Emergency Medical Teams

Minimum technical standards and recommendations for spinal cord injury management in emergencies

World Health Organization

Minimum technical standards and recommendations for spinal cord injury management in emergencies

World Health Organization

Minimum technical standards and recommendations for spinal cord injury management in emergencies

(Emergency Medical Teams)

ISBN 978-92-4-010394-8 (electronic version)
ISBN 978-92-4-010395-5 (print version)

Suggested citation. Minimum technical standards and recommendations for spinal cord injury management in emergencies. Geneva: World Health Organization; 2024 (Emergency Medical Teams). Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at https://iris.who.int/.

Cover Photo: Physical Therapy at the Spinal Injury Rehabilitation Centre, (SIRC) Nepal; 2015. © Kiran Kreer

Design and layout by Valerie Assmann.

Contents

Foreword

The Emergency Medical Teams (EMT) initiative significantly contributes to the global emergency response landscape by encouraging and supporting the development of surge capacities on a national and international level. Continued efforts are made to identify, develop and disseminate technical standards, while also supporting countries in adapting and integrating those standards into national systems and responses. An increasing number of requests for assistance for targeted and specialized clinical care underscore the importance of developing flexible, scalable and tailored response capacities, such as specialized care teams (SCTs), while maintaining quality, reliability and predictability *(1)*. Lessons learnt from past emergencies demonstrated that responding to the trauma needs of populations affected by disasters, conflict and other emergencies can often be challenging, particularly in settings with a limited health and rehabilitation infrastructure. Spinal cord injury (SCI) care is resource intensive and surges in spinal cord injuries can create specific acute and long-term challenges for health systems, emphasizing the need for technical guidance and standardization of SCI care in emergencies. This document provides practical guidance for Member States, ministries of health, national and international EMTs and other key stakeholders wishing to build surge capacity and capability for SCI management in emergencies and thus will contribute to enhanced preparedness and readiness to provide affected communities with a well-coordinated emergency response and access to targeted SCI services, always adhering to clearly defined quality standards of care.

Dr Nedret Emiroglu

Director
Country Readiness Strengthening Department
WHO Health Emergencies Programme

Acknowledgements

The World Health Organization (WHO) extends its sincere gratitude to the EMT Technical Working Group and the many individuals, organizations and professional bodies who contributed to this document's development by providing foundational work, support, ongoing review, scoping, feedback, assistance and technical advice. We are extremely grateful to the International Spinal Cord Society (ISCoS), all WHO technical units involved and the entire EMT community for their valuable feedback and contribution throughout various consultations.

WHO Technical Working Group Steering Group responsible for the guidance development
Nadine Vahedi (WHO), Pete Skelton (WHO), Jorge Durand (WHO), under the overall supervision of Flavio Salio (WHO).

EMT Technical Working Group Members
Jo Armstrong (National Spinal Injuries Centre, United Kingdom of Great Britain and Northern Ireland), Mandira Baniya (Spinal Injury Sangh Nepal), Michael Baumberger (ISCoS), Erica Bleakley (National Critical Care and Trauma Response Centre, Australia), Zoe Clift (Humanity & Inclusion, United Kingdom of Great Britain and Northern Ireland), Esha Thapa Dhungana (Spinal Injury Sangh Nepal), Michael Fehlings (University of Toronto, Canada), Felix Fellmer (Arbeiter-Samariter-Bund, Germany), Mohsen Ghasami (International Federation of Red Cross and Red Crescent Societies (IFRC), Iran), Trevor Glass (International Search and Rescue Advisory Group (INSARAG)), Alexander Krenauer (Navis, Germany), Fiona Stephenson (International Network of Spinal Cord Injury Nurses, United Kingdom of Great Britain and Northern Ireland), Colleen O'Connell (Praxis Spinal Cord Institute, Canada), Gustavo Perez Reina (Spanish Agency for International Development Cooperation (AECID) Spain), Rohit Kumar Pokharel (Tribhuvan University, Nepal), Sophia Rapti (Save the Children, United Kingdom of Great Britain and Northern Ireland), Eric Weerts (Humanity & Inclusion, Belgium).

Special thanks to peer reviewers and external reviewers
Najmedden Attabib (Dalhousie University, Canada), Teresa Yolanda Barrios De La Fuente (AECID, Spain), Dorothy Boggs (WHO), Alberto Cairo (International Committee of the Red Cross (ICRC), Sean Casey (WHO), Rachael Craven (Médecins Sans Frontières (MSF)), Tim Das (WHO), Raju Dhakal (Spinal Injury Rehabilitation Centre (SIRC), Nepal), Wagih El Masri (Keele University, United Kingdom of Great Britain and Northern Ireland), Abdelrahman Elwishahy (WHO), Nina Enersen (Sunnaas sykehus, Norway), Filippo Gatti (ICRC), Justine Gosling (WHO), Eystein Grusd (WHO), Olivier Hagon (Center for Humanitarian Medicine and Disaster Management, Switzerland), Melanie Johnson (UK-MED, United Kingdom of Great Britain and Northern Ireland), Shirin Kiani (WHO), Edo Lihoc (Malteser International, Germany), Bronte Martin (National Critical Care and Trauma Response Centre, Australia), Alexandra Rauch (WHO), Erin Noste (WHO), Rob Ravinsky (University of Arizona, United States of America), Andrew Scanlon (Sunnaas sykehus, Norway), Kylie Shae (WHO), Emma Tebbutt (WHO), Harald Veen (WHO), Simon Walling (Dalhousie University, Canada), Joan Wilson (Public Health Protection Unit, Greater Glasgow and Clyde, National Health Service (NHS), United Kingdom of Great Britain and Northern Ireland), Shoji Yokobori (Japan International Cooperation Agency (JICA)/Japan Disaster Relief (JDR), Japan).

Special thanks to the following collaborators/organizations

The development and publication of this document was made possible with generous support from the Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO) and the Spanish Agency for International Development Cooperation (AECID), Spain.

All members of the Technical Working Group and all external experts completed and submitted a Declaration of Interest (DOI) to WHO, disclosing potential conflicts of interest that might affect, or might reasonably be perceived to affect their objectivity and independence in relation to the subject matter of the guidance. WHO reviewed each of those and had concluded that none could give rise to a potential or reasonably perceived conflict of interest related to the subjects covered by the guidance.

Abbreviations

AD autonomic dysreflexia

ADL activities of daily living

AT assistive technology

AP assistive product

CT computed tomography

CSF cerebrospinal fluid

EMT Emergency Medical Team

HEOC Health Emergency Operations Centre

ICU intensive care unit

IPC Infection prevention and control

ISNCSCI International Standards for Neurological Classification of Spinal Cord Injury

IV intravenous

ISCoS International Spinal Cord Society

MDS Minimum Data Set

MILS manual in-line stabilization

MRI magnetic resonance imaging

OR operating room

OSL Operations support and logistics

SCI spinal cord injury

SCIM Spinal Cord Independence Measure

SCT specialized care team

SOP standard operating procedure

TWG technical working group

VTE venous thromboembolism

WASH water, sanitation and hygiene

WHO World Health Organization

Methodology

The EMT Secretariat applied a standardized, systematic process to develop this guidance document on SCI management in emergencies. Following identification and definition of the scope of the document, a comprehensive literature review and an assessment of available guidance documents and guidelines from major internationally recognized institutions and authorities was conducted. Terms of Reference (TORs) for the technical working group (TWG) were developed and a call for expressions of interest was sent to partner organizations, as well as to the entire EMT network and the International Spinal Cord Society (ISCoS) network globally. The EMT Secretariat assessed the nominations and applications, and identified participants based on a fair representation of WHO regions, gender, academic background, expertise and experience. A steering group of experts was convened to guide the project and a TWG was formed, including identified EMT stakeholders and internationally recognized SCI experts. The EMT Secretariat led and coordinated the implementation of the TWG and the steering group through regular virtual consultation sessions. Multiple rounds of written submissions and technical contributions on adapted SCI care in emergencies were consolidated into a draft and combined with evidence generated by the literature review and existing best practice guidelines. The decisions and consensus of the TWG provided the basis for the developed minimum technical standards and recommendations relevant for the establishment of SCI SCTs. Following the finalization of the TWG document, and following routine WHO Quality Assurance, Norms and Standards procedures for development of WHO normative and standard-setting products, an external expert review of the final document was undertaken. Feedback was incorporated and consented to by the TWG.

Chapter 1

Introduction

1 Introduction

Health emergencies that cause large numbers of traumatic injuries can result in surges of SCI in a short period of time that can easily overwhelm services in even the strongest health system. Initial survival will depend heavily on a wide range of factors, including the nature of the injury, the availability of safe extrication and pre-hospital care, and the ability of the health system to provide appropriate acute and post-acute care. Limited specialized services, lack of awareness or knowledge of SCI management and weak coordination mechanisms may lead to significant delays in appropriate care for patients who have sustained a SCI, resulting in preventable and potentially life-threatening complications. These complications can be costly, delay discharge and compromise functioning outcomes. Correct initial management of patients with SCI is vital to long-term survival and quality of life. SCI management must be undertaken with a clear understanding of the context and available acute and long-term spinal care. Effective care of patients with SCI is complex, multidisciplinary, and time and resource intensive. The continuum of care starts from the point of injury, through acute care and surgical care and on to post-acute inpatient SCI care, including comprehensive rehabilitation. It must then continue with ongoing rehabilitation at home or community level, follow up and social reintegration. In low- and middle-income settings pre-existing services may not always be available, which presents additional challenges. This guidance has been developed to inform about the often-unmet need for SCI care in emergencies, to facilitate preparation and to particularly emphasize the importance of aligning practices with local context and capacities. It complements the minimum standards and recommendations as defined in the 2021 EMT publication *Classification and minimum standards for emergency medical teams*, commonly referred to as the "Blue Book" *(1)* and builds on the concept of SCTs, introducing additional verification requirements for medical teams preparing for or involved in responding specifically to requests for assistance for SCI management.

Chapter 2

How to use this guidance

2 How to use this guidance

This document complements and expands on the guidance provided by the WHO EMT publication *Classification and minimum standards for emergency medical teams*. It provides guidance on additional components of SCI specific emergency care for Member States, ministries of health, national and international EMTs and other key stakeholders wishing to build SCI management surge capacity and defines minimum standards for the development and classification of respective SCTs within the EMT framework. Each technical standards chapter opens with a narrative which describes SCI care in emergencies and how to adapt practice. This is followed by minimum technical standards, recommendations and guidance notes applicable specifically to SCI SCTs – though they can also be utilized by all EMTs to strengthen SCI care. Table 1 provides the definitions of minimum standards, recommendations and guidance notes in the context of this publication. Table 2 provides an overview of the defined standards on SCI care provided by the Blue Book *(1)*.

Table 1. Definitions of minimum standards, recommendations and guidance notes for SCTs in the context of this publication

Minimum technical standards	Promote a consistent approach and a basic level of standardization informed by available evidence, expertise and experience and obtained through a consultative process.
Recommendations for optimal patient care	Cover additional services and procedures that can contribute to achieving optimal care and ideally should be strived for.
Guidance notes	Provide additional information to apply the minimum standards and recommendations.

Table 2. Blue Book minimum technical standards on SCI care for all EMTs

1. Assess each trauma patient for SCI, handle and transfer patients appropriately to avoid secondary injury (for example using a log roll).
2. Ensure appropriate examination, analgesia and immobilization of the spine.
3. Avoid prolonged periods on hard transfer boards to prevent pressure ulcers.
4. Ensure bladder and bowel care, pressure area care and prevention of other complications.
5. Transfer patients with suspected SCI to a facility with the ability to definitively manage their injury.
6. Inform ministry of health/EMT Coordination Cell (EMTCC) of all patients with suspected SCI via the established reporting system.

Head of nursing at the Spinal Injury Rehabilitation Centre (SIRC) assists a patient during physical rehabilitation activities, Nepal, 2017. © WHO / Conor Ashleigh

Chapter 3

Definition of specialized care teams

3 Definition of specialized care teams

In recognition of the need for a more modular approach to best suit the local context, the use of SCTs to support critical health-care gaps has emerged. SCTs provide specialized clinical services, reflected by their team composition, skills and competencies, and deploy with the appropriate equipment and consumables that are required to provide their specialist services.

3.1 SCI SCTs

SCI SCTs are multidisciplinary and offer standardized services that extend from comprehensive inpatient spinal care to comprehensive inpatient spinal care with surgical capacity, known as SCI SCT (surgical), as outlined in Table 3. SCI SCTs (surgical) need to ensure continuity of care and that either the host facility or other medical teams such as SCI SCT provide comprehensive inpatient SCI care, including additional rehabilitation capacities to cater for the increased complexity of patients. Continuity of care is ensured through a dedicated coordination mechanism, well established referral pathways and strong collaboration among national and international stakeholders. All SCI SCT must align their services to the local context and ensure service provision and continuity of care after their departure. They must have the capacity to deliver training to local staff, be self-sufficient and adhere to the core standards and guiding principles as defined by the EMT framework *(1)*. SCI management must be undertaken with a clear understanding of the local context and nationally available long-term spinal care. SCI SCT will deploy into or alongside existing spinal specialist centres if available, referral hospitals or EMT facilities. They may have a role in advising local health-care facilities and EMTs on standards of care for spinal injured patients during the emergency response.

Table 3. Overview of the defined SCI SCT capacities

SCT	Key characteristics	Services	Possible modalities of deployment
SCI	Inpatient specialist SCI care	Autonomous, comprehensive nonsurgical management of SCI patients	Embedded or coupled to an existing facility (EMT, referral hospital offering SCI patient cohorting, or a SCI centre).
SCI (surgical)	SCI surgical management Continuity of care needs and comprehensive inpatient SCI care needs to be ensured by either the host facility or other medical teams, such as SCI SCT.	SCI surgical management (5.8.2) including SCI specific anaesthesia (5.8.3) Perioperative nursing and rehabilitation ***Plus*** services provided by either the host facility or other medical teams, such as SCI SCT, including rehabilitation care/additional rehabilitation capacities to cater for the increased complexity of patients.	**Embedded** Can only embed into an existing host facility that meets predefined minimum standards. (Annex 7.3 checklist)

3.2 Modalities of deployment

In general, and unless otherwise specified, SCTs are designed to embed into or couple with existing health-care facilities. Some specific types of SCT (such as some of the outbreak/HID SCT inpatient capacities) *(2)* may be required to deploy as self-sustained facilities, however this does not apply to SCI SCTs. Any SCI SCT is expected to have the ability to provide self-sufficient embedded care within a host facility as defined by this document. The ability to deploy a coupled facility with its own infrastructure is, however, recommended, as evidence suggests that it may be necessary to expand the treatment space available to host facilities. Regardless of the modality of deployment, teams need to ensure self-sufficiency and the ability to provide the required equipment and consumables to deliver their services for the entire period of their deployment. Table 4 provides a general overview of embedded and coupled modalities of deployment. Table 5 outlines the requirements and potential modalities of deployment for the two team types of SCI SCT and SCI SCT (surgical) as defined by this guidance.

Table 4. Overview of embedded and coupled modalities of deployment for SCTs to deploy

Modality of deployment	Description	Clinical care	Staffing	Spaces/ structures	Supplies/ equipment
Embedded	The SCT integrates into an existing facility to provide specialized clinical care. The operational support component is provided by the host, except for specific clinical devices, equipment, consumables and pharmaceutical products needed for specialized clinical care as defined by the SCT's clinical specialty.	Provided by SCT	SCT provides all staff with skills and competencies required to provide specialized clinical care. In many cases SCT staff will complement the facility`s existing staff.	The host facility provides appropriate and accessible space for SCT to provide specialized clinical care.	SCT provides its own specific clinical devices, medical equipment, pharmaceutical products and nonmedical supplies needed to provide specialized clinical care and services, with the exception of elements the host facility is required to provide (see Annex 7). Additional requirements will be assessed in coordination with the host facility prior to deployment.
Coupled	The SCT provides specialist SCI surge support alongside an existing host facility, such as an EMT, referral hospital (where SCI patients have been cohorted) or a SCI centre. The SCT provides its own infrastructure, co-located on the same site and shares some predefined operational support elements with the host. The SCT may also provide some operational support services to guarantee appropriate clinical care as defined by the SCT's clinical specialty, such as logistic and water, sanitation and hygiene (WASH) elements. The type and amount of support services offered by the host facility must be confirmed prior to deployment, such as power, waste management and safe and sufficient water supply.	Provided by SCT	SCT provides all staff with skills and competencies required to provide specialized clinical care.	SCT provides its own infrastructure and space to support specialized clinical care.	SCT provides its own clinical devices, medical equipment, pharmaceutical products, and nonmedical supplies needed to provide clinical care, with the exception of clearly predefined criteria, that a host facility is required to provide as prerequisite for SCT to couple. Additional requirements will be assessed in coordination with the host facility and the SCT-specific host facility checklist prior deployment. (see Annex 7).

Operations support and logistics (OSL) staff setting up treatment structures, Gaza, Occupied Palestinian Territory, 2024. © UK-Med

Table 5. Overview of different requirements and potential modalities of deployment for SCI SCT and SCI SCT (surgical)

DETAIL	SCI embedded	SCI coupled	SCI SCT (surgical) only embedded
Length of stay* *Potential team rotations, not of individual personnel*	1 month Recommendation: 3 months	1 month Recommendation: 3 months	2 weeks Consider acute and delayed deployments Continuity of care and comprehensive inpatient SCI care needs to be ensured by either the host facility or other medical teams, such as SCI SCT.
Capacity	24/7 Minimum: Simultaneous management of 10 SCI inpatients	24/7 Minimum: Simultaneous management of 10 SCI inpatients Recommended: Ability to expand to up to 20 beds	24/7 Management of up to 10 surgical patients in 2 weeks.
Staff	*See staffing considerations in Annex 1*	*See staffing considerations in Annex 1*	*See staffing considerations in Annex 1*
Supplies	SCT provides its own clinical devices, medical equipment, pharmaceutical products and non-medical supplies needed to provide SCI SCT embedded clinical care.	SCT provides its own clinical devices, medical equipment, pharmaceutical products and non-medical supplies needed to provide SCI SCT coupled clinical care.	SCT provides its own clinical devices, medical equipment, pharmaceutical products and non-medical supplies needed to provide clinical/surgical care, with the exception of clearly predefined criteria the host facility is required to provide as prerequisite for the SCT to embed, such as computed tomography (CT) imaging, a sterile operating room (OR) environment and critical care for SCI SCT (surgical).

*refers to international deployment

DETAIL	SCI embedded	SCI coupled	SCI SCT (surgical) only embedded
Space	Embeds into host facility structures. Provides additional beds and other equipment to set up inside the facility if indicated.	Deploy with infrastructure/tent, beds and supporting infrastructure for at least 10 patients, ensures sufficient space for access to beds from all sides and a minimum of 1.5 metres between beds. Recommendation: a treatment area allowing 2 metres between beds. Additional considerations: Space for additional mattresses for caregivers. Space for a clinical staff desk, sink, small storage for medical consumables. Floor must be flat; entrances must be flat or ramped. Team deploys additional storage tent, if no available storage space in proximity of the unit. Note: a rehabilitation SCT may need to be deployed if there is no rehabilitation space in the host facility.	Embeds into host facility structures
Power	Provided by host facility	Minimum 5–10 KVA generator based on calculated power requirements, including climate control methods, lighting and power sockets.	Provided by host facility Note to teams: bring backup power supply
Water supply	Provided by host facility	Storage of at least a 48-hour supply of water at all times to ensure a continuous water supply *(3)* (40–60 litres per patient per day, 15 litres per staff member and caregiver, min 50 litres for cleaning per day).	Provided by host facility
Sanitation	Provided by host facility	Establish accessible patient latrines and showers if required.	Provided by host facility

DETAIL	SCI embedded	SCI coupled	SCI SCT (surgical) only embedded
Hygiene	Provided by host facility	Establish hand hygiene stations at all points of care *(4)*.	Provided by host facility
Environmental cleaning	Provided by host facility	Teams bring sufficient supplies, including spill kits.	Provided by host facility
Waste management	Provided by host facility	Teams safely collect and store medical and nonmedical waste on site. Disposal by host facility or teams provide their own medical waste treatment technology, liaise with local teams or facilities, or contract local private waste management companies.	Provided by host facility
Infection prevention and control (IPC)	Bring sufficient IPC supplies and consumables for the entire deployment period.	Bring sufficient IPC supplies and consumables for the entire deployment period.	Bring sufficient IPC supplies and consumables for the entire deployment period.
Communication	Minimum: Unlocked mobile phones with local sim cards for staff. 1 satellite phone 2-way radios for staff Recommended: portable Internet such as Broadband Global Area Network (BGAN).	Minimum: Unlocked mobile phones with local sim cards for staff. 1 satellite phone Recommended: portable internet such as BGAN. 2-way radios if staff is dispersed in hospital	Same as SCI embed

OSL staff conducting a maintenance check on a generator, Gaza, Occupied Palestinian Territory, 2024. © UK-Med

Chapter 4

Integration of SCI considerations into preparedness and coordination

4 Integration of SCI considerations into preparedness and coordination

A Health Emergency Operations Centre (HEOC) or equivalent, including a surge coordination mechanism, such as an EMT Coordination Cell (EMTCC), plays a vital role in coordinating emergency responses. Effective care for acutely injured SCI patients is resource intensive and requires expertise, from pre-hospital care through to definitive surgery and rehabilitation. All of this can be challenging in an emergency setting, therefore, coordination of SCI patient care in emergencies requires specific consideration to ensure an effective and efficient response. Many of the steps to ensure effective coordination are ideally taken in the preparedness phase.

EMTCC Meeting, Mozambique, 2019. © Secretariat of Japan Disaster Relief Team, Japan International Cooperation Agency

4.1 National and subnational preparedness

As part of preparedness, it is critical for national authorities to map pre-existing SCI care capacity in the country and its ability to maintain and expand SCI care, as well as to develop an emergency management strategy that extends beyond the initial acute phase of the emergency. Member States are recommended to integrate SCI care into their standard trauma care protocols and to include specific provisions for a potential surge in SCI into their national and subnational health emergency preparedness and response plans. These should be tested regularly by conducting simulation exercises with relevant local, national and regional stakeholders.

RECOMMENDATIONS

- Map available SCI capacity, such as spinal surgery services, CT and magnetic resonance imaging (MRI), specialized SCI (or related) inpatient rehabilitation centres and community level rehabilitation services and identify potential gaps in the ability to manage a surge in SCI patients.
- Develop specific routine and emergency adapted protocols and care pathways for SCI patients, including a cohorting strategy if indicated *(5)*.
- Identify a focal point to lead on the coordination of SCI care in an emergency.
- Develop a plan for mobilization of SCT surge support to fill any identified gaps.
- Support identified SCI service providers to prepare emergency plans, including preparedness of staff, management or stockpiling of supplies and safety of infrastructure.
- Test plans regularly by conducting simulation exercises with relevant local, national and regional stakeholders that include patients with SCI.
- Develop patient and caregiver education material on SCI in locally appropriate language.
- If not already available, establish and agree on an information management and reporting system, that can be adapted to the emergency context and disaggregates patients with SCI.

4.2 Coordination of SCI surge in an emergency response

In many large-scale emergencies, a coordinated prehospital system may be absent or not functional, and patients often present to their nearest operational health facility. Transport to health-care facilities ranges from a fully equipped ambulance to patients arriving carried in arms, on makeshift stretchers, in wheelbarrows, cars or on motorbikes. Early identification and onward referral of SCI patients to more specialized facilities may often be required. However, receiving facilities are also likely to be overwhelmed. In large scale emergencies, access to definitive spinal surgery may be challenging due to the lack of theatre capacity and required imaging, and the limited availability of specialized surgical SCI management capacities. Coordination challenges extend beyond immediate care and referral. Ensuring longer-term follow-up care can be difficult, and where it is absent, patients may quickly develop life threatening complications. From the outset of the response, coordinating authorities need to begin to plan for extended inpatient rehabilitation, a need for specialized assistive products (APs) and home adaptation as well as psychosocial support and community follow-up care. In countries where these services are weak, emergencies present opportunities to strengthen them, however this requires solid data on patients with SCI and specific early planning.

Coordination of SCI care during an emergency requires a rapid mapping of the status of key facilities, identification of patients with SCI, coordination of patient transport such as ambulances or inter-referral of hospitals, and communication of updated referral pathways to facilities. Clear communication between referring and receiving health-care facilities is essential, as is the ability to safely transport patients between them. Requests for SCI SCTs require an understanding of the locally available SCI care capacities and the realities of longer-term capabilities. This ultimately facilitates requests for assistance as well as exit planning for any team offering various levels of care and support. It needs to be acknowledged that in a system with little or no pre-existing specialized SCI management, it may be challenging to ensure appropriate post-acute SCI care will be in place in the first weeks of an emergency. However, past responses have demonstrated that emergencies are often a catalyst for the rapid establishment of SCI services. Cohorting of patients with SCI in dedicated centres remains a priority, facilitates effective and safe SCI management, and ensures that patients receive the best possible care, while also freeing resources at other health-care facilities. As well as improving patient outcomes, this can increase access to quality medical and nursing care and maximize the efficient use of resources *(6)*.

From the outset of an emergency, suspected SCI patients should be directed initially to designated trauma centres with the capacity to manage their emergency and surgical needs, before being cohorted together, either at a specialist SCI centre, or, in the absence of such a facility, at a designated health facility where spinal resources can be focused. In emergencies with significant surges in spinal injuries, a surge in both expertise and equipment is required at any centre that is cohorting patients, as well as the potential deployment of surgical expertise to any facility that has been appointed to provide spinal surgery. If patients face an extended wait for definitive surgery, once medically stable they may be best cohorted in a centre specializing in SCI care rather than occupying an acute trauma bed. Type 2 and Type 3 EMTs are not typically expected to cohort SCI patients and should transfer them at the earliest possible stage to a centre for definitive treatment. However, they must be prepared to provide nonoperative management of SCI patients until a safe onward destination is identified.

RECOMMENDATIONS

- Rapidly map available capacity for acute SCI care, imaging, surgery and rehabilitation, identify gaps and communicate clear pathways to responders.
- Activate a commonly agreed information management and reporting system in close coordination with the local authorities, such as the EMT Minimum Data Set (MDS), that is adapted to the context and includes disaggregation of SCI patients.
- Implement a strategy to cohort SCI patients to receive the most efficient and effective care.
- Identify if surge support is required and rapidly request national or international assistance.

Example

Cohorting as the basis for providing quality SCI care

Cohorting patients with similar clinical presentations, such as SCI, in the same facility or location, can have a significant impact on the quality of care in an emergency by facilitating a focused allocation of resources and allowing access to specialized multidisciplinary care and expertise. Cohorting also supports capacity building by grouping clinical specialists with non-specialized staff, caregivers and patients. It provides the significant benefit of peer support for patients and can enable access to peer counsellors that have been through a similar recovery in the past.

Cohorting in a sudden onset disaster

Following the catastrophic 2015 earthquake in the Kathmandu Valley, the Ministry of Health and Population Nepal, in collaboration with the Injury Rehabilitation Sub Cluster and EMTCC, quickly designated the Spinal Injury Rehabilitation Centre (SIRC), run by Spinal Injury Sangh Nepal, as the location to cohort patients with SCI. Efforts were made to free up space in the centre and to rapidly scale up services. To support this, EMTs deployed specialized teams with equipment and supplies to provide a surge in clinical care while also supporting the rapid training of new national staff. Some existing centre staff were redeployed to provide spinal outreach services to key acute hospitals to improve acute care and reduce complications. To decompress hospitals and improve outcomes, post-operative patients and those being managed conservatively were then transferred to the centre where they could receive comprehensive specialized care, including long-term follow-up. By focusing effort and resources in one location and building on existing capacity, it was possible to rapidly scale up care while freeing up acute hospital beds. This not only improved care for those injured in the earthquake, but also supported a longer-term expansion of SCI capacity.

Cohorting in a conflict setting

In anticipation of a surge in SCI cases in Ukraine, a facility was identified to cohort SCI patients, and a team of SCI experts deployed to support a rapid scale up. Centre capacity was increased rapidly through the conversion of space and donation of equipment (including beds) and consumables, and the training of new and re-tasked national staff. Efforts were made to strengthen referral pathways between acute hospitals and community-level follow-up. To maximize impact, surge deployments must be part of a comprehensive approach that includes consideration of longer-term financing, referral pathways and continuity of care, and must be integrated into overall national response and recovery planning. Ideally, when an emergency strikes, a country has existing designated SCI referral centres and well-rehearsed plans to protect and scale up SCI care during an emergency. The current reality is that many countries at greatest risk of emergencies have weak or absent services and systems, and work is needed in the midst of an emergency to develop referral pathways for cohorting while trying to rapidly build SCI services.

Chapter 5

Clinical care technical standards on SCI management in emergencies

5 Clinical care technical standards on SCI management in emergencies

Many major trauma emergencies, such as earthquakes and conflicts can result in surges in SCI *(7)*. Presentations vary dramatically, but patients commonly present with multiple injuries. Earthquake injuries are often closed injuries due to blunt trauma, and in some instances include burst fractures due to people jumping from height to escape buildings. Historically, earthquake injuries are more likely to be thoracic or lumbar than cervical, and depending on speed and quality of extrication, may be more likely to be complete than incomplete. Presentations in conflict may be very different – closed injuries may still occur due to building collapse or blunt trauma from being thrown by blasts, but penetrating injuries are more common, due to bullet, shrapnel or knife injury. Both earthquakes and conflicts can lead to the displacement of populations and destruction of health-care facilities and homes. Especially, the context of conflict may potentially present additional challenges in ensuring continuity of care due to security concerns. Regardless of context or mechanism of injury, outcomes in SCI greatly depend on availability of appropriate care, from point of injury through to definitive rehabilitation. Care is multi-disciplinary, and requires extended medical, nursing and rehabilitation management. SCI SCTs can play a key role in the management of a surge in SCI cases as part of an overall trauma response by providing safe and effective SCI care in accordance with their capacity, and through the deployment of SCTs to work inside or alongside health facilities that have been designated to receive SCI cases.

Patients with suspected SCI should be directly transported to a facility that can provide appropriate assessment and definitive management. However, in emergencies, patients often first present directly to their nearest health-care facility, which may include Type 1 facilities or trauma stabilization points. All medical teams, therefore, need to be prepared to provide initial stabilization, assessment and support. Spinal injury should be suspected in any patient with multiple traumatic injuries *(8)*. Life threatening conditions need to be managed before any ongoing referral and transfer to higher levels of care. Knowledge of the mechanism of injury, whether blunt or penetrating, is important during the assessment and management of the SCI *(9)*. Patients may quickly develop serious, yet preventable complications. Common acute SCI complications include respiratory impairments, pressure injury, contractures, urinary tract infections, bowel issues and pain. Acute and ongoing SCI management includes nursing, early rehabilitation, family and caregiver education and mental health and psychosocial support. Decision-making in regard to the SCI management approaches in emergencies is complex. Considerations must include the staff and resource intensive nonoperative care of patients with unstable spinal injuries that are being managed nonoperatively, following meticulous management procedures. Surgical management should only be undertaken by specialist surgeons working in appropriately equipped facilities (see Annex 7.3).

5.1 Prehospital considerations

Depending on pre-existing national capacities, first responder activities during an emergency may be delivered by non-medically trained persons, search and rescue teams, rapidly mobilized medical teams, ambulance services or bystanders. Patients with spinal trauma may experience a significant delay from the time of injury to the time of extrication (if required), transport and presentation to an appropriate care facility. Safe disentanglement and extrication of a patient with suspected SCI is critical in minimizing an exacerbation of primary and limiting secondary SCI. When there is an immediate threat to a person's life and rapid extrication is needed, all efforts need to be made to limit spinal movement without delaying treatment. It is critical to ensure a structured, prioritizing sequence in the initial assessment of the trauma patient *(10)*, initial stabilization, including haemorrhage control and for accompanying injuries and initiate direct transfer *(11)*.

RECOMMENDATIONS FOR FIRST RESPONDERS

- If using spinal boards for extrication, make sure to minimize pressure point areas, protect bony areas, check for any debris or pocket content and transfer patients off the board as soon as possible onto a firm padded surface, to minimize the risk of pressure injury, while maintaining spinal alignment *(12, 13)*.
- Protect the cervical spine, while restricting movement of the remainder of the spine in suspected spine injury at all stages of the assessment, including during any airway evaluation and intervention, until injury is ruled out through further assessments at the definitive treatment facility *(13)*.
- Adapt appropriate spinal precautions for pregnant and paediatric patients *(13)*.
- Anticipate an altered level of consciousness and a potential associated airway compromise when extricating a patient in a supine position. Ensure frequent re-evaluations of the airway *(14)*.
- Provide early thermo-protection.
- Document accurate initial and ongoing neurological status during extrication and transport process.

GUIDANCE NOTES FOR FIRST RESPONDERS

- The approach to cervical stabilization needs to be informed and selective and will depend on team training and accepted practice. The routine use of hard collars in prehospital settings is increasingly controversial with many providers now preferring to use manual in-line stabilization (MILS) and/or head blocks *(15)*.
- In uncooperative, agitated, or distressed individuals, including children, it is advised to let them find a comfortable position with manual in-line spinal immobilization *(11)*.
- Patients with a kyphotic spine should be stabilized in a position similar to their habitual spinal curvature.
- Consider contraindications for the use of spinal boards, such as significant pelvic fractures *(16)*.
- The Canadian C-Spine/National Emergency X-Radiography Utilization Study (NEXUS) rules are NOT applicable in polytrauma as they cannot be used safely if distracting injuries or any other peripheral injuries exist. When in doubt, treat such injuries as a SCI until proper imaging or exam is possible *(17)*.

Japan Disaster Relief Team supporting the Türkiye - Syria earthquakes response, Türkiye, 2023. © WHO

5.2 Patient transport and transfer considerations

Patients with a suspected SCI need to be safely transported from the scene or from a receiving facility that cannot provide definitive care once they are stabilized. Most medical teams will not be able to provide definitive care for spinal cord injured patients and ambulance services and staff trained in spinal precautions may not be available, thus teams need to be prepared to support safe transfer. Early transfer (<24 hours) to a specialized SCI centre has been associated with improved long-term outcomes *(18)*; however, in many emergency contexts such centres may not exist or may be overwhelmed. It is crucial to minimize the number of patient transfers to and from various facilities. Ideally, health-care facilities with appropriate capacity will be appointed to receive suspected SCI patients in the event of a MCI, and a coordinated pre-hospital system directs patients to these hospitals. Where road access is limited, or road transport will take a significant amount of time, transfer by air may be preferable, but is not commonly available.

WHO and partners medically evacuate a 32-year patient with a spinal fracture from Al-Ahli hospital in northern Gaza, 2024. © WHO

RECOMMENDATIONS

- Stabilize the patient's condition before transfer – this may include the management of other life-threatening conditions.
- Be prepared to provide staff to support patient transport to or from the centre to ensure safe transfer of patients.
- Ensure an adequate number of health-care personnel to provide safe interventions and maintain spinal alignment, such as repositioning and to attend to ongoing patient needs.
- Transfer patients off any spinal boards, either actual or makeshift, as soon as possible to prevent pressure injury and initiate measures to prevent skin breakdown if prolonged immobilization is anticipated *(11)*.
- Provide safe patient transport under spinal precautions including spinal motion restriction, cervical spine protection with MILS and other devices such as head blocks during transport in every patient with a suspected spine injury to minimize unwanted movement until injury can be ruled out at a treatment facility, where definitive treatment will be determined *(13, 19)*.
- Provide continuous monitoring during transfer.
- Provide thermo-protection.
- Perform and document a baseline skin assessment and protect skin from pressure injury.
- Adapt services to the requirements of specific patient groups, such as children and pregnant women, or other vulnerable populations *(1)*.
- If available, allow a caretaker to be transferred with the patient and ensure that any known family/caregivers know the patient's destination.

GUIDANCE NOTES

- Ensure clear documentation in a locally appropriate language, including neurological level and completeness of injury and details of the clinician who accepted the referral, immediately prior to and during transfer.
- Make sure that all obtained imaging and other medical records accompany the patient during interfacility transport.
- Provide vasopressor when clinically indicated only when continuous monitoring is available.
- Consider the provision of anti-emetics to prevent vomiting in immobilized patients.
- If clinically appropriate and scope of care is available, provide airway support, including oxygen and capnography.

5.3 Neurological assessment

The receiving health-care facility should be prepared to provide early spinal clearance and, if used, to remove cervical collars as soon as possible. It is critical to protect the cervical spine with manual in-line spinal immobilization at all stages of the assessment, especially during any airway intervention, and use caution to prevent secondary injury to the spinal cord while performing life support techniques. The neurological assessment will inform management decisions.

MINIMUM TECHNICAL STANDARDS

- Perform and document a detailed neurologic exam and assessment on any patient with suspected spinal injury or SCI *(11)*.
- Document motor and sensory function and determine the level and severity of an injury as soon as possible, ideally within the first 24 hours post-injury, as well as before and after surgery, using the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI)/American Spinal Injury Association (ASIA) Impairment Scale (AIS) *(20)*.
- Assess the patient applying validated SCI management decision-making tools *(21)*.

GUIDANCE NOTES

- Provide continuous and serial evaluation and documentation of neurologic function as well as spinal pain to demonstrate if the patient's condition is worsening, improving or unchanged.

5.4 Hemodynamic support

Acute SCI can lead to both cardiovascular and respiratory compromise. Even brief periods of hypotension have detrimental effects on long-term outcomes after SCI. Initial stabilization includes adherence to damage control principles, c-ABCDE assessment, ruling out other injuries and haemorrhage control *(22)*. Teams need to be able to rapidly recognize and manage hypotension, bradycardia and shock, including hypovolemic and neurogenic shock *(9)*. Neurogenic shock is a potentially life-threatening consequence of upper thoracic and cervical SCI and requires intensive management and monitoring in a higher-level care facility where available.

MINIMUM TECHNICAL STANDARDS

- Have standard operating procedures (SOPs) for the management of neurogenic shock, including vasopressor administration, appropriate to the level of service provided.

RECOMMENDATIONS

- Provide a focused assessment with sonography for trauma (FAST) if available and indicated as additional conditions, such as intra-abdominal bleeding, may be easily missed in the presence of altered pain sensation.

GUIDANCE NOTES

- Be aware that haemorrhagic shock may be present as well as neurogenic shock.
- Adjust the permissive hypotensive resuscitation in neurological trauma to a higher mean arterial pressure.
- Patients may have a poor response to volume replacement therapy, and excessive fluid resuscitation in neurogenic shock may rapidly lead to pulmonary oedema.
- Pharmacological treatments for neurogenic shock are based on vasopressor administration, requiring central and arterial lines for monitoring which may not be feasible in many contexts. When onward transfer is not an option or delayed, peripheral intravenous (IV) provision of vasopressors may be considered only under close patient monitoring at all times and additional pharmacological support to manage bradycardia *(23)*.

5.5 Pain management

Pain is a prominent complication in SCI, and its management is a priority in the care of SCI patients. Teams need to ensure the adequate and effective management of acute and chronic pain. In SCI, nociceptive and neuropathic pain can emerge simultaneously. Differentiation of the different types of pain is essential for a comprehensive, targeted and patient focused treatment. A significant proportion of people with SCI develop chronic neuropathic pain *(9)*. Pain management must be appropriate to the context and may include pharmacological and nonpharmacological approaches *(24, 25)*. In general, the pharmacological treatment of neuropathic pain following SCI is a long-lasting process, and its anticipated effects, side effects, as well as local sustainability, availability and regulations need to be carefully considered before starting the treatment and during follow up *(26)*.

MINIMUM TECHNICAL STANDARDS

- Use validated classification tools for the diagnosis of SCI related pain, such as the International Spinal Cord Injury Pain (ISCIP) Classification *(27)*.
- Provide acute and ongoing multimodal pain management of both nociceptive and neuropathic pain, that can be efficiently and reliably sustained longer term and beyond the departure of medical teams and in accordance with local regulations.
- Conduct and document continuous pain re-assessment in patients with known or suspected spine/spinal cord trauma, using a pain assessment scale suitable for the patient's age, developmental stage and cognitive function and understandable across cultures *(28)*.
- Teams need to ensure access to an effective and reliable supply chain of analgesic pharmaceuticals *(1)*.

GUIDANCE NOTES

- Be aware that opioids, and in some countries, neuropathic agents, such as gabapentinoids are classified as controlled drugs.

Physical Therapy at the Spinal Injury Rehabilitation Centre, (SIRC) Nepal; 2015. © Kiran Kreer

5.6 Imaging

Imaging of the spine is a crucial part of the initial assessment of acute SCI *(29)*. To accurately diagnose SCIs, plain X-rays are not considered to be a sufficient imaging modality, because of their low sensitivity *(9)*. Unless there is an obvious dislocation, X-ray will miss a high percentage of injuries, and thus can't exclude the presence of a serious fracture. However, CT imaging is likely to be unavailable or a scarce resource in the first days of an emergency. This is even more the case for MRI, which is the imaging modality of choice *(30)*. MRI is the gold standard imaging modality in children up to 16 years old, as they will present with higher rates of ligamentous injuries that can be missed on CT *(25)*. If only X-ray imaging is available, it can be used as an initial investigation tool to provide some diagnostic information in the absence of CT or MRI.

MINIMUM TECHNICAL STANDARDS

- Obtain X-ray imaging of the spine in every patient with suspected spinal trauma.
- Do not perform spinal surgery beyond wound debridement without CT imaging.

RECOMMENDATIONS

- If available, identify referral pathways for MRI in children *(31)*.

GUIDANCE NOTES

- Teams need to identify a pathway to CT imaging if needed and possible, always ensuring to reduce transfer to a minimum.
- While MRI provides additional information in regard to injury to the soft tissues, in most instances CT provides sufficient diagnostic information, and early surgical decompression should not be delayed in order to obtain an MRI *(11)*.
- If only x-ray imaging is available, it can be used as an initial investigation tool to provide some diagnostic information in the absence of CT or MRI. For cervical spine, full C-spine plain radiographs include anterior-posterior, lateral and odontoid views.

Surgeons of an embedded specialized care team using intraoperative imaging at Al-Awda Hospital in North Gaza, 2024; Gaza, Occupied Palestinian Territory, 2024. © WHO

5.7 Challenging decisions, ethical considerations and palliative care

Due to resource limitations, the provision of critical care services in emergencies may be limited. Responding medical teams may face challenging ethical decisions and only a few will be able to provide essential critical care, including mechanical ventilation *(32)*. However, the provision of critical care services in emergencies can be controversial and should only be considered if sustainability of treatment and continuity of care is likely in the local context. In patients with SCI, decisions on advanced life support interventions such as ventilation are, whenever possible, made collaboratively with the patient and family. Where survival is not expected, or when advanced life supporting measures are not possible or agreed to by the informed patient and family, teams need to ensure access to palliative and end-of-life care that relieves pain and suffering, maximizes the comfort, dignity and quality of life of patients, and provides support for family members. The health-care provider has the duty to inform the patient and the family as appropriate of the prognosis, expected care needs and functional outcomes, always ensuring cultural appropriateness *(3)*.

5.8 Operative versus nonoperative SCI management

While early spinal surgery of unstable spinal fractures is considered to be the gold standard of care, in large-scale emergencies, access to definitive spinal surgery remains challenging due to the limited access to required resources, such as safe surgical capacity, including competent and experienced spinal trauma teams, adequate diagnostics and the availability of a sterile OR environment. The minimum requirement to perform spinal surgery is adequate CT imaging and a sterile OR, and thus it should not be performed in a temporary field hospital setting.

5.8.1 Operative versus nonoperative SCI management – decision-making

Patients with a suspected SCI should be transferred to a specialized treatment facility as quickly as possible, as early management is associated with improved long-term outcomes. Decisions on how to manage spinal trauma and fractures are multifactorial, need to be made on a case-by-case basis, and include considerations such as the availability of safe surgical capacity, including the availability of a sterile OR environment, and whether the trauma is closed or penetrating *(33)*. While early spinal surgery of unstable spinal fractures is considered to be the gold standard of care, in large scale emergencies, access to definitive spinal surgery may be challenging. In many emergencies, the lack of adequate theatre capacity, and required imaging modalities, and the limited availability of specialized surgical SCI management capacities will often result in spinal surgery being performed in a delayed fashion or not at all, requiring extended non-surgical management of SCI. The management decision can be guided by well-established classification systems with good inter- and intra-observer reliability *(34, 9)*. These classification systems incorporate injury characteristics, fracture morphology and clinical factors, such as the patient's neurologic status, relevant for clinical decision-making and to determine the relative stability of the spine. A number of fractures can be managed nonoperatively, but the decision as to whether or not neurologically intact patients with spinal fractures require surgical intervention, even in a delayed fashion, needs to be made by an experienced spinal trauma surgeon in order to interpret the classification correctly. This may also be done via telemedicine, if detailed clinical presentation and imaging is provided. In case the decision is made to manage the injuries non-surgically, meticulous nonoperative management protocols and the infrastructure to ensure the intensive amount and expertise of nursing care that is required need to be in place (see Annex 1 for staffing considerations). Even in the nonsurgical management of spinal trauma, wound management may require careful surgical debridement, especially in penetrating injuries. SCI SCTs (surgical) embedding into an existing facility have a high obligation to assess the facilities IPC and Water Sanitation and Hygiene (WASH) standards, and if needed, work with the host facility to ensure that minimum standards are met.

5.8.2 Surgical management

Please see Annex 7 for minimum requirements for host facilities for SCI SCT (surgical)

Due to the traumatic nature of most injuries sustained in disasters and conflict, it is not uncommon for patients to sustain multiple injuries, large proportions of which may require multiple surgical interventions. If the decision is made to manage the spinal injury surgically, an earlier intervention will potentially lead to improved neurologic outcome and reduced complications. Ideally, decompression and internal fixation of closed injuries is performed within 24 hours *(35)*. This, however, is unrealistic in most emergency settings and is not an option in a penetrating and contaminated injury. There is no true cut-off point for surgery. To minimize deformity and pain, as well as facilitate mobilization, delayed surgery even after 2 to 3 months can be considered, including in paraplegic patients. However, the neurological benefit may be limited. In multiply injured patients, initial surgery can be performed to clean wounds and stabilize the spine, which may be either a temporary measure, or definitive treatment. If further stabilization is needed, it can be followed by secondary definitive management at a later stage. In terms of mobilization, rehabilitation, prevention of painful non-union and deformity, there are many benefits in using internal fixation on a severely fractured spine. This does not apply to the acute management of penetrating *(9)* and contaminated injuries, in which case the initial management, following strict adherence to advanced trauma and life support priorities, for likely accompanying trauma, focuses on careful debridement and cleaning of the wound and provision of IV antibiotics. If no spine surgeon experienced in the surgical management of spinal trauma is available, surgery will cause more harm than an initial nonoperative approach. Any surgical team needs to ensure

The World Health Organization (WHO) and partners visited Public Aid Hospital in north Gaza to support the deployment of a specialized medical team and assessment of wound care and rehabilitation services. Gaza, Occupied Palestinian Territory, 2024. © WHO

appropriate follow up, the ability to provide extended postoperative care and ensure the safe management of potential postoperative complications. Additional surgical considerations need to be made to address complications following SCI. Patients with spinal injuries are, for example, at increased risk of developing pressure injuries (see 5.11). When conservative treatments of pressure injuries fail, surgical management is recommended *(36)*.

MINIMUM TECHNICAL STANDARDS

- SCI surgery can only be performed by a SCI surgeon experienced in the surgical management of spinal trauma.
- SCI SCTs (surgical) need to ensure that the host facility meets minimum requirements for SCI surgery (see Annex 7).
- Manage patients nonoperatively where surgery is not available or delayed.

GUIDANCE NOTES

- Only use autologous material, if needed for surgical reconstruction.
- Depending on context, consider the colonization with multi-resistant bacteria in complex conflict-related injuries, and ensure an antibiotic-sensitivity testing-guided antimicrobial therapeutic approach *(37, 38)*, if available.

GUIDANCE FOR SCI DAMAGE CONTROL FOR THE GENERAL SURGEON

- Be aware of the critical anatomy and demonstrate caution when doing a wound debridement. Do not pull anything out of the wound.
- Do not remove any bony structures due to the danger of a dura tear or puncture, and the risk of meningitis and further neurological deterioration.
- In contaminated wounds and penetrating injuries, only perform careful wound irrigation and sterile wound dressing locally.
- Cover with IV antibiotics.
- In case of a cerebrospinal fluid (CSF) leak, provide a sterile wound cover and refer to a specialized surgical facility without delay.
- In the surgical management of pressure injury in the paraplegic patient, make sure to use local anaesthetics.
- In open thoracolumbar CSF leaks in children with a high risk of developing into a fistula, perform:
    - good skin closure
    - accept CSF leak outside the dura
    - cover with IV antibiotics
    - refer to specialized care.

5.8.3 Anaesthetic considerations in SCI surgery

Please see Annex 7 for minimum requirements for host facilities for SCI SCT (surgical)

It is critical to understand the specifics of SCI, and the additional considerations that need to be made by the spinal anaesthetist to safely manage the patient and minimize secondary injury to the spinal cord. Patients referred to the SCI SCT are likely to have associated injuries that may require additional surgical interventions, such as the external fixation of other fractures, wound debridement and reconstructive skin grafts or flaps and pressure injury management. These surgeries may need to occur during the acute phase when neurogenic shock and spinal instability are still an issue. Surgeries will also occur after the initial spinal fixation at a later stage. Operations in areas with sensory loss may still need anaesthesia. Spinal reflexes may cause severe muscle spasms and stimulation below the injury level may provoke autonomic dysreflexia (AD). History of either of these problems should be elicited. Spinal anaesthesia is possible but sometimes not acceptable to patients with incomplete lesions. Patients with neurology and surgery above the level of C6 are likely to require postoperative ventilation in the immediate postoperative period with gradual wean. The decision whether to return the patient to the ward or to critical care after surgery is based on the patient's condition, injury level and medication requirements. In many contexts, the need for oxygen, appropriate pain management and observation will require them to be taken to critical care postoperatively. Teams need to be trained to provide safe prone positioning and routines for the management of emergencies in the prone position.

MINIMUM TECHNICAL STANDARDS

- Provide complex airway management under spinal precautions in cervical injury.
- Provide continuous monitoring during surgery and postoperative recovery.
- Monitor and manage increased risk of major blood loss in spinal surgery, especially when completed on more than one vertebral level.
- Ensure continuous presence of appropriately trained staff during the postoperative recovery.

RECOMMENDATIONS

- Consider fibreoptic intubation capacity, including appropriately trained staff and adequate equipment.

GUIDANCE NOTES

- Maintain a MAP of 85–90 mm Hg.
- Use non-depolarizing muscle relaxant with reversal agent and a nerve stimulator.
- Suxamethonium should be avoided from 3 days up to 9 months after spinal injury due to the risk of succinylcholine-induced hyperkalaemia.
- If not already in place, provide a urinary catheter if surgery takes longer than 2 hours or there is a history of AD.
- Injuries above T6 may be prone to severe bradycardia or even asystole on laryngoscopy.
- Prone position is associated with a higher incidence of postoperative blindness. Ensure appropriate eye protection to prevent direct injury *(39)*.
- If one lung surgery is anticipated and one lung ventilation is required, then either place a double lumen tube or an endotracheal tube with bronchial blocker.

5.8.4 Nonoperative SCI management and treatment

If the decision is made to manage spinal injuries non-surgically, teams need to establish and implement meticulous nonoperative management protocols and the infrastructure to ensure the intensive amount and expertise of nursing care and rehabilitation that is required (see Annex 1 for staffing considerations) for the entire period of immobilization, which may extend to 12 weeks. The level of spinal stability or instability determines the treatment modality *(40, 41)*. Neurological deficits suggest an unstable injury but can exist in the absence of instability. At the same time, the absence of obvious clinical signs of neurological impairment does not exclude the presence of SCI. Intact neurologic function does not mean that a fracture is stable. Children can have neurologic injuries without a fracture or without instability. Elderly patients with cervical spondylosis can have a cervical cord injury without a fracture and patients can be neurologically intact but may have deformity or instability.

MINIMUM TECHNICAL STANDARDS

- All teams must be able to manage patients nonoperatively until they can be referred to a specialized service.
- Use well established classification and scoring systems to support decision-making in regard to operative and nonoperative management (see 5.8.1).
- Manage patients with unstable fractures and no access to surgery with bed rest and bracing or prolonged traction for up to 12 weeks, as decided by the spinal surgeon, until healing of the fracture is confirmed *(9)*.
- Maintain pressure above 85 MAP or above for 7 days post injury.
- Ensure mobilization in patients with stable, nonsurgically managed fractures as soon as pain is managed (ideally within 72 hours). Bracing can be used as a strategy to support pain management and mobilization, and then gradually weaned.
- Ensure appropriate long-term follow-up.

RECOMMENDATIONS

- Nonoperatively managed unstable fractures should undergo regular radiographic surveillance. Once the patient is allowed to mobilize, obtain upright follow-up films to ensure stability and no progression of deformity *(9)*.

GUIDANCE NOTES

- Bracing can be used as a strategy to support pain management and mobilization, which can then be gradually weaned.
- Patients with major ligamentous injuries with no bony injuries may require longer periods of bracing before healing occurs if treated conservatively.

C-spine fractures

- Stable cervical fractures can be mobilized, as long as neurologically intact, with a rigid cervical orthosis for up to 12 weeks, to be determined by the medical team.
- Unstable cervical fractures need to be treated with a halo brace or prolonged traction with bed rest until they can be definitively managed with surgery.
- Any form of closed reduction and realignment is only safe in very experienced hands and should only be considered in the first 24–48 hours from injury, as cord oedema is at its maximum at 48 hours from injury and for a number of days beyond.

5.9 Respiratory support and management

The respiratory function of all patients with SCI needs to be closely monitored, and the early identification of patients at risk of respiratory deterioration and potential need for ventilation is critical. This may require an early referral to appropriate levels of care. However, in resource scarce settings, teams will often face challenging ethical decisions. The decision to intubate in emergency settings where ventilator capacity may be scarce or entirely absent, requires critical and contextualized assessment. In the acute phase, patients with known or suspected cervical spine injury may require intubation and ventilatory support for airway protection. The goal of airway management in a patient with a possible spinal injury is to secure the airway with as little movement of the cervical spine as possible. To provide safe and efficient care in these patients, practitioners must identify high-risk patients, be comfortable with available methods of airway adjuncts, and know how airway manoeuvres, neck stabilization and positioning affect the cervical spine *(10)*. Patients with cervical and high thoracic spinal cord injuries are likely to develop a respiratory impairment, characterized by low lung volumes and a weak cough secondary to respiratory muscle weakness. Respiratory management may involve different interventions provided by a multidisciplinary team. High complete cervical injuries (C2–C4) require early mechanical ventilation and may be less likely to survive long enough to reach higher-level care in low resource disaster settings *(42)*. High incomplete cervical lesions and lower cervical and higher thoracic injuries will also involve some impairment of respiratory muscles *(43)*. While spontaneous ventilation is possible, respiratory function may be substantially compromised, potentially resulting in reduced inspiratory capacity, (respiratory) fatigue and atelectasis, which needs to be prevented and managed through appropriately adapted respiratory interventions. Some respiratory physiotherapy interventions, such as positioning and manually assisted cough or chest vibrations, require specific training and adaptations to ensure maintenance of spinal alignment in patients with unstable injuries and to ensure safe administration in patients with chest trauma, rib fractures or cardiovascular instability *(44)*.

MINIMUM TECHNICAL STANDARDS

- Conduct regular assessments of the patient's respiratory function *(45)*.
- Manage respiratory dysfunction with pharmacological and respiratory interventions *(27)*.
- Maintain spinal precautions and consider contraindications depending upon the level, stability, and completeness of the injury, when providing respiratory interventions *(27)*.
- Train and equip staff to identify patients at risk of respiratory deterioration in need of transfer.
- Use suctioning where the patient is unable to clear secretions.

RECOMMENDATIONS

- Use lung volume recruitment to passively increase lung volume, augment cough effectiveness, help clear secretions and decrease the risk of respiratory complications.
- Obtain chest X-rays to assess for atelectasis or pneumonia, if indicated.

GUIDANCE NOTES

- Supine posture improves respiratory function for patients with an injury above T6. These patients may benefit from the use of an abdominal binder in sitting.
- Provide respiratory interventions such as positioning and postural drainage, breath stacking, respiratory muscle training, deep breathing and coughing technique exercises, and the use of incentive spirometry *(27)*.
- Cough peak flow can be used to identify the risk of deterioration and need of higher-level care.
- Lung volume recruitment (LVR) uses a 1.5 litre resuscitation bag with a one-way valve, bacterial filter and mouthpiece.
- For patients at risk of respiratory deterioration, identify a management plan, including maximum ceiling limitations of care or decisions on where the patient can be referred to.

5.10 Venous thromboembolism prophylaxis

Patients with SCI are at risk of developing venous thromboembolism (VTE), which may lead to potentially life-threatening complications *(9)*. Anticoagulant thromboprophylaxis should be initiated as early as medically possible in all SCI patients. The duration of chemoprophylaxis needs to be determined on a case-by-case decision, depending on injury severity, mobility status, bleeding risk and other comorbidities or concomitant trauma, but should continue for at least eight weeks after injury in SCI patients with limited mobility. In addition to anticoagulant therapy, basic measures in the prevention of VTE include the earliest possible mobilization, active or manually assisted passive exercises and sufficient hydration *(46)*.

MINIMUM TECHNICAL STANDARDS

- Provide anticoagulant thromboprophylaxis as early as medically possible *(47)*.
- Utilize basic prophylactic measures, such as early mobilization, exercise and sufficient hydration.

RECOMMENDATIONS

- Use mechanical methods like graduated compression stockings.
- Perform doppler ultrasound investigation of suspected thromboembolism, when the patient is symptomatic.

GUIDANCE NOTES

Mechanical prophylaxis, such as compressive stockings offer some protection only if used on a continuous basis and may not always be available or used appropriately in an emergency context *(27, 47)*.

5.11 Skin assessment and care

Patients with SCI are at high risk of pressure injury, and complications from pressure injuries often result in an increased morbidity and mortality, especially in low-income settings *(48)*. Risk of pressure injury for people with SCI in emergencies is likely to be elevated due to delays in accessing appropriate health-care, lack of staff to perform regular repositioning, and a lack of appropriate mattresses or seating. Every SCI patient needs to undergo a comprehensive assessment of pressure risk and a visual and tactile assessment of pressure areas, with ongoing daily assessment of vulnerable areas.

Pressure injury prevention

Regular patient repositioning is a critical activity to prevent pressure injury. Patients need to be turned or repositioned every 2 hours, as their medical condition and spinal stability allows. For patients with suspected unstable injuries, spinal alignment must be maintained at all times (see 5.12 Early mobilization and exercise), which requires a minimum of five people for repositioning to be performed safely. In addition, any moisture accumulation needs to be avoided where skin interfaces with surfaces. Active pressure relieving (electric) mattresses are unlikely to be available in most humanitarian settings. Where formal pressure reducing mattresses are not available, regular foam mattresses, ideally of high specification foam should be used, to redistribute pressure areas, prioritizing patients that are not able to reposition themselves. Education of patients and caregivers to support pressure care, both while in the facility and on discharge, is of paramount importance. For patients that can sit out of bed, any patient with loss of sensation should use a pressure relief/distribution cushion and maintain an offloaded position from the seating surface for at least 2 minutes every hour *(49, 50)*. See 5.18.1 Assistive technology (AT) for further information on wheelchairs.

Pressure injury management

Appropriate pressure injury management requires complete pressure relief of the injury through appropriate positioning and critical assessment of the patient appropriate wound care as per the team's SOPs or other relevant protocols in accordance with local context and resources *(51)*.

MINIMUM TECHNICAL STANDARDS

- Use validated risk assessment tools to assess and monitor pressure risk, formal scales to classify the severity of the injury, or locally appropriate guidance *(9, 51)*.
- Deploy sufficient staff to implement 2 hourly position changes while adhering to spinal precautions.

MINIMUM TECHNICAL STANDARDS

- Provide wound care and pressure ulcer management in accordance with best practice guidelines and established EMT standards.
- Educate caregivers to assist repositioning and care activities and support pressure care, both while in the facility and on discharge.
- Use pressure reducing mattresses (and seating where appropriate) for patients at risk of pressure injury.
- Maintain or adapt nutrition and hydration (see 5.15 Feeding and nutrition).

RECOMMENDATIONS

- If indicated, ensure provision of appropriate antimicrobial therapy in chronic infected ulcers, following resistance/sensitivity testing if available.

GUIDANCE NOTES

- Educate patients and their caregivers to take responsibility for their own skin care and integrity checks whenever possible.
- Dynamic air mattresses are contraindicated in unstable injuries.
- Wherever possible, do not position the patient directly onto the pressure ulcer. Use pillows or cushions to reduce pressure on existing pressure ulcers or vulnerable skin areas by elevating them away from the support surface.
- If discharging a patient with a SCI, consider if an appropriate mattress can be provided for use at home.
- If managed surgically, simultaneous surgical management of more than one pressure ulcer in a single procedure is feasible. However, postoperative positioning to avoid pressure on suture lines needs to be considered *(52)*.
- Provide smooth, low-friction, breathable fabrics for bedding, and slide sheets for repositioning.
- A range of specialist dressings are available in high income settings, but unlikely to be available in most emergency contexts. Basic wound care and dressings (saline-impregnated, moistened or paraffin gauze as a primary dressing, with or without secondary dressing such as foam or alginate) can support healing.

Example

The role of capacity building

Previous emergency responses highlighted the various roles medical team members can have when supporting facilities that experience a surge of SCI patients, including direct patient care, capacity building, and re-enforcing local staff, who themselves may be overwhelmed by a steep surge in patient influx, exhausted and potentially coping with personal experiences as part of the emergency-affected community.

Specialized care teams can provide support in patient care and capacity building for medical, nursing and rehabilitation staff, as well as patients and caretakers by working alongside local staff in a collaborative and supportive way. Collaboration is critical to learn from each other's experiences and expertise, to understand the reality of providing services in a specific setting, local customs and practices, as well as access to locally available resources. This facilitates the provision of quality care in the immediate aftermath of a disaster, as well as the availability of a skilled workforce to sustainably provide longer-term care.

Nurse training on how to safely reposition patients, maintaining spinal alignment, Haiti, 2010. © Fi Stephenson

5.12 Early mobilization and exercise

Manual handling and mobilization restrictions need to be clearly established at the earliest stage following injury. Early mobilization is favourable where permitted. However, where a patient is managed nonoperatively with a likely unstable injury, full spinal precautions continue to be used until stability is confirmed and it is safe to progress. Even in a immobile patient, certain exercises may be permitted, depending on the level of injury and guidance of the medical team. Active and passive exercise and positioning, as permitted, are required to prevent stiffness and contracture as well as to improve function. For patients that can be mobilized, early mobilization requires caution while the patient remains at risk of spinal shock and postural hypotension. Close monitoring of blood pressure is required. Tilt tables with incremental increases may be used but are unlikely to be available in most emergency settings. For patients with thoracic or cervical injuries, the use of an abdominal binder may help reduce postural hypotension and improve respiratory function. For patients that can sit out of bed, appropriate seating (a chair or wheelchair) that includes pressure relief and postural support is required. Once a patient is able to mobilize, the level and completeness of SCI will determine the type of transfers each patient is taught during rehabilitation and the type of AT they require. Early mobilization to bedside typically requires 2–3 personnel to stabilize the patient in an upright position. The use of transfer boards and slide sheets may improve the independence and reduce risks during transfers.

MINIMUM TECHNICAL STANDARDS

- Provide abdominal binders when first mobilizing patients with cervical and thoracic injuries *(53)*.
- Ensure availability and use of transfer boards to improve the independence and reduce risks during transfers.
- Provide appropriate seating with accompanying pressure relief.

GUIDANCE NOTES

- Early mobilization (verticalization), especially during the stage of spinal shock (areflexia), may not be safe or beneficial to a neurologically impaired patient.
- Commence transfer practice at the earliest possible opportunity while ensuring safety, spinal and medical stability.

5.13 Bladder care

Traumatic SCI is often followed by neurogenic bowel and bladder dysfunction. Inadequate bladder management in SCI can result in significant secondary complications *(9)*. Timely assessment and an appropriate voiding programme ensure safe bladder management *(44)*. As there is an increased risk of urinary tract infections while using urethral catheters, increased fluid intake, proper hygiene, routine changing of the indwelling urethral catheter and urobag, as well as proper handling of catheters are crucial. Depending upon the level of neurological injury, SCI can result in different types of neurogenic bladder dysfunction. However, during emergencies, urodynamic study may not be feasible, and bladder management methods to improve continence are similar. Intermittent catheterization is recommended after a few weeks of injury to maintain bladder capacity and compliance. Longer term, in both male and female patients with paraplegia or males with tetraplegia and sufficient hand function, clean intermittent self-catheterization every 4 to 6 hours is the preferred method, accompanied by anticholinergic medication.

MINIMUM TECHNICAL STANDARDS

- Provide indwelling catheterization during the first few weeks following SCI for ongoing protection from urinary retention or overflow incontinence and to facilitate the monitoring of urinary output, while maintaining fluid balance.
- Train and instruct appropriate patients to carry out safe and sustainable intermittent self-catheterization.
- Educate patients and caretakers on prevention and treatment of urinary tract infections, and depending on context and if appropriate, train caregivers in intermittent catheterization.

GUIDANCE NOTES

- Where catheter reuse is standard practice, and disposable single use catheter use cannot be sustained, educate patients on effective and safe catheter reuse. In such scenarios, catheters can be re-sterilized by boiling before each use or washing with antibacterial soap and clean water and storing it in a clean cotton bag *(33, 54)*.
- For those who need a longer duration of indwelling catheterization, suprapubic catheterization may be an option when locally sustainable, but is not usually indicated in the first few weeks following injury.

5.14 Bowel care

Patients with acute SCI are at risk of paralytic ileus and should be closely monitored, particularly during the first 2–3 days following injury. Once identified, they should be managed nil by mouth with enteral feeding. Nasogastric (NG) aspiration of stomach contents may be required. SCI can result in neurogenic bowel and has a profound impact on the maintenance of faecal continence *(55)*. There are two different types of neurogenic bowel, reflexic and areflexic bowel *(56)*. Patients will be incontinent of faeces in the initial days of injury and chronically constipated after a few weeks. Early identification and active bowel management will allow the individual some degree of continence and minimize the risk of secondary complications *(9)*. Patient and family education about the importance of bowel management is vital. Immediately after SCI, patients with high thoracic and cervical injuries are at risk of paralytic ileus, which is associated with spinal shock.

Bowel management

The aim of bowel management is to achieve regular and predictable emptying of the bowel at a socially acceptable time and place, avoiding constipation, unplanned evacuations and autonomic dysreflexia *(44)*. Privacy and dignity should be maintained at all times. Screens or curtains should be used, whenever possible and only relevant staff should be present. In unstable injuries, spinal alignment needs to be maintained at all times and correct positioning needs to be ensured when bowel care is completed. Bowel management should be performed daily during the acute phase, and the bowel programme should be re-evaluated regularly, at least fortnightly and during illness, increased mobility, change in diet or change in medication. Standardized tools can be used to monitor the bowel programme.

MINIMUM TECHNICAL STANDARDS

- Monitor closely for paralytic ileus in the first days of injury. NG tube aspiration of gastric contents may be required early to limit risk of vomiting and aspiration.
- Provide appropriate bowel management, including daily monitoring with standardized tools *(57)*, diet and fluid management, safe use and documentation of oral and rectal medications, daily rectal examination, and assisted defecation by means such as manual disimpaction and digital removal of faeces.
- Provide medication and suppositories to support bowel management as required.

GUIDANCE NOTES

- Bowel evacuation in reflex neurogenic bowel dysfunction can be produced by the use of chemical rectal stimulants or digital rectal stimulation, or a combination of both, but often must be followed by digital removal of faeces to ensure complete evacuation.
- Pharmacological or digital stimulation is not effective in areflexic bowel, as there are no preserved anorectal reflexes. Digital removal of faeces is the basic physical intervention in these cases.
- Use of straining/valsalva manoeuvre without digital removal of faeces is the cultural norm in some countries, but associated with a high degree of incontinence, constipation and other difficulties with evacuation and development of haemorrhoids and prolapse and should not be introduced. To facilitate digital removal of faeces, and to reduce the risk of "stress" incontinence due to the areflexic, relaxed anal sphincters, individuals are recommended to aim for a firm stool.
- Avoid the use of diapers to prevent moisture accumulation that may lead to pressure injury.

5.15 Feeding and nutrition

Maintaining appropriate nutrition after acute SCI is critical, and teams need to consider specific nutritional requirements of patients. Eating and drinking while maintaining spinal precautions can be challenging and may involve the need of lateral positioning. Weight loss following acute SCI is common, due to a combination of factors including increased metabolic demand due to trauma. Patients with, or at risk of, pressure ulcers may benefit from a high protein diet, while patients at risk of constipation should be offered a diet that is high in fibre *(58, 59)*.

A frequent complication in cervical SCI is dysphagia, which in addition with a diminished cough reflex can increase the risk of aspiration. Patients with cervical SCI need to be assessed for dysphagia early on and appropriate management measures taken.

MINIMUM TECHNICAL STANDARDS

- Assess every cervical SCI patient for dysphagia and provide appropriate management, such as provision of appropriate swallowing training and enteral nutrition, when required and available *(60)*.
- Assess and manage each SCI patient's specific nutritional needs, including nutritional adaptations for pressure injury, bowel impairments *(61)*, weight reduction and nutritional deficiencies.
- Train caregivers in appropriate feeding position and food administration.
- Ensure appropriate oral fluid intake in all SCI patients, including monitoring of fluid balance and appropriate assessment and management of dysphagia.
- Provide gastric ulcer prophylaxis to all new SCI patients.

5.16 Autonomic dysreflexia

After the resolution of neurogenic shock, patients with lesions at T6 and above (occasionally lower) are vulnerable to autonomic dysreflexia (AD) as a result of uncontrolled sympathetic response to a triggering physiologic stimulus below the level of injury, such as bladder distension, pressure injuries, or bowel impaction *(9)*. Onset of AD is most commonly in the post-acute phase. Signs of AD include a sudden rise in blood pressure, bradycardia, flushing, sweating, headache, piloerection, nasal stuffiness, vomiting, or a general feeling of not being well. AD needs to be identified and managed as an emergency, as it can result in stroke, myocardial infarction and death.

MINIMUM TECHNICAL STANDARDS

- Closely monitor, recognize and appropriately manage any signs that indicate the presence of AD *(62)*.
- Manage AD by rapidly correcting the noxious stimuli *(63)*.
- Provide additional pharmacological interventions if required *(44)*.
- Closely monitor and appropriately manage sudomotor, bladder, bowel and respiratory changes.
- Educate all patients with SCI at T6 and above and their caregivers about the possible causes of AD, and ways to identify and manage the symptoms.

GUIDANCE NOTES

- Sitting the patient up as a first intervention can produce an orthostatic decrease in blood pressure.
- For very young children symptoms may be vague and hard to recognize due to verbal and developmental stages.

5.17 Spasticity management

Spasticity is a common motor control disorder frequently encountered in people with a SCI. It usually emerges over a period of weeks to months following injury, but its management should be considered by those involved in the longer-term care or follow up of SCI patients. Not every manifestation of spasticity requires treatment, and some symptoms of spasticity may be beneficial by enhancing stability for sitting, standing, dressing and transfers. However, a change of the spasticity pattern can be a warning sign of a secondary complication. Assessment of spasticity can be very challenging due to the variability of symptoms but can be facilitated by a number of reliable assessment tools *(64)*. Careful documentation of changes in spasticity alongside changes in medical and therapeutic interventions can support the long-term management of spasticity. Treatment should be focused on therapeutic goals and not only on symptoms. Different pharmacological and nonpharmacological treatments of post-SCI spasticity are available *(9)*. First line management is always nonpharmacological. In emergency settings, this is likely to include stretching, positioning, strength training, splinting and casting to prevent secondary complications. Splinting and casting require specific competence relating to safe management of neurological presentations. The decision to use pharmacological agents will depend not only on clinical indication but also on local availability (including sustainable affordability) and national regulations.

MINIMUM TECHNICAL STANDARDS

- Provide nonpharmacological management of spasticity including positioning, stretching and splinting, strength training and casting.

RECOMMENDATIONS

- Provide locally sustainable pharmacological management of spasticity where indicated *(44)*.

GUIDANCE NOTES

- In case of pharmacological management, consider national regulations, local availability and cost, to ensure sustainability.
- Be aware that some pharmacologic agents for treatment of post-SCI spasticity are classified as controlled drugs, which may have implications on import and sustainability.

5.18 Activities of daily living

Rehabilitation professionals are involved in all stages and components of SCI care, including multidisciplinary assessment, respiratory care, pain management, spasticity management, early mobilization, skin care and assistive product (AP) provision *(65)*. This section focuses only on rehabilitation interventions aimed at restoring or preserving function. Functional outcomes can be predicted based on the injury level and severity and used as a guide to set individual goals. Teams should use a standardized assessment tool to guide their approach that is sensitive to change and appropriate to measure the impact of rehabilitation, such as the Spinal Cord Independence Measure (SCIM). This can also assist with individual goal setting and treatment planning *(66)*. Rehabilitation should include training for activities of daily living (ADL), skills training, safe transfer training, mobility practice, including wheelchair skills, and education about strategies to manage range of movement, tone/spasticity and muscle power. Gait training may be possible for some individuals depending on the level and completeness of their injury. For many patients, task modification and training in the use of assistive devices will be an essential part of their rehabilitation to optimize mobility and individual independence (see 5.18.1 Assistive technology). Establishing routines as soon as possible can assist in reducing the risk of complications, particularly bladder, bowel and pressure injuries, while also reducing more general deterioration of physical and mental health.

Coordinated long-term support is required to meet the ongoing needs of individuals with SCI. Links should be made, via appropriate coordination mechanisms, between EMTs and local organizations for people with disability, outpatient or community-based rehabilitation providers, and peer support networks for both patients and family/caregivers. Where follow-up services do not exist, acute service providers have an obligation to advocate for the establishment of services.

MINIMUM TECHNICAL STANDARDS

- Include experienced rehabilitation professionals in the care of SCI patients from admission onwards *(65)*.
- Deploy with all required rehabilitation equipment and APs to meet appropriate minimum standards.
- Assess the level of disability and functional impact once medically stable (using a standardized tool such as SCIM III).

5.18.1 Assistive technology

Assistive technology (AT) helps to maintain or improve an individual's functioning related to mobility and self-care, thus enabling their health, well-being, inclusion and participation *(67)*. Many patients will require AT to promote independence, reduce the risk of secondary complications and enable participation in education, employment, family and community life. AT required in the management of SCI, depending on the level and complexity of injury, includes mobility devices, splints and orthoses, toilet and shower chairs, dressing and eating aids, transfer aids and communication boards. Deploying teams should assume, unless proven otherwise, that APs are not available locally and should deploy with required equipment. APs should be durable, affordable and be able to be maintained in the country of use, with components and parts available locally. If local rehabilitation services are available, AP provision will ideally be completed in partnership with local personnel who will be able to provide ongoing follow up, monitoring and maintenance. If local services do not exist, the team needs to ask coordinating authorities for guidance and advocate for services. In addition, AT should always be provided with appropriate physical rehabilitation and training for the patient and their caregivers on AP use and maintenance.

Group session for patients with spinal cord injuries and physical therapists as part of an in-field supervision and management visit to build the capacity of the hospital's multidisciplinary team of medical professionals serving SCI patients; Lviv, Ukraine 2023. © Momentum Wheels for Humanity

5.18.2 Mobility products

Any team with inpatient capacity is required to provide mobility products, such as wheelchairs, walkers and crutches for their patients. Decisions about which type of mobility product to provide to patients with SCI will be largely related to the level of injury and degree of motor control in the lower limbs *(68)*. Mobility products should meet the user's requirements and be appropriate for their environment. They should be appropriately sized, with proper fit, alignment and support. Instructions must be provided for appropriate maintenance. Wheelchairs should be provided in line with established WHO guidance *(69)*. SCI patients with sensation loss should be assessed and provided with a pressure relief cushion that is matched to their wheelchair and seating needs. Long-term mobility products are best provided by local services that can adapt them to the local context and remain available for maintenance or replacement if a patient requires long-term mobility products. The rehabilitation professional should refer the patient to a local provider, in accordance with the practices of the host country, and plan for assessment and prescription as early as possible. If local services do not exist, the EMT should ask the host ministry of health or coordination cell for guidance. Sometimes, temporary mobility products are necessary for purposes such as facilitating smooth, timely discharge. In these situations, the devices should be configured to the user's needs as closely as possible, and follow up, whether by the EMT or a different service provider, must be ensured. Walking aids, such as crutches, walking frames and rollators may be provided to patients who have incomplete or lower-level injuries which allow them to stand and walk independently or with assistance.

5.18.3 Splints, braces and orthoses

Splints and orthoses may be provided to position or stabilize body parts to enable participation in activity. They may also be used to support specific positioning either to reduce the risk of secondary complications or to promote functional activity *(70, 71)*. Braces can be used for pain management in stable spinal fractures, or to restrict spinal movement in patients with unstable injuries being managed nonoperatively under spinal precautions. With all splints, braces and orthoses, care must be taken to avoid pressure injury. Splints and orthoses may be available as prefabricated devices which are adjustable or sized to the patient or may be created using locally available materials. Teams with inpatient capacity must have the capability to assess for and provide or fabricate basic splints to prevent complications. Other splints to support rehabilitation activities, for example eating splints, are recommended. Follow up should be completed after provision of a splint or orthosis to ensure consistent fit and function of the device, including evaluation of areas of potential pressure at risk of pressure injuries. Patients with impaired or absent sensation must be carefully reviewed for potential pressure areas when providing splints and orthoses. All patients should be educated about safe wear and care of their splints or orthoses, with a particular focus on skin hygiene and pressure injury prevention.

5.18.4 Assistive products for self-care

Depending on the level of injury, patients may be able to engage in independent or assisted bathing, toileting, dressing, personal hygiene, and/or eating and drinking through the use of aids to daily living. Commonly used products in emergencies include bath or shower chairs, transfer boards and commodes. Other items include adapted handles for items such as toothbrushes, razors and hairbrushes, adapted utensils, plates and bowls, sock aids, dressing sticks and pushing gloves. Many of these can be manufactured locally and adapted to local needs. Teams with inpatient capacity should strongly consider provision of APs for use on discharge where it is not locally available.

MINIMUM TECHNICAL STANDARDS

- Deploy with appropriate APs, including wheelchairs, walking frames, crutches, splints and orthoses in adult and paediatric sizes (see examples of rehabilitation and AP equipment and consumables in Annex 2).
- Document and report met, and unmet AP needs to coordinating authorities to facilitate provision and allow for future follow up.

GUIDANCE NOTES

Teams should map availability of local assistive products including suitability, quality and affordability, and ability to maintain, repair or replace products.

5.19 Patient and caregiver education

Teams providing care for patients with SCI should consider steps to accommodate caregivers within their facility to encourage their presence, including providing a place to sleep, food and water *(72)*. Not only does this reduce the patient load on health-care professionals, it also strengthens the ability of caregivers to provide vital ongoing care for many patients once they leave the facility *(73)*. The provision of high quality and relevant education to patients and caregivers about SCI recovery and rehabilitation is a key role of all health professionals. Given teams are often operating under significant time and resource shortages, education should be prioritized to support the early and ongoing development of functional independence and self-management of SCI specific conditions and complications. Medical teams should prepare appropriate pictorial and translated resources to deliver patient and caregiver education about priority topics. For patients

A baby sleeps while the mother cares for the father at the Spinal Injury Sangh Nepal, 2015. © Kiran Kreer

with SCI and caregivers this includes, but is not limited to, prevention and management of pressure injuries, bladder, bowel, sexual and reproductive function following SCI, wheelchair skills and maintenance, weight management, AT, pain management and fitness. Where SCI patients are cohorted in a facility, rehabilitation staff should consider delivering group sessions that foster self-management and allow individuals to ask questions and actively participate in discussions *(74)*. Peer input, wherever possible, should be integrated into education sessions and other rehabilitation activities such as wheelchair skills training *(75)*. All patient and caregiver education should be considerate of local cultural practices and health and information literacy skills. Interpreters should be used whenever possible when health professionals do not speak the local language fluently enough to communicate health information *(76)*.

MINIMUM TECHNICAL STANDARDS

- Include caregivers in all aspects of clinical care.
- Consider space for caregivers and take specific steps to facilitate their presence in the facility.
- Use interpreters to communicate important information when required.
- Ensure cultural practices are respected in relation to gender, procedures, consent, communication of information such as bowel and bladder management, and sexual function.
- Provide simple pictorial-based patient education materials on key SCI topics, translated into local languages where appropriate.
- Provide an education programme focused on developing SCI self-management skills and knowledge.

RECOMMENDATIONS

- Provide a place to sleep as well as food and water for one caregiver per SCI patient.
- Make special considerations for children with SCI (see 5.21), or parents with SCI who have young children that require care.

5.20 Mental health and psychosocial support

SCI is a life-changing injury. With the right support, many people with SCI adapt well after injury, but adaptation is culture and context dependent, and patients may face an increased risk of acute stress disorder, depression and post-traumatic stress disorder. Successful rehabilitation is dependent upon psychological adjustment *(73)*. In many emergencies, individuals may be faced not only with their injury but loss of home, loved ones and livelihood. Medical teams providing care for people with SCI should anticipate a significant need for psychological support *(72)*. Staff should be able to recognize the psychological support needs of people with SCI, communicate difficult information, including diagnoses and prognoses, with compassion and provide basic psychological support *(74)*. Staff should instil hope without making false promises about a patient's potential for recovery *(75)*. Prognosis should be delivered to the patient with caregivers present and during in-patient stay for interdisciplinary follow-up of potential reactions. The team's health professionals should be able to recognize and respond appropriately to acute stress responses and avoid inappropriately pathologizing these responses. The psychological well-being of patients with SCI should be monitored using standardized, culturally appropriate tools to assess patient mood and anxiety. Basic psychological monitoring and support approaches, such as Psychological First Aid should be integrated across the health-care facility and continuum of care *(77, 78)*. All support needs to be culturally appropriate. Persistent psychological distress or pre-existing mental health conditions must be appropriately identified and referred for specialist treatment where available. Specialist psychological or psychiatric care may not be available in many humanitarian settings. Medical teams should rapidly establish collaborative coordination and referral pathways to ensure availability of these services where required. It can be a challenge for international teams to provide effective cross-cultural psychological support. All teams providing care to patients with SCI should investigate if any SCI peer support networks are available locally that could be mobilized to visit the facility. Where they do not exist, an SCT should strongly consider identifying and providing training for potential peer support workers. Areas such as sexuality, intimacy and relationship may best be delivered through local experts where available, but team members should be prepared to offer appropriate guidance to patients and their partners in a culturally sensitive manner. Ongoing long-term follow-up and monitoring of psychological well-being should be ensured wherever possible, including following discharge. Establishing links with existing peer support networks or engaging local peer support workers can be a useful means of providing effective psychological support to people with SCI where appropriate and available. Providing patients and caregivers with information about local SCI or disability support networks and resources is important. Family members and caregivers of people with SCI may experience psychological distress as a result of their relatives' injury. They may have experienced traumatic incidents themselves. The psychological well-being of family members and caregivers should be monitored in the same way as for patients of the health facility, with appropriate management and referral as indicated *(74)*.

MINIMUM TECHNICAL STANDARDS

- Ensure timely, accurate and consistent communication of information including diagnosis, prognosis, treatment plan and available support.
- Monitor psychological well-being of patients and families/caregivers, using standardized tools to assess and monitor patient mood and anxiety.
- Integrate specialized support such as peer support or locally appropriate counselling into the service where appropriate.
- Facilitate long-term psychological support wherever possible, including onward referral to specialized services and links to peer support networks.

Patient follow up by a peer supporter, following the 2015 earthquake, Nepal. © Fiona Stephenson

5.21 Paediatric considerations

Please also refer to the EMT guiding principles and core standards on protection, as well as the child health chapter 5.1.12. in the Blue Book (1).

SCI in children is associated with severe morbidity and immense socioeconomic costs *(79)*. The risk for cervical spine injury must be assessed in children who sustain blunt trauma *(80)*. Injuries to the thoracic spine and the thoracolumbar junction have a higher incidence of SCI, often associated with neurologic deficit and children with fractures of the lower thoracic and upper lumbar spine often present with associated small bowel and visceral injury *(81)*. Many children will not have a bone injury, but rather a higher rate of ligamentous injury and possible instability that may not be seen on CT or X-ray. Hence, clinical manifestations are unique, one of which is SCI without radiological abnormality (SCIWORA). If there is a neurologic deficit in conjunction with a ligamentous injury, assessment should consider the level of neurologic injury. Immobilization should be removed after confirming stability through dynamic X-rays, or MRI, if available. Unless the injury is clearly unstable, or there is deteriorating neurological function, children with SCI are mostly treated nonoperatively *(82)*. Resulting deformities may be managed surgically in a delayed fashion. Triage tools for detecting cervical spine injury in paediatric trauma patients *(83)* and classification and severity scores can be used in combination with clinical assessment to support management decisions *(84, 85)*.

An EMT is assessing a child in Turkoglu district of Kahramanmaras following the 2023 earthquake; Türkiye, 2023. © WHO/ Tunç Özceber

MINIMUM TECHNICAL STANDARDS

- Do not separate children from their caregivers and ensure to accommodate caregivers within the facility.
- Establish a child-friendly space in any facility adapted for children to ensure their protection and include age-appropriate toys.
- Ensure availability of paediatric-sized equipment and adapt medication to paediatric dosages.
- Involve family members and caregivers during paediatric patient transport.

RECOMMENDATIONS

- During paediatric patient transport, use a combined means of immobilization of the cervical spine, such as a modified half-spine board, soft collar, blocks/towels and tape, as rigid collars may increase the risk of secondary injury.

GUIDANCE NOTES

- Allow distressed, uncooperative children to stay in a position they find most comfortable in order to avoid secondary injury during initial transfer.
- Closed reduction or traction should not be performed in children in low resource settings, as it requires sedation, very experienced supporting care, traction devices and a sling.

5.22 Continuity of care

The length of inpatient stay of patients with SCI varies from weeks to months, depending on a range of factors, including injury characteristics, resource availability, characteristics of health-care systems, financial incentives and accountabilities, and health-care policies and administration *(86)*. Furthermore, the needs of SCI patients persist well beyond inpatient discharge. Post discharge challenges in emergencies may include inaccessible homes (with environmental and/or internal barriers), inaccessible communities, damage or destruction of homes, limited access to ongoing health-care with expertise in SCI and lack of access to essential consumables. A lack of ongoing support on discharge may compromise all gains made during acute and inpatient care and lead to the rapid development of complications.

Discharge planning for patients with SCI requires multidisciplinary input and should commence shortly after admission *(65)*. In conflict and disaster response environments, patients with SCI may be discharged before they have reached their optimal recovery. However, patients who are identified as being at risk on discharge, due to unstable injuries, care needs not able to be met by family or caregivers, unmanaged secondary complications, inaccessible discharge destination or unmet acute rehabilitation goals such as bladder and bowel management, should not be discharged home or to a facility that does not have appropriately skilled staff *(75, 87)*. Teams must maximize opportunities to prepare patients and caregivers for discharge through education and functional rehabilitation. They must ensure timely notification of patients and caregivers regarding planned transfer or discharge. Patients and caregivers considered safe to discharge to a non-clinical environment should receive effective education to minimize risks of secondary complications, such as pressure injuries, urinary tract and respiratory infections or contractures, and enable home-based rehabilitation to progress and maintain rehabilitation gains. Caregivers and patients should be observed completing required care tasks safely, independently and consistently prior to discharge. Wherever possible, patients with SCI should be referred for ongoing rehabilitation and linked to SCI and disability support services. Where services are absent or lack capacity, this should be raised as a priority with the health response to support the strengthening of capacity during the recovery phase of the response. To make appropriate discharge decisions, EMTs must have an understanding of the intended discharge destination and available support for the patient with SCI. Commencing this assessment process early in the patient's admission allows for home preparations or modifications to be completed in advance, and for the identification of required APs such as mobility products or self-care products. The provision of packages of basic items, such as hygiene and personal care consumables, including soap, disinfectant solution, towels and buckets, can support the maintenance of safe hygiene where patients and caregivers are unable to easily access these items themselves.

MINIMUM TECHNICAL STANDARDS

- Integrate discharge planning into patient assessment at admission and review processes, including details of a patient's discharge destination (access issues, support, local health services, risks and transport).
- Include a formal programme of patient and caregiver education that is adapted to local realities.
- Ensure all AP needs have been met prior to discharge.

RECOMMENDATIONS

- Provide an initial package of supplies to support bladder and bowel, as well as wound care if required.

Wheelchair volleyball in SCI rehabilitation, Sri Lanka 2009. © Jo Armstrong

5.23 Information management and documentation

Medical record keeping and reporting should all be undertaken in line with existing EMT minimum standards and the MDS *(1)*. Teams should maintain a database of all patients with SCI treated at the facility to facilitate referral for long-term rehabilitation follow-up, disability support services, community-based rehabilitation, and humanitarian relief. These supports may become operational sometime after the patient's discharge or team's departure, and patients are therefore at high risk of being lost to follow up. This information should be provided, with patient consent, to the HEOC and/or host health or social care coordinators to inform response planning and coordination. The collected information should include the patient's name, telephone number or best contact, discharge destination, injury, diagnosis and what follow up is required, such as further medical, surgical, rehabilitation or assistive product needs. Written information about diagnosis, treatment and provided APs, functional status and outstanding treatments, required dressing changes, postoperative wound care and specialist rehabilitation should be provided to the patient at the time of transfer or discharge.

MINIMUM TECHNICAL STANDARDS

- Maintain a SCI patient database of all patients treated at the facility.
- Keep confidential patient records of all multidisciplinary interventions and treatment, possible complications and clinical monitoring, and provide a copy to the patient upon discharge together with information on provided APs and continued care and follow-up requirements.
- Regularly monitor correct documentation.
- Report patients with newly diagnosed SCI to authorities via MDS or agreed national reporting system.

RECOMMENDATIONS

- Use a standardized data collection and reporting tool, such as the ISCoS international SCI core data set on admission and discharge *(88)*.
- Use standardized tools for any systematic assessment, review and documentation, such as the ISNCSCI as part of neurological assessment and follow up, and the SCIM to monitor functioning *(89)*.

GUIDANCE NOTES

- Teams undertake not to conduct research without appropriate consent of the patient and ethical board approval from national authorities *(1)*.

Japan Disaster Relief Team supporting the Türkiye Earthquake response; 2023. © WHO

Chapter 6

Exit planning

6 Exit planning

Exit planning for medical teams providing surge support begins from the moment a team is requested, with continuity of care considered a priority by all teams. Teams need to ensure the capability to provide their services for a minimum time frame in accordance with the SCT's defined minimum length of stay (Table 5). However, their actual length of stay should be agreed collaboratively with any host facility. Emergencies often present opportunities to improve resourcing and capacity for spinal injury care. EMTs have the potential to influence a response from its inception, and often have access to coordination meetings, donors and other networks that can all be mobilized to help develop sustainable long-term spinal injury care. In some instances, international teams may also play an important role in setting up spinal units or centres which may persist beyond the limited scope of the emergency and continue to improve SCI services for the community. Exit planning is of particular importance for SCI SCTs. Any deployment must consider the length of stay of the team and the sustainability of any care prior to the team deploying. Teams can support exit planning through training, donation of supplies, rehabilitation of infrastructure, or longer-term partnerships with host facilities, but sustainability is also dependent on a systemic approach, with the integration of SCI services into recovery and reconstruction efforts.

MINIMUM TECHNICAL STANDARDS

- Consider exit planning at the point of offering assistance and agree on a joint plan with the host facility at the earliest possible opportunity.

References

1 World Health Organization. (2021). Classification and minimum standards for emergency medical teams. World Health Organization. https://apps.who.int/iris/handle/10665/341857. Lizenz: CC BY-NC-SA 3.0 IGO

2 World Health Organization. (2024). Minimum standards and recommendations for medical teams responding to highly infectious disease outbreaks. World Health Organization. https://iris.who.int/handle/10665/377995. License: CC BY-NC-SA 3.0 IGO

3 Sphere Association. The Sphere Handbook (2018): Humanitarian Charter and Minimum Standards in Humanitarian Response, fourth edition, Geneva, Switzerland; www.spherestandards.org/handbook

4 World Health Organization & WHO Patient Safety. (2009). WHO guidelines on hand hygiene in health care. World Health Organization. https://iris.who.int/handle/10665/44102

5 World Health Organization, International Society of Surgery & International Association for the Surgery of Trauma and Surgical Intensive Care. (2004). Guidelines for essential trauma care / World Health Organization, International Society of Surgery/Société Internationale de Chirurgie and the International Association for the Surgery of Trauma and Surgical Intensive Care (IATSIC). World Health Organization. https://iris.who.int/handle/10665/42565

6 Priebe MM. Spinal cord injuries as a result of earthquakes: lessons from Iran and Pakistan. J Spinal Cord Med. 2007;30(4):367-8. doi: 10.1080/10790268.2007.11753953. PMID: 17853659; PMCID: PMC2031935.

7 World Health Organization (2024); Fact Sheets, Spinal Cord Injury; https://www.who.int/news-room/fact-sheets/detail/spinal-cord-injury

8 Polytrauma Guideline Update Group. Level 3 guideline on the treatment of patients with severe/multiple injuries. Eur J Trauma Emerg Surg 44 (Suppl 1), 3–271 (2018). https://doi.org/10.1007/s00068-018-0922-y

9 American College of Surgeons (2022); Best Practice Guidelines; Spinal Cord Injuries; https://www.facs.org/media/k45gikqv/spine_injury_guidelines.pdf

10 National Institute for Health and Care Excellence (NICE Guideline, No. 41.) (2016); National Clinical Guideline Centre (UK). Spinal Injury: Assessment and Initial Management; algorithms; https://www.ncbi.nlm.nih.gov/books/NBK367851/

11 Canadian Spinal Cord Injury Practice (Can-SCIP) Guideline (2024); Recommendations; https://kite-uhn.com/can-scip/en/recommendations

12 National Institute for Health and Care Excellence (NICE) guideline; 17 February 2016; Spinal injury: assessment and initial management; guidance; https://www.nice.org.uk/guidance/ng41

13 World Health Organization & International Committee of the Red Cross (ICRC). (2018). Basic emergency care: approach to the acutely ill and injured: participant workbook. World Health Organization. https://iris.who.int/handle/10665/275635. License: CC BY-NC-SA 3.0 IGO

14 Kwan I, Bunn F, Roberts I. Spinal immobilisation for trauma patients. Cochrane Database Syst Rev. 2001;2001(2):CD002803. doi: 10.1002/14651858.CD002803. PMID: 11406043; PMCID: PMC7003994.

15 Kornhall, D.K., Jørgensen, J.J., Brommeland, T. et al. The Norwegian guidelines for the prehospital management of adult trauma patients with potential spinal injury. Scand J Trauma Resusc Emerg Med 25, 2 (2017). https://doi.org/10.1186/s13049-016-0345-x

16 Scott I, Porter K, Laird C, Greaves I, Bloch M. The prehospital management of pelvic fractures: initial consensus statement. Emerg Med J. 2013 Dec;30(12):1070-2. doi: 10.1136/emermed-2013-203211. PMID: 24232012.

17 Saragiotto BT, Maher CG, Lin CWC, Verhagen AP, Goergen S, Michaleff ZA. Canadian C-spine rule and the National Emergency X-Radiography Utilization Study (NEXUS) for detecting clinically important cervical spine injury following blunt trauma. Cochrane Database Syst Rev. 2018 Apr 11;2018(4):CD012989. doi: 10.1002/14651858.CD012989. PMCID: PMC6494628.

18 Hachem LD, Ahuja CS, Fehlings MG. Assessment and management of acute spinal cord injury: From point of injury to rehabilitation. J Spinal Cord Med. 2017 Nov;40(6):665-675. doi: 10.1080/10790268.2017.1329076. Epub 2017 Jun 1. PMID: 28571527; PMCID: PMC5778930. Assessment and management of acute spinal cord injury: From point of injury to rehabilitation.

19 Cuthbertson JL, Weinstein ES. Spinal Immobilization in Disasters: A Systematic Review. Prehosp Disaster Med. 2020 Aug;35(4):406-411. doi: 10.1017/S1049023X20000680. Epub 2020 May 29. PMID: 32466810.

20 American Spinal Injury Association (ASIA); International Standards for Neurological Classification of SCI (ISNCSCI); https://asia-spinalinjury.org/international-standards-neurological-classification-sci-isncsci-worksheet/

21 National Clinical Guideline Centre (UK). Spinal Injury: Assessment and Initial Management. London: National Institute for Health and Care Excellence (NICE); 2016 Feb. (NICE Guideline, No. 41.) 7, Spinal injury assessment risk tools. Available from: https://www.ncbi.nlm.nih.gov/books/NBK367841/

22 National Institute for Health and Care Excellence (NICE) guideline; 17 February 2016; Major Trauma: assessment and initial management; overview; https://www.nice.org.uk/guidance/ng39

23 World Health Organization. (2021). World Health Organization model list of essential medicines: 22nd list (2021). World Health Organization. https://iris.who.int/handle/10665/345533. License: CC BY-NC-SA 3.0 IGO

24 Franz S, Schulz B, Wang H, et al. Management of pain in individuals with spinal cord injury: Guideline of the German-Speaking Medical Society for Spinal Cord Injury. Ger Med Sci. 2019;17:Doc05. Published 2019 Jun 17. doi:10.3205/000271

25 National Institute for Health and Care Excellence (NICE); National Clinical Guideline Centre (UK) (2016); Spinal injury: assessment and initial management: Spinal injury assessment: assessment and imaging for spinal injury; NICE Guideline NG 41; Methods, evidence and recommendations; February 2016; https://www.nice.org.uk/guidance/ng41/evidence/full-guideline-2358425776

26 Hagen EM, Rekand T. Management of Neuropathic Pain Associated with Spinal Cord Injury. Pain Ther. 2015 Jun;4(1):51-65. doi: 10.1007/s40122-015-0033-y. Epub 2015 Mar 6. PMID: 25744501; PMCID: PMC4470971.

27 Spinal Cord Injury Research Evidence (SCIRE); Professional; Evidence Modules; https://scireproject.com/evidence/

28 Mahnig S, Landmann G, Stockinger L, Opsommer E. Pain assessment according to the International Spinal Cord Injury Pain classification in patients with spinal cord injury referred to a multidisciplinary pain center. Spinal Cord. 2016 Oct;54(10):809-815. doi: 10.1038/sc.2015.219. Epub 2016 Jan 12. PMID: 26754471.

29 American College of Surgeons (2018); Best Practices Guidelines; Best Practices Guidelines in imaging; https://www.facs.org/media/oxdjw5zj/imaging_guidelines.pdf

30 Fehlings MG, Martin AR, Tetreault LA, et al. 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. Global Spine Journal. 2017;7(3_suppl):221S-230S. doi:10.1177/2192568217703089

31 Easter JS, Barkin R, Rosen CL, Ban K. Cervical spine injuries in children, part I: mechanism of injury, clinical presentation, and imaging. J Emerg Med. 2011 Aug;41(2):142-50. doi: 10.1016/j.jemermed.2009.11.034. Epub 2010 May 20. PMID: 20493655

32 World Medial Association Statement on Medical Ethics in the Event of Disasters; revised by the 68th WMA General Assembly, Chicago, United States, October 2017; https://www.wma.net/policies-post/wma-statement-on-medical-ethics-in-the-event-of-disasters/

33 The International Committee of the Red Cross (2013); War Surgery; Working with limited resources in armed conflict and other situations of violence; Volume 2;

34 AO Spine Classification Systems; https://www.aofoundation.org/spine/clinical-library-and-tools/aospine-classification-systems

35 Wilson JR, Tetreault LA, Kwon BK, et al. Timing of Decompression in Patients With Acute Spinal Cord Injury: A Systematic Review. Global Spine Journal. 2017;7(3_suppl):95S-115S. doi:10.1177/2192568217701716

36 Kruger EA, Pires M, Ngann Y, Sterling M, Rubayi S. Comprehensive management of pressure ulcers in spinal cord injury: current concepts and future trends. J Spinal Cord Med. 2013;36(6):572-585. doi:10.1179/2045772313Y.0000000093

37 Yaacoub S, Truppa C, Pedersen TI, Abdo H, Rossi R. Antibiotic resistance among bacteria isolated from war-wounded patients at the Weapon Traumatology Training Center of the International Committee of the Red Cross from 2016 to 2019: a secondary analysis of WHONET surveillance data. BMC Infect Dis. 2022 Mar 14;22(1):257. doi: 10.1186/s12879-022-07253-1. PMID: 35287597; PMCID: PMC8922823.

38 The International Committee of the Red Cross (2019); Antibiotic Protocol for Weapon Wounded; https://www.icrc.org/en/publication/4593-icrc-antibiotic-protocol-weapon-wounded#:~:text=The%20ICRC%20Antibiotic%20Protocol%20for,and%20treatment%20of%20established%20infection.

39 Stambough JL, Dolan D, Werner R, Godfrey E. Ophthalmologic complications associated with prone positioning in spine surgery. J Am Acad Orthop Surg. 2007 Mar;15(3):156-65. doi: 10.5435/00124635-200703000-00005. PMID: 17341672.

40 Sandean D. Management of acute spinal cord injury: A summary of the evidence pertaining to the acute management, operative and non-operative management. World J Orthop. 2020;11(12):573-583. Published 2020 Dec 18. doi:10.5312/wjo.v11.i12.573

41 Divi SN, Schroeder GD, Oner FC, Kandziora F, Schnake KJ, Dvorak MF, Benneker LM, Chapman JR, Vaccaro AR. AOSpine-Spine Trauma Classification System: The Value of Modifiers: A Narrative Review With Commentary on Evolving Descriptive Principles. Global Spine J. 2019 May;9(1 Suppl):77S-88S. doi: 10.1177/2192568219827260. Epub 2019 May 8. PMID: 31157149; PMCID: PMC6512201.

42 Hendershot KA, O'Phelan KH. Respiratory Complications and Weaning Considerations for Patients with Spinal Cord Injuries: A Narrative Review. J Pers Med. 2022 Dec 31;13(1):97. doi: 10.3390/jpm13010097. PMID: 36675758; PMCID: PMC9861966.

43 Jones TS, Burlew CC, Johnson JL, Jones E, Kornblith LZ, Biffl WL, Stovall RT, Pieracci FM, Stahel PF, Moore EE. Predictors of the necessity for early tracheostomy in patients with acute cervical spinal cord injury: a 15-year experience. Am J Surg. 2015 Feb;209(2):363-8. doi: 10.1016/j.amjsurg.2014.07.016. Epub 2014 Oct 13. PMID: 25457250.

44 World Health Organization. (2023). Package of interventions for rehabilitation: module 3: neurological conditions. World Health Organization. https://iris.who.int/handle/10665/370504. License: CC BY-NC-SA 3.0 IGO

45 Berlowitz DJ, Wadsworth B, Ross J. Respiratory problems and management in people with spinal cord injury. Breathe (Sheff). 2016 Dec;12(4):328-340. doi: 10.1183/20734735.012616. PMID: 28270863; PMCID: PMC5335574.

46 Weidner N, et al. Prevention of thromboembolism in spinal cord injury -S1 guideline. Neurol Res Pract. 2020 Dec 10;2:43. doi: 10.1186/s42466-020-00089-7. PMID: 33324943; PMCID: PMC7727164.

47 Eichinger S, Eischer L, Sinkovec H, Wittgruber G, Traby L, Kammer M, Kyrle PA, Steinbrecher O, Kaloud H, Kyrle V, Moser H, Wildburger R. Risk of venous thromboembolism during rehabilitation of patients with spinal cord injury. PLoS One. 2018 Mar 28;13(3):e0193735. doi: 10.1371/journal.pone.0193735. PMID: 29590126; PMCID: PMC5873993.

48 Spinal Cord Medicine; Pressure Ulcer; Prevention and Treatment Following Spinal Cord Injury; A clinical Practice Guideline for Health Care Professionals, second edition 2014; https://pva.org/wp-content/uploads/2021/09/cpg_pressure-ulcer.pdf

49 Vecin, N.M.; Gater, D.R. Pressure Injuries and Management after Spinal Cord Injury. J. Pers. Med. 2022,12,1130. https://doi.org/10.3390/jpm12071130

50 Coggrave MJ, Rose LS. A specialist seating assessment clinic: changing pressure relief practice. Spinal Cord. 2003 Dec;41(12):692-5. doi: 10.1038/sj.sc.3101527. PMID: 14639449.

51 European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA: 2019; https://internationalguideline.com/2019

52 Thomson CH, Choudry M, White C, Mecci M, Siddiqui H. Multi-disciplinary management of complex pressure sore reconstruction: 5-year review of experience in a spinal injuries centre. Ann R Coll Surg Engl. 2017;99(2):169-174. doi:10.1308/rcsann.2016.0227

53 Consortium for Spinal Cord Medicine Clinical Practice Guideline (2009); Respiratory Management Following Spinal Cord Injury: What You Should Know; A Guide for People with Spinal Cord Injury; https://pva.org/research-resources/consortium-for-scm/

54 Saadat SH, Shepherd S, Van Asseldonk B, Elterman DS. Clean intermittent catheterization: Single use vs. reuse. Can Urol Assoc J. 2019 Feb;13(2):64-69. doi: 10.5489/cuaj.5357. Epub 2018 Jul 31. PMID: 30138101; PMCID: PMC6363567.

55 Kurze I, Geng V, Böthig R. Guideline for the management of neurogenic bowel dysfunction in spinal cord injury/disease. Spinal Cord. 2022 May;60(5):435-443. doi: 10.1038/s41393-022-00786-x. Epub 2022 Mar 25. PMID: 35332274; PMCID: PMC8948006.

56 Coggrave M., Guidelines for Management of Neurogenic Bowel Dysfunction in Individuals with Central Neurological Conditions, Initiated by the Multidisciplinary Association of Spinal Cord Injured Professionals. 2012; https://scireproject.com/wp-content/uploads/2023/01/Feb-2021-MASCIP-Neurogenic-Bowel-Guidlines-text-compressed-1.pdf

57 Bristol Stool Chart; https://www.bladderandbowel.org/wp-content/uploads/2018/03/BABC002_Bristol-Stool-Chart-Jan-2016.pdf

58 Langer G, Wan CS, Fink A, Schwingshackl L, Schoberer D. Nutritional interventions for preventing and treating pressure ulcers. Cochrane Database of Systematic Reviews 2024, Issue 2. Art. No.: CD003216. DOI: 10.1002/14651858.CD003216.pub3

59 Bernardi M, Fedullo AL, Bernardi E, Munzi D, Peluso I, Myers J, Lista FR, Sciarra T. Diet in neurogenic bowel management: A viewpoint on spinal cord injury. World J Gastroenterol. 2020 May 28;26(20):2479-2497. doi: 10.3748/wjg.v26.i20.2479. PMID: 32523306; PMCID: PMC7265150.

60 McRae J, Morgan S, Wallace E, Miles A. Oropharyngeal Dysphagia in Acute Cervical Spinal Cord Injury: A Literature Review. Dysphagia. 2023 Aug;38(4):1025-1038. doi: 10.1007/s00455-022-10535-0. Epub 2022 Nov 14. PMID: 36374337; PMCID: PMC10326135.

61 Munoz N, Posthauer ME. Nutrition strategies for pressure injury management: Implementing the 2019 International Clinical Practice Guideline. Nutr Clin Pract. 2022 Jun;37(3):567-582. doi: 10.1002/ncp.10762. Epub 2021 Aug 31. PMID: 34462964.

62 Wecht JM, et al. International Standards to document Autonomic Function following SCI (ISAFSCI): Second Edition. Top Spinal Cord Inj Rehabil. 2021 Spring;27(2):23-49. doi: 10.46292/sci2702-23. PMID: 34108833; PMCID: PMC8152176.

63 Conti, Keith & Yellapu, Vikas & Sweeney, Joan & Falowski, Steven & Stawicki, Stanislaw. (2020). Spinal Shock: Differentiation from Neurogenic Shock and Key Management Approaches. 10.5772/intechopen.92026.

64 Akpinar P, Atici A, Ozkan FU, Aktas I, Kulcu DG, Sarı A, Durmus B. Reliability of the Modified Ashworth Scale and Modified Tardieu Scale in patients with spinal cord injuries. Spinal Cord. 2017 Oct;55(10):944-949. doi: 10.1038/sc.2017.48. Epub 2017 May 9. PMID: 28485384.

65 World Health Organization. (2016). Emergency medical teams: minimum technical standards and recommendations for rehabilitation. World Health Organization. https://iris.who.int/handle/10665/252809. Lizenz: CC BY-NC-SA 3.0 IGO

66 The SCIRE Project (Spinal Cord Injury Research Evidence); Toolkits, Info Sheets, and Treatment Algorithms; https://scireproject.com/videos-and-toolkits/information-sheets-and-treatment-algorithms/

67 World Health Organization 2024; Fact sheets, Assistive technology https://www.who.int/news-room/fact-sheets/detail/assistive-technology

68 World Health Organization, USAID & International Disability Alliance. (2016). Priority assistive products list: improving access to assistive technology for everyone, everywhere. World Health Organization. https://iris.who.int/handle/10665/207694. License: CC BY-NC-SA 3.0 IGO

69 World Health Organization, International Society for Prosthetics and Orthotics & United States. Agency for International Development. (2008). Guidelines on the provision of manual wheelchairs in less resourced settings. World Health Organization. https://iris.who.int/handle/10665/43960

70 The SCIRE Project (Spinal Cord Injury Research Evidence); Evidence Modules; Upper limb; Orthoses; https://scireproject.com/evidence/upper-limb/therapy-based-interventions/orthoses/

71 The SCIRE Project (Spinal Cord Injury Research Evidence); Evidence Modules; Lower limb and walking; Orthoses/Braces; https://scireproject.com/evidence/lower-limb-and-walking/orthoses-braces/

72 World Health Organization. (2021). A guidance document for medical teams responding to health emergencies in armed conflicts and other insecure environments. World Health Organization. https://apps.who.int/iris/handle/10665/341858. License: CC BY-NC-SA 3.0 IGO

73 Dezarnaulds, A., & Ilchef, R. (2014). Psychological adjustment after spinal cord injury: useful strategies for health professionals. Agency for Clinical Innovation; https://aci.health.nsw.gov.au/__data/assets/pdf_file/0010/155197/ACI-Psychological-adjustment-spinal-cord-injury.pdf

74 Craig, A., & Perry, K.N. (2014). Guide for health professionals on the psychosocial care of adults with spinal cord injury. Agency for Clinical Innovation. https://aci.health.nsw.gov.au/__data/assets/pdf_file/0019/155233/Guide-Psychosocial-Care.pdf

75 Humanity and Inclusion (2020); Early rehabilitation in conflict and disasters; https://hi.org/sn_uploads/document/36199-Humanity--Inclusion-Clinical-Handbook-web_1.pdf

76 Inter-Agency Standing Committee. (2007). IASC guidelines on mental health and psychosocial support in emergency settings. https://interagencystandingcommittee.org/iasc-task-force-mental-health-and-psychosocial-support-emergency-settings/iasc-guidelines-mental-health-and-psychosocial-support-emergency-settings-2007

77 World Health Organization, War Trauma Foundation & World Vision International. (2011). Psychological first aid: guide for field workers. World Health Organization. https://iris.who.int/handle/10665/44615

78 World Health Organization, War Trauma Foundation & World Vision International. (2013). Psychological first aid: facilitator's manual for orienting field workers. World Health Organization. https://iris.who.int/handle/10665/102380

79 Boese CK, Oppermann J, Siewe J, Eysel P, Scheyerer MJ, Lechler P. Spinal cord injury without radiologic abnormality in children: a systematic review and meta-analysis. J Trauma Acute Care Surg. 2015 Apr;78(4):874-82. doi: 10.1097/TA.0000000000000579. PMID: 25807412.

80 PECARN: Predictors of Pediatric Cervical Spine Injuries; https://www.jwatch.org/em201011240000002/2010/11/24/pecarn-predictors-pediatric-cervical-spine

81 The Royal Children's Hospital Melbourne; The paediatric trauma manual, https://www.rch.org.au/trauma-service/manual/

82 Kalanjiyam GP, Kanna RM, Rajasekaran S. Pediatric spinal injuries- current concepts. J Clin Orthop Trauma. 2023 Feb 4;38:102122. doi: 10.1016/j.jcot.2023.102122. PMID: 36846073; PMCID: PMC9945789.

83 Slaar A, Fockens MM, Wang J, Maas M, Wilson DJ, Goslings JC, Schep NW, van Rijn RR. Triage tools for detecting cervical spine injury in pediatric trauma patients. Cochrane Database Syst Rev. 2017 Dec 7;12(12):CD011686. doi: 10.1002/14651858.CD011686.pub2. PMID: 29215711; PMCID: PMC6486014.

84 Dauleac C, Mottolese C, Beuriat PA, Szathmari A, Di Rocco F. Superiority of thoracolumbar injury classification and severity score (TLICS) over AOSpine thoracolumbar spine injury classification for the surgical management decision of traumatic spine injury in the pediatric population. Eur Spine J. 2021 Oct;30(10):3036-3042. doi: 10.1007/s00586-020-06681-4. Epub 2021 Jan 21. PMID: 33475841.

85 Mo AZ, Miller PE, Troy MJ, Rademacher ES, Hedequist DJ. The AOSpine thoracolumbar spine injury classification system: A comparative study with the thoracolumbar injury classification system and severity score in children. OTA Int. 2019 May 14;2(4):e036. doi: 10.1097/OI9.0000000000000036. Erratum in: OTA Int. 2019 Dec 13;2(4):e051. Erratum in: OTA Int. 2019 Dec 27;2(4):e063. PMID: 33937667; PMCID: PMC7997116

86 Burns AS, Santos A, Cheng CL, Chan E, Fallah N, Atkins D, Dvorak MF, Ho C, Ahn H, Paquet J, Kwon BK, Noonan VK. Understanding Length of Stay after Spinal Cord Injury: Insights and Limitations from the Access to Care and Timing Project. J Neurotrauma. 2017 Oct 15;34(20):2910-2916. doi: 10.1089/neu.2016.4935. Epub 2017 Mar 29. PMID: 28245734; PMCID: PMC5653133.

87 Handicap International, 2015; Rehabilitation in sudden onset disasters

88 The International Spinal Cord Society (ISCoS); International SCI Data Sets; https://www.iscos.org.uk/page/Int-SCI-Data-Sets

89 Rick Hansen Institute, 2016; Toolkit for Spinal Cord Independence Measure III (SCIM III); https://scireproject.com/wp-content/uploads/2022/04/SCIM_Toolkit_Printable-1-1-1.pdf

Bibliography

AO Spine; Volume 7 Issue 3_suppl, September 2017; Special Issue: Clinical Practice Guidelines for the Management of Degenerative Cervical Myelopathy and Traumatic Spinal Cord Injury; https://journals.sagepub.com/toc/gsja/7/3_suppl

Consortium for Spinal Cord Medicine. Bladder management for adults with spinal cord injury: A clinical practice guideline for health-care providers. Paralyzed Veterans of America; 2006. Retrieved December 23, 202; https://pva.org/wp-content/uploads/2021/09/cpgbladdermanageme_1ac7b4.pdf

The International Committee of the Red Cross (2010); War Surgery; Working with limited resources in armed conflict and other situations of violence; Volume 1; https://www.icrc.org/en/doc/assets/files/other/icrc-002-0973.pdf

National Pressure Ulcer Advisory Panel, Pressure Ulcer Scale for Healing (PUSH Tool 3.0); https://www.sralab.org/sites/default/files/2017-06/push3.pdf

The Royal College of Anaesthetists (2023); Guidelines for the Provision of Anaesthetic Services, London; https://www.rcoa.ac.uk/safety-standards-quality/guidance-resources/guidelines-provision-anaesthetic-services

Annexes

7 Annexes

Annex 1. Staffing considerations

The objective of the following staffing overview is to provide a nonexhaustive, but reasonable approximation of staffing needs, based on experience, existing literature, multiple consultation rounds with experts within WHO, the EMT network, partners, and members of the TWG. All staffing considerations in tables A1.1 and A1.2 depend on context and the available health workforce, provide guidance on competencies and functions for SCI SCT and SCI SCT (surgical) and complement staffing recommendations provided in the Blue Book *(1)*. Additional functions, such as protection focal point, risk communication and community focal point, mental health and psychosocial support focal point, social workers and others need to be anticipated. Depending on the context and language skills of the team, translators may be essential and can be deployed or arranged locally. Assessing local staff availability as part of an initial needs assessment can facilitate the early integration of local professionals into the team. Teams should be prepared to provide capacity building through education and training of local staff, patients, caregivers, community health workers and family members.

As team rosters need to take shift patterns into account, all staffing considerations below reflect staffing per shift (see Table A1.1.). Teams need to assess the host facility capabilities before deployment and have arrangements in place to ensure sufficient staff to safely provide their services, including the ability to perform two-hourly turns in patients with an unstable spine both during day and night shifts. Safely turning a tetraplegic patient with an unstable spine, requires five staff. Turn teams should at least include one to two specialist staff members, and can be complemented by rehabilitation staff, and non-specialist members of the turn team, such as community health workers or caregivers, that must have received a comprehensive log-roll training and work only under close supervision of specialist staff.

The initial phase of the emergency response may be more staff resource intensive, and staffing numbers may be adapted once teams have been able to conduct capacity-building activities on SCI care and educate caretakers to support some of the patient care activities.

Staffing numbers below are minimum requirements for international deployments for teams seeking global classification status.

Annex 1.1. SCI SCT team configuration

Table A1.1. SCI SCT team configuration per shift

Note that a minimum of five people is required to safely turn (log roll) a tetraplegic patient with an unstable spine for two-hourly turns on both day and night shifts. Numbers below reflect staffing for 10 patients.

	Team configuration	Competencies	Minimum per 10 patients
	Team lead*	1 Team lead per team with experience in humanitarian emergency response and low-income setting operations. Leadership experience, including team safety and security.	
PHYSICIANS	Medical doctor	At least 1 spinal specialist: 10 patients per daytime shift, with on-call cover out of hours. - Spinal specialist with a background in rehabilitation medicine or neurology with at least 3 years SCI experience, and experience in emergency and critical care medicine *(90)*. - Leads comprehensive SCI assessment and treatment planning. - Management of complications including respiratory impairment, AD, pain, bladder, bowel and skin impairment. - Prescription of medication. - Decision-making on clinical management, collaborates closely with experienced spinal surgeon, in person or via telemedicine, providing imaging and clear clinical documentation. A second medical doctor with a background in general medicine can complement the spinal specialist, with at least 3 years of experience in emergency and critical care medicine, ideally with experience in SCI.	1
	1 surgeon in nonoperative role (may be remote)	1 specialized surgeon per team, experienced in spinal trauma surgery, and clinical decision-making to support initial decision-making around spinal stability and operative needs. May be a remote role, consulted via telemedicine, or deployed as part of initial response.	1

*These are roles, not necessarily separate positions. Can be simultaneously covered by someone in another position.

	Team configuration	Competencies	Minimum per 10 patients
NURSES: 5 NURSES: 10 PATIENTS PER SHIFT	Acute spine nurse	At least 2 acute spine nurses per 10 SCI patients per shift. At least 3 years post qualification, including 2 years of specialized experience in the management of SCI and acute trauma patients, including: - experienced in SCI assessment (ISNCSCI) - 24-hour positioning, transfers, management of the unstable spine - capacity-building for staff on safe SCI care - experienced in the management of postoperative spine - patient, family and caregiver education - recognition and identification of common complications - bladder care (including catheterization) - bowel care (including digital removal of faeces and NG aspiration) - skin care - wound care - psychosocial support - nutritional support - respiratory care including suctioning.	2
	General nurse	At least 3 general nurses: 10 patients per shift. At least 3 years post-qualification experience, including: - 24-hour positioning, transfers, management of the unstable spine - management of perioperative spine - patient, family and caregiver education - recognition and identification of common complications - experienced in SCI assessment (ISNCSCI) - bladder care (including catheterization) - bowel care (including digital removal of faeces and NG aspiration) - skin care - wound care - psychosocial support.	1

	Team configuration	Competencies	Minimum per 10 patients
REHABILITATION PROFESSIONALS	Rehabilitation professional	At least 2 rehabilitation professionals: 10 patients per daytime shift At least 3 years post qualification, including 2 years of specialized experience in the acute and long-term management of SCI, including: - comprehensive patient assessment - respiratory techniques - Swallowing/dysphagia training - 24-hour positioning, splinting, bracing - assistive product prescription including wheelchair prescription, fitting and training - early functional (ADL) rehabilitation including mobilization, self-care and feeding - assessment and management of spasticity - discharge planning - capacity building for staff on safe SCI care - patient and caregiver education - psychosocial support.	2
OSL AND WASH	OSL focal point*	1 OSL focal point per team, experienced in: - OSL in the humanitarian emergency context - infrastructure set-up - responsible for overseeing the availability, delivery and distribution of context-specific supplies and equipment - coordinates with suppliers and if available the storage/warehouse staff to ensure timely delivery of supplies - maintains records of supplies and equipment and provides regular reports on the status of supplies and equipment - ensures that all deliveries are properly secured and transported according to national guidelines and regulations - responsible for reliable functioning of electricity and WASH systems - ensures maintenance and repair of equipment as needed.	1
	WASH and IPC focal point*	1 WASH focal point per team, experienced in: - WASH and IPC management in the humanitarian emergency context. - ensures provision of clean water and adequate sanitation facilities for patients and staff. - responsible for the set up and maintenance of WASH related equipment and components of the facility, such as potable water distribution and excreta management systems. - ensures availability of appropriate handwashing stations and leads hygiene promotion activities. - oversees and ensures appropriate medical waste management; and - monitors and reports water quality regularly.	1

*These are roles, not necessarily separate positions. Can be simultaneously covered by someone in another position.

	Team configuration	Competencies	Minimum per 10 patients
PHARMACY	Pharmacy focal point*	1 Pharmacy focal point per team, experienced in: - pharmacy management - responsible for pharmacy stock and supply.	1

AECID Spain Warehouse; Türkiye Earthquake response; 2023. © WHO

Annex 1.2. SCI SCT (surgical) team configuration

The SCI SCT (surgical) must ensure that continuity of care needs and comprehensive inpatient SCI care needs are provided by either the host facility or other medical teams, such as SCI SCT (as laid out in Table A1.2.). The SCI SCT (surgical) embeds into an existing host facility and ensures minimum requirements are met to perform spinal surgery.

Minimum: 2 weeks stay (consider acute and delayed deployments), 24/7 services, surgical management of up to 10 surgical patients in 2 weeks.

See minimum requirements for host facility to perform SCI surgery below (Annex 7.3).

EMT embedded into Al Aqsa Hospital, providing surgical trauma care, Deir Al Balah, Gaza, 2024. © UK-Med

Table A1.2. SCI SCT (surgical) team configuration

	Team configuration	Competencies	Minimum per 10 patients
	Team lead*	1 Team lead per team with experience in humanitarian emergency response and low-income setting operations. Leadership experience, including team safety and security.	
PHYSICIANS	Medical doctor	At least 1 spinal specialist: 10 patients per daytime shift, with on-call cover out of hours, with a background in rehabilitation medicine and neurology, with at least 3 years' experience in emergency and essential critical care medicine *(90)*. Rotation with anaesthesiologists to oversee the critical care unit. If there is more than one MD, the additional MD with a background in general medicine can complement the spinal specialist, but must have at least 3 years' experience in emergency and essential critical care medicine, ideally with experience in SCI.	1
	Spinal surgeon	At least 1 specialized spinal surgeon: SCI SCT (surgical). Requires a background in orthopaedics or neurosurgery with advanced training and experience in traumatic spinal surgery (autonomously performing this role on a regular basis) and ideally experienced in disaster and/or conflict settings.	1
	General surgeon	At least 1 general surgeon: SCI SCT (surgical) with a background in general surgery, skilled assistant, consultant level	1
	Anaesthesiologist, neuro-anaesthesia	At least 1 specialized neuro-anaesthetist: SCI SCT (surgical), with on-call cover, fully specialized, consultant level, experienced in: - neuro-anaesthesia, complex airway management including awake fibreoptic - management of neurogenic shock and autonomic dysfunction - assessment, planning, implementation and evaluation of care of SCI patients undergoing complex surgical procedures, including SCI surgery - perioperative management of polytrauma patients - perioperative management of major haemorrhage - prone positioning and prevention and management of associated complications - critical care management of SCI patients - acute surgical and neuropathic pain management - one lung anaesthesia - paediatric anaesthesia from age 1 - the management of patients' airways, respiration and circulation, including children.	1
	1 General anaesthesiologist	Consultant level Combined competencies with spinal anaesthesia colleague to take turns and cover intensive care/high dependency care.	1

	Team configuration	Competencies	Minimum per 10 patients

NURSES	Acute spine/ neurosurgical nurse	At least 2 acute spine nurses, 10 patients/shift:
		- at least 3 years post qualification;
		- at least 2 years specialized experience in management of SCI and acute trauma patients, including immediate pre- and postoperative care, including:
		  - SCI assessment (ISNCSCI)
		  - 24-hour positioning, transfers, management of the unstable spine
		  - management of postoperative spine
		  - recognition and identification of common complications
		  - bladder and bowel care
		  - skin and wound care;
		- psychosocial support;
		- capacity building for staff on safe SCI care;
		- respiratory care including suctioning; and
		- nutritional support.
			2

	Critical care nurse	At least 1 critical care nurse: 10 patients/shift: - trained and at least 3 years of experience in essential critical care - may cross-over with acute spine nurse - recognizes postoperative complications, including AD - experienced in SCI assessment (ISNCSCI) - 24-hour positioning, transfers, management of the unstable spine - management of postoperative spine - patient, family and caregiver education - recognition and identification of common complications - bladder care (including catheterization) - bowel care (including digital removal of faeces and NG aspiration) - skin care - wound care - psychosocial support - nutritional support - respiratory care including suctioning.	1
	Perioperative/ post-anaesthetic nurse	At least 1 perioperative/post-anaesthetic nurse: 10 patients per daytime shift, with on-call cover out-of-hours. Experienced in: - managing patient care in the post anaesthetic/recovery room - critical care - medicines management, including drug administration - the recognition and appropriate management of complications or side effects.	1

	Team configuration	Competencies	Minimum per 10 patients
NURSES	**General nurse**	At least 2 general nurses, 10 patients per shift, experienced in: - 24-hour positioning, transfers, management of the unstable spine - management of postoperative spine - patient, family and caregiver education - recognition and identification of common complications - SCI assessment (ISNCSCI) - bladder care (including catheterization) - bowel care (including digital removal of faeces and NG aspiration) - skin care - wound care - psychosocial support.	2
	Anaesthetic assistant (or equivalent)	At least 1 anaesthetic assistant (or equivalent): 10 patients per daytime shift, with on-call cover out-of-hours. Experienced in: - the role of perioperative nurse within the anaesthetic role - complex, emergency anaesthetic SCI procedures - the management of patients' airways, respiration and circulation, including children - equipment sterilization.	1
	Surgical scrub/ circulating nurse *(91)*	At least 1 surgical scrub/circulating nurse: 10 patients per daytime shift, with on- call cover out-of-hours. Experienced in: - complex, emergency SCI procedures - managing the SCI surgical environment, including sterilization of equipment.	1

	Team configuration	Competencies	Minimum per 10 patients
REHABILITATION	Rehabilitation professional	At least 2 rehabilitation professionals: 10 patients per daytime shift Experienced in the acute and long-term management of SCI, including: - comprehensive patient assessment - respiratory techniques - positioning, splinting, bracing - assistive product prescription, including wheelchair prescription, fitting and training - early functional (ADL) rehabilitation, including mobilization, self-care and feeding - assessment and management of spasticity - discharge planning - patient and caregiver education.	2
OSL AND WASH	OSL focal point*	1 OSL focal point per team, experienced in: - OSL in the humanitarian emergency context - responsible for overseeing the availability, delivery and distribution of context specific supplies and equipment - coordinates with suppliers and if available, storage/warehouse staff to ensure timely delivery of supplies - maintains records of supplies and equipment and provides regular reports on the status of supplies and equipment - ensures that all deliveries are properly secured and transported according to national guidelines and regulations - responsible for reliable functioning of electricity and WASH systems - ensures maintenance and repair of equipment as needed.	
	WASH focal point*	1 WASH focal point per team, experienced in: - WASH and IPC management in the humanitarian emergency context; - ensures provision of clean water and adequate sanitation facilities for patients and staff; - responsible for the set up and maintenance of WASH related equipment and components of the facility, such as the potable water distribution and excreta management systems; - ensures availability of appropriate handwashing stations and leads hygiene promotion activities; - oversees and ensures appropriate medical waste management; and - monitors and reports water quality regularly.	
PHARMACY	Pharmacist*	- pharmacy management - responsible for pharmacy stock and supply.	

*These are roles, not necessarily separate positions. Can be simultaneously covered by someone in another position.

References

90 ISCOS (2015); Recommended Knowledge and Skills Framework for Spinal Cord Medicine; Version 4

91 NHS Training and development (theatre nurse competencies) https://www.healthcareers.nhs.uk/explore-roles/nursing/roles-nursing/theatre-nurse/training-and-development-theatre-nursing

EMT training in Fiji; the FEMAT trauma team safely transfers a trauma patient off a stretcher during a simulation exercise; Fiji, 2022. © WHO / Jason Chute

Annex 2. Examples of equipment and consumables for SCI SCT

Teams need to be able to demonstrate self-sufficiency in line with established EMT core standards *(1)*. Table A2.1. provides nonexhaustive examples and is highly dependent on local context, availability and national regulations. Teams need to assess potential local availability of items with the host facility prior to deployment.

Table A2.1. Example list of equipment and consumables for SCI SCT

	ITEM	NOTES
IPC	Gloves, examination	All sizes
	Gloves surgical	All sizes
	Aprons, plastic, single use	water resistant
	Alcohol-based hand rub	At all points of care
	Spill kits	
	Waste and sharps containers	
PATIENT ASSESSMENT	Portable monitor incl. SpO2, ECG, BP, Temp.	
	Reflex hammer	
	Neurotips	Single use neurological examination pins (box of 100)
	Stethoscope	
	Examination torch	
TREATMENT	IV fluids	
	IV giving sets	
	IV stopcocks, 3 ways	
	IV cannula, multiple sizes	
	IV dressing films, transparent	
	Syringe, various sizes	
	Syringe, luer lock, various sizes	
	Alcoholic wipes	

	ITEM	NOTES
FEEDING AND NUTRITION	NG tubes (various sizes)	
	Tape	To secure NG
	50 ml syringe	
	NG (enteral) drainage bag	
CARDIAC AND RESPIRATORY	Peak flow meter with disposable mouthpiece	
	Disposable mouthpieces	
	Lung volume recruitment bag with filter and mask	
	Digital spirometer with disposable tubes	
	Yankauer suction tips	
	Portable, reusable suction unit	
	Suction catheter	Range of sizes, CH8–18
	Abdominal binder	1 per lesion above T10, range of sizes
	Incentive spirometer	1 per lesion above T10
	Airway, guedel	various sizes
	Airway, nasopharyngeal	various sizes
	Laryngoscope	various sizes
	Oxygen mask, adult, paediatric, with tubing	
	Oxygen mask, non-rebreather, adult, paediatric, with tubing	
	Additional oxygen tubing	
	Nasal cannula, adult and paediatric	
	Bag/valve/mask adult and paediatric	
	Oxygen concentrator	
	Automatic electronic defibrillator (AED)	

	ITEM	NOTES
BLADDER AND BOWEL	Intermittent catheters	Different sizes for adults *(14)* and children (size 8)
	Silicone (indwelling) catheters	Lower occurrence of allergic responses, reduced likelihood of mineral encrustations in comparison to latex and PVC 1–2 per patient, for extended use (several weeks).
	Catheter hanger	
	Catheterization set	
	Urine bottle	
	Leg bags	Used for mobilization of patients with catheters.
	Urine collection bags	1 per catheterized patient. Weekly changes.
	Urometer bags	1 per catheterized patient in acute phase. Weekly changes.
	Incontinence sheets	5 per patient per day
	Lubricant	Bowel care and catheter insertion: 250 single use packs per patient per week, or 2 tubes per week, per patient.
	Wipes	
	Mobile and static commode with washable bed pan.	2 per 10 beds for inpatient care. Additional for discharge if not available locally.
SKIN CARE	Bed frame	Height adjustable, with pressure reducing mattress and bedding.
	Slide sheet (single patient)	One per immobile patient
	Tape, micropore and surgical, roll.	Hypo-allergenic. Taping of catheters to reduce pull. 1 role per patient/week.
	Compress gauze (pack)	In various sizes, wound packing and dressing.
	Paraffin gauze	Hydrocolloid dressings can be used but may not be available in all settings.
	Secondary dressing (foam or alginate)	Secondary cover for pressure ulcers.
	Crepe bandage (roll)	Bandaging, towel splinting.
	Dressing scissors	
	Barrier cream (500ml)	Skin protection from urine and faeces on vulnerable areas.
	Povidone iodine 10%, solution 500 ml	Skin preparation for surgery/cleaning. Diluted for wound management
	Scalpel, sterile, disposable	
	Forceps	
	Wound probe	
	Bone curette	
	Measuring tape (soft)	For wound measurement

	ITEM	NOTES
REHABILITATION AND ASSISTIVE TECHNOLOGY	Hand-held mirror	One per patient. Prevention and monitoring of pressure injuries, and intermittent female catheterization.
	Walking frames	Range of sizes, including provision for paediatric patients and a forearm walker.
	Elbow crutch, pair, adult	Range of sizes
	3-point spinal brace (thoraco-lumbar spinal orthosis or TLSO)	Selection of different sizes required.
	Cervical immobilization collar	Different sizes needed (may be adjustable) including for paediatric patients. These are for long-term use NOT extrication collars.
	Wheelchair (with pressure cushion and maintenance kit)	Ensure appropriate fit for the patient but not bespoke. For temporary use in the community only and not for long-term use. All wheelchairs should have at least a pressure-relieving (high-specification foam or gel) cushion, depending on the patient's risk for pressure ulcers.
	Pushing gloves, also known as Tetra Gloves.	For wheelchair training
	Tape measure (soft)	For wheelchair fitting
	Goniometer	
	Additional pillows for positioning	May be sourced locally
	Cushion wedge + plastic cover	May be sourced or made locally
	Transfer boards	May be sourced or made locally
	Prefabricated ankle and foot orthosis	For low level injuries with foot drop and ability to ambulate. Not for ankle positioning in bed. Should be rigid anterior AFO (aka toe off).
	Prefabricated wrist splint	Range of sizes, left and right
	Elastic exercise bands; light, medium, high resistance	Minimum of 5 m of each resistance
	Splinting kit	Plaster of Paris and/or thermoplastic, including undercast and strapping/fixation.
	Rehabilitation space/tents	Where the host facility cannot provide rehabilitation space, the deployment of a rehabilitation space is required. Teams should consider the provision of parallel bars and more complex gait orthoses.
	Tilt table	Recommended – to support progressive verticalization
OTHER	Stretcher, scoop	
	PAT slide	

Annex 3. Example medicines list for the management of SCI

Table A3.1. provides a nonexhaustive example list of medicines for the management of SCI and is highly dependent on local context, availability and national regulations. Teams need to assess potential local availability of items with the host facility prior to deployment. Additional information is provided in the WHO model list of essential medicines* *(92)*.

Table A3.1. Example medicines list

MEDICINES	EXAMPLES AND INDICATIONS 2-week supply per SCI patient required
DVT prophylaxis	Daily, all acute patients Low molecular weight heparin is recommended. Low-dose or adjusted-dose unfractionated heparin* or new oral anticoagulants (NOACs) can be used where low molecular weight heparin is not available. Teams should bring sufficient for an 8-week course.
Rectal stimulant	Daily where indicated Glycerin (glycerol) suppositories. All patients may need this until out of spinal shock and bowel type confirmed.
Laxatives	Daily, when indicated Bulk forming laxative, such as ispaghula husk or methylcellulose. Osmotic laxative or stool softener, such as lactulose, polyethylene glycol, macrogol, docusate sodium. Oral stimulant laxative, such as Senna 7.5 ml, bisacodyl or sodium picosulfate.
Proton pump inhibitor	Daily, all acute patients, gastric ulcer prevention. Omeprazole*
Nociceptive pain medication	When indicated Paracetamol, NSAIDs* and cox inhibitors. Opioids, in adherence with local regulations (controlled drugs). Teams need to ensure secure storage.
Neuropathic pain medication	When indicated Gabapentinoids such as pregabalin and gabapentin, only if long term continuous supply over several months (up to one year) is locally sustainable and assured. Note, that depending on local regulations, gabapentinoids may be classified as controlled substances. Antidepressants, such as Amitriptyline may also be used*.
Antibiotics	When indicated Management of UTI, pneumonia and wound infection. Choice of antibiotic depends on local antibiotic resistance patterns and patient age. Examples: amoxicillin, amoxicillin + clavulanic acid*, trimethoprim*, cephalosporins*, Ofloxacin*, Gentamicin*.

MEDICINES	EXAMPLES AND INDICATIONS 2-week supply per SCI patient required
Vasopressors	Management of hypotension, extended use for patients in neurogenic shock. Ephedrine, epinephrine* NOTE: ephedrine is a controlled drug in some countries.
Anticholinergic medication	Management of neurogenic shock*.
Emergency antihypertensive medication	When indicated, for management of AD. Nifedipine* Glyceryl trinitrate (GTN)*
Antispasmodic medication	Daily, when indicated Neurogenic bladder management Oxybutynin
Bronchodilators	When indicated, Salbutamol*
Antiemetic medication	When indicated Ondansetron*
Anti-spasticity medication	Daily, where indicated Diazepam* Tizanidine, Baclofen Should be locally available for long-term use beyond the stay of an EMT.
Antidepressant	Daily, where indicated, locally appropriate and sustainable.
IV fluids	
Mucolytics	Nebulizer Saline

*can be found in the WHO model list of essential medicines *(92)*.

References

92 World Health Organization. (2023). The selection and use of essential medicines 2023: web annex A: World Health Organization model list of essential medicines: 23rd list (2023). World Health Organization. https://iris.who.int/handle/10665/371090. License: CC BY-NC-SA 3.0 IGO

Annex 4. Example medicines list for the surgical management of SCI

Table A4.1. provides a nonexhaustive example list of medicines for the surgical management of SCI and complements the examples in Annex 3. Medicine lists are highly dependent on local context, availability and national regulations. Additional information is provided in the WHO model list of essential medicines* *(92)*.

Table A4.1. Example list for the surgical management of SCI (complemented by Table A3.1)

MEDICINES	EXAMPLES/NOTES
Antibiotics	- Cefazolin/cephalosporin: Pre-, Intra-, postoperatively (7 days) - Vancomycin (powder): administered directly into the wound to prevent wound infection in posterior cervical/thoraco-/lumbar surgery. - Clindamycin - Gentamicin iv - Metronidazole inj.
Vasopressors	Norepinephrine intraoperatively, when lines are in place. Ephedrine or dilute adrenaline may be given peripherally, close monitoring required. NOTE: ephedrine is a controlled drug in many countries.
Haemostatic agents	Tranexamic acid, absorbable haemostatic agents
Corticosteroids	Dexamethasone, Betamethasone

	MEDICINES	EXAMPLES AND INDICATIONS
ANAESTHESIA	Sedation	Midazolam
	General anaesthesia	- Propofol - Sevoflurane: Only if have DPA draw over or plenum system - Ketamine; NOTE: Often controlled
	Muscle relaxants	- Rocuronium: cold chain required (Vecuronium is a good alternative, can be reversed by Sugammadex and no cold chain requirement) - Atracurium: cold chain required NOTE: Suxamethonium contraindicated from 72 h to up to 9 months post-SCI
	Intraoperative pain management	- Remifentanil; NOTE: Controlled substance - Fentanyl; NOTE: Controlled substance - Morphine; NOTE: Controlled substance - Tramadol; NOTE: Often controlled
	Local anaesthetic	- Mucosal topicalization and vasoconstriction for awake fibreoptic assessment and intubation with Lidocaine and Phenylephrine. - 10% Lidocaine spray; mucosal topicalization for awake fibreoptic. - 4% Lidocaine spray, nebulized for awake fibreoptic.
	Anticholinergic medication	Atropine
	Drug reversal	Naloxone Glycopyrrolate/neostigmine Sugammadex
	Calcium	IV Calcium, in case of massive transfusion
	MgSO4	Useful adjunct and beneficial in AD.

*can be found in the WHO model list of essential medicines *(92)*.

Annex 5. Example consumables list for SCI SCT (surgical)

Table A5.1. provides a nonexhaustive example list of consumables to be provided by an SCI SCT (surgical). Teams ensure self-sufficiency for the entire period of deployment.

Table A5.1. Example consumables list for SCI SCT (surgical)

	ITEM	NOTES
IPC	Surface disinfection	
	Skin disinfection	10% iodine for all spine surgeries. Reported cases of chemical keratitis in prone position posterior cervical with chlorhexidine.
	Surgical scrub	
	Surgical linens	
	Surgical gowns	Consider bringing different sizes.
	Surgical gloves	All sizes
	Examination gloves	All sizes
	Aprons	
	Surgical cap	
	Surgical masks	
	Medical masks	Special consideration during infectious disease outbreaks (respirator masks; N95)
	Disposable sterile surgical drapes	Different sizes; 75 x 90 cm; +/- 90 x 150 cm; 150 x 240 cm
DRESSING MATERIAL	Sterile gauze	Sterile gauze 5 cm x 5 cm; 10 cm x 10 cm
	Adhesive tape	
	Sterile air permeable, self-adhesive dressing	Different sizes, S, M, L

	ITEM	NOTES
SUTURE MATERIAL	Sutures	- 1-0 antibiotic infiltrated braided resorbable for muscle and fascia. - 2-0 absorbable braided suture for platysma and subcutaneous tissue. - 4-0 absorbable monofilament suture for subcuticular closure. - 6-0 non-absorbable monofilament suture for primary closure of the dura/CSF leak.
	Skin staplers	
OTHERS	Safe blood transfusion equipment	
	Haemostatic agents	Various absorbable topical haemostatic products depending on local availability.
	Hemovac drain	Different types and sizes, such as Hemovac drains, Jackson-Pratt or bulb style drains.
	CSF leak repair	- Absorbable haemostatic agents - Fibrin sealant - Dural sealant - Collagen matrix sponge (soaked in antibiotics, such as Vancomycin) - Resorbable collagen dura repair membrane.
	Cottonoid patties	
	Bone graft sets	Osteotomes Electric bone saw

Annex 6. Example list for surgical and anaesthesia equipment for SCI SCT (surgical)

Table A6.1. provides a nonexhaustive examples list on surgical and anaesthesia equipment for SCI surgery. The WHO Trauma and Emergency Surgery Kit (TESK 2019) *(93)*, WHO Major Trauma Backpack 2021 *(94)* and other WHO standard emergency health kits *(95)* provide several modules which may replace or supplement the considerations below.

Table A6.1. Example list for surgical and anaesthesia equipment for SCI SCT (surgical)

ITEM	NOTES
Scalpel, sterile	
Retractors	Anterior cervical retractor set, cerebellar retractor, hinge retractors in variable sizes, nerve root retractors.
Dissectors	Penfield, Woodson
Nerve hooks	Blunt dandy nerve hook, long Cushing nerve hook
Mayfield 3-point fixation head clamp or Gardner-Wells tongs with traction	Radiolucent flat-top operating table, ideal.
Halo frame/brace	Can be used with weighted traction for closed/open reductions of cervical dislocations. Can also be used as temporary stabilization if no spinal instrumentation is available for definitive internal fixation. Halo vest may also be appropriate for definitive stabilization of certain injuries.
Anterior cervical procedure	Anterior Cervical Plating System (system of implants and instruments). Many of these systems use self-tapping screws; for those that do not, a hand drill can be used in case a power drill is not available.
Posterior cervical procedure	Occipito-Cervico-Thoracic (OCT) posterior instrumentation system with titanium implants (fixation rods, screws and reduction/persuasion equipment). Usual screw dimension: 3.5mm diameter, 14–16 mm length. 18 mm for lateral mass fixation. Rod dimension: 3.5mm diameter. Dual diameter rod to fix both cervical and thoracic vertebrae.
Thoraco-lumbar procedures	Thoracolumbar spinal system for posterior fixation of the thoracolumbar regions of the spine. Spine retractors. Polyaxial, Uniplanar, Monoaxial, and Reduction Pedicle Screws: 4.0–7.5 mm diameter, 35–50 mm length. Titanium alloy rods: 5.5 mm diameter.

ITEM	NOTES
Miniscrews rods, crosslink, plates, kits, instruments to apply them.	Different sizes, 100 screws for 2 weeks. Crosslink, not a minimum. Stainless steel wires can be used if titanium implants are unavailable (titanium preferred).
High speed pneumatic/electric power drills with voltage adapter, plus irrigation.	Need to be brought by team, electric or battery powered; do not rely on pressure systems (pneumatic systems) to be in place.
Drill bits	Diamond ball, match head/coarse diamond ball, match head.
K-wires for pilot hole	
Cages	Titanium or Polyetheretherketone for anterior cervical cases; interbody cages for thoracolumbar procedures; autograft from iliac crest. For a deployment of 2 weeks, bring at least 10 anterior cervical cages. Add additional for thoracic procedures. Bring different sizes.
Rongeurs	Leksell Rongeurs of various sizes, pituitary rongeurs and Kerrison Rongeurs (45 and 90 degree, numbers 1–4).
Caspar distraction pins	For anterior cervical fusion
Curettes	(variable angle and sizes)
Absorbable haemostatic agents	Various absorbable topical haemostatic products depending on local availability.
Bone wax	
Fibrin sealant	
Collagen matrix sponge	
Suction machine	
Suction cannulas	Teardrop, thumb control, in various sizes
Osteotomes	Straight and curved, multiple sizes
Electrocautery (monopolar, bipolar)	Monopolar diathermy machine with monopolar cautery tip. Bipolar diathermy machine with bipolar forceps.
Means of sufficient magnification and illumination	Minimum: teams need to bring their own individual magnifying surgical loupes with headlight.
Neuromonitoring	Intraoperative neuromonitoring device somatosensory evoked potential monitoring (SSEPS). Motor evoked potential (MEP) (not a minimum, recommended if feasible). If feasible and available, option to bring portable intraoperative neuromonitoring set.
Fibreoptic intubation equipment	Complex airway management
Intraoperative high-resolution ultrasound	Determination if adequate decompression of spinal cord has been achieved intraoperatively. Not a minimum, recommended if feasible.

	ITEM	NOTES
ANAESTHESIA EQUIPMENT	**Advanced airway management**	Complex airway in cervical injury. Video laryngoscope with standard and hyper-angulated blade, stylet and bougie. Fibreoptic intubation/scope capacity. Range of flexometallic armoured tubes. Monitoring
	Anaesthesia delivery	Where oxygen supplies are unpredictable and oxygen concentrators in use, use a draw over circuit and vaporizers or alternatively rely on total intravenous anaesthesia.
	Ventilation	If there is any doubt about availability/reliability of local pressurized oxygen supplies, the host facility will need ventilators that are compatible with low pressure oxygen delivery from concentrators. At least one for the theatre and one for the intensive care unit (ICU). Consideration to type of machine, circuit, supplies of CO2 absorber and availability of gas analysis need to be established prior to deployment/departure.
	Anaesthesia and critical care monitoring	- For monitoring in operating theatre and ICU: ECG, SpO2, automated noninvasive blood pressure measurement, ETCO2, arterial blood gas. - Neuromuscular Train of Four (TOF) monitor - Ideally, invasive arterial monitoring and disposables available. - Temperature monitoring - If total intravenous anaesthesia available/entropy bispectral index technology (BIS) would be ideal, not available in many settings.
	Patient warming	Fluid warmer. Forced air warmer plus disposables.
	VTE prophylaxis	Heparin Compression stockings or devices; if not available locally, team needs to provide.
	Post-anaesthesia care unit (PACU) monitoring	SpO2, noninvasive blood pressure measurement, temperature minimum
	Portable ultrasound	Linear and curved probe.
	Nebulizer	

References

93 The WHO Trauma and Emergency Surgery Kit (TESK 2019); https://www.who.int/emergencies/emergency-health-kits/trauma-emergency-surgery-kit-who-tesk-2019

94 WHO Major Trauma Backpack 2021; https://www.who.int/emergencies/emergency-health-kits/major-trauma-backpack

95 WHO standard emergency health kits; https://www.who.int/emergencies/emergency-health-kits

Annex 7 Checklists

All teams must provide their own emergency life support, such as tents, food, insurances and medevac, in accordance with EMT core standards. Team transport is required but may be locally contracted. Teams may have an agreement in place with the host or a local contractor for the provision of transport, food and accommodation over a longer period of time. In order for an SCI SCT or SCI SCT (surgical) to embed or couple to an existing facility, any potential host facility needs to meet the following minimum requirements as demonstrated in the respective tables A7.1., A7.2. and A7.3. below.

Annex 7.1. Minimum requirements to be met by the host facility for all SCI SCT

Table A7.1. Minimum requirements to be met by host facility for all SCI SCT

Requirement of host facility/ pre-deployment clarification	Yes	No	Possible mitigation/ additional considerations
Host facility is structurally sound (formal assessment) and evacuation procedures are in place.			If there is any damage to the facility, engage with the facility to arrange a structural review. Ensure teams are briefed on evacuation.
Is there sufficient safe space in the facility to absorb the anticipated increase in SCI patients?			Deploy "coupled" SCI SCT and refer to coupled checklist. If no coupled facility is available, work with the authorities to identify infrastructure and equipment based on the lists provided here.
Will the host provide accommodation for SCT staff?			Team to provide or arrange their own accommodation
Will accommodation be on site?			Team to organize transport if required. Requires additional budget and protocols.
Is there continuous access to potable water?			If water has not been tested, or there is no reliable supply, arrange via relevant authorities, HEOC or WASH clusters. Teams must be self-sufficient for their own drinking water.
If accommodation is provided, can staff access latrines and showers?			Team needs to provide their own sanitation solutions, such as setting up latrines and showers.
Does the host provide a laundry service for patients and staff?			Anticipate budget to contract a private laundry service for staff uniforms, patient linen and clothing.
Will the host provide food and water for patients and caregivers?			SCT requires a budget to provide food and water for patients and caregivers under their care.

Requirement of host facility/ pre-deployment clarification	Yes	No	Possible mitigation/ additional considerations
Is food and drinking water available in the proximity of the facility?			Teams will depend on their initial self-sufficiency for food and water, then can identify via local markets (if available) or continue to rely on rations and purification.
Does the host facility and accommodation have reliable power and back up required for the functions and services provided by the SCI SCT or SCI SCT (surgical)?			Team must bring their own power supply for team welfare, including communication, security and lighting at night. Any critical equipment should have adequate battery backup and/ or uninterruptible power source (UPS) in event of power failure.
Are the SCT staff expected to work daylight hours only?			If night shifts or 7-day work schedule is required, ensure staffing, safety and security plans are appropriately adapted.
Is appropriate waste management in place?			Hospital should liaise with local waste management authorities. Teams bring their own waste containers to allow safe segregation and temporary storage of medical and nonmedical waste and may provide their own medical waste treatment technology, liaise with local teams or facilities, or contract local private waste management companies.
Does the facility have an updated safety and security plan that the team can be included in?			Ensure the team has the capability to jointly develop a plan that meets their own needs and aligns closely with a centre-based plan.
Does the facility have the means of providing oxygen if required (such as oxygen concentrator or piped oxygen)?			Ensure access to an effective and reliable supply of oxygen necessary for the medical team to meet clinical standards of care through deployment of cylinders and/or concentrators.
Does the facility provide critical/ICU level care, including mechanical ventilation or have the ability to rapidly transfer patients needing higher levels of care?			Clarify how the facility manages deteriorating patients and ensure all teams are aware of protocols to follow. If not available, ensure clear admission criteria and ethical considerations.
Is there an identified referral pathway for patients requiring higher levels of care?			No mitigation available. Pathways must be identified.
Does the facility have means of sterilization of equipment?			Bring sterilized and sealed material/sterile single use instruments or bring sterilizer and redundancy of power supply.
Is there an appropriate number of beds and bedding for anticipated surge in spinal patients?			Consider deployment of beds and mattresses or work with partners to source. Deploy a coupled team if insufficient space.
Is there currently medical leadership and oversight for spinal injured patients?			Work closely with the host facility to identify a SCI focal point.
Will the host facility provide any health professionals to work alongside the SCT?			SCT to deploy a team capable of autonomous staffing of the unit, with a phased plan to introduce host staff as workload allows.
Does the host facility include staff that are specialized in acute spinal injury care?			Discuss existing team's capacity and if additional training is required.

Requirement of host facility/ pre-deployment clarification	Yes	No	Possible mitigation/ additional considerations
Are there clear admission criteria for SCI patients in the facility?			Ensure criteria are agreed on by all parties. Engage with HEOC to work on refining the cohorting of patients.
Can the host facility provide X-ray imaging?			The facility needs to identify an X-ray referral pathway.
Can the host facility refer to CT for diagnosis/ surgical decision-making?			Where surgery is required, the facility needs to identify a CT referral pathway. Where not available, plan for nonoperative management.
Is there secure storage space available for deployed equipment and consumables?			If not, consider alternative solutions, such as bringing your own storage tent, ensuring safety and security considerations. Stock management needs to be agreed with the host facility.
Does the facility have a list of locally used medications for SCI management?			Teams must always be self-sufficient for medication for their active caseload. Effort should be made to align team medications with locally available and affordable medicines to ensure sustainability.

Annex 7.2. Additional checklist on host facility requirements for SCI SCT coupled teams

Table A7.2. outlines additional requirements a host facility needs to meet for the SCI SCT to consider a coupled modality of deployment.

Table A7.2. Additional checklist on host facility requirements for SCI SCT coupled teams

Requirement of host facility/ pre-deployment clarification	Yes	No	Possible mitigation/ additional considerations
Has a space been identified to establish the coupled SCT, on level, well drained ground, that is accessible for patients and staff, secure and away from any hazards?			No mitigation available. Be aware that if the site is separate from the main facility, there may be additional WASH, power and staffing requirements.
Is power available for the coupled facility?			Identify requirements to plug into host electrics. Own generator should always be deployed with sufficient power to meet anticipated requirements. All electrical SCT equipment will need voltage stabilizers and AC converters with surge protection. If indicated, critical equipment should have adequate battery backup and/or UPS in event of power failure.
Is a water supply available for the coupled facility?			Coupled teams must plan to provide and store their own water, bring portable water treatment capabilities and ensure continuous water supply through storage of at least a 48-hour supply at all times (40–60 litres per patient per day, 15 litres per staff member and caregiver, minimum 50 litres for cleaning per day) *(3)*. Handwashing stations must be available in line with existing EMT minimum standards.
Are there accessible latrines and showers in close proximity to the proposed site?			SCT to deploy patient latrines and showers.
Will the host facility provide dedicated rehabilitation space?			Teams may need to deploy with rehabilitation tents and additional supplies. Where deployment of a rehabilitation space is required, teams should refer to the minimum technical standards and recommendations for rehabilitation for more information *(65)*.
Will the host make auxiliary staff, such as cleaners, available to the SCT when required?			Deployment must include a plan to ensure core functions are covered.

Annex 7.3. Minimum requirements to be met by the host facility for SCI SCT (surgical)

In order for a SCI SCT (surgical) to embed, a host facility must demonstrate to have a sterile OR environment and regularly perform trauma surgery, including orthopaedic internal fixation and anaesthesia. Table A7.3. outlines the minimum requirements a host facility needs to meet for a SCI SCT (surgical) to embed.

Table A7.3. Minimum requirements of the host facility for SCI SCT (surgical)

Requirement of host facility/ pre-deployment clarification	Yes	No	Possible mitigation/ additional considerations
Does the host facility have access to CT imaging for diagnosis/surgical decision-making, when indicated?			Where surgery is required, the facility needs to identify a CT referral pathway. If not available, no surgery can take place. Plan for nonoperative management.
Does the host facility provide an intraoperative C-Arm fluoroscopy/image intensifier?			No mitigation, not safe to perform SCI surgery at the facility.
Does the host facility provide a sterile OR environment?			No mitigation, not safe to perform SCI surgery at the facility.
Does the host facility routinely conduct orthopaedic internal fixation to a suitable infection control standard?			No mitigation, not safe to perform SCI surgery at the facility.
Will the host facility provide reliable access to oxygen in theatres and postoperatively with cylinder backup for power failure?			Provide oxygen supply through cylinders and/or concentrators. If not available, it is not safe to perform SCI surgery at the facility.
Does the host facility provide critical care, including mechanical ventilation, or have the ability to rapidly transfer patients needing higher levels of care?			No mitigation, not safe to perform SCI surgery at the facility.
Does the host facility provide means of sufficient magnification and Illumination, such as an operating microscope?			Teams/surgeons to bring individual magnifying surgical loups with headlight.

Requirement of host facility/ pre-deployment clarification	Yes	No	Possible mitigation/ additional considerations
Does the host facility provide an appropriate OR table that allows for: - supine or prone positioning/ Trendelenburg/lateral positioning and safe turning of the patient, with appropriate head pillows, patient bolsters and gel padding? - appropriate fixation and adaptor equipment? - appropriate equipment to accommodate the head in prone position?			No mitigation
Will the host facility provide anaesthetic machine?			If using a host facility anaesthetic machine, consideration to type of machine, circuit, supplies of CO2 absorber and availability of gas analysis should be established prior to deployment/departure.
Will the host facility provide lead aprons of different sizes?			Team to bring their own.
Is an autoclave/sterilization in place with traceability? Is there a mechanical control of temperature and humidity in the sterilization area?			Bring sterilized and sealed material/sterile implants and single use instruments or bring sterilizer and redundancy of power supply.
Laboratory/rapid diagnostic testing Does the host facility have available laboratory capacity for haemoglobin (Hb POC), crossmatch, electrolytes, urine myoglobin (dipstick), blood gases, INR, PTT, blood glucose testing?			Teams need to bring their own point of care testing capacities, including an arterial blood gas analyser, test strips.
Does the host facility have a blood bank and can perform crossmatch for safe blood transfusion?			Establish access to safe blood supply/safe blood banks for transfusion.
Does the host facility provide a forced air warmer?			

UMKE Türkiye-Syria earthquakes response; Türkiye, 2023. © WHO

Emergency Medical Teams
World Health Organization
Avenue Appia 20
CH-1211 Geneva
Switzerland
Email: emteams@who.int
Web: https://extranet.who.int/emt/