

The Stabilization Protocol: A Mini Review on Evidence-based Traumatic Stabilization

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Abstract

Standard spinal immobilization traditionally involving a spinal board and cervical collar, has long been the prehospital standard of care for trauma patients. However, recent studies highlight potential adverse effects, including pain and respiratory impairment. A narrative mini-review was conducted using Medline, Web of Science, Scopus, and Google Scholar. Nine articles published in the last five years were selected, comprising observational studies, literature reviews, and expert consensus documents. The S.T.A.B.I.L.E. protocol emerged as a structured, evidence-based decision-making model for prehospital spinal management. Integrated within the Airway, Breathing, Circulation, Disability, Exposure framework, it supports emergency medical services personnel in assessing whether to apply and, if so, how to apply spinal motion restriction, considering clinical and logistical variables. Compared to traditional protocols such as NEXUS and the Canadian C-Spine Rule, S.T.A.B.I.L.E. emphasizes a broader clinical context-such as respiratory status, hemodynamic stability, and environmental conditions-providing a more pragmatic and patient-centered approach. The protocol may enhance patient safety, reduce unnecessary immobilization, and support clinical decision-making. While the S.T.A.B.I.L.E. protocol represents a promising alternative to traditional immobilization practices, further clinical validation is needed to confirm its efficacy and facilitate its adoption in prehospital trauma care.

Keywords: Trauma, emergency medical services, spinal cord, immobilization, spinal motion restriction

Introduction

For a long time, conventional spinal immobilization (SI), which includes the use of a spinal board and cervical collar, has been considered the standard procedure for protecting traumatized patients in the pre-hospital environment. However, recent investigations have questioned the efficacy and safety of this approach, highlighting potential risks and complications associated with it [1]. In particular, prolonged use of the spinal board can induce pain, pressure sores, and respiratory difficulties [2]. As a result, the need has arisen to develop

alternative evidence-based strategies for managing trauma patients.

SI in the pre-hospital setting has represented a standardized practice since the 1960s [2,3]. Its application is determined during the scene and patient assessment, particularly in the presence of suspected head or spinal trauma, altered mental status, or neurological deficits [2,4]. The goal of SI is to prevent or minimize secondary spinal cord injury caused by potential spinal column injuries.



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The SI technique involves the use of a spinal board, cervical collar, head fixation devices, and strapping systems. The spinal board serves both as an immobilization device and a support for patient transport. The material of this device must be shock-resistant and easily sanitizable [4]. The strapping system ensures the patient is secured to the board, while the cervical collar prevents flexion, extension, or rotation of the neck. Head fixation devices are used to limit rotational movements of the head. Overall, the system should not obstruct the performance of cardiopulmonary resuscitation maneuvers and must allow for the implementation of advanced rescue procedures.

Despite the widespread use of the spinal board in SI, its actual effectiveness remains largely unproven. In recent years, doubts have arisen regarding the utility of this practice due to the increasing number of adverse effects associated with it [2,3].

An emerging alternative technique is spinal motion restriction (SMR) [5]. This technique involves maintaining the patient's body alignment on the ambulance stretcher using a cervical collar and securing straps. In this context, at the trauma scene, the spinal board is used solely as a tool for extrication and transfer of the patient, to be removed from the ambulance stretcher or as soon as possible [6].

To assist professionals in applying the most effective and safe protocol, decision-support tools such as the NEXUS and the Canadian C-Spine Rule have been developed. These tools, initially used to determine the need for diagnostic investigations, are now essential for operational decisions in emergency care.

Häske [7] developed a “traffic light” system to assist emergency medical services (EMS) in selecting patients for immobilization. This method provides immediate visual guidance to assess the risk level and the need for SI, optimizing resource management and patient safety.

The objective of this article is to conduct a mini-review on the topic and then present the S.T.A.B.I.L.E. protocol, a decision-

making strategy aimed at guiding EMS personnel in managing trauma patients. It evaluates the effectiveness of spinal board techniques compared to alternative methods, mainly SMR, and explores the main limitations of its use.

Ethical Considerations

This study did not require approval from an ethics committee as it is a proposal of a clinical decision-making protocol based on a narrative literature review. The S.T.A.B.I.L.E. protocol has not yet been applied or tested in clinical practice.

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Methodology

A mini-review was conducted using the Medline, Web of Science, Science Direct, and Google Scholar databases between February and March 2024. Keywords included: out-of-hospital, EMS, trauma, spinal cord, SI, SMR, pain, and radiological tests, combined using Boolean operators.

Inclusion Criteria: Peer-reviewed articles published in English or Italian in the last five years, focusing on pre-hospital SI strategies.

Exclusion Criteria: studies not involving EMS contexts, pediatric-specific research, and opinion pieces lacking scientific backing. Various study types were considered, including observational research, systematic reviews, and narrative reviews (Table 1). The selection process involved title/abstract screening and full-text analysis. No formal risk of bias assessment was conducted. Ethical approval was not required, as this study did not involve human participants or primary data collection.

This narrative literature analysis was carried out to explore the scientific evidence related to the assessment and treatment of trauma patients in the pre-hospital setting. The primary goal was to identify key parameters for an accurate evaluation and develop a standardized protocol to guide clinical decisions. From this analysis, the S.T.A.B.I.L.E. protocol emerged.

Table 1. Summary of reviewed studies

Study	Design	Main findings	Limitations
Sundstrøm et al. [2] (2014)	Critical review	Limited evidence for collar use in trauma	Non-systematic
Hauswald et al. [3] (1998)	Observational study	No neurological benefit from immobilization	Small sample
Kwan and Bunn [4] (2005)	Systematic review	Risks may outweigh benefits in some cases	Inconsistent quality of studies
Dixon et al. [5] (2014)	Biomechanical study	Spinal boards increase biomechanical stress	Simulated setting
Connor et al. [6] (2013)	Consensus statement	Initial agreement on reduced immobilization	Expert opinion
Häske et al. [7] (2022)	Descriptive model	Traffic light system aids EMS decisions	Lacks validation
Walters et al. [8] (2013)	Guidelines	Supports targeted cervical immobilization	Broad scope
Haut et al. [9] (2010)	Retrospective study	Spinal immobilization may harm in penetrating trauma	Limited generalizability
Righi et al. [1] (2024)	Narrative review	Emerging model S.T.A.B.I.L.E. could be safer	Conceptual only

EMS: Emergency medical services

The S.T.A.B.I.L.E. protocol (Figure 1) integrates with the systematic Airway, Breathing, Circulation, Disability, Exposure (ABCDE) approach used in the primary assessment of trauma patients. After an initial quick look, to determine the most appropriate operational strategy, “Scoop and Run” or “Stay and Play”, it would be advisable to sequentially apply the stages of the S.T.A.B.I.L.E. protocol.

A PRISMA flow diagram (Figure 2), summarizing article selection is recommended for future iterations to enhance transparency.

This step-by-step approach allows for the identification of specific conditions that may influence the decision to proceed with SI, ensuring a complete and accurate assessment of the patient.

Description of The S.T.A.B.I.L.E. Protocol

The S.T.A.B.I.L.E. protocol involves a detailed assessment through the following phases, aligned with the ABCDE sequence:

A) Airway-Airway Management: Cervical immobilization is not recommended when the airway is compromised or at risk, as it could hinder life-saving interventions needed to ensure airway patency [2].

B) Breathing-Respiration: In cases of thoracic trauma, such as pneumothorax or rib fractures, or severe respiratory failure, SI may exacerbate respiratory compromise and is therefore discouraged [4].

C) Circulation-Circulation: Conditions such as cardiac arrest, traumatic brain injury with increased intracranial pressure, or signs of hypotension (mean arterial pressure <70 mmHg) represent contraindications to SI, as it could interfere with resuscitation efforts or worsen hemodynamic instability [5].

D) Disability-Disability/Neurological Status: SI is recommended for unconscious patients [Glasgow Coma Scale (GCS) <8] or those with evident neurological deficits resulting from trauma. Conversely, in conscious patients (GCS >8) without neurological deficits, immobilization should be avoided, and the patient should be instructed to limit movement, unless other specific indications exist [6].

E) Exposure-Exposure and Other Factors: SI is discouraged in patients with a body mass index (BMI) greater than 25, due to the increased risk of skin injuries, in cases where transportation is expected to exceed 30 minutes, due to the heightened risk of pain and complications associated with prolonged immobilization, and when the body temperature

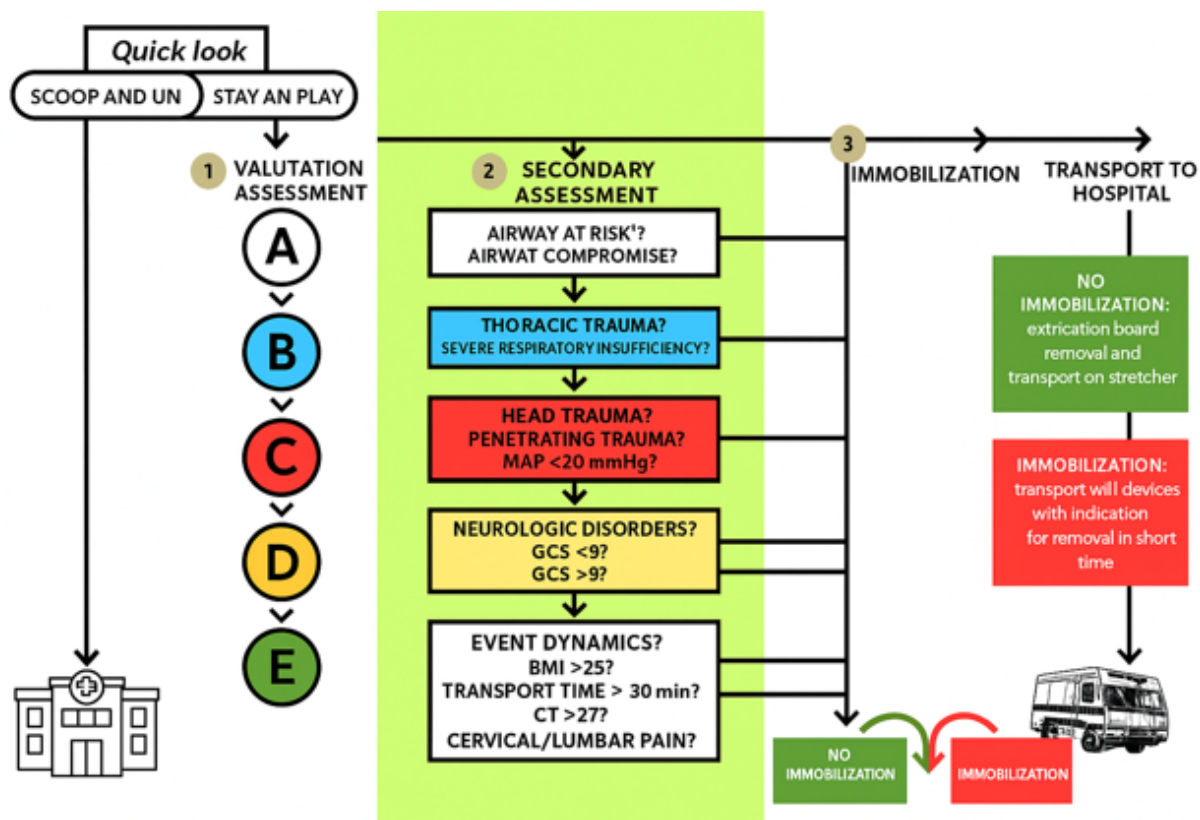


Figure 1. The S.T.A.B.I.L.E. protocol-evidence-based traumatic

GCS: Glasgow Coma Scale, BMI: Body mass index, CT: Computed tomography

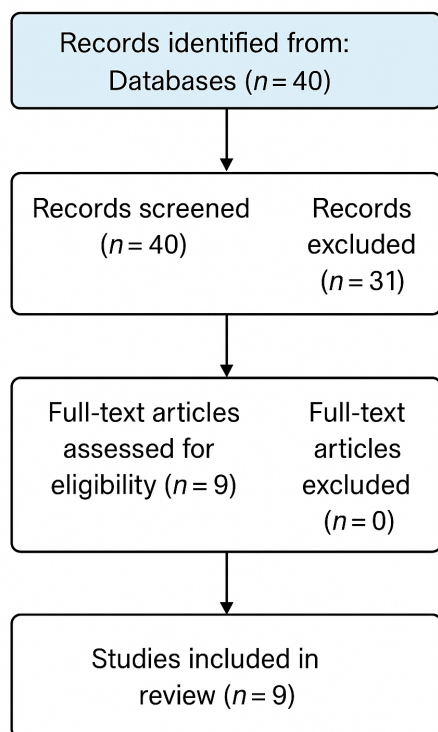


Figure 2. PRISMA flow diagram

exceeds 37°C, due to the risk of exacerbating thermal stress. However, immobilization becomes necessary in the presence of cervical or lumbar pain upon the arrival of rescue teams or in cases of high-energy trauma events [7].

Transfer and Transport Methods

After determining the need for SI or not, the following steps are taken:

- **Absence of Complete Immobilization:** If complete immobilization is not deemed necessary, the spinal board can be used to transfer the patient onto the stretcher and then removed. Transport to the emergency department is preferably conducted using a vacuum mattress or the standard stretcher mattress, ensuring greater comfort and reducing the risk of complications [8].
- **Presence of Complete Immobilization:** If complete SI has been performed (including the spinal board, cervical collar, fixation systems such as the “spider”, and head blocks), the spinal board may be maintained during transport. However, it is essential to remove it as soon as possible upon arrival at the ED, after ruling out any spinal injuries, to prevent complications associated with prolonged immobilization [9].

This review highlights the evolution of prehospital SI strategies and the emergence of more tailored approaches such as S.T.A.B.I.L.E. Unlike prior protocols (e.g., NEXUS, Canadian C-Spine Rule), which focus primarily on ruling out cervical

spine injury, S.T.A.B.I.L.E. integrates clinical, physiological, and operational considerations into a comprehensive framework. By addressing the limitations of traditional immobilization—particularly in cases with altered airway, respiratory distress, or prolonged transport—the protocol offers a nuanced guide aligned with the realities of emergency care.

Discussion

The S.T.A.B.I.L.E. protocol presents a structured, decision-oriented model that complements existing literature on SI. Compared to previous reviews focused on the NEXUS criteria or the Canadian C-Spine Rule, S.T.A.B.I.L.E. adds value by aligning immobilization decisions with the ABCDE trauma assessment framework, ensuring a more integrated clinical response. While NEXUS and Canadian rules focus on ruling out cervical spine injury through clinical signs, S.T.A.B.I.L.E. emphasizes operational practicality in prehospital settings. Furthermore, protocols like the Immo Traffic Light System provide color-coded guidance but do not account for patient-specific physiological conditions as clearly as S.T.A.B.I.L.E. does. The integration of hemodynamic parameters, thermal status, transport duration, and body habitus makes S.T.A.B.I.L.E. a more holistic tool in complex trauma care. However, its clinical utility remains to be validated through prospective trials. Comparison with established systems highlights its promise, but also underlines the need for harmonization with global trauma guidelines. Limitations of this review include its narrative nature, potential selection bias, and lack of a formal quality assessment of included studies.

...of this protocol and significantly improve trauma patient outcomes.

Conclusion

In conclusion, emerging scientific literature highlights the S.T.A.B.I.L.E. protocol as a potentially promising, evidence-based approach for the optimal management of trauma patients in pre-hospital settings. It’s clear and systematic decision-making sequence could offer advantages over standard immobilization, contributing to the overall safety of the patient.

However, it is crucial to recognize that although the theoretical evidence is encouraging, the practical application of the S.T.A.B.I.L.E. protocol requires careful consideration. Its implementation should be guided by standardized clinical protocols and supported by adequate training for healthcare personnel involved in pre-hospital emergency care.

Further research and clinical studies are encouraged to more thoroughly evaluate the effectiveness, feasibility, and safety of the S.T.A.B.I.L.E. protocol in real-world contexts, as well as to

identify and address any barriers to its implementation. Only through an integrated approach, combining scientific evidence with prudent clinical practice and experience-based decision-making, will it be possible to fully harness the potential.

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.V.R., S.R., H.G., Concept: M.R., L.R., Design: C.R.I., L.R., Data Collection or Processing: M.V.R., S.R., H.G., L.R., Analysis or Interpretation: M.V.R., S.R., H.G., M.R., L.R., Literature Search: M.V.R., S.R., H.G., L.R., Writing: M.V.R., S.R., H.G., C.R.I., L.R.

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