



# North East London & Essex Trauma Network

## Adult Spinal Trauma Pathway – V1.0 Apr 2021

### Key Facts

- A 24/7 specialist spine service is available for all patients within NELETN at The Royal London Hospital Major Trauma Centre (MTC) and at Queen's Hospital Romford (in the case of isolated spinal injuries).
- All referrals to the MTC and Queens Hospital Romford must be via the online referral portal, [www.referapatient.org](http://www.referapatient.org)
- Emergency specialist advice should be provided by the neurosurgical on-call team within 30 minutes of the referral being received, via *referapatient*
- Outcomes for the patient could include:
  - Transfer for specialist MTC care and treatment
  - Referral to the local spinal unit e.g. in the context of decompensated chronic degenerative spinal pathology.
  - Non-operative management at the Trauma Unit (TU) which could include
    - further investigation e.g., MRI scan
    - definitive management in a spinal orthosis, in which case a brace and collar proforma will be provided on *referapatient*
    - Where outpatient follow-up is required, this will be arranged with the specialist spine team at the MTC via *referapatient*
- It may be recommended that patients with decompensated chronic degenerative spinal pathology are referred to their local spinal unit.
  - The National Hospital for Neurology and Neurosurgery (Queen's Square) via *referapatient*
  - Queen's Hospital Romford via *referapatient*
  - The Royal National Orthopaedic Hospital via [www.rnoh.nhs.uk/services/spinal-surgical-unit/spinal-trauma-referral-form](http://www.rnoh.nhs.uk/services/spinal-surgical-unit/spinal-trauma-referral-form)
- The responsibility for making this referral lies with the referring Trauma Unit. In rare circumstances where the consultant at the local spinal unit feels they cannot meet the needs of the patient; they should escalate directly to the on-call consultant neurosurgeon at the MTC via the hospital switchboard.
- The North East London and Essex Trauma Network can be contacted where any discrepancy remains or for pathway amendments, though do not have an on-call service. Normal working hours are Monday to Friday, 9-5. [bartshealth.nel-etn@nhs.net](mailto:bartshealth.nel-etn@nhs.net)

### 1: Background

- The principle aim of prehospital and hospital reception teams in the management of spinal cord injury is to prevent further secondary injury and further neurological damage.
- Spinal precautions describe the use of devices and manoeuvres used to minimise spinal cord injury.
- Secondary injury is prevented through:
  - Maintenance of a high index of suspicion of potential injuries.
  - The prevention and reversal of life-threatening injury in the primary survey.
  - Appropriate spinal immobilisation.
  - Cardiovascular and ventilatory support.
  - Maintaining appropriate thermoregulation and glucose levels.

## 2: Immediate Management of spinal cord injuries

<b>Airway Management</b>	<ul style="list-style-type: none"> <li>• In cervical or high thoracic injuries anticipate autonomic instability. Tracheal stimulation can cause profound bradycardia and hypotension.</li> <li>• In this situation, where haemorrhage can be excluded as a cause of hypotension, it is appropriate to have a lower threshold for the administration of vasoactive drugs to increase systemic vascular resistance.</li> </ul>
<b>Oxygenation</b>	<ul style="list-style-type: none"> <li>• The spinal cord is neurological tissue and as a result may suffer secondary injury in the same manner as the brain.</li> <li>• Titrate oxygen flow to maintain saturation of at least 94%.</li> </ul>
<b>Ventilation</b>	<ul style="list-style-type: none"> <li>• The patient should be asked if their breathing feels normal or whether they feel short of breath.</li> <li>• Observe for diaphragmatic breathing as this may indicate a high cervical lesion.</li> <li>• There should be a low threshold for intubation if the patient has a high cervical injury or there are concomitant major injuries (e.g. chest). Aim for an ETCO<sub>2</sub> of 3.0 to 4.5 KPa and a normal PaCO<sub>2</sub>.</li> </ul>
<b>Hypotension</b>	<ul style="list-style-type: none"> <li>• Hypotension may require correction if the systolic blood pressure is less than 100 mmHg.</li> <li>• In isolated spinal cord injuries blood pressure can be elevated using fluid boluses or by using intravenous catecholamines. Catecholamines can be administered using carefully titrated boluses or by using an infusion.</li> <li>• In polytrauma patients, causes of hypotension should be sought in the usual manner and treatment should occur through standard procedures.</li> <li>• If other causes for the patient's hypotension have been excluded, then inotropic/vasopressor support should be initiated.</li> <li>• The target Mean Arterial Pressure should be 85 mmHg.</li> </ul>
<b>Temperature control</b>	<ul style="list-style-type: none"> <li>• Spinal injury patients may become cold through vasodilation and loss of normal thermoregulation reflexes.</li> <li>• Patients should be kept normothermic.</li> </ul>
<b>Neurological examination &amp; documentation</b>	<ul style="list-style-type: none"> <li>• A thorough exam should be performed. This should include: <ul style="list-style-type: none"> <li>○ An assessment of limb movements.</li> <li>○ A sensory level.</li> <li>○ Digital rectal examination. (DRE)</li> <li>○ Any obvious deformity of the spine.</li> <li>○ Cardiovascular findings</li> <li>○ Priapism.</li> <li>○ This should be performed before anaesthesia or sedation.</li> <li>○ An ASIA chart should be completed.</li> </ul> </li> </ul>
<p>Other measures include urinary catheterisation and keeping the patient NBM (NG/OG tube insertion).</p>	

### 3: Cervical Spine Precautions

The principles of cervical immobilisation are:

- Self-immobilisation by a conscious, co-operative patient.
- The use of manual in line stabilisation. (MILS)
- Limitation of log rolls to 10 degrees if possible.
- The correct use of rigid cervical collars.
- The use of orthopaedic scoop stretchers (OSS) and other transfer devices.
- The use of head restraints and straps.
- An awareness of other devices for example, prehospital vacuum mattresses

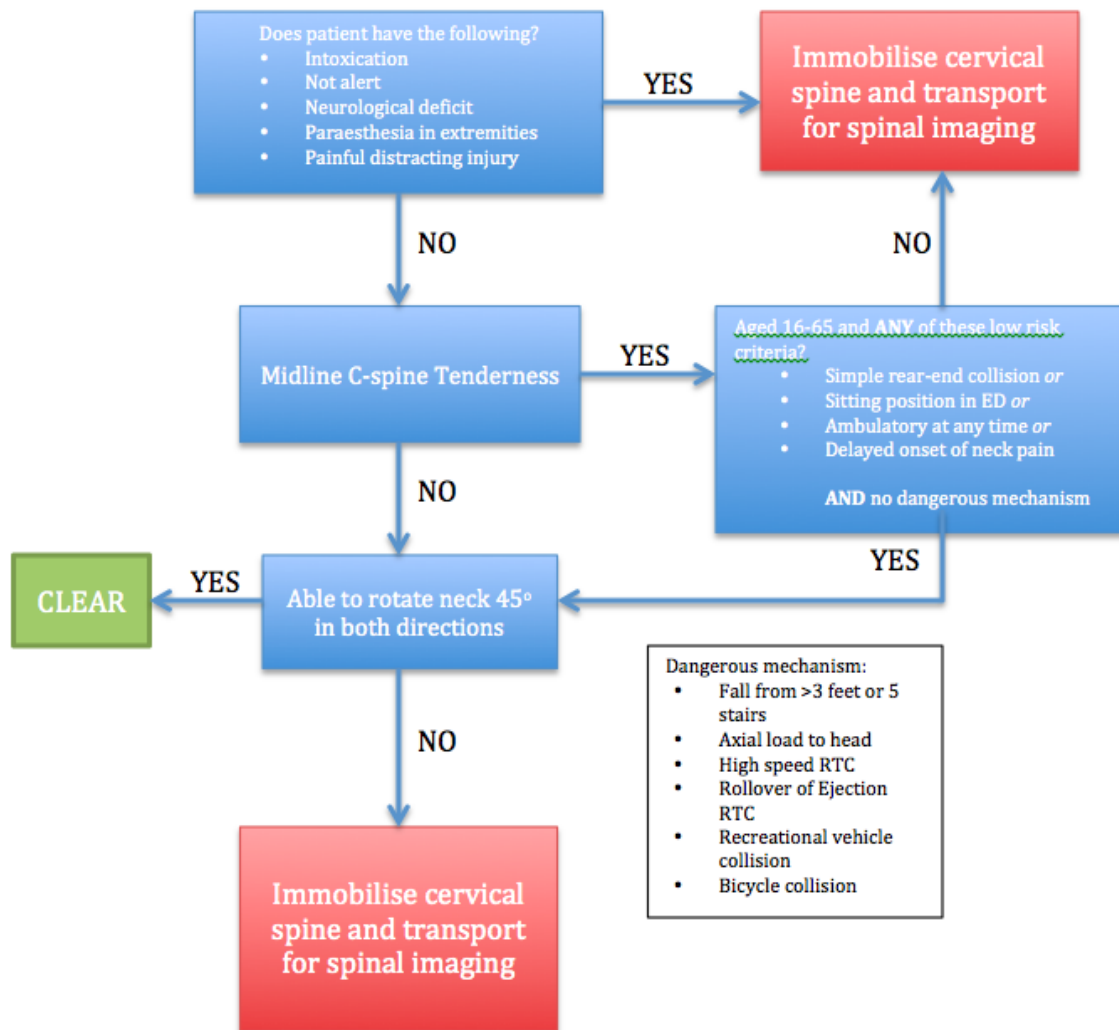
A long spinal board is an extrication device and therefore is unsuitable for transferring patients, the use of this device may result in pressure areas where a patient has sustained spinal injury.

### 4: Clearing the cervical spine injuries

Clinical judgement should be used in all cases and a physical examination made by a senior clinician appropriately trained in the assessment of cervical spine injuries. Where doubt or clinical concern remains, immobilisation measures should be retained .

Patients can be stratified into four main groups:

Alert, compliant and co-operative with <u>no</u> neurology:	Alert, compliant and co-operative with <u>altered</u> neurology:
<ul style="list-style-type: none"> <li>• No value in immobilisation.</li> <li>• Clear the c-spine if possible, using the Canadian Cervical Spine Rule (CCR). (see Appendix 1).</li> <li>• Transfer in position of comfort if imaging required.</li> </ul>	<ul style="list-style-type: none"> <li>• Keep in a neutral position.</li> <li>• Correct use of manual inline stabilization (MILS) with blocks and straps.</li> </ul>
Non-compliant:	Unconscious:
<ul style="list-style-type: none"> <li>• Do not impose immobilisation.</li> <li>• Try to keep in a neutral position.</li> <li>• Transfer for imaging as soon as practically possible.</li> </ul>	<ul style="list-style-type: none"> <li>• There is a higher likelihood of spinal cord injury, but other traumatic injuries are also possible.</li> <li>• Try to keep in a neutral position.</li> <li>• Optimum care is MILS with blocks and tape.</li> <li>• Transfer for definitive imaging as soon as practically possible.</li> </ul>



## 5: Thoracolumbar injuries

- Patients with suspected thoracolumbar spinal injuries should be kept in a position of comfort or lying flat if tolerated.
- A pragmatic approach may be required if there are concurrent chest wall injuries and oxygenation is a factor in the patient's care.

## 6: Spinal Imaging

- If patients require spinal imaging, it should be reviewed and reported by an appropriately trained radiologist within 4 hours of arrival, and whilst the patient is in ED.
- Decisions regarding the initial imaging modality should be made based on clinical judgement.
- The risk/benefit for plain x-ray over CT scan should be clearly understood by the requesting clinician.
- Patients with altered neurology are likely to require an MRI as soon as practically possible. In the presence of spinal fracture(s) and objective motor neurology, the MRI should be undertaken in the MTC.

- During transfer to imaging, movement of the spine should be minimised. Local protocols and procedures should be in place to transfer patients. Whilst it is accepted that transfers to imaging can be undertaken on a scoop stretcher or vacuum mattress, a dedicated trauma mat is preferable.

## 7: Documentation

- All patients with spinal cord injury must have their neurology documented on an ASIA chart.
- The status of the cervical spine should be clearly documented in the notes as well as the type of cervical spine immobilisation to be used.
- The chart below should be used along with clinical judgement to determine requirement for immobilisation and further imaging.
- Transient neurological symptoms should also be documented and should raise the index of suspicion for spinal injury.

## 8: Definitive spinal cord injury management

- All spinal cord injuries with neurological deficit should be discussed with the network spinal service within 4 hours of diagnosis.
- Further care within the Trauma Unit includes initiation of turning regime, commence proton pump inhibitor (PPI), placement of TED stockings according to local policy and prescribing atropine or glycopyrrolate.

## 9: Triage and Automatic Acceptance

- Patients with suspected spinal trauma with new motor neurology at scene will be conveyed directly to the MTC, unless catastrophic haemorrhage or airway cannot be managed.
- Patients with suspected spinal trauma with no new motor neurology but multisystem trauma at scene will be conveyed directly to the MTC, unless catastrophic haemorrhage or airway cannot be managed.
- Patients with spinal trauma and no new neurology OR sensory neurology only will be conveyed to their nearest Trauma Unit – most are treated conservatively and are unlikely to require transfer to the MTC.
- Patients who sit within the first two points will be eligible for automatic acceptance as soon as airway and haemorrhage are adequately managed. Close liaison with the MTC receiving consultant is required in this scenario and a Referapatient should also be completed to Major Trauma
- Patients who fall or sustain spinal trauma whilst an inpatient at a TU should be referred into the MTC via Referapatient to the spinal team, and will be assessed via the spinal MDT.

Communication is vital throughout the whole process. Keep in touch with the MTC ED team via 020 3519 7165. All transfers MUST have a *referapatient* referral in place, even if it needs to be completed after the patient has left.

RIGHT		KEY SENSORY POINTS		KEY SENSORY POINTS		LEFT	
MOTOR KEY MUSCLES		Light Touch (LTR)	Pin Prick (PPR)	Light Touch (LTL)	Pin Prick (PPL)	MOTOR KEY MUSCLES	
		C2		C2			
		C3		C3			
		C4		C4			
UER (Upper Extremity Right)		C5 Elbow flexors		C5 Elbow flexors		UEL (Upper Extremity Left)	
		C6 Wrist extensors		C6 Wrist extensors			
		C7 Elbow extensors		C7 Elbow extensors			
		C8 Finger flexors		C8 Finger flexors			
		T1 Finger abductors (little finger)		T1 Finger abductors (little finger)			
Comments (Non-key Muscle? Reason for NT? Pain?):		T2		T2			
		T3		T3			
		T4		T4			
		T5		T5			
		T6		T6			
		T7		T7			
		T8		T8			
		T9		T9			
		T10		T10			
		T11		T11			
		T12		T12			
		L1		L1			
LER (Lower Extremity Right)		L2 Hip flexors		L2 Hip flexors		LEL (Lower Extremity Left)	
		L3 Knee extensors		L3 Knee extensors			
		L4 Ankle dorsiflexors		L4 Ankle dorsiflexors			
		L5 Long toe extensors		L5 Long toe extensors			
		S1 Ankle plantar flexors		S1 Ankle plantar flexors			
(VAC) Voluntary Anal Contraction (Yes/No)		S2		S2			
		S3		S3			
		S4-5		S4-5			
RIGHT TOTALS (MAXIMUM)		(50)	(56)	(56)	(56)	LEFT TOTALS (MAXIMUM)	
MOTOR SUBSCORES							
UER	+ UEL	= UEMS TOTAL	LER	+ LEL	= LEMS TOTAL		
MAX (25)	(25)	(50)	MAX (25)	(25)	(50)		
SENSORY SUBSCORES							
LTR	+ LTL	= LT TOTAL	PPR	+ PPL	= PP TOTAL		
MAX (56)	(56)	(112)	MAX (56)	(56)	(112)		

**NEUROLOGICAL LEVELS**  
Steps 1-5 for classification as on reverse

1. SENSORY R L

2. MOTOR R L

3. NEUROLOGICAL LEVEL OF INJURY (NLI)

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

5. ASIA IMPAIRMENT SCALE (AIS)

(No complete injuries only)

ZONE OF PARTIAL PRESERVATION  
Most caudal level with any innervation

SENSORY R L

MOTOR R L

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### 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
- 5\* = (normal) active movement, full ROM against gravity and sufficient resistance to be considered normal if identified inhibiting factors (i.e. pain, disuse) were not present
- 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)

### Sensory Grading

- 0 = Absent
- 1 = Altered, either decreased/impaired sensation or hypersensitivity
- 2 = Normal
- NT = Not testable

### 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, abduction, adduction, internal and external rotation	C5
Elbow: Supination	C5
Elbow: Pronation	C6
Wrist: Flexion	C6
Finger: Flexion at proximal joint, extension.	C7
Thumb: Flexion, extension and abduction in plane of thumb	C7
Finger: Flexion at MCP joint	C8
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	L4
Knee: Flexion	L4
Ankle: Inversion and eversion	L5
Toe: MP and IP extension	L5
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-S5) 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.



### 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 and can record ZPP (lowest dermatome or myotome on each side with some preservation)  
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; the ASIA Impairment Scale does not apply.