

PERSPECTIVE



# What should be clarified when learning the International Standards to Document Remaining Autonomic Function after Spinal Cord Injury (ISAFSCI) among medical students

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The International Standards to Document Remaining Autonomic Function after Spinal Cord Injury (ISAFSCI) is a classification system to assess autonomic dysfunction after spinal cord injury (SCI) [1, 2]. The system was developed as an adjunct to the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) [3]. ISAFSCI describes important aspects of the neurologic exam after SCI and has been proposed as a standard assessment during the evaluation of individuals with SCI [4].

The Autonomic Standards Committee of the American Spinal Injury Association (ASIA) leads the development and revision of the ISAFSCI, which will be updated and revised based on the recommendations from users [2, 5]. The previous studies on ISNCSCI reliability [6–13] and its training [14–18] have helped us to know more about the tool, and have facilitated its implementation in the clinical practice. In a recent study, inter-rater reliability of the ISAFSCI was moderate or strong [19]. Healthcare professionals have found the ISAFSCI useful in documentation of autonomic function [5, 20, 21]. Systematic use of ISAFSCI is recommended to document blood pressure changes in the SCI population [22]. Using both ISAFSCI and ISNCSCI can obtain more detailed information about the retention of sacral function within the SCI population [23]. Accurate ISAFSCI implementation needs clear instructions [5]. Based on feedbacks from a group of medical students who have received ISAFSCI training, our study attempted to identify the problems during ISAFSCI implementation, and to provide revision suggestion for a better instruction.

We collected comments from 36 medical students through an interactive group discussion after a training course of ISAFSCI. Based on their reported difficulties and confusions about ISAFSCI, we made suggestions on how to improve understanding of the ISAFSCI.

The training session of the ISAFSCI was performed during a workshop in a Physical Medicine and Rehabilitation course. Thirty-seven fifth-year medical students attended the workshop at the Department of Clinical Medicine, Peking University Health Science Center. After completing ISAFSCI training, they participated an interactive group session to discuss following questions about the ISAFSCI instructions: “What are the difficulties in understanding and remembering the terms in ISAFSCI?”, “What confused you

when choosing options in the assessment form?”. A physician with expertise in the field of SCI and autonomic function led the discussion and gave specific explanations. If more than one student expressed the same difficulty of understanding an ISAFSCI item/question, it was considered as a potential common problem and would be further evaluated. After a 1-h discussion, all potential common problems were summarized and categorized according to their features.

We have categorized all potential common problems into three groups: (1) definitions needed further clarification; (2) inconsistent descriptions for the same item; and (3) confusions to choose answer options.

First, some medical students indicated the definitions of following three items were difficult to remember: resting hypotension, orthostatic hypotension (OH), and autonomic dysreflexia (AD). According to the definitions, systolic blood pressure (SBP) at the threshold value of 90 mmHg should not be diagnosed as resting hypotension, and an increase in SBP of 20 mmHg above the threshold should not be considered as AD. However, for OH, the SBP and diastolic blood pressure decrease at thresholds of 20 mmHg and 10 mmHg respectively are designated as a diagnostic indicator. These definitions are contradictory on whether the diagnostic criteria should include the threshold value or not.

Second, the same ISAFSCI item had inconsistent descriptions between instruction text and assessment form (Table 1). Supine hypotension and neurogenic shock are defined within the text of the ISAFSCI, while supine hypotension is described as resting hypotension and neurogenic shock is not mentioned in the assessment form. A similar situation exists in the descriptions of temperature dysregulation and antegrade ejaculation used within the text, whereas their names change to hyperthermia/hypothermia and ejaculation in the assessment form. These inconsistencies made obstacles in understanding the accurate definitions of the terms.

Third, there were nine ISAFSCI items having confusions to choose the answer options. These included when to use “normal” for determination of autonomic control of the heart, blood pressure and broncho-pulmonary system, whether determining

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**Table 1.** Similar item descriptions within the ISAFSCI that need to be explained.

Terms in the text of the ISAFSCI	Terms in Assessment Form	Recommended terms
Supine hypotension	Resting hypotension	Resting hypotension
Temperature dysregulation	Hyperthermia and hypothermia	Hyperthermia and hypothermia
Antegrade Ejaculation	Ejaculation	Antegrade Ejaculation

ISAFSCI International Standards to Document Remaining Autonomic Function after Spinal Cord Injury.

**Table 2.** Confusions with the option within the ISAFSCI and recommendations.

Scenario	Recommendations
If a patient only has a record of HR between 60 and 100 bpm, but did not perform cardiac auscultation or ECG.	Not choose “normal” until further examination is performed
AD episode with reflex bradycardia and/or sweating above the level of the lesion	“Bradycardia” and/or “hyperhydrosis above lesion” should be chosen if it is related to an AD episode.
If a patient only has a record of resting SBP equal or more than 90 mmHg, but did not perform orthostatic challenge test (for OH) or any triggering events (for AD).	“Normal” is not recommended without any attempts to diagnose (or rule out) AD/OH
If a patient does not need ventilatory assistance, how to distinguish between normal and impaired does not require vent support?	Without objective measurement, it is more appropriate to choose the “unknown” option
If a patient has urinary/fecal incontinence, how to distinguish between reduced (“1”) and complete loss of control (“0”)?	Complete loss of control means that the patient is not at all able to control retention/leakage of urine/feces. Incontinence occurring urgency only or at less frequency could be classified as reduced or altered (partial)
If a patient has indwelling catheter without urinary incontinence	“NT” for the item of urine leakage

ISAFSCI International Standards to Document Remaining Autonomic Function after Spinal Cord Injury, HR heart rate, bpm beats per minute, ECG electrocardiogram, AD autonomic dysreflexia, SBP systolic blood pressure, OH orthostatic hypotension, NT not testable.

AD accompanying signs or symptoms (reflex bradycardia, sweating above the level of the lesion) as a separate autonomic abnormality, how to differentiate reduced and complete loss of control for urinary and fecal incontinence, as well as how to determine urinary incontinence in case the patient use an indwelling catheter. The details regarding the difficulty in selection the appropriate options are shown in Table 2.

## DISCUSSION

We collected the feedbacks from medical students by using interactive group discussion after their ISAFSCI training session. We found three types of problems and provided suggestion to make further clarifications, which may facilitate a better understanding of the ISAFSCI content and more accurate ISAFSCI implementation.

### Clarification of the definitions

Five ISAFSCI items, also used as the diagnostic criteria, have different definitions: bradycardia, tachycardia, resting hypotension, OH and AD. According to the description of these five items, OH could be diagnosed when the blood pressure is less than or equal to the threshold. But for the other four items, diagnosis could be made only when the measurement is more or less than (but not equal to) the threshold. This subtle discrepancy inherent in the definitions eventually led to the difficulties in remembering the knowledge related to these items. Similar difficulties have also been reported by clinical professionals from previous studies [5, 21].

To improve the ISAFSCI training outcome, clarification of these five items during the learning process is necessary. It is also recommended that the CAPITAL or bold font should be used in the text of the ISAFSCI to highlight their definitions. In addition, the mathematic symbols such as  $>$ ,  $<$ , or  $\geq$ ,  $\leq$  could be added in the text for easier understanding, i.e. LESS THAN ( $<$ ), AT LEAST ( $\geq$ ) and MORE THAN ( $>$ ).

### Reduce inconsistency

The same item had different descriptions between the assessment form and the ISAFSCI text. The inconsistency caused confusion among medical students. Based upon their feedbacks, five issues were detected, and we listed terms recommended to use consistently in both text and assessment form in Table 1.

Among these items, the inconsistent descriptions of “supine hypotension” in the text and “resting hypotension” in the assessment form resulted in misunderstandings during the training session. It is recommended to use the consistent term (either “supine hypotension” or “resting hypotension”) in both text and assessment form.

The other four items seemed not confusing at first look, but some students indicated the inconsistencies among these items. Hyperthermia and hypothermia are the equivalent terms for temperature dysregulation. Thus, the term “temperature dysregulation” should be more specific (e.g., hyperthermia and hypothermia) in the text to match the assessment form. The normal ejaculation function refers to forceful propulsion of semen externally from the urethral meatus, which is also named as antegrade ejaculation [24]. Therefore, abnormal ejaculation should be better defined as diminished antegrade or retrograde in the text and in the assessment form.

Given that neurogenic shock is a pathophysiological process that is not included in the assessment form, this should be clarified to avoid confusion. Lastly, “supine hypotension” in the text should be replaced by “resting hypotension” to match the term in the assessment form.

### Confusions related to answer options

The medical students have obtained the relevant information on internal medicine (regarding dysrhythmias, orthostatic hypotension, and ventilatory support) and clinical diagnostics (regarding urinary incontinence and indwelling catheter) from their previous medical courses. During the ISAFSCI training and the following revealing process, the tutor explained the definitions of some concepts of

ISAFSCI, i.e. the exact meaning of fecal incontinence and voluntary anal sphincter contraction, as well as AD. For AD, it was emphasized that bradycardia is the most common dysrhythmia accompanying the onset of AD, although only dysrhythmias were described in the ISAFSCI. In addition, the fact that AD is mostly triggered by stimuli from the lower urinary tract was emphasized. Consequently, the students commented about confusions related to the answer options available for some items. The recommendations to clarify answer options were summarized in Table 2.

When assessing general autonomic function and filling in the form, we believe the answer option of “normal” can be chosen only when all dysfunctions are absent. For the autonomic control of the heart, it is easier to exclude bradycardia and tachycardia by the heart rate documented in the medical record, but if there is no proof from cardiac auscultation or ECG to rule out the possibility of arrhythmia and other potential abnormalities, we think it is difficult to decide whether it should be classified as “normal” or “unknown”. In this situation, we suggest it may not suffice to choose “normal” until further examination is performed for the patient. A similar situation occurs when a patient has only a record of normal SBP. In this case the normal autonomic control of the blood pressure is not easy to determine. We think it is difficult to choose “normal” option when we have not ruled out the possibility of AD/OH. For the autonomic control of the broncho-pulmonary system, there was confusion about distinguishing the patients with “normal” function from those with impaired voluntary respiration but not requiring ventilator support. Without an objective measurement, it seems more appropriate to choose the “unknown” option.

AD may be symptomatic or asymptomatic. The symptoms may include headache, flushing, piloerection, stuffy nose, as well as sweating above the neurological level of injury (NLI) [2]. In addition, bradycardia is a common accompanying sign during episodes of AD. Some of these signs and symptoms have already been included in the ISAFSCI assessment as separate items, such as autonomic control of the heart and sweating. After being told that bradycardia is the most common dysrhythmias accompanying the onset of AD, students were confused with the scenario that a patient has bradycardia or sweating above the NLI during the episodes of AD. Similar feedback has also been found in a survey-based research among SCI clinicians and scientists [21]. In this situation, we suggest that bradycardia and hyperhidrosis should be chosen if they are related to an AD episode.

Urinary or fecal incontinence will result in urine or stool leakage. As to the severity of incontinence, it is reasonable to consider complete incontinence as the result of complete loss of control, while partial incontinence as reduced neurological function. However, if only asking whether the patient suffer from urine or stool leakage, it is difficult to determine whether the urinary/fecal incontinence is complete or partial. Therefore, we could not score them accurately. We think the complete incontinence means the patient is not able to control the retention/leakage of urine/feces at all. And the partial incontinence means it happens at urgency only or it does not happen frequently. It is also proposed to follow a standard instruction on how to distinguish the complete and partial urinary or fecal incontinence. We recommend checking with the descriptions in the respective International SCI Basic Data Sets for Lower Urinary Tract [25] and Bowel function [26, 27].

If a patient has an indwelling catheter in the urinary bladder draining urine from the bladder directly, it will be impossible to observe urine leakage, and difficult to decide whether the patient has urinary incontinence. According to the discussion among the medical students, the “not testable” option seems more reasonable.

## CONCLUSION

ISAFSCI training extended medical students’ knowledge in areas of autonomic dysfunctions and medical terminology. We summarized the existing problems and provided revision suggestion for ISAFSCI

based on the discussion and feedbacks from the medical students. Our study contributed to improve the understanding and implementation of ISAFSCI in clinical practice. Efforts should be made to add supplementary material with more detailed explanation for the grading system of the ISAFSCI form, and to encourage teachers making further clarification during the ISAFSCI training.

## DATA AVAILABILITY

The data generated or analyzed in this study are available from the corresponding author upon reasonable request.

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#### COMPETING INTERESTS

The authors declare no competing interests.

#### ADDITIONAL INFORMATION

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