



Adopting and Adapting Clinical Practice Guidelines for the Use of Baseline MRI in Acute Spinal Cord Injury in a Developing Country

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Received 2023 January 29; Revised 2023 July 15; Accepted 2023 August 08.

Abstract

Background: Spinal cord injury (SCI) imposes a heavy burden on patients and health systems. Magnetic resonance imaging (MRI) provides a detailed evaluation of the spinal cord and associated soft tissues in a non-invasive manner.

Objectives: We aimed to adopt and adapt suitable recommendations and guidelines in Iran for the utilization of MRI in the management of acute SCI patients based on available international guidelines and through a systematic review of literature, followed by guideline development based on the Delphi technique.

Methods: After the primary systematic search and review of the literature and guidelines on the use of MRI in the management of acute SCI, all relevant recommendations were retrieved. Desired recommendations were then extracted and presented to our expert panel through the Delphi technique. The final decision for the inclusion or adaptation of recommendations to improve SCI care in the Iranian population was made through expert panel meetings.

Results: Our literature search resulted in 769 records. Only three records provided recommendations on the role of MRI in the management of acute SCI, from which a total of six recommendations were extracted. Of these, the two final recommendations were extracted: (I) "Use MRI in adult patients with acute SCI prior to surgical interventions, when feasible, to facilitate clinical decision making," and (II) "Use MRI in adult patients in the acute period following SCI and before or after surgical interventions (only when fixation is not used) to improve the prediction of neurologic outcomes following acute SCI."

Conclusions: The final recommendations help appropriately use MRI in patients with acute SCI, facilitating the management of these patients and improving their outcomes. This study shows that it is possible for developing countries to indigenize international guidelines, and with minor changes, an appropriate therapeutic framework can be created to improve service delivery.

Keywords: Spinal Cord Injuries, Magnetic Resonance Imaging, Guideline, Iran

1. Background

Traumatic spinal cord injury (SCI) results in the loss of sensory, motor, and/or autonomic functions in patients (1). Based on the most recent review of literature and data integration, the incidence of traumatic SCI varies widely in the world, ranging from about 5 to 150 cases per million (2), as well as in developing countries (3). The management of SCI patients requires substantial healthcare resources, with estimated annual costs up to six times more than

other chronic diseases (4). The requirement for high-level acute care in the short-term and management of long-term secondary consequences account for the majority of these costs (5).

Magnetic resonance imaging (MRI) provides a detailed evaluation of the spinal cord parenchyma and ligaments in a non-invasive manner (6). However, there are barriers, including hemodynamic instability, traumatic injuries, respiratory difficulties, the difficulty of safe patient

transfer, and the need for close monitoring of acute SCI, that limit MRI utilization for traumatic SCI patients in the acute phase of the condition (7). The benefits of MRI, such as delineation of the extent and etiology of spinal cord compression, detection of ligamentous instability at the spinal injury site, and identification of vertebral artery injury, make this modality an interesting option for the evaluation of acute SCI patients (1, 8). On the other hand, MRI has disadvantages when it comes to utilization for acute settings like traumatic SCI, including being time-consuming, which may place unstable trauma patients in life-threatening conditions, especially when it postpones vital surgical interventions and requirement for extensive resources and costs to become available round-the-clock for a 24/7 emergency trauma center (1). The latter is a major obstacle to the early management of acute traumatic SCI in low- and middle-income countries (LMICs) due to restrictions on medical and instrumental resources like MRI (9, 10). The lack of guideline-based evaluation and care of acute SCI cases is another obstacle to the effective use of MRI in this condition (11, 12).

Variation in patient outcomes is affected by the treatments offered by healthcare providers, and this exerts more extensive impacts in emergency clinical settings like trauma (13). As such, Clinical Practice Guidelines (CPGs) provide recommendations to reduce heterogeneity and variations in care provision to optimize health outcomes (14, 15). There have been several attempts to develop guidelines for the use of MRI in individuals with acute traumatic SCI and to provide evidence-based recommendations for SCI management (1). Efforts for developing a guideline for MRI use for acute SCI started with the 2002 AANS/CNS guideline, suggesting that MRI might be applicable as an option for the evaluation of acute SCI in a couple of clinical scenarios (16). The 2013 update of the same guideline upgraded the position of MRI as an optional modality and suggested this procedure as a level III recommendation for specific scenarios in patients with acute SCI (6, 17). The application of such recommendations provides an opportunity for homogeneous and integrated patient management. However, the developed countries where these guidelines were created have significant infrastructures such as level I, II, III, and IV trauma centers (16, 17). In developing countries such as those located in West Asia, there are fewer specialized and coordinated trauma centers and CPGs for the management of acute traumatic SCI (3, 18). Developing new CPGs faces many challenges and needs high costs and resources (19); therefore, it is rational to adopt/adapt the guidelines prepared in developed countries and implement them in LMICs to reduce the burden of acute SCI as a major public health issue (20-22).

For this purpose, it is of paramount importance to promote CPG recommendations and facilitate their use by clinical practitioners.

2. Objectives

The objective of this study was to adopt and adapt present guidelines on the use of MRI for acute SCI patients in accordance with Iran's clinical infrastructure and resources by optimizing and adjusting existing recommendations and guidelines.

3. Methods

The adoption and adaptation of the recommendations of different CPGs were accomplished using the Iranian Ministry of Health and Medical Education (MOHME)'s "Clinical Practice Guideline (CPG) Adaptation Model in I.R Iran" (23), which was developed based on the ADAPTE process (24). To adopt/adapt CPGs, the following steps were taken according to the national model. The main two steps of the methodology of the current study were (1) a primary systematic review to obtain relevant literature and guidelines related to the topic under study and (2) guideline development by the Delphi technique. The details of these two main steps are provided below.

First, a committee of five members specially trained in guideline adaptation was formed. The executive team consisted of four general practitioners and a neurosurgeon as the leader of the team. Also, a multi-disciplinary national panel of experts from across the country was gathered as an expert panel consisting of 20 specialists experienced in the management and care of SCI patients. This panel consisted of ten neurosurgeons, an orthopedist, a health economist, a health policymaker, three traumatologists, a radiologist, a general practitioner, and two emergency medicine specialists.

Second, the scope and purpose of the study were determined through consensus-based discussions among the members of the executive committee. The committee decided that the study's aim ought to be to provide evidence-based recommendations for the use of MRI in patients with acute traumatic SCI. A search was performed to obtain any adopted or adapted guidelines on this topic in Iran, which revealed no adopted/adapted guidelines on this topic.

Third, in May 2021, a thorough systematic search was conducted to identify relevant published guidelines following the PRISMA checklist for systematic reviews. Eight different bibliographic databases, including PubMed, Cochrane, Guidelines International Network, Trip Database, Australian Government Department of

Health, National Institute for Health and Care Excellence, Canadian Medical Association, and National Health and Medical Research Council/Australian Government, were searched for guidelines and other publications on recommendations on the use of MRI for acute SCI. The search terms to retrieve relevant publications were (A) SCI, spinal injury, or spinal cord injury; AND (B) guidelines, guidance, or recommendations; AND (C) MRI, or magnetic resonance imaging, and other similar terms. We assessed titles, abstracts, and full texts of the extracted publications based on the following inclusion criteria: The population (adults and pediatrics with acute SCI), study type (either a guideline or a systematic review with recommendations), and scope (the role of MRI in acute SCI management). Two researchers applied these inclusion criteria to screen selected guidelines and evaluate studies in terms of quality, content, and currency. During the final guideline assessment, four appraisers scored the initial guidelines using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) (25). The final guidelines were selected based on a cutoff score of 60% as a minimum score on the key AGREE II domain Rigor of Development (25).

The final guidelines were then selected, and clinical recommendations were extracted. The extracted recommendations were summarized into Population, Intervention, Professionals, Outcomes, and Healthcare setting (PIPOH), and clinical scenarios were formulated. Since the level of evidence did not differ between the recommendations, existing controversies between recommendations were also determined by the members of the executive committee. Finally, we gathered different scenarios and extracted their controversies to present to the expert panel for decision-making and adapting them to Iranian trauma healthcare settings and resources.

The decision-making step on the proposed recommendations was performed in two phases. First, a survey was performed on the list of the recommendations and controversies by the expert panel. Each recommendation was presented with its designated guideline and the PIPOH and AGREE II tables. Each page of the survey contained the recommendations, their levels of supporting evidence, financial applicability (if available), questions for descriptive suggestions, and their adaptability to available infrastructure (if necessary) to decide on the applicability of the recommendations. The questionnaire assessed three domains: Feasibility, generalizability to the Iranian population, and acceptability by Iranian patients. In addition to previous questions, we assessed each recommendation for eligibility to be on the final list and the list of “key” recommendations. The recommendations

that acquired 80% or more votes were included in the final list. The expert panel also discussed the controversies existing between recommendations and decided to include or exclude one of two or more conflicting recommendations. Later, a second expert panel session was held anonymously to evaluate comments on each recommendation proposed in the first session. After comments were adequately discussed, necessary and final changes were applied to the recommendations included. Also, we discussed the controversies existing between recommendations during the second session as well to resolve grey areas.

4. Results

Our systematic review of available relevant literature resulted in 769 records, and after screening titles and abstracts, only 19 publications remained for full-text screening. Each full text was thoroughly evaluated by the members of the executive committee, leading to the selection of only three records on recommendations addressing the role of MRI in the management of acute SCI. Of those excluded, two records were guidelines but did not provide any recommendations on MRI use, and 14 records did not have any recommendations. All three guidelines were assessed by the AGREE scale and then included for the adaptation of recommendations. The finally included guidelines, along with their recommendations, have been listed in [Table 1](#).

After two expert panel sessions, all of the recommendations were found to be highly adaptable (scores > 80%). Recommendations 1a and 1b suggested the use of MRI in all acute SCI patients, whilst other recommendations only indicated MRI in a subset of acute SCI patients. This controversy was discussed in an expert panel session and was voted on. The final decision was to include recommendations 1a and 1b in the final list since MRI availability is growing in the country and the fact that the consequences of missing an injury outweigh the additional use of resources. Regarding recommendation 1b, the expert panel believed that post-operative MRI would not yield much information, and the relationship between postoperative MRI findings and prognosis remains unclear. The committee decided that pre-operative MRI serves better as a prognostic item, and post-operative MRI is only indicated in cases without spinal fixation or complicated injuries to rule out compression. Recommendation 2a states that “in suspected spinal cord or cervical column injury, if there is a neurological abnormality that could be attributed to spinal cord injury, MRI is indicated after CT, regardless of whether or not the abnormality is

Table 1. Included Guidelines and Their Recommendations on the Role of MRI in the Management of Acute SCI

No.	Sub-sections	Recommendations, Developers, Guidelines, Year of Issuance
1		"A Clinical Practice Guideline for the Management of Patients with Acute Spinal Cord Injury: Recommendations on the Role of Baseline Magnetic Resonance Imaging in Clinical Decision Making and Outcome Prediction" (26); AOSpine North America, AOSpine International, and the American Association and Congress of Neurological Surgeons (AANS)/2017
	1a	MRI is suggested in adult patients with acute spinal cord injury prior to surgical intervention, when feasible, to facilitate better clinical decision-making.
	1b	MRI should be performed in adult patients in the acute period following SCI and before or after surgical intervention to improve the prediction of neurologic outcomes.
2		"Spinal injury: Assessment and initial management" (27); The National Institute for Health and Care Excellence/2016
	2a	In suspected spinal cord or cervical column injury, if there is a neurological abnormality that could be attributable to spinal cord injury, one ought to perform an MRI after CT, regardless of whether or not the abnormality is evident on CT.
3		"Guidelines for the Management of Acute Cervical Spine and Spinal Cord Injuries: 2013 Update" (17); American Association of Neurological Surgeons (AANS)/Congress of Neurological Surgeons (CNS)/2013
	3a	In acute cervical spine and spinal cord injuries, an MRI of the cervical spine is recommended to exclude spinal cord or nerve root compression, to evaluate ligamentous integrity, or provide information regarding neurological prognosis.
	3b	In acute cervical spine and spinal cord injuries, an MRI of the region of suspected neurological injury is recommended in a patient with SCIWORA (spinal cord injury without radiographic abnormalities).
	3c	In acute cervical spine and spinal cord injuries, MRI is recommended for the diagnosis of vertebral artery injury after blunt cervical trauma in patients with complete SCI or vertebral subluxation injuries.

evident on CT.". Recommendation 3a states that "in acute cervical spine and spinal cord injuries, MRI of the cervical spine is recommended to exclude spinal cord or nerve root compression, to evaluate ligamentous integrity, or to provide information regarding neurological prognosis.". The recent two recommendations were merged into one item due to their similarity. In the second expert panel session, some suggestions were further discussed to improve the adaptability of the finalized recommendations based on the Iranian healthcare setting and cultural and social factors.

5. Discussion

Considering the growing role of MRI in the management and treatment of patients with acute traumatic SCI and the absence of an appropriate national clinical guideline on the controversial issue of using MRI in the evaluation process of SCI patients in Iran, this study was designed to review the available literature and provide a validated and nationally adaptable guideline. The main finding of this study was the high agreement on one (out of three) of the finally included guidelines, which was the most recent guideline in the field and focused on the role of baseline MRI in the management of acute SCI (26).

The efforts made in this study were directed toward developing a national guideline in Iran to reduce the burden of SCI as a major contributor to injuries, specifically caused by road traffic injuries (as a key cause of injuries in Iran and a main focus of national action

plans), and alleviate the burden of non-communicable diseases and injuries (28). Alongside endeavors to curb the burden of injuries in Iran, the increasing utilization of newly-introduced imaging techniques such as MRI, which is mainly used to evaluate various parts of the central nervous system, has led to the widespread use of this imaging technique where it is available; however, timely access to MRI is still a major obstacle in the country (29).

In this study, a consensus was achieved among the experts in the country on the use of MRI in the evaluation of SCI patients, and a high agreement was found on the two recommendations derived from the AOSpine North America, AOSpine International, and the American Association and Congress of Neurological Surgeons' (AANS) Clinical Practice Guideline for the Management of Patients with Acute Spinal Cord Injury (26). According to the changes made to the recommendations during adapting the guideline and validating their terms by the clinical expert panel, the two final recommendations were (I) "Use MRI in adult patients with acute spinal cord injury prior to surgical intervention, when feasible, to facilitate better clinical decision-making," and (II) "Use MRI in adult patients during the acute period of SCI and before or after surgical intervention (only when fixation is not used) to improve prediction of neurologic outcome".

It is important to highlight that our findings vouched for the beneficial use of MRI both in the decision-making process during patient care and also in the improvement of SCI patients' outcomes. A high agreement on both these factors makes MRI a suitable option in the management of

SCI. Although MRI is a relatively affordable and available tool in Iran, where the costs of this imaging technology are largely covered by insurance organizations, the overuse of this method due to commercial and marketing factors is alarming in the country, and we need proper national guidelines and policies to bring its utilization under control (30). Efforts, like what is happening in the current piece of evidence, are needed to make the use of MRI more evidence-based while saving patients with acute SCI as much as possible through timely diagnostic MRI assessments where it is available. In addition, we have developed a quality-of-care assessment tool for evaluating individuals with traumatic SCI, considering various aspects of SCI management, including the use of MRI in the evaluation and care of affected cases, paving the way for improving the outcomes of patients with SCI (18).

This study had some limitations. The scarcity of national guidelines and recommendations and the lack of diversity in international guidelines on the studied topic were the main limitations in providing a nationally adaptable guideline with recommendations. The other limitation could be the expert panel-based commenting on extracted recommendations, which could be biased by various factors. However, it was tried to summon a diverse group of experts, who scored the recommendations in several rounds, to minimize any possible bias in this regard. Adopting and adapting guidelines instead of developing de novo guidelines could have lowered the strength of items, which might be another major limitation of this study; nevertheless, considering the huge logistic and financial resources needed to develop guidelines from the ground, adopting/adapting guidelines seems a more cost-effective approach to address vital gaps in patient management. All these limitations aside, this study also had several strengths, including being the first effort to provide an evidence-based recommendation for MRI indications in patients with acute SCI, conducting a thorough systematic review to identify relevant recommendations, and gathering a robust group of experts to evaluate available recommendations and modify them in order to be implemented in the clinical setting of Iran.



5.1. Conclusions

In conclusion, to the best of our knowledge, this study was the first attempt to provide a nationally-approved guideline for the use of MRI in patients with acute SCI in Iran. Two highly agreed-upon recommendations on the use of MRI in SCI patients were presented in this study. The final recommendation favored the use of MRI in these patients to improve clinical outcomes besides any surgical interventions. We employed a two-step process

to validate the recommendations retrieved from selected clinical guidelines.

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Footnotes

Authors' Contribution: The study was designed and conceptualized by VRM. Also, SFM and SA prepared the material and primary draft. SFM, SA, GK, SBJ, ZG, APR, HG, MK, FF, HA, MM, MB, MSA, AGK, MFJ, JSH, MGF, and VRM provided critical comments on the methodology and study results and contributed to discussions in expert sessions. All authors commented on the initial draft and approved the final manuscript. VRM was the corresponding author and supervised all study steps.

Conflict of Interests: The authors declare no conflicts of interests.

Ethical Approval: The Ethics Committee of Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences, approved the study, and the reference number is 98-01-38-361.

Funding/Support: This work was funded by Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences [grant number: 98-01-38-41412].

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