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Original article

ARE WE TRAINING MEDICAL STUDENTS TO MANAGE AUTONOMIC DYSREFLEXIA IN SPINAL CORD INJURY? A STUDY

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Abstract: **Background:** Autonomic dysreflexia (AD) is a potentially life-threatening complication of spinal cord injury (SCI), characterized by sudden, paroxysmal episodes of hypertension. Healthcare professionals and family members caring for individuals with SCI must be able to recognize and manage AD promptly and appropriately. This study aimed to assess the level of knowledge about AD among final-year medical students, evaluate their preparedness to manage AD, and highlight the importance of educating families of SCI patients on its recognition and management.

Methods: A questionnaire-based, descriptive cross-sectional study was conducted among final-year (MD-4) medical students at the College of Medicine, Qassim University. Data were collected, cleaned, and analyzed using Microsoft Excel 2021. Students were then categorized into three groups based on their knowledge level: poor, fair, and good.

Results: Significant gaps were identified in students' knowledge of AD. Out of 68 students initially surveyed, 24 (35.3%) had not heard of AD and were excluded. Among the 44 participants included in the final analysis, scores ranged from 4 to 12 out of a maximum of 21, with a mean score of 7.02 (33.4%). A total of 27 students (61%) were classified as having poor knowledge, and 17 (39%) as fair. None of the students qualified for the "good" knowledge category.

Conclusions: The findings underscore the need for incorporating autonomic dysreflexia into the undergraduate medical curriculum. Early education would ensure that medical graduates are better prepared to manage AD and can help prevent complications by educating patients' families.

Keywords: spinal cord injury, autonomic dysreflexia, stroke, hypertension, pain, fecal impaction, pressure ulcer, Foley catheter.

INTRODUCTION

Spinal cord injury (SCI) is a life-altering condition with devastating consequences, resulting in the loss of motor, sensory, and autonomic functions. In addition to the primary injury, patients are at risk for a range of secondary health complications. One such complication is autonomic dysreflexia (AD), a potentially life-threatening medical emergency that affects individuals with SCI. It is characterized by sudden, paroxysmal hypertensive episodes and typically presents with symptoms such as a pounding headache, bradycardia, flushing and sweating of the face and neck, piloerection (goosebumps), and shivering (1, 2).

If not recognized and treated promptly, AD can lead to serious cardiophysiological and systemic complications (3), including seizures (4), recurrent cardiac arrest (5), retinal or subarachnoid hemorrhage (6, 7), stroke (4, 6), and even death (3, 7, 8, 9).

AD most commonly occurs in individuals with SCI at or above the T6 spinal level, where supraspinal control of the sympathetic preganglionic neurons (SPNs) involved in blood pressure regulation—particularly in the splanchnic circulation—is interrupted (10). Without descending inhibitory control from the brain, these SPNs become hyperreactive to noxious stimuli originating below the level of injury. This hyperactivity causes vasoconstriction and a dangerous rise in blood pressure. The brain detects this sudden increase in BP through baroreceptor input from the aortic arch and carotid sinuses, transmitted via cranial nerves IX and X. In response, the brainstem sends descending parasympathetic inhibitory impulses to counteract the hypertension. However, due to the spinal lesion, these impulses are blocked at the injury level, resulting in vasodilation (manifesting as headache, flushing, and diaphoresis) only in the upper body (Figure 1), and failing to reduce systemic blood

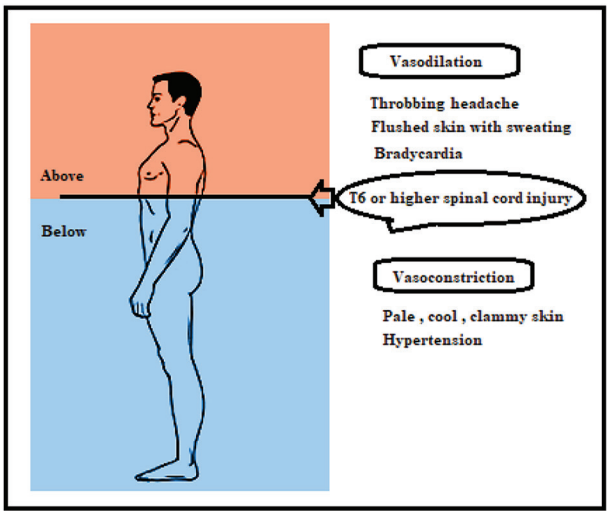

Figure 1. *Pathophysiology of autonomic dysreflexia. (Image credits: Sajad Ahmad Salati)*

pressure. Additionally, stimulation of the vagus nerve (cranial nerve X) leads to secondary bradycardia (10, 11, 12).

Although AD is more commonly associated with complete spinal cord lesions, studies have shown that individuals with motor-incomplete injuries are also at risk (10, 11, 12).

The peer-reviewed literature indicates that health-care professionals often possess limited knowledge of autonomic dysreflexia (AD), and many physicians not directly involved in rehabilitation may be unfamiliar with the condition. This knowledge gap is largely attributed to the minimal emphasis placed on AD during undergraduate medical education. In this context, the present study was conducted to assess the level of awareness and understanding of AD among final-year undergraduate medical students.

MATERIALS AND METHODS

Study Design

A cross-sectional descriptive study was conducted to assess the level of knowledge related to autonomic dysreflexia among medical students. Pre-validated

Table 1. *Questionnaire for assessment of knowledge related to Autonomic Dysreflexia*

Questions		Yes	No	Not sure
PART 1: Have you heard about Autonomic Dysreflexia (AD) in Spinal Cord Injured patients?				
PART 2: If answer is YES, then please answer the following questions.				
1.	**Which of the following are the symptoms of AD?**			
i.	Pounding headache			
ii.	Profuse Sweating over the face and neck			
iii.	Goose-bumps			
iv.	Flushing over face and neck			
v.	Blurred vision			
2.	**Which of the following can precipitate AD?**			
i.	Blocked urinary catheter			
ii.	Faecal impaction / constipation			
iii.	Anal fissure			
iv.	Pressure ulcers			
v.	In growing nail			
vi.	Gallstones			
vii.	Tight clothing, stockings /straps			
viii.	Sexual stimulation			
3.	What happens to the blood pressure in AD?			
i.	Increases			
ii.	Decreases			
iii.	Stays normal			
4.	**What happens to the heart rate in AD?**			
i.	Increases			
ii.	Decreases			
iii.	Stays normal			
5.	**Which of the following are the possible complications of AD?**			
i.	Seizures			
ii.	Intracerebral haemorrhage			
iii.	Retinal haemorrhage			
iv.	Arrythmias			
v.	Death			
6.	**What level of injury to the spinal cord is crucial in predicting the development of AD?**			
i.	Cervical			
ii.	Midthoracic			
iii.	Lumbar			

questionnaires from previous studies by Kaydok (13), Tederko (14), Strcic and Marki (15), and McGillivray et al. (16) were selected and appropriately modified for this purpose (Table 1).

Sampling and Study Population Definition

Total sampling coverage was employed to include all students who consented to participate in the study. The enrolled cohort consisted of final-year (MD-4) undergraduate medical students from the male campus of the College of Medicine (Unaizah), Qassim University, Kingdom of Saudi Arabia.

Exclusion Criteria:

Participants were excluded if they (i) had not yet reached the final year (MD-4) and therefore had not completed all curriculum blocks covering spinal trauma, or (ii) were MD-4 students who responded negatively to Part A of the questionnaire, indicating they had never heard or read about autonomic dysreflexia (AD).

Execution:

After consultation with two medical education specialists, a content expert (MIF, the first author and board-certified neurosurgeon) evaluated the questionnaire for criterion validity. Reliability and face validity were confirmed through an offline pilot study involving eight students. Subsequently, enrolled students completed an anonymous online survey. Only those who answered "yes" to the initial question regarding familiarity with the term "autonomic dysreflexia" proceeded to the second section, which assessed their knowledge of AD's pathophysiology, contributing factors, symptoms, and complications.

Data Handling and Analysis:

Data were collected, cleaned, and analyzed using Microsoft Excel 2021 (Data Analysis ToolPak). Descriptive statistics, including frequency distributions and percentages, summarized participant responses and knowledge levels. Results were presented in tables and figures. Statistical significance was considered at $p < 0.05$ or $p < 0.01$.

Scoring Scheme:

Each correct answer was awarded one point; no points were awarded or deducted for incorrect or "not sure" responses. The questionnaire comprised 21 items, setting the maximum achievable score at 21 and the minimum at zero. Based on total scores, participants were categorized as shown in Table 2.

Table 2. *Categorization of students based upon the score achieved in the questionnaire*

Category	Score
Poor Knowledge	0-7
Fair Knowledge	8-14
Good Knowledge	15-21

Ethical Considerations

Participation in the study was entirely voluntary. Students who declined to participate were assured that their decision would not result in any negative consequences. The questionnaire was administered anonymously. In accordance with the principles of the Declaration of Helsinki, all data were kept confidential, not disclosed to third parties, and used solely for the purposes outlined in the study protocol.

RESULTS

A total of 68 students participated in the study. Of these, only 44 students (22 males and 22 females) had heard or read about AD, responding affirmatively in Part 1 of the questionnaire and thus proceeding to Part 2. Consequently, 24 students (35.3%) were excluded at this stage. Overall scores among the 44 participants ranged from 4 to 12 (Figure 2), with a mean score of 7.02 out of 21 (33.4%). The mean scores for male and female students were 6.95 and 7.09, respectively, with no statistically significant difference observed between genders.

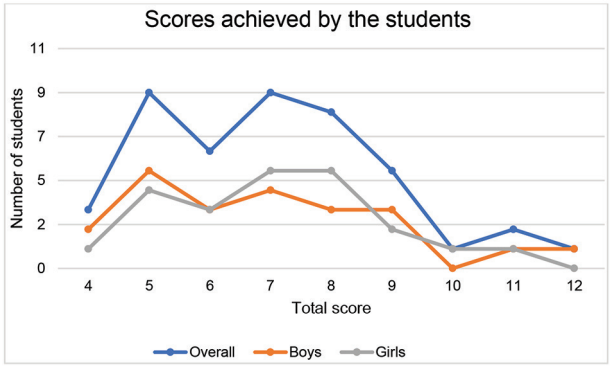

Figure 2. *Scores achieved by the students in the questionnaire. (Image credits: Sajad Ahmad Salati)*

Accordingly, the level of knowledge was categorized as shown in Figure 2, with 27 students (61%) classified as having poor knowledge and 17 students (39%) as having fair knowledge. None of the students met the criteria for the good knowledge category.

The percentage of correctly identified symptoms and precipitating factors was only 32% and 27%, respectively. Similarly, 39% of students knew that SCI cases above the midthoracic level are vulnerable to

Figure 3. *Level of knowledge related to autonomic dysreflexia. (Image credits: Sajad Ahmad Salati)*

AD. Only 41% were aware that heart rate can decrease, while 75% correctly recognized that blood pressure increases during AD. No student knew that AD could result in death, although 33% identified other possible complications.

DISCUSSION

Autonomic dysreflexia (AD) is a serious and potentially life-threatening complication that can occur following spinal cord injury (SCI) (17, 18). According to peer-reviewed studies, the prevalence of AD among patients with SCI above the sixth thoracic level ranges from 48% to 90%. The condition may occur as often as 40 times a day and significantly increases the risk of stroke—by 300% to 400% (18–20). The likelihood of experiencing AD and its complications increases with the severity and extent of the spinal lesion (1, 2, 3, 18, 19, 20).

This study reveals notable gaps in knowledge about AD among final-year medical students, who will soon assume clinical roles as interns or residents responsible for educating caregivers of SCI patients. These findings are consistent with other research, which shows that many healthcare professionals have limited understanding of AD, and that physicians outside rehabilitation specialties may be unfamiliar with this condition. A major reason for this gap appears to be the limited emphasis on AD during undergraduate medical education, despite its clinical importance.

This issue is particularly relevant in the Kingdom of Saudi Arabia (KSA), where the incidence of spinal cord injuries is among the highest worldwide—approximately 62 cases per million residents—raising the risk of AD considerably (12, 21, 22, 23). Around 25% of SCI patients develop neurological deficits such as quadriplegia or paraplegia, and about 68% sustain injuries involving the cervical and thoracic spine. Complete neurological injuries are more common than incomplete ones (23, 24, 25). Al-Habib et al. found that cervical spine injuries are more frequent in younger patients, while thoracic injuries are predominant in older individuals (23).

Several studies involving healthcare providers working with SCI patients have confirmed that AD remains a largely under-recognized complication, with widespread knowledge gaps. For example, Kaydok et al. (13) surveyed nurses and physiotherapists at a rehabilitation center and found low awareness of AD among both groups. They emphasized the need for standardized training programs worldwide to raise awareness among patients, caregivers, and medical professionals.

Similarly, Tederko et al. (14) studied undergraduate and postgraduate physiotherapists in Poland and found poor knowledge of AD. Their findings showed that lower test scores were linked to limited professional education and clinical exposure to SCI, leading them to recommend enhanced teaching on AD at both undergraduate and postgraduate levels.

Strcic and Marki (15) assessed nursing and physiotherapy students in Croatia and discovered that despite 57% having clinical contact with SCI patients, 74% demonstrated poor knowledge of AD regardless of their experience. They concluded that targeted educational initiatives are necessary to improve understanding.

McGillivray et al. (16) surveyed community-dwelling individuals with SCI and their families, revealing significant knowledge gaps. Notably, 41% had never heard of AD despite being at high risk, and 22% reported symptoms consistent with the condition. The authors recommended that education on AD be provided during rehabilitation by qualified healthcare professionals.

Limitations and Significance Statement

The small number of students included in the study is a major limitation; hence, the outcomes cannot be generalized and require larger, more robust studies to establish a true state of affairs. The average knowledge level and real-world readiness may have been artificially inflated by excluding students who had not heard of or read about AD; the overall statistics might have been lower if all students had been included rather than only the remaining participants.

However, this study revealed the need to incorporate AD into the undergraduate curriculum. Accordingly, the departmental curriculum committee approved teaching this topic through a team-based learning (TBL) session in the next academic year (2026). A follow-up study will be undertaken to assess the impact of this curriculum change.

CONCLUSION

Medical students are not adequately equipped with knowledge related to autonomic dysreflexia. For students assuming the role of junior healthcare providers to effectively manage this potentially fatal condition and educate families of spinal cord injury patients on first aid and preventive measures for skin, bladder,

and bowel care, this topic must be included in the undergraduate medical curriculum.

Abbreviations

SCI - Spinal cord injury
AD -Autonomic dysreflexia
TBL - Team-based learning
KSA - Kingdom of Saudi Arabia
BP - Blood pressure
SPN - Sympathetic preganglionic neurons

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Conflicts of Interest: None.

Authors' contributions: SAS conceived the project and conducted the literature review. MIF conducted the survey and performed the data analysis. Both authors approved the final draft of the manuscript.

Note: Artificial intelligence was not utilized as a tool in this study.

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Sažetak

DA LI SE STUDENTI MEDICINE ADEKVATNO OSPOSOBLJAVAJU ZA LEČENJE AUTONOMNE DISREFLEKSIJE KOD POVREDE KIČMENE MOŽDINE?

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Uvod: Autonomna disrefleksija (AD) je ozbiljna komplikacija povrede kičmene moždine (PKM), karakterisana iznenadnim, paroksizmalnim epizodama hipertenzije. Zdravstveni radnici i članovi porodice koji se brinu o osobama sa PKM moraju biti u stanju da pravovremeno i adekvatno prepoznaju i tretiraju AD. Cilj ove studije bio je da se proceni nivo znanja o AD među studentima završne godine medicine, oceni njihova spremnost za lečenjem AD, kao i da se istakne značaj edukacije porodica pacijenata sa PKM o prepoznavanju i lečenju ovog stanja.

Metode: Deskriptivna studija preseka zasnovana na upitniku sprovedena je među studentima završne godine medicine (MD-4) na Medicinskom fakultetu Univerziteta Kaseem. Podaci su prikupljeni, obrađeni i analizirani korišćenjem Microsoft Excel 2021. Studenti su zatim svrstani u tri grupe na osnovu nivoa znanja: loš, zadovoljavajući i dobar.

Rezultati: Identifikovani su značajni nedostaci u znanju studenata o AD. Od ukupno 68 anketiranih studenata, 24 (35,3%) nisu bili upoznati sa pojmom AD i isključeni su iz analize. Među preostalih 44 učesnika, rezultati su se kretali od 4 do 12 bodova od maksimalnih 21, sa prosečnim rezultatom od 7,02 (33,4%). Ukupno 27 studenata (61%) svrstano je u kategoriju sa lošim znanjem, dok je 17 (39%) imalo zadovoljavajuće znanje. Nijedan student nije ispunio kriterijume za dobar nivo znanja.

Zaključak: Rezultati ukazuju na potrebu uključivanja teme autonomne disrefleksije u osnovni medicinski kurikulum. Rano obrazovanje osiguralo bi da budući medicinski stručnjaci budu bolje pripremljeni za lečenje AD i da mogu doprineti prevenciji komplikacija edukacijom porodica pacijenata.

Ključne reči: povreda kičmene moždine, autonomna disrefleksija, moždani udar, hipertenzija, bol, fekalna impakcija, dekubitus; Foley kateter.

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