergraduate medical students, with a demographic spread ranging from 18 to 28 years, averaging  $22.1 \pm 4.9$  years. The gender distribution was predominantly male, constituting 76.5% ( $n = 231$ ) of the sample. The academic years of the participants were diverse, with 32.1% ( $n = 97$ ) in their preclinical years (2nd and 3rd years) and a majority of 67.9% ( $n = 205$ ) in their clinical years (4th to 6th years). The GPA of the students were categorized into three distinct ranges for a clearer understanding of their academic standing. These ranges included less than 3.0, between 3.0 and 3.4, and between 3.5 and 4.0 (**Table 1**). This comprehensive demographic and academic profiling laid the foundation for assessing the students' awareness and understanding of SCIs, a vital aspect of their medical education and future professional responsibilities. The categorization of GPAs, in particular, offered a nuanced view of the academic diversity within the participant group.

Table 1. Participants' personal data

Personal data	Number	%	
Age in years	<20	53	17.5%
	20–24	242	80.1%
	25–30	7	2.3%
Sex	Male	231	76.5%
	Female	71	23.5%
Marital status	Single	297	98.3%
	Married	5	1.7%
Academic year	2nd	54	17.9%
	3rd	43	14.2%
	4th	45	14.9%

### Awareness of SCI

The study meticulously explored the medical students' awareness of SCIs. **Table 2** presents a detailed account of their understanding of various SCI risk factors. A notable majority recognized RTAs as the primary contributor to spinal injuries

(88.7%), followed by falls (75.5%) and sports-related incidents (70.2%). Interestingly, factors like incorrect sitting posture (54.0%) and prolonged use of devices (35.4%) were also acknowledged, albeit to a lesser extent. Participants generally understood the consequences of cervical spine injuries, with a high percentage acknowledging accompanying damage to the spinal cord (78.1%) and the potential for lifelong disability (83.1%). Awareness about complications stemming from cervical injuries, such as motor and sensory function disabilities, breathing complications, and urinary or bowel incontinence, was considerable, ranging from 34.8% to 81.8%. Additionally, there was a strong awareness (76.8%) of the need for long-term medical and physical management for cervical spine injuries. Regarding first aid, a significant proportion recognized the importance of promptly calling emergency services (44.0%) and restricting movement during transport (35.8%). However, gaps in awareness were evident in some areas, notably in identifying signs indicative of cervical SCIs and medical conditions that increase susceptibility to such injuries, where awareness levels varied widely among participants. Overall, while there's a commendable level of awareness in many aspects, there remain opportunities for further education and enhancement of understanding, particularly in specific nuanced areas related to SCI signs and associated medical conditions.

### *Responses to witnessed SCIs*

The study provides insightful data on how the participating medical students would react to real-life scenarios involving SCIs (**Table 3**). A significant majority displayed a willingness to assist individuals involved in accidents or falls (81.8%) and recognized the potential benefit of an appropriate response for the victim (86.4%). Moreover, a substantial percentage acknowledged the impact of cervical spine injuries on a patient's quality of life (85.4%). When dealing with an unconscious trauma patient, a considerable proportion demonstrated an intention to implement spinal movement precautions (79.1%) and avoid moving the patient while promptly seeking emergency services (83.1%). Most participants emphasized the necessity of contacting emergency services before initiating first aid measures (90.4%). Additionally, a majority (90.1%) indicated a commitment to exercising utmost caution to maintain proper alignment of the head, neck, and spine. However, when it came to steps to be taken if suspecting a cervical spine injury in a responsive patient, while reassuring the patient to remain still was commonly reported (68.5%), there were varied responses regarding checking neck mobility or attempting to change the patient's position, indicating potential areas for further education or training to ensure standardized responses in such scenarios.

Table 2. Awareness of spinal cord injuries among the study participants

Awareness items	Number	%
RTAs	268	88.7%
Falls	228	75.5%
Sports	212	70.2%
Factors contributing to spinal injuries		
Tumors	195	64.6%
Inflammation	166	55.0%
Incorrect sitting posture	163	54.0%

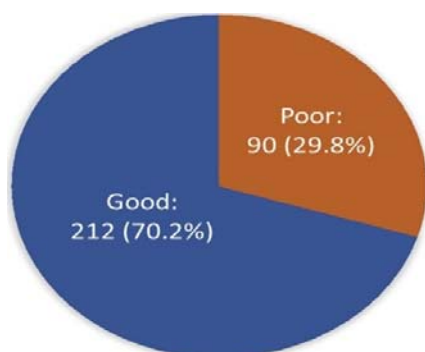
	Prolonged use of devices	107	35.4%
	I don't know	12	4.0%
Cervical spine injuries are often accompanied by damage to the spinal cord.	Yes	236	78.1%
	No	17	5.6%
	I don't know	49	16.2%
	Yes	251	83.1%
Cervical spine injuries could lead to lifelong disability.	No	16	5.3%
	I don't know	35	11.6%
Complications due to cervical injuries	Motor function-related disability	247	81.8%
	Sensory function-related disability	231	76.5%
	Breathing complications	166	55.0%
	Urinary incontinence	113	37.4%
	Bowel incontinence	105	34.8%
	Smell and taste problems	65	21.5%
	I don't know	35	11.6%
Long-term medical and physical management is required for cervical spine injuries	Yes	232	76.8%
	No	17	5.6%
	I don't know	53	17.5%
First aid management required for cervical spine injuries	Call emergency services	133	44.0%
	Restricted movement during transport	108	35.8%
	Change in patient position	18	6.0%
	Do not know	43	14.2%
Role of early detection in preventing complications due to cervical spine injuries	Yes	242	80.1%
	No	20	6.6%
	I don't know	40	13.2%
Importance of adequate on-site management in preventing permanent spinal cord damage	Yes	234	77.5%
	No	22	7.3%
	Don't know	46	15.2%
Key considerations for safely stabilizing patients with spinal injuries	Keep the patient in the same position until the arrival of emergency service personnel	234	77.5%
	Correct deformity pulls arms neck and Legs	17	5.6%
	Set Patient Up	9	3.0%
	Do not know	42	13.9%
Proper response when resuscitation is needed for a patient	Call emergency services, start resuscitation, and ensure spine immobilization	225	74.5%
	Patient transfer to the nearest hospital in one's own vehicle	22	7.3%
	Do nothing	15	5.0%
	Do not know	40	13.2%
Signs indicative of cervical spinal cord injuries	Inability to move the hands	20	6.6%
	Arm pain	13	4.3%
	Numbness	13	4.3%
	Deformity in the neck	9	3.0%
	All of the above	208	68.9%
Medical conditions that increase the susceptibility to cervical spine injuries	Do not know	39	12.9%
	Down syndrome	100	33.1%
	Rheumatoid arthritis	178	58.9%
	Diabetes mellitus	64	21.2%
	Obesity	154	51.0%

Table 3. Participants' self-reported first reactions to witnessed spinal cord injuries

Practice	Number	%
<b>I am willing to assist individuals who are involved in a car accident or a fall</b>		
Yes	247	81.8%
No	55	18.2%
<b>An appropriate response can be beneficial for the victim.</b>		
Yes	261	86.4%
No	23	7.6%
I don't know	18	6.0%
<b>A cervical spine injury can affect the patient's quality of life until their death</b>		
Yes	258	85.4%
No	17	5.6%
I don't know	27	8.9%
<b>I would implement spinal movement precautions for an unconscious patient with trauma</b>		
Yes	239	79.1%
No	63	20.9%
<b>I will avoid moving the patient and promptly call for emergency services</b>		
Yes	251	83.1%
No	32	10.6%
I don't know	19	6.3%
<b>I will contact emergency services prior to initiating first aid measures</b>		
Yes	273	90.4%
No	29	9.6%
<b>I will consistently exercise utmost caution to keep the head, neck, and spine properly aligned</b>		
Yes	272	90.1%
No	30	9.9%
<b>If the patient is responsive and I suspect a cervical spine injury, I will take the following steps</b>		
Provide reassurance and tell the patient to remain still	207	68.5%
Check the patient's neck mobility	34	11.3%
Try to change the patient's position	10	3.3%
I don't know	51	16.9%



**Figure 1** represents a visual breakdown of the SCI awareness levels among the medical student participants. The graphical depiction demonstrates that 70.2% of the surveyed students exhibited a commendable understanding of SCI-related aspects, classified as having "Good Knowledge." Conversely, 29.8% of the participants fell into the category of "Poor Knowledge," signifying a lesser understanding of SCI-related concepts.



**Figure 1:** Overall awareness level regarding SCIs among medical students at Umm Al-Qura University in Makkah City, Saudi Arabia

### Factors influencing SCI awareness

The study delves into the variables influencing the students' awareness levels about SCIs (**Table 4**). An intriguing trend emerged concerning age groups, with participants aged 20-24 exhibiting significantly higher levels of good awareness (75.2%) compared to those under 20 (47.2%) and those between 25-30 (71.4%) years old ( $p < 0.001$ ). Regarding academic progression, preclinical students showed lower awareness levels (54.6%) compared to clinical students (77.6%) with a notable statistical significance ( $p < 0.001$ ). However, no significant associations were observed concerning sex ( $p = 0.522$ ) or marital status ( $p = 0.629$ ). These findings indicate a potential correlation between age and academic year with awareness levels of SCIs among participants, suggesting the importance of tailored educational strategies or interventions targeting specific age groups or academic stages to enhance awareness uniformly among participants.

**Table 4. Factors associated with participant' awareness of spinal cord injuries.**

Factors	Number	Overall awareness level		p-value
		Poor %	Good Number %	
Age in years				
<20	28	52.8%	25 47.2%	<b>.001*\$</b>
20-24	60	24.8%	182 75.2%	
25-30	2	28.6%	5 71.4%	
Sex				
Male	71	30.7%	160 69.3%	.522
Female	19	26.8%	52 73.2%	
Marital status				
Single	89	30.0%	208 70.0%	.629\$
Married	1	20.0%	4 80.0%	
Academic year				
Preclinical	44	45.4%	53 54.6%	<b>.001*</b>
Clinical	46	22.4%	159 77.6%	

P: Pearson X2 test

\*  $p < 0.05$  (significant)

\$: Exact probability test

**Table 5** illustrates the relationship between participants' awareness of SCIs and their reported practices in certain scenarios. There is a consistent trend observed across various practices and the participants' overall awareness levels regarding SCIs. For instance, individuals reporting a willingness to assist those involved in accidents or

falls showed a significantly higher proportion of good awareness (86.8%) compared to those with poor awareness (70.0%) ( $p < 0.001$ ). Similarly, those recognizing an appropriate response as beneficial for victims demonstrated significantly higher good awareness (93.9%) versus poor awareness (68.9%) ( $p < 0.001$ ).

Table 5. Relation between participants' awareness of spinal cord injuries and their self-reported practice in cases					
Practice	Overall awareness level				p-value
	Poor		Good		
	Number	%	Number	%	
<b>I am willing to assist individuals who are involved in a car accident or a fall</b>					
Yes	63	70.0%	184	86.8%	.001*
No	27	30.0%	28	13.2%	
<b>An appropriate response can be beneficial for the victim</b>					
Yes	62	68.9%	199	93.9%	.001*\$
No	16	17.8%	7	3.3%	
I don't know	12	13.3%	6	2.8%	
<b>A cervical spine injury can impact the patient's quality of life until their death</b>					
Yes	59	65.6%	199	93.9%	.001*\$
No	11	12.2%	6	2.8%	
I don't know	20	22.2%	7	3.3%	
<b>I would implement spinal movement precautions for an unconscious patient with trauma</b>					
Yes	62	68.9%	177	83.5%	.004*
No	28	31.1%	35	16.5%	
<b>I will make an effort to avoid moving the patient and promptly call for emergency services</b>					
Yes	59	65.6%	192	90.6%	.001*\$
No	18	20.0%	14	6.6%	
I don't know	13	14.4%	6	2.8%	
<b>I will contact emergency services prior to initiating first aid measures</b>					
Yes	72	80.0%	201	94.8%	.001*\$



No	18	20.0%	11	5.2%	
<b>I will consistently exercise utmost caution to keep the head, neck, and spine properly aligned</b>					
Yes	71	78.9%	201	94.8%	<b>.001*\$</b>
No	19	21.1%	11	5.2%	

*P: Pearson X2 test, P-Value <0.05 is statistically Significant \$: Exact probability test*

Moreover, participants acknowledging that a cervical spine injury could significantly impact a patient's quality of life until their death exhibited notably higher good awareness (93.9%) compared to those with poor awareness (65.6%) ( $p < 0.001$ ). The trend continues across various reported practices, including implementing spinal movement precautions ( $p = 0.004$ ), making efforts to avoid moving the patient and promptly calling for emergency services ( $p < 0.001$ ), and consistently exercising utmost caution to maintain head, neck, and spine alignment ( $p < 0.001$ ), where higher rates of good awareness are consistently associated with reported positive practices. These findings suggest a strong correlation between participants' awareness levels regarding SCIs and their reported practices in emergency scenarios related to spinal injuries.

## Discussion

An SCI is a severe and potentially life-threatening condition that requires immediate and proper management (4). Mishandling cervical trauma patients risks permanent disability or death (12). Thus, immobilization becomes the primary step in initial aid, supporting the back and neck during patient movement. Evaluating and safeguarding the cervical spine during trauma resuscitation poses challenges. Various risk factors contribute to the development of SCIs. Road traffic accidents are the predominant cause, accounting for approximately 85% of all TSCIs. Additional risk factors include falls, acts of violence, and sports-related injuries (2, 6, 12).

Our findings revealed that the majority of participants exhibited a high awareness level, with 70.2% exhibiting a strong overall awareness of first aid for SCIs. Notably, students in their clinical years

demonstrated more pronounced awareness, with 77.6% of them achieving a good overall awareness level compared with only 54.6% of students in the preclinical years achieving this awareness level. In addition, female students exhibited a slightly higher overall awareness level (73.2%), whereas male students showed a solid overall awareness level (69.3%).

In 2021, a study was conducted by AlMarhoon et al. to evaluate public awareness of SCIs in Saudi Arabia. In this study, 75.2% of participants recognized RTAs as a risk factor for SCIs, while 79.4% of participants indicated that damage to the spinal cord could be associated with cervical spine injuries (11). Our study revealed similar findings, with a notable majority of participants (88.7%) recognizing RTAs as a significant SCI risk factor. Moreover, 78.1% consistently associated cervical spine injuries with potential spinal cord damage. Additionally, 83.1% of participants comprehended that cervical spine injuries could result in lifelong disability. Furthermore, AlMarhoon et al. demonstrated that 71.3% of participants noted that cervical spine injuries might result in enduring impairments (11).

In a study from 2012, it was shown that falls accounted for 9% of TSCIs in Saudi Arabia (2). Intriguingly, in the present study, 75.5% of participants demonstrated awareness regarding falls as a risk factor for SCIs.

The proportion of students who indicated their intention to contact emergency responders before offering first aid in this study closely aligns with findings from another study involving medical students in Riyadh in 2018 (90.4% vs. 89%) (10). This study also revealed that 77.5% of the students

understood the necessity of maintaining the patient's position until the arrival of emergency services. The findings of our study indicated that medical students at Umm Al-Qura possessed a commendable awareness level regarding first aid for SCIs (70.2%). Interestingly, in a previous study conducted to assess public awareness in Saudi Arabia in 2021, 72.9% of participants were knowledgeable about immobilizing patients (11).

Regarding complications related to cervical injuries, motor disability was recognized as the most prevalent complication by the students (81.8%). Notably, other studies have demonstrated that 80% of participants were aware that the early detection of cervical spine injuries could help prevent further complications. In a previous study in Riyadh, 91% of participants reported that a prompt intervention within 2 h of the injury could prevent tetraplegia as a complication (10).

Comparative analyses with previous studies conducted in Saudi Arabia highlighted similarities in findings, affirming the consistent awareness levels among different cohorts regarding SCI risk factors and management. Noteworthy similarities were found in recognizing the association between cervical spine injuries and potential spinal cord damage, as well as the understanding of lasting disabilities resulting from such injuries.

### ***Strengths and Limitations***

The study demonstrates significant strengths, including comprehensive coverage of SCI aspects, a focused target population of medical students, robust data collection through a structured online questionnaire, a substantial response rate, and rigorous statistical analysis.

However, it faces limitations such as geographical confinement to a single university, the cross-sectional nature of capturing awareness at a single point in time, the potential response bias inherent in survey-based research, and the absence of practical skill assessments.

### ***Future research and recommendations***

Future research on SCI awareness should focus on expanding the scope to include multiple medical

universities across Saudi Arabia and a diverse range of healthcare professionals to enhance the generalizability and comprehensiveness of the findings. Longitudinal studies and practical skill assessments are essential to track the progression of awareness and capabilities over time. Additionally, interventional studies to evaluate the efficacy of specific educational interventions would be valuable. It is recommended that medical curricula be augmented to include more comprehensive training on SCI, both theoretical and practical, supplemented by regular workshops, simulations, and hands-on training sessions to ensure proficiency in SCI management among future healthcare professionals.

### **Conclusion**

In conclusion, this study among Umm al-qura university medical students in Saudi Arabia highlighted a commendable overall awareness of SCIs. While demonstrating strong recognition of risk factors, consequences, and appropriate responses, there were areas for improvement, particularly in nuanced aspects of identifying signs and associated medical conditions. Academic progression and age exhibited correlations with awareness levels, emphasizing the need for tailored educational strategies.

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### **Disclosure**

#### ***Conflict of interest***

There is no conflict of interest.

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#### ***Ethical consideration***

Prior to the study initiation, ethical approval was obtained from the "Biomedical Ethics Committee" at Umm Al-Qura University, Makkah, Saudi Arabia. The ethical approval reference number for

this study is HAPO-02-K-012-2022-06-1122. Overall, 302 participants were included, all of whom provided informed consent.

**Data availability**

Data that support the findings of this study are embedded within the manuscript.

**Author contribution**

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by Alabbas Alshrif, Abdulrahman Alnashri, Bandar Alzubaidi, Naif Abeeri and Mohammed Almalki. The first draft of the manuscript was written by Mohammed Alhuzali, Mohammed Alshinkity, Jamil Samkari, and Abdullah Tawakul and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript after supervision by Omar babateen.

**References**

1. Nas K, Yazmalar L, Şah V, Aydın A, Öneş K. Rehabilitation of spinal cord injuries. *World journal of orthopedics*. 2015;6(1):8.
2. Alshahri SS, Cripps RA, Lee BB, Al-Jadid MS. Traumatic spinal cord injury in Saudi Arabia: an epidemiological estimate from Riyadh. *Spinal Cord*. 2012;50(12):882-4.
3. Kumar R, Lim J, Mekary RA, Rattani A, Dewan MC, Sharif SY, et al. Traumatic Spinal Injury: Global Epidemiology and Worldwide Volume. *World Neurosurgery*. 2018;113:e345-e63.
4. Yin Y, Yang X, Tian Y, Zhang Y, Zhang P, Jia Y, et al. Synchronized and integrated prehospital treatment for acute cervical spinal cord injury. *American Journal of Translational Research*. 2021;13(6):7008.
5. Robert AA, Zamzami MM. Traumatic spinal cord injury in Saudi Arabia: a review of the literature. *The Pan African medical journal*. 2013;16.
6. Ansari S, Akhdar F, Mandoorah M, Moutaery K. Causes and effects of road traffic accidents in Saudi Arabia. *Public Health*. 2000;114(1):37-9.

7. Hachem LD, Ahuja CS, Fehlings MG. Assessment and management of acute spinal cord injury: From point of injury to rehabilitation. *The Journal of Spinal Cord Medicine*. 2017;40(6):665-75.
8. Galeiras Vázquez R, Ferreiro Velasco ME, Mourelo Fariña M, Montoto Marqués A, Salvador de la Barrera S. Actualización en lesión medular aguda postraumática. Parte 1. *Medicina Intensiva*. 2017;41(4):237-47.
9. Khan A, Shaikh S, Shuaib F, Sattar A, Samani SA, Shabbir Q, et al. Knowledge attitude and practices of undergraduate students regarding first aid measures. *Journal of the Pakistan Medical Association*. 2010;60(1):68.
10. AlMarhoon EA, Alhabib RA, Alshaalan AA. Evaluation of knowledge, attitude, and practice about first aid of spinal injury among medical students in Saudi Arabia, 2018. *The Egyptian Journal of Hospital Medicine*. 2018;73(5):6734-7.
11. Al-Otaibi ML, Almutairi KH, Al-Otaibi KM, Alghaeb AN, Al-Hadi SH. Levels of public awareness regarding cervical spine injury and the suitable first aid response among adults in Saudi Arabia. *Saudi Medical Journal*. 2021;42(5):543-9.
12. Yisheng W, Fuying Z, Limin W, Junwei L, Guofu P, Weidong W. First aid and treatment for cervical spinal cord injury with fracture and dislocation. *Indian Journal of Orthopaedics*. 2007;41(4):300.