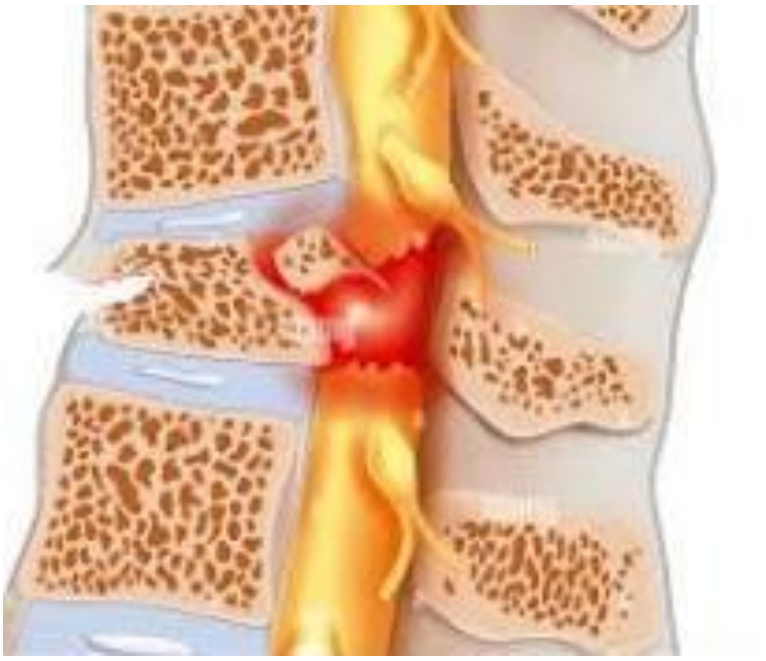
Sussex Trauma NETWORK

Prevention | Pre-hospital | Acute Care | Rehab

Sussex Trauma Network

Guidelines for Management of:

Spinal Cord Injury



May 2024

Management of Spinal Cord Injuries

Control Page

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Contents

1 Executive Summary

- The Specialist Spinal Surgery Centre for the Sussex Trauma Network is the Royal Sussex County Hospital.
- The linked Spinal Cord Injury Centre for the Sussex Trauma Network is, the National Spinal Injuries Centre at Stoke Mandeville Hospital.
- Adult patients identified as having spinal injury with new abnormal neurology should be triaged to the adult Major Trauma Centre (MTC) at the Royal Sussex County Hospital.
- Children identified or suspected of having any spinal column injury (with or without spinal cord injury) should be conveyed to the nearest paediatric MTC. If the nearest paediatric MTC is >60 minutes away and the child required immediate lifesaving intervention, they should be taken to the nearest TU or adult MTC for stabilisation.
- Patients with suspected spinal trauma should be prioritised and assessed expeditiously to identify potential life-threatening conditions as well as minimise the risk of complications such as pressure sores.
- Pre-hospital or hospital practitioners are expected to provide full in-line spinal immobilisation in all patients. with actual or at risk of spinal injury.
- Patients with spinal cord injury should have full detailed neurological examination recorded on an ISNCSCI chart, within 2 hours of admission.
- For seriously injured adult patients, whole-body contrast-enhanced head-to-thigh CT (CT Traumagram) is the default imaging procedure of choice.
- If there is a neurological abnormality which could be attributable to spinal cord injury, a MRI of the while spine should be done (after the CT if done), regardless of whether or not the abnormality is evident on CT.
- All patients with spinal or spinal cord injury, whichever hospital they are in, should be referred to the duty spinal surgery team at the Royal Sussex County Hospital (RSCH) using www.referapatient.org/refer-a-patient.
- For people who have a spinal cord injury, the specialist neurosurgical or spinal surgeon at the MTC should contact the linked SCIC consultant within 4 hours of diagnosis to establish a partnership of care.
- Most patients with SCI will be admitted to the MTC in the first instance.
- Prior to discharge, patients should be given full information about their condition and likely ongoing problems.
- Nearly all patients with SCI will need some form of rehabilitation. In the first instance this will be defined and provided by the Spinal Cord Injury Centre.
- All patients with spinal cord injury should be entered onto the National Spinal Cord Injuries Database.

2 Introduction

Spinal cord injury (SCI) resulting in neurological deficit is a rare but potentially devastating injury. Compromise to the spinal cord may be due to trauma, vascular injury or other disease processes and can result in immediate or insidious onset of neurological symptoms including loss or reduction of voluntary motor function, sensory impairment, bowel or bladder dysfunction and loss of autonomic function.

The incidence in the United Kingdom is estimated at 12-16 per million population with about 75% of cases due to trauma.

Appropriate management from the time of diagnosis of cord injury has been shown to have significant effect on the long-term outcome for patients and reduce short and long-term complications.

3 Purpose of the Guideline

The purpose of this guideline is to clearly define the care pathway for patients with spinal injuries duty to trauma including referral pathways to and from the Major Trauma Centre (MTC) (Royal Sussex County Hospital (RSCH)) and network Trauma Units (TUs). It includes guidance for pre-hospital and hospital management, and rehabilitation.

3.1 Aims & Objectives

The aims and objectives of this guideline are:

- To provide a system-wide approach for management of patients with spinal cord injuries due to trauma
- To define appropriate patient pathways for these patients
- To list appropriate accepted routes of communication
- To highlight continuing areas of contention
- To help meet TQUIN requirements for creation of network-agreed guidelines for the Network and Trauma Units (TUs)

4 Definitions

4.1 Spinal Cord Injury

A spinal cord injury involves damage to any part of the spinal cord due to trauma. It also can include damage to nerves at the end of the spinal cord, the cauda equina.

4.1.1 Complete Spinal Cord Injury

A complete injury means that there is no nerve communication below the injury site such that muscle control, feeling, or function below the injury is lost.

4.1.2 Incomplete Spinal Cord Injury

People with incomplete injuries still have some feeling, function, and muscle control below the site of their injury.

4.1.3 Canadian C-spine rule

This is a simple bed-side risk-stratification system for cervical spinal injury. It classifies patients into high risk, low risk or no risk. See Appendix 5 for details of the rule.

4.1.4 Specialist Spinal Surgery Centre (SSSC)

According to the BOAST 8 Guideline – The Management of Traumatic Spinal Cord Injury, each major trauma network should have a linked Specialised Spinal Surgery Centre where all spinal surgery is performed.

The Specialist Spinal Surgery Centre for the Sussex Trauma Network is the Royal Sussex County Hospital.

4.1.5 Spinal Cord Injury Centre (SCIC)

According to the BOAST 8 Guideline – The Management of Traumatic Spinal Cord Injury, each major trauma network should have a linked Spinal Cord Injury Centre.

The linked Spinal Cord Injury Centre for the Sussex Trauma Network is, the National Spinal Injuries Centre at Stoke Mandeville Hospital.

5 Scope

The guideline covers all major trauma patients with spinal cord injuries due to trauma within the Sussex Trauma Network. It replaces and supersedes all relevant previous STN guidelines. It applies to management of all patients with traumatic spinal cord injury resulting in complete or incomplete paraplegia or tetraplegia. The guideline applies to those patients with polytrauma and those with isolated spinal cord injuries but does not apply to patients with spinal column injury without cord involvement.

It is applicable to adults and children, but relevant sections contain statements where different processes apply to management of children.

6 Relevant Documents and Guidance

This guideline refers to:

- NICE Guideline [NG41] – Spinal injury: assessment and initial management
- BOAST 2 Guideline – Spinal Clearance in the Trauma Patient – January 2015 – see also Appendix 2 for summary

- BOAST Guideline – Cervical Spinal Clearance in the Trauma Patient – May 2021 – see also Appendix 3 for summary
- BOAST 8 Guideline – The Management of Traumatic Spinal Cord Injury - November 2022 – see also Appendix 4 for summary
- Wessex Children's Major Trauma Guidelines – on the Paediatric Innovation, Education and Research Network website (piernetwork.org)
- International Standards for Neurological Classification in Spinal Cord Injury (ISNCSCI)

This guideline also aspires to compliance with the relevant 2016 Major Trauma Service Quality Indicators (TQUINs) issued by the NHS England Quality Surveillance Team - tquins_resources_measures_major_trauma_measures_final_230416_7_.pdf (wymtn.com) and the subsequent 2020 version applying to Trauma Units.

The relevant extracts from the indicators are:

6.1 For Trauma Networks

- **T16-1C-107**
  There should be network agreed clinical guidelines for the management of:
  - spinal cord injury

- **T16-1C-109**
  There should be a network protocol for the management of spinal injuries which covers:
  - protecting and assessing the whole spine in adults and children with major trauma including that
    - all spinal imaging should be reviewed and reported by a consultant radiologist within 24 hours of admission;
    - all patients with spinal cord injury have their neurology documented on an ASIA chart;
    - all spinal cord injuries with neurological deficit should be discussed with the network spinal service within 4 hours of diagnosis.
  - resuscitation and acute management of spinal cord injury, agreed with the linked Spinal Cord Injury Centre (SCIC), and available in all emergency departments that may receive patients with spinal cord injury. These must include:
    - skin care,
    - gastric care,
    - bowel care
    - bladder care
  - emergency transfer of spinal injuries

6.2 For Major Trauma Centres

- **T16-2B-116**
  The MTC should agree the network trauma management guidelines as specified in

T16-1C-107.
The MTC should include relevant local details.

- **T16-2C-109**
  The MTC should agree the network protocol for protecting and assessing the whole spine in adults and children with major trauma.
  There should be a linked Spinal Cord Injury Centre (SCIC) for the MTC which provides an out-reach nursing and/or therapy service for patients with spinal cord injury within 5 days of referral.
  All patients with spinal cord injury should be entered onto the national SCI database.

- **T16-2D-104**
  There should be referral pathways for patients requiring specialist rehabilitation for:
  - spinal injuries

6.3 For Trauma Units

- **T20-2B-311**
  There are network agreed guidelines in place for the management of major trauma including:
  - spinal cord injuries.

7 Standard Operating Procedure

7.1 Pre-Hospital Care

Pre-hospital practitioners are required to use clinical judgement to determine whether a patient who was subjected to trauma may be at risk of having sustained a spinal injury and whether they have evidence of new neurological abnormality. According to the STN Patient Pathways, an adult patient identified as having spinal injury with new abnormal neurology should be triaged to the adult Major Trauma Centre (MTC).

Children identified or suspected of having any spinal column injury (with or without spinal cord injury) should be conveyed to the nearest paediatric MTC. If the nearest paediatric MTC is >60 minutes away and the child required immediate lifesaving intervention, they should be taken to the nearest TU or adult MTC for stabilisation.

Pre-hospital practitioners are expected to provide full in-line spinal immobilisation in all patients. with actual or at risk of spinal injury.

These patients should be transported using a scoop stretcher with blanket rolls or vacuum mattress. They should not be transported on a longboard or extrication device.

7.2 Hospital Care

7.2.1 Immediate Management

- Patients with suspected spinal trauma should be prioritised and assessed expeditiously to identify potential life-threatening conditions as well as minimise the risk of complications such as pressure sores. Full spinal immobilisation should be maintained unless and until the patient has had full spinal injury clearance – see:
    - BOAST 2 Guideline – Spinal Clearance in the Trauma Patient – January 2015 – see also Appendix 2 for summary
    - BOAST Guideline – Cervical Spinal Clearance in the Trauma Patient – May 2021 – see also Appendix 3 for summary

.

7.2.2 Neurological Assessment

Full detailed neurological examination should be recorded on an ISNCSCI chart, within 2 hours of admission, in keeping with the International Standards for Neurological Classification in Spinal Cord Injury (ISNCSCI). This should also occur weekly as well as before and after major interventions and/or surgical procedures.

7.2.3 Imaging

According to the STN – Imaging for Trauma Guideline - Adults and Children, for seriously injured adult patients, whole-body contrast-enhanced head-to-thigh CT (CT Traumagram) is the default imaging procedure of choice.

If there is a neurological abnormality which could be attributable to spinal cord injury, a MRI of the while spine should be done after the CT, regardless of whether or not the abnormality is evident on CT.

If CT Traumagram is not indicated, then whether to image and how should be guided by use of the Canadian C-Spine rule and NICE guidelines.

7.2.3.1 Spinal Imaging for Children

Perform MRI for children (under 16s) if there is a strong suspicion of:

- cervical spinal cord injury as indicated by the Canadian C-Spine rule and by clinical assessment or
- cervical spinal column injury as indicated by clinical assessment or abnormal neurological signs or symptoms, or both.

Consider plain x-rays in children (under 16s) who do not fulfil the criteria for MRI above, but clinical suspicion remains after repeated clinical assessment.

Discuss the findings of the plain x-rays with a consultant radiologist and perform further imaging if needed.

For imaging in children (under 16s) with head injury and suspected cervical spine injury, follow the recommendations in section 1.5 of the NICE guideline on head injury.

7.2.4 Specialist Referral

All patients with spinal or spinal cord injury, whichever hospital they are in, should be referred to the duty spinal surgery team at the Royal Sussex County Hospital (RSCH). Patients with spinal cord injuries and neurological deficit should be discussed with the duty spinal surgery team within 4 hours of diagnosis. This should be done by completing the on-line referral form on www.referapatient.org/refer-a-patient. The ID key generated must be recorded in the patient's medical records to allow future access to the information given and decisions. The spinal surgery team will give advice and decisions via the on-line system.

In emergency, also contact the duty Spinal Consultant or Registrar at the RSCH (01273 696955).

7.2.5 Transfers

Patients with spinal cord injury requiring transfer to the RSCH, as advised by the spinal surgery team, should be transferred with spinal immobilisation as specified by the spinal surgeons.

7.2.6 Spinal Cord Injury Centre Referral

For people who have a spinal cord injury, the specialist neurosurgical or spinal surgeon at the MTC should contact the linked SCIC consultant within 4 hours of diagnosis to establish a partnership of care. An agreed management plan between the admitting unit and SCIC must be formulated and recorded in the medical notes within 72 hours of diagnosis. All patients with spinal cord injury and neurological deficit must be submitted to the National Spinal Cord Injuries Database within 24 hours of diagnosis.

7.2.7 Admission

Most patients with SCI will be admitted to the MTC in the first instance. Any surgery required will be performed in the MTC. The MTC must ensure that specialist SCI nursing can be provided.

BOAST 8 Guideline – The Management of Traumatic Spinal Cord Injury specify that transfer to a SCIC should take place within 24 hours, unless it is in the patient's best interest to remain locally. In practice this is rarely achieved due to national shortage of inpatient spinal cord beds in these centres.

Many patients will remain in the MTC until transfer. However, in some cases patients may be repatriated to a TU or other suitable hospital, as long as the patient's ongoing SCI nursing needs can continue to be met at the receiving hospital. See STN Repatriation Policy.

7.2.8 Discharge

Prior to discharge, patients should be given full information about their condition and likely ongoing problems.

The family of patients with ongoing disability should also be engaged and fully informed.

7.3 Rehabilitation

Nearly all patients with SCI will need some form of rehabilitation. In the first instance this will be defined and provided by the Spinal Cord Injury Centre. A rehabilitation prescription form must be completed.

Thereafter, the patient may need transfer to a variety of facilities for ongoing care and rehabilitation.

7.4 Audit

All patients with spinal cord injury should be entered onto the National Spinal Cord Injuries Database.

Any patients whose treatment falls outside this guideline should be reported via the network Clinical Governance Framework and discussed through internal clinical governance mechanisms.

All patients with traumatic vascular injury are eligible for inclusion in and should be entered into the National Major Trauma Registry (NMTR).

8 Training Implications

This document represents the standard of practice acceptable for trauma networks and so all participating clinicians should already have relevant skills and training.

The major training deficit that has been identified is that staff working on wards that do not usually have SCI patients may have to care for such patients with while waiting for SCIC placement or if readmitted for another reason. The network should have a strategy to meet these training needs.

Staff in both TUs and the MTC should have training sufficient to allow adequate care for patients with SCI. This includes nursing on general and trauma wards.

9 Documentation

There is no formal documentation of these processes, other than the following:

- Written and computer patient medical records including ISNCSCI charts
- Referapatient on-line records
- Electronic order comms records
- PACS images
- Paper and/or electronic imaging reports

10 Monitoring Arrangements

These include:

- National Spinal Cord Injuries Database
- STN Clinical Governance log
- NMTR Audit

11 Equality Impact Assessment Screening

None in process.

12 Links to other SOPs and Trust policies

This guidance refers to and links with the following STN and Trust publications:

- STN Patient Pathways
- STN Guideline – Imaging for Trauma Guideline – Adults and Children
- STN Repatriation Policy

13 References

- NICE Guideline [NG41] – Spinal injury: assessment and initial management
- BOAST 2 Guideline – Spinal Clearance in the Trauma Patient – January 2015 – see also Appendix 2 for summary
- BOAST Guideline – Cervical Spinal Clearance in the Trauma Patient – May 2021 – see also Appendix 3 for summary
- BOAST 8 Guideline – The Management of Traumatic Spinal Cord Injury - November 2022 – see also Appendix 4 for summary
- Wessex Children's Major Trauma Guidelines – on the Paediatric Innovation, Education and Research Network website (piernetwork.org)
- International Standards for Neurological Classification in Spinal Cord Injury (ISNCSCI)

14 Appendices

14.1 Appendix 1 – Abbreviations

BOAST	British Orthopaedic Association Audit Standards for Trauma
CT	Computerised Tomography
ED	Emergency Department
EDs	Emergency Departments
ISNCSCI	International Standards for Neurological Classification of Spinal Cord Injury
MRI	Magnetic Resonance Imaging
MTC	Major Trauma Centre
NICE	National Institute for Health Care and Excellence
NMTR	National Major Trauma Registry
PACS	Picture Archiving and Communication System
RSCH	Royal Sussex County Hospital
SSSC	Specialised Spinal Surgery Centre
SCI	Spinal Cord Injury
SCIC	Spinal Cord Injury Centre
STN	Sussex Trauma Network
TQUIN	Trauma Quality Indicator
TU	Trauma Unit
TUs	Trauma Units

14.2 Appendix 2 – BOAST Guideline – Spinal Clearance in the Trauma Patient

British Orthopaedic Association | Society of British Neurological Surgeons | BASS British Association of Spine Surgeons | SYNTHES

BRITISH ORTHOPAEDIC ASSOCIATION STANDARDS for TRAUMA (BOAST) 2015

Spinal Clearance in the Trauma Patient

Background and justification

All patients involved in significant blunt trauma must be assumed to have an unstable injury to their spine; the incidence is approximately 2% and increases up to 34% in the unconscious patient. 50% of spinal injuries occur in the thoracic or lumbar spine; 20% at two levels. Immobilisation with full spinal precautions for prolonged periods creates difficulties in intensive care units. Spinal immobilisation is associated with pressure sores and pulmonary complications and is not recommended for more than 48 hours. Audits in the UK suggest poor implementation of spinal clearance policies. In the neck ligamentous disruption without a major bony injury may lead to instability. Recent comparative evaluations have shown that a modern helical CT scanning with reformatting can demonstrate the subtle abnormalities offering high sensitivity and specificity in detecting unstable injuries of the cervical spine. Plain radiographs are insensitive in the neck and the upper thoracic spine. MRI scanning has high sensitivity but only moderate specificity and is logistically difficult for ICU patients.

Inclusions:

All trauma patients who are unconscious, unable to cooperate or who have distracting injuries that exclude reliable clinical assessment.

Exclusions:

Children under the age of 16

Standards for Practice

1. A protocol for protection of the entire spine must be in place in all hospitals managing trauma patients at risk ofspinal injury. This protection must be maintained from arrival until appropriate examination or investigations arecompleted and the spine cleared of injury.
2. Documentation of the neurological status must be made in all at-risk patients; any sign of spinal cord injurymandates urgent scanning.
3. A clinical examination of the whole spine should be documented.
4. If it is anticipated a patient will remain unconscious, unassessable or unreliable for clinical examination for morethan 48 hours, radiological spinal clearance imaging should be undertaken.
5. For the cervical spine, the appropriate standard is a thin slice (2-3mm) helical CT scan from the base of the skullto at least T1 with both sagittal and coronal reconstructions; extending that scan to T4/5 overcomes the difficultiesof imaging the upper thoracic spine.
6. It is recommended that this cervical spine CT scan be undertaken as a routine with the first CT brain scan in allhead-injured patients who have an altered level of consciousness.
7. The remaining thoracic and lumbar spine may be adequately imaged either by AP and lateral plain radiographs orby sagittal and coronal reformatting of helical CT scans of the chest, abdomen and pelvis undertaken as part of amodern CT trauma series (<5mm slices).
8. A senior radiologist must report spinal clearance images prior to withdrawal of spinal protection precautions.
9. If a spinal injury is detected, a neurological assessment must be made, even if incomplete, and repeated regularlyprior to urgent transfer to an appropriate spinal injury service.
10. MRI is the urgent investigation of choice for spinal cord injury.

Evidence base:

Predominantly retrospective case series but with good reviews and an evolved multinational professional consensus over 15 years.

14.3 Appendix 3 – BOAST Guideline – Cervical Spine Clearance in the Trauma Patient

British Orthopaedic Association | BASS British Association of Spine Surgeons | British Society of Skeletal Radiologists

BOA STANDARD

Cervical spine clearance in the trauma patient

May 2021

Background and justification

Following blunt trauma, particularly if associated with impaired cognition, the potential for an unstable cervical spine is generally recognised and the patient is protected appropriately. Early formal spinal precautions are frequently necessary but their continuation for more than 48 hours is not recommended because of the requirement for log rolling and complications such as pressure sores.[1] It is recognised that there is a potential for occult cervical spine injury associated with disc or ligamentous disruption. This guideline defines an early clinical and radiological pathway to direct appropriate withdrawal of full spine precautions in patients initially suspected of having sustained a cervical spine injury.

Inclusions:

Adult patients sustaining blunt trauma.

Standards

1. A spinal protection protocol must be in place in all hospitals managing trauma patients.
2. Spinal protection must remain in place if an injury is identified, or until it is excluded via an established protocol.
3. Assessment of the whole spine should be performed and documented where injury is suspected.
4. If abnormal clinical signs are found, complete neurological examination must be performed and documented on an agreed proforma, such as an ASIA chart.
5. If abnormal neurological signs consistent with spinal cord injury are found, immediate discussion with and referral to a centre capable of emergency spinal surgery must occur.
6. Significant spinal injury is excluded following:
    a. Normal clinical examination in an awake and orientated patient[2,3] or;
    b. Completion of spinal imaging protocols (standard 7) in unconscious or uncooperative patients and in patients with significant distracting injuries.
7. Imaging protocols:
    a. Thoracic and lumbar spine scans should be obtained according to major trauma protocols.
    b. If a cervical spine injury is suspected, thin slice CT scanning from occiput to T4, including sagittal and coronal reconstructions should be performed without delay.
    c. If whole-body CT (WBCT) for trauma is necessary, this should include the cervical spine if injury is suspected.
    d. If brain CT is necessary for head injury, this should include the cervical spine.
    e. An initial report of cervical spine clearance imaging should be available before the patient leaves the Emergency Department and a definitive report within 18 hours of injury, indicating one of the following scenarios and actions:

Option	Scenario	Action
1	This investigation demonstrates an injury that may affect spinal stability.	Continue spinal protection and seek advice from an appropriate clinical team.
2	This scan is of good quality and there are no comorbidities confounding its interpretation. No features of instability, such as fracture, haematoma or joint disruption are seen.	An unconscious or obtunded patient may be labelled "C-Spine radiologically cleared". Spinal precautions can be removed. Clinical clearance is not confirmed until a tertiary survey is completed and documented.
3	Whilst there are no obvious features of spinal instability, the CT scan is either not of good quality and/or there are comorbidities confounding its interpretation.	Spinal protection should be continued until an MRI is performed or the patient is fully conscious and has a normal clinical examination documented.

8. Magnetic Resonance Imaging is necessary when the following are present:
    - Suspected cord injury
    - Ambiguous CT scans, as per option 3 of standard 7
    - Ankylosed spines with negative or indeterminate CT appearances for fracture
    - Contraindications to ionising radiation, for example in pregnancy

References

1. Spinal immobilisation for unconscious patients with multiple injuries BMJ 2004; 329:495-9.
2. Stiell IG, Wells GA, Vandemheen KL, Clement CM, Lesiuk H, De Maio VJ, Laupacis A, Schull M, McKnight RD, Verbeek R, Brison R, Cass D, Dreyer J, Eisenhauer MA, Greenberg GH, MacPhail I, Morrison L, Reardon M, Worthington J. The Canadian C-spine rule for radiography in alert and stable trauma patients. JAMA. 2001 Oct 17;286(15):1841-8. doi: 10.1001/jama.286.15.1841. PMID: 11597285.
3. National Institute for Health and Care Excellence. (2016). Spinal injury: assessment and initial management [NICE Guideline No. 41]. www.nice.org.uk/guidance/ng41

14.4 Appendix 4 – BOAST Guideline – The Management of Traumatic Spinal Cord Injury

British Orthopaedic Association

BOA STANDARD

BASS British Association of Spine Surgeons

BASCIS British Association of Spinal Cord Injury Specialists

The Management of Traumatic Spinal Cord Injury

November 2022

Background and justification

Acute Spinal Cord Injury (SCI) due to traumatic or vascular damage, resulting in neurological deficit is a rare but devastating injury. Spinal cord compromise can result in immediate or insidious onset of neurological symptoms. Appropriate urgent management from the time of diagnosis has been shown to reduce complications and improve outcomes.

Inclusions:

All patients (adults and children) with traumatic spinal cord injury resulting in complete or incomplete para- or tetraplegia.

Standards for Practice

1. All hospitals receiving patients with SCI must have a named linked Spinal Cord Injury Centre and named linked Specialised Spinal Surgery Centre (SSSC) which offers 24 hour consultant spinal surgeon availability. SCI Centres should provide 24 hour advice and support to the Major Trauma Network (MTN).
2. All hospitals within a MTN should have an agreed, common protocol for protecting the neck and spine and exclude injury in line with BOAST-2 (Spinal Clearance in the Trauma Patient (2015)).
3. Centres receiving patients with SCI require 24-hour access to CT and MRI. Initial trauma CT scanning must be followed by whole spine MRI scanning once safe.
4. Daily generalised neurological review should be recorded as part of the routine ward round or multidisciplinary assessment.
5. Full detailed neurological examination should be recorded on an ISNCSCI chart, within 2 hours of admission, in keeping with the International Standards for Neurological Classification in Spinal Cord Injury (ISNCSCI).* This should also occur weekly as well as before and after major interventions and/or surgical procedures.
6. ISNCSCI charts should be completed by clinicians trained in their use.
7. Protocols for skin care, gastric, bowel and bladder care, neuroprotection, joint protection and therapy requirements must be agreed with the linked SCI Centre and follow national guidance.
8. For patients requiring surgery, protocols for anaesthesia and spinal stabilisation must follow national guidance.
9. All major trauma and SSSCs should have dedicated link nurse and therapy arrangements to provide specialised care until transfer to SCI centre.
10. All patients with SCI in England must be submitted to the National Spinal Cord Injuries Database** within 24 hours of diagnosis. An agreed management plan between admitting unit and SCI centre must be formulated and recorded in the medical notes within 72 hours of diagnosis.
11. Transfer to a SCI Centre should take place within 24 hours, unless it is in the patient's best interest to remain locally. Regionally agreed support / liaison arrangements need to be in place in the event of a delay.
12. Appropriate psychological support should be provided for patients, family and carers.

* ISNCSCI chart (replaces ASIA chart) https://asia-spinalinjury.org/international-standards-neurological-classification-sci-isncsci-worksheet/
** National Spinal Cord Injuries Database: https://www.nscisb.nhs.uk

SCI referrals can be made via: https://referrals.mdsas.com

14.5 Appendix 5 - Canadian C-spine rule

Assess whether the person is at high, low or no risk for cervical spine injury using the Canadian C-spine rule as follows:

- the person is at **high risk** if they have at least one of the following high-risk factors:
  - age 65 years or older
  - dangerous mechanism of injury (fall from a height of greater than 1 metre or 5 steps, axial load to the head – for example diving, high-speed motor vehicle collision, rollover motor accident, ejection from a motor vehicle, accident involving motorised recreational vehicles, bicycle collision, horse riding accidents)
  - paraesthesia in the upper or lower limbs
- the person is at **low risk** if they have at least one of the following low-risk factors:
  - involved in a minor rear-end motor vehicle collision
  - comfortable in a sitting position
  - ambulatory at any time since the injury
  - no midline cervical spine tenderness
  - delayed onset of neck pain
- the person remains at **low risk** if they are:
  - unable to actively rotate their neck 45 degrees to the left and right (the range of the neck can only be assessed safely if the person is at low risk and there are no high-risk factors).
- the person has no risk if they:
  - have one of the above low-risk factors and
  - are able to actively rotate their neck 45 degrees to the left and right.

Be aware that applying the Canadian C-spine rule to children is difficult and the child's developmental stage should be taken into account.

14.6 Appendix 6 - International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) Chart

See next 2 pages for the chart.

INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY (ISNCSCI)

ASIA American Spinal Injury Association — ISCOS International Spinal Cord Society

Patient Name _____ Date/Time of Exam _____

Examiner Name _____ Signature _____

RIGHT

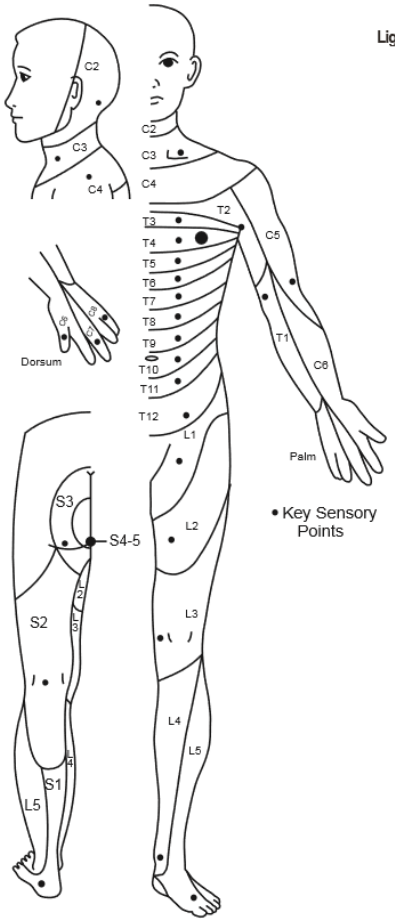
		MOTOR KEY MUSCLES	SENSORY KEY SENSORY POINTS Light Touch (LTR)	Pin Prick (PPR)
	C2			
	C3			
	C4			
Elbow flexors	C5			
Wrist extensors	C6			
Elbow extensors	C7			
Finger flexors	C8			
Finger abductors (little finger)	T1			
	T2			
	T3			
	T4			
	T5			
	T6			
	T7			
	T8			
	T9			
	T10			
	T11			
	T12			
	L1			
Hip flexors	L2			
Knee extensors	L3			
Ankle dorsiflexors	L4			
Long toe extensors	L5			
Ankle plantar flexors	S1			
	S2			
	S3			
	S4-5			
RIGHT TOTALS				
(MAXIMUM)		*(50)*	*(56)*	*(56)*

UER (Upper Extremity Right)

LER (Lower Extremity Right)

Comments *(Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):*

(VAC) Voluntary Anal Contraction (Yes/No) ☐



LEFT

		MOTOR KEY MUSCLES	SENSORY KEY SENSORY POINTS Light Touch (LTL)	Pin Prick (PPL)
	C2			
	C3			
	C4			
C5	Elbow flexors			
C6	Wrist extensors			
C7	Elbow extensors			
C8	Finger flexors			
T1	Finger abductors (little finger)			
	T2			
	T3			
	T4			
	T5			
	T6			
	T7			
	T8			
	T9			
	T10			
	T11			
	T12			
	L1			
L2	Hip flexors			
L3	Knee extensors			
L4	Ankle dorsiflexors			
L5	Long toe extensors			
S1	Ankle plantar flexors			
	S2			
	S3			
	S4-5			
LEFT TOTALS				
(MAXIMUM)		*(50)*	*(56)*	*(56)*

UEL (Upper Extremity Left)

LEL (Lower Extremity Left)

(DAP) Deep Anal Pressure (Yes/No) ☐

MOTOR (SCORING ON REVERSE SIDE)

0 = Total paralysis
1 = Palpable or visible contraction
2 = Active movement, gravity eliminated
3 = Active movement, against gravity
4 = Active movement, against some resistance
5 = Active movement, against full resistance
NT = Not testable
0, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present*

SENSORY (SCORING ON REVERSE SIDE)

0 = Absent — *NT = Not testable*
1 = Altered — *0*, 1*, NT* = Non-SCI condition present*
2 = Normal

MOTOR SUBSCORES

UER ☐ **+UEL** ☐ = ***UEMS TOTAL*** ☐ *MAX (25) (25) (50)*

LER ☐ **+ LEL** ☐ = ***LEMS TOTAL*** ☐ *MAX (25) (25) (50)*

SENSORY SUBSCORES

LTR ☐ **+ LTL** ☐ = ***LT TOTAL*** ☐ *MAX (56) (56) (112)*

PPR ☐ **+ PPL** ☐ = ***PP TOTAL*** ☐ *MAX (56) (56) (112)*

NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse

	R	L
1. SENSORY	☐	☐
2. MOTOR	☐	☐

3. NEUROLOGICAL LEVEL OF INJURY (NLI) ☐

4. COMPLETE OR INCOMPLETE? ☐
Incomplete = Any sensory or motor function in S4-5

5. ASIA IMPAIRMENT SCALE (AIS) ☐

6. ZONE OF PARTIAL PRESERVATION *(In injuries with absent motor OR sensory function in S4-5 only)*
Most caudal levels with any innervation

	R	L
SENSORY	☐	☐
MOTOR	☐	☐

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REV 04/19

Muscle Function Grading

0 = Total paralysis

1 = Palpable or visible contraction

2 = Active movement, full range of motion (ROM) with gravity eliminated

3 = Active movement, full ROM against gravity

4 = Active movement, full ROM against gravity and moderate resistance in a muscle specific position

5 = (Normal) active movement, full ROM against gravity and full resistance in a functional muscle position expected from an otherwise unimpaired person

NT = Not testable (i.e. due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of > 50% of the normal ROM)

0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present [a]

Sensory Grading

0 = Absent **1** = Altered, either decreased/impaired sensation or hypersensitivity

2 = Normal **NT** = Not testable

0*, 1*, NT* = Non-SCI condition present [a]

[a] Note: Abnormal motor and sensory scores should be tagged with a '*' to indicate an impairment due to a non-SCI condition. The non-SCI condition should be explained in the comments box together with information about how the score is rated for classification purposes (at least normal / not normal for classification).

When to Test Non-Key Muscles:

In a patient with an apparent AIS B classification, non-key muscle functions more than 3 levels below the motor level on each side should be tested to most accurately classify the injury (differentiate between AIS B and C).

Movement	Root level
Shoulder: Flexion, extension, adbuction, adduction, internal and external rotation **Elbow:** Supination	**C5**
Elbow: Pronation **Wrist:** Flexion	**C6**
Finger: Flexion at proximal joint, extension **Thumb:** Flexion, extension and abduction in plane of thumb	**C7**
Finger: Flexion at MCP joint **Thumb:** Opposition, adduction and abduction perpendicular to palm	**C8**
Finger: Abduction of the index finger	**T1**
Hip: Adduction	**L2**
Hip: External rotation	**L3**
Hip: Extension, abduction, internal rotation **Knee:** Flexion **Ankle:** Inversion and eversion **Toe:** MP and IP extension	**L4**
Hallux and Toe: DIP and PIP flexion and abduction	**L5**
Hallux: Adduction	**S1**

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved at the most caudal sacral segments for voluntary anal contraction (VAC) OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments S4-5 by LT, PP or DAP), and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body. (This includes key or non-key muscle functions to determine motor incomplete status.) For AIS C – less than half of key muscle functions below the single NLI have a muscle grade ≥ 3.

D = Motor Incomplete. Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the single NLI having a muscle grade ≥ 3.

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

Using ND: To document the sensory, motor and NLI levels, the ASIA Impairment Scale grade, and/or the zone of partial preservation (ZPP) when they are unable to be determined based on the examination results.

AMERICAN SPINAL INJURY ASSOCIATION

INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

INTERNATIONAL SPINAL CORD SOCIETY

Steps in Classification

The following order is recommended for determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides.
The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides.
Defined by the lowest key muscle function that has a grade of at least 3 (on supine testing), providing the key muscle functions represented by segments above that level are judged to be intact (graded as a 5).
Note: in regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level, if testable motor function above that level is also normal.

3. Determine the neurological level of injury (NLI).
This refers to the most caudal segment of the cord with intact sensation and antigravity (3 or more) muscle function strength, provided that there is normal (intact) sensory and motor function rostrally respectively.
The NLI is the most cephalad of the sensory and motor levels determined in steps 1 and 2.

4. Determine whether the injury is Complete or Incomplete.
(i.e. absence or presence of sacral sparing)
*If voluntary anal contraction = **No** AND all S4-5 sensory scores = **0***
*AND deep anal pressure = **No**, then injury is **Complete.***
*Otherwise, injury is **Incomplete**.*

5. Determine ASIA Impairment Scale (AIS) Grade.
Is injury Complete? If YES, AIS=A

NO ↓

Is injury Motor Complete? If YES, AIS=B

NO ↓ (No=voluntary anal contraction OR motor function more than three levels below the motor level on a given side, if the patient has sensory incomplete classification)

Are at least half (half or more) of the key muscles below the neurological level of injury graded 3 or better?

NO ↓ AIS=C **YES ↓ AIS=D**

If sensation and motor function is normal in all segments, AIS=E
Note: AIS E is used in follow-up testing when an individual with a documented SCI has recovered normal function. If at initial testing no deficits are found, the individual is neurologically intact and the ASIA Impairment Scale does not apply.

6. Determine the zone of partial preservation (ZPP).
The ZPP is used only in injuries with absent motor (no VAC) OR sensory function (no DAP, no LT and no PP sensation) in the lowest sacral segments S4-5, and refers to those dermatomes and myotomes caudal to the sensory and motor levels that remain partially innervated. With sacral sparing of sensory function, the sensory ZPP is not applicable and therefore "NA" is recorded in the block of the worksheet. Accordingly, if VAC is present, the motor ZPP is not applicable and is noted as "NA".