SESLHD PROCEDURE COVER SHEET

Health
South Eastern Sydney
Local Health District

NAME OF DOCUMENT	Acute Spinal Cord Injury of the Adult – Management and Referral Procedure
TYPE OF DOCUMENT	Procedure
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FORMER REFERENCE(S)	PD 162 Acute Spinal Cord Injury of the Adult – Management of
EXECUTIVE SPONSOR or EXECUTIVE CLINICAL SPONSOR	SESLHD Director Emergency Clinical Stream
AUTHOR	Dr Ralph Stanford Staff Specialist / Orthopaedic Surgeon Prince of Wales Hospital
POSITION RESPONSIBLE FOR THE DOCUMENT	Jennifer Ings Acting CNC Trauma & P.A.R.T.Y SESLHD Jennifer.Ings@health.nsw.gov.au
FUNCTIONAL GROUP(S)	Critical Care and Emergency Medicine
KEY TERMS	Acute Spinal Cord Injury, Spinal Cord Injury Service
SUMMARY	Procedure for the transfer of **Adults** with acute spinal cord injury to the Major Trauma Service and/or to the Spinal Cord Injury Service (SCIS) for South Eastern Sydney Local Health District (SESLHD) and its referral network.

Acute Spinal Cord Injury of the Adult – Management and Referral Procedure

SESLHDPR/291

1. POLICY STATEMENT

Early referral and transfer of patients with spinal cord injury (SCI) to a specialised Spinal Cord Injury Service (SCIS) improves outcomes and reduces major complications. This is in line with the NSW Policy Directive PD2018_011 Critical Care Tertiary Referral Networks and Transfer of Care (ADULTS), Improving the Quality of Trauma Care in NSW: Trauma Services Model of Care (2019) and Selected Specialty and Statewide Service Plans, NSW Trauma Services Number Six, December 2009. The purpose of this procedure is to ensure patients with SCI are able to access speciality SCIS when needed. Admission should be timely and equitable. Timely admission means as soon as is practically possible, with an ideal being a direct admission less than 24 hours following injury.

2. BACKGROUND

2.1 The NSW State Spinal Cord Injury Service for **adults (age 16 years or greater)** is co-located at Prince of Wales Hospital (POWH) and Royal North Shore Hospital (RNSH). This is a tertiary level service that delivers multidisciplinary care in an appropriate physical environment as required by the NSW Health Model of Care for SCI. This combination of expertise is not available at or transferable to other sites and so transport of patients to one of the SCIS hospitals is required.

2.2 Acute spinal cord injury

The rapid deterioration in neurological function due to injury of the spinal cord or cauda equina (covering neurological segments C1 to S5) from non-progressive disease, including trauma, intervertebral disc herniation, transverse myelitis, bacterial infection, ischaemia or haematoma. Progressive neurological disorders and metastatic neoplastic disease are specifically excluded. Unilateral injury to single nerve roots (sciatica or brachialgia) is not included in the definition of spinal cord injury.

2.3 The SCIS at POWH

The POWH SCIS is the default service to provide immediate and continuing care for acute spinal cord injured patients from within SESLHD and its referral network within NSW. Referring Local Health Districts include:

- South Eastern Sydney
- Illawarra Shoalhaven
- Murrumbidgee
- Southern NSW
- South Western Sydney
- Sydney
- Australian Capital Territory (ACT)
- St Vincent's Health Network

2.4 Non-refusal policy at POWH

The SCIS at POWH is bound to accept any appropriate referral of acute spinal cord injury that is notified within 24 hours of the injury occurring. Referrals to POWH later than 24 hours after the onset of SCI will be accommodated at the earliest possible opportunity based on availability of appropriate resources within the hospital.

It is not expected that POWH will be mandated to accept all referrals of SCI, in some circumstances transfer of the patient may not be appropriate. In cases where a bed is not available at POWH SCIS, the spinal surgeon on call will liaise with RNSH for admission of the patient. Spinal cord injury, Non-refusal policy for

2.5 Appropriate Referral Type

The SCIS at POWH will accept patients with the following clinical characteristics:

- Age 16 years or older
- Sudden onset of neurological deficit affecting spinal segments from C1 to S5 (but not unilateral, single nerve root compromise)
- Presentation following trauma or presumed non-progressive pathology
- Has a reasonable expectation of surviving the acute injury and/or medical co-morbidities
- Spinal cord and spinal column imaging are not required prior to referral or transfer.

Patients with the following characteristics will not be accepted

- Age younger than 16 years (refer to Sydney Children's Hospital Network at Randwick or Westmead)
- Moribund patients or patients with such severe injury as to put their immediate survival in jeopardy
- Patients with documented or presumed progressive pathology affecting the spinal cord or cauda equina (demyelinating and degenerative conditions of the spinal cord, metastatic tumours or congenital disorders).

2.6 Network SCIS and Major Trauma Service SESLHD

The SCIS at POWH is networked with the Major Trauma Service at St George Hospital in SESLHD. The SCIS at POWH will be the primary referral centre for SCI patients referred to the Trauma Service at St George Hospital and will provide a non-refusal service to such patients. Referral of multisystem injured patients with SCI to St George Hospital is appropriate for triage directly to the most appropriate service (the Trauma Service or SCIS).

St George Trauma Hotline Use and Referral Procedure

2.7 NSW Aeromedical and Medical Retrieval Service (AMRS)

The need for physician-assisted transfer is determined by AMRS in consultation with the receiving SCIS and ICU. Transfer will generally require medically supervised transport which may be via AMRS. AMRS should be contacted on **1800 650 004** by the referring hospital to facilitate the medical retrieval of adults with an acute spinal cord injury.

3. RESPONSIBILITIES

3.1 Referring clinicians:

- Refer cases of acute spinal cord injury at the time of diagnosis without delay
- Seek advice from the SCIS at POWH if uncertain of the appropriateness of referral

- Ensure adequate spinal precautions are implemented
- Ensure adequate management of airway and ventilation in cases of cervical spinal cord injury
- Complete the Spinal Cord Injury Referral and Transfer form to accompany the patient
- Ensure that any imaging studies performed are sent with the patient
- Contact AMRS to arrange patient transfer.

3.2 Trauma Consultant/Fellow at St George Hospital:

- Assess referred cases for physiological stability
- May refer cases of multisystem trauma with SCI that require major intervention for non-spinal injuries to RNSH (evidence of motor and /or sensory deficit is required, paraesthesia alone is not sufficient evidence of spinal cord injury)
- May accept cases of multisystem trauma with life-threatening injuries for immediate trauma care at St George Hospital trauma service
- Refer patients with isolated SCI or SCI with associated minor injuries or who have been stabilised following multi-system injury to POWH SCIS.

3.3 Spinal Surgeon at POWH Spinal Cord Injury Service:

- Assess referred cases for suitability for transfer to the SCIS
- Discuss referral with the consultant on-duty in POWH ICU and the on-call POWH spinal rehabilitation specialist
- Use the POWH SCIS 'Non-Refusal' policy to accept urgent appropriate referrals or otherwise determine an appropriate time of patient transfer
- Establish suitable plan of management if delays in transfer are expected
- Liaise with the SCIS at Royal North Shore Hospital in the event that POWH does not have sufficient resources to accept the patient at the time of referral.

3.4 Receiving Spinal Surgical Team at POWH:

- Notify POWH Emergency Department (ED) of the expected arrival of the patient
- Arrange for a 'trauma call' on all cases of post-traumatic SCI
- Arrange for an appropriate in-patient bed for the patient
- Review the patient in the ED within 30 minutes of arrival at POWH
- Notify the Spinal Rehabilitation team of the arrival of the patient.

3.5 Receiving Spinal Rehabilitation Team at POWH:

- Review the patient within 12 hours of arrival at POWH.

4. PROCEDURE

See flow chart in Appendix 1.

5. DOCUMENTATION

Acute Spinal Cord Injury Referral and Transfer Form and Neurological Assessment Form (see Appendix 2).

6. MANAGEMENT

- Remove from spinal board
- Replace rigid collar with semi-rigid (Miami-J or Philadelphia) collar
- Keep nil by mouth
- Insert urinary catheter
- Maintain mean arterial blood pressure above 80mmHg where possible
- Controlled turn every two hours for pressure area care
- Monitor ventilation if there is injury at the level of the cervical spine:
    - Look for respiratory distress
    - Check oxygen saturation and/or serial arterial blood gasses
    - Measure vital capacity
    - Consider intubation and ventilation if oxygen saturation falls, CO_2 levels rise or vital capacity is falling.

7. AUDIT

Annual analysis of the Spinal Cord Injury Database held jointly between POWH and Royal North Shore Hospital. This database will capture all cases of spinal cord injury in NSW and allows analysis of referral times.

8. REFERENCES

1. NSW Ministry of Health 'Selected Specialty and Statewide Service Plans: NSW Trauma Services' (Number 6) December 2009.

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3. Non-Refusal Policy for Acute Spinal Cord Injury at POWH. October 2017.

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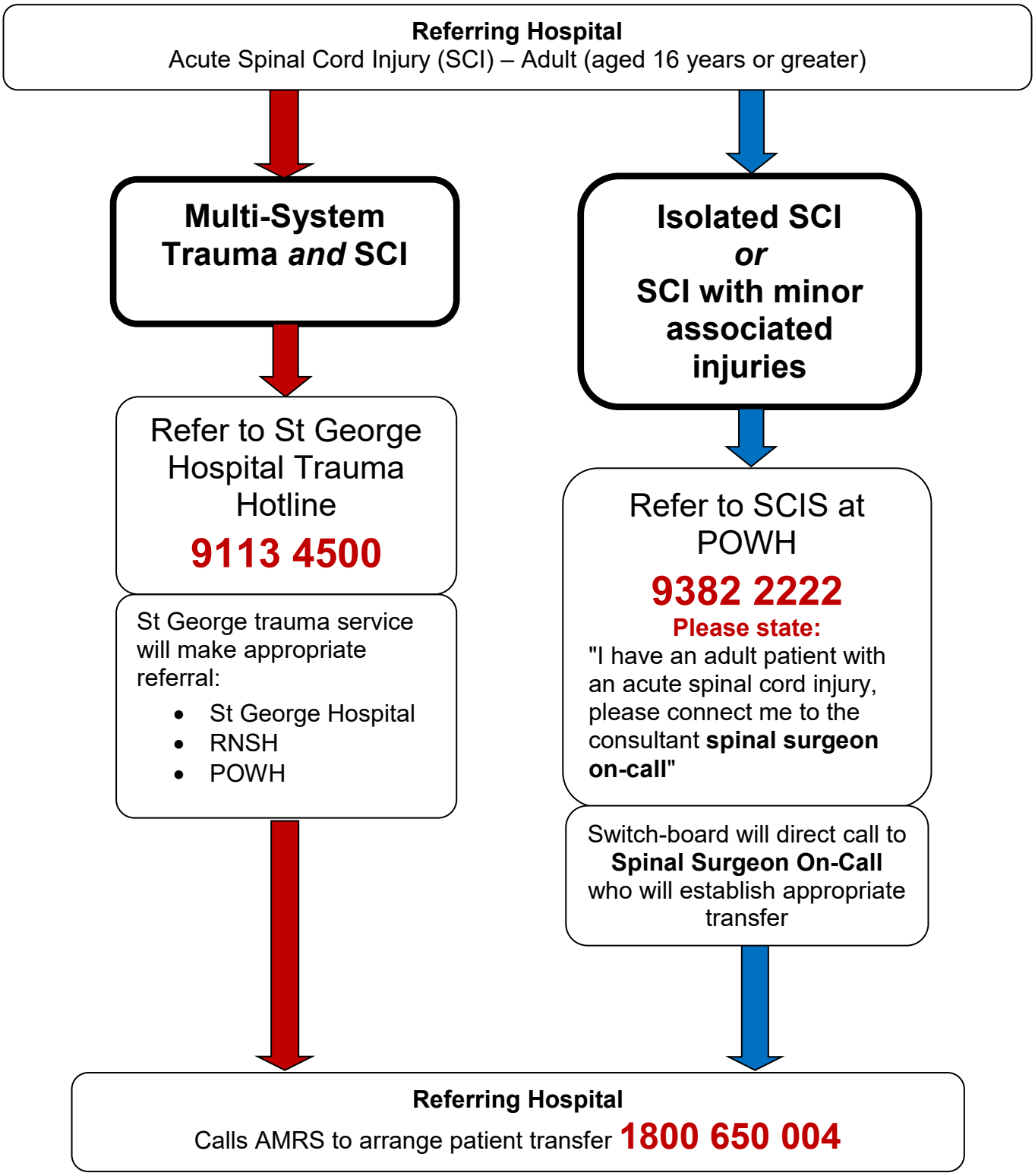
9. REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
May 2013	1	Revised by Leanne Horvat, Clinical Stream Nurse Manager, Medicine, Critical Care and Emergency
Sept 2013	2	Converted to procedure and re-formatted by Scarlette Acevedo, District Policy Officer
Sept 2013	2	Revised by Dr Ralph Stanford, Staff Specialist/Orthopaedic Surgeon, Prince of Wales Hospital and Leanne Horvat, Clinical Stream Nurse Manager, Medicine, Critical Care & Emergency
Nov 2013	3	Clinical & Quality Council provided requested further amendments to be made. Further amendments made by Leanne Horvat, Clinical Stream Nurse Manager, Medicine, Critical and Emergency Clinical Stream and Dr Ralph Stanford, Staff Specialist/Orthopaedic Surgeon POW.
Dec 2013	3	Finalised and re-formatted by Scarlette Acevedo, District Policy Officer.
Nov 2015	4	Revised by Liz Walter, District Trauma CNC, SESLHD
Dec 2015	4	Endorsed by: The Network Trauma Committee
January 2016	4	Endorsed by: Dr Tony Joseph, Director of Trauma, RNSH
February 2016	4	Endorsed by Executive Sponsor
June 2016	4	Approved by SESLHD CQC
November 2018	5	Review undertaken with no changes – approved by Executive Sponsor.
November 2018	5	Processed by Executive Services prior to publishing.
August 2021	6	Minor review by Jennifer Ings, District CNC Trauma & PARTY, SESLHD: formatting changes, new links and ASIA form updated to current version. Endorsed by Executive Sponsor.
September 2021	7	Reference Number 7 replaced. Approved by Executive Sponsor.

Appendix 1



Appendix 2

ACUTE SPINAL CORD INJURY REFERRAL AND TRANSFER FORM (v March 2016)

This form is to be completed prior to transfer of the person with a SCI to a spinal or trauma unit and given to the Retrieval or NSW Ambulance Service teams as part of the medical record and/or faxed to the receiving hospital.

Patient label

CONTACT DETAILS	**Patient name:**		**Age:**
	Referring Hospital:	**Referring Doctor:**	**Weight (kg):**
		Referring Doctor's contact number:	
		Referral date ____/_____/____ **Referral time** _____:____**AM/PM**	
	Hospital accepting referral:	**Doctor accepting referral:**	**Destination ward:**
		Accepting Doctor's contact number:	
SPINAL CORD INJURY	**Date of injury** _____/_____/_____	**Time of injury** _____:_____**AM/PM**	For guidance on sensory and motor level refer to attached neurological chart.
	Mechanism of Injury:		
	Approximate sensory level:	**Approximate motor level:**	
	Is peri-anal sensation present: YES ☐ **NO** ☐	**Is anal contraction present? YES** ☐ **NO** ☐	
	Results of Spinal X-Rays, CT or MRI Scan		
SPINAL PRECAUTIONS & STABILISATION	**Cervical collar** ☐ **YES** ☐ **NO** **Type of collar** _____	**Surgery** ☐ **YES** ☐ **NO** **Date of surgery** _____/_____/_____ **Type of surgery** _____	

Appendix 2

	Time of application of collar ___:____AM/PM		
AIRWAY *	☐ ETT in situ ☐ Correct ETT position	☐ ETT secure ☐ NGT/OGT if intubated or vomiting	☐ Mechanical vent.
BREATHING *	Resp rate_____SpO2_____ Vital Capacity _____(10-15mls/kg)	FiO2 _____lt/min ABGs - PaO2_____PaCO2_____pH_____	Chest tubes ☐ YES ☐ NO
CIRCULATION *	Pulse _____/min Blood Pressure ____/____ mmHG	Urine Output >0-5mls/kg/hr ☐ YES ☐ NO Arrhythmias	☐ IDC ☐ SPC Core Temp_____^{0}C
	☐ Peripheral IVs – number _____ ☐ Other IV / arterial access	Fluid resuscitation _____ Total fluids in_____ Litres.	
LEVEL OF CONSCIOUSNESS *	Level of consciousness at scene: GCS _____ Seizures: ☐ NO ☐ YES _____:_____AM/PM Current level of consciousness: GCS _____ _____:_____AM/PM		
ASSOCIATED INJURIES			
MEDICAL CONDITIONS			
SKIN PROTECTION	Has the patient been log rolled and skin checked 2nd hourly? ☐ YES ☐ NO Time of last log roll _____hours Time skin under cervical collar checked _____hours		
DOCUMENTATION FOR TRANSFER	☐ AMRS / NETS Transfer form * Relevant records: ☐ medical & ☐ nursing	☐ X-rays/CT/MRI scans - spinal column ☐ X-rays/CT/MRI scans-head/chest/abdo/pelvis/limbs	
NEXT OF KIN (NOK)	Notified ☐ YES ☐ NO NOK Name…… Ph ……		

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

Patient Name_____ Date/Time of Exam _____

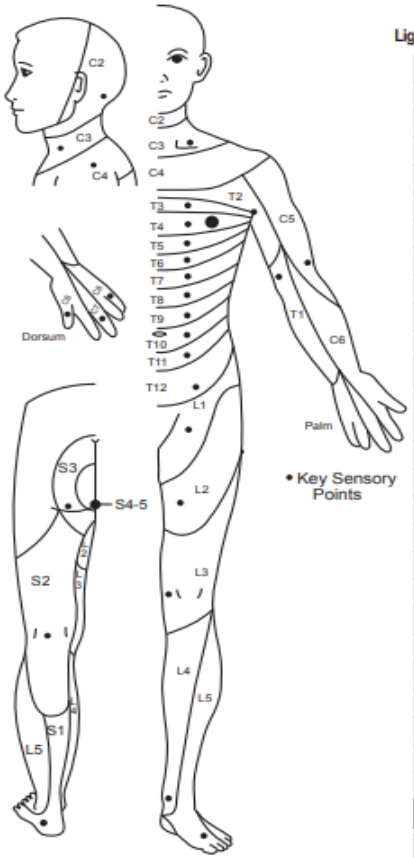
Examiner Name _____ Signature _____

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

UEL (Upper Extremity Left)

LEL (Lower Extremity Left)

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



• Key Sensory Points

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

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

(DAP) Deep Anal Pressure (Yes/No) ☐

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) ☐

(In injuries with absent motor OR sensory function in S4-5 only)

6. ZONE OF PARTIAL PRESERVATION (Most caudal levels with any innervation)

	R	L
SENSORY		
MOTOR		

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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

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.

ASIA
AMERICAN SPINAL INJURY ASSOCIATION

INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

ISCOS
INTERNATIONAL SPINAL CORD SOCIETY

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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".