Advanced Life Support Group
A charity dedicated to saving life by providing training

# TRAUMA SIMULATION 6

## Simulation focus – Spinal injury (Neurogenic shock – discussion)

### Expected outcomes

**Team Leader** - Guides the faculty helper through the initial ABCDE assessment (primary survey), direct team and lead care – taking over any skills as necessary. Identify that the child has suffered a significant cervical spine injury and that there is a high possibility of paralysis.

**Team/More experienced candidate** - Recognise that there is a lesion at C5 level based on the neurological findings and that breathing may be compromised given the level of the injury.

### History

**Emergency staff**

12-year-old named Jessie is brought in by a private ambulance crew from an equine cross-country event. They have been thrown from a 16 hands horse and landed on their head. Appropriate protective equipment was worn. Jessie is complaining of not being able to move her hands.

**Ward staff**

12-year-old named Jessie is brought in by a private ambulance crew from an equine cross-country event to the ward, they were unsure where they were heading. They have been thrown from a 16 hands horse and landed on their head. Appropriate protective equipment was worn. Jessie is complaining of not being able to move her hands.

### Immediately apparent

Please ensure the prompt card with global overview is placed on the manikin for the start of the sim.

*As you approach the child you notice she looks scared and is lying very still.*

### Clinical course *(to be given as the simulation progresses)*

| Assess | Features | Action | Key treatment points |
|---|---|---|---|
| <c> | No signs of external bleeding | Assess | |
| A | Talking and complaining of severe neck pain | MILS<br>Assess | **Continue MILS**<br>Call for help – trauma team |
| B | **RR 20, $SpO_2$ 99%** | Consider oxygen | Oxygen use to be discussed |
| C | **HR 100, CRT 2, BP 110/60** | Look for potential sources of bleeding | Attach cardiac monitor<br>**Establish IV access**<br>Bloods |
| D | GCS 15, PEARL, **BM 6.7** | | |
| E | **Tender C5**, neurological exam would reveal numbness and loss of power below C5 | Recognises cervical spine injury<br>20º tilt required to assess spine | **20º tilt to assess spine**<br>Does not attempt to clear the cervical spine |


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## Reassessment

As the candidate starts their reassessment Jessie complains that she is struggling to breathe.

| Assess | Features | Action | Key treatment points |
|---|---|---|---|
| A | Talks in short sentences, complaining feels hard to breathe | MILS<br>MILS discontinued when blocks and tape fitted | **MILS continued** |
| B | **RR 24,**<br>**SpO2 99% (15L), 92% (air)**<br>Symmetrical air entry, diaphragmatic breathing | Recognise deterioration in breathing and the potential need for respiratory support | Oxygen at 15L |
| C | **HR 80, CRT 2, BP 82/60** | Recognise that the "**C**" numbers are not correct for a trauma patient and ask for assistance | **Ensure senior paediatric trauma help is on the way** |
| D | **GCS 14** (E4V4M6), child is agitated, **BM 8.1** | | |
| E | **Temp 36.9**<br>Consideration of multilevel spinal injury | | Discussion of CT versus MRI for child |

| NB | |
|---|---|
| | • **Discuss 20º tilt**<br>• **A more able candidate should consider on reassessment that the child is showing signs of neurogenic shock and breathing irregularities due to a C5 unstable.**<br>• **They should ensure the child has their breathing supported and drug therapies are commenced to support the neurogenic shock.** |

## Debrief

Using the learning conversation, discuss the technical and non-technical elements of the simulation.

## Assessment

This station makes up part of the continuous assessment process, therefore candidates need to know whether they are meeting the standard.

At the end give the opportunity for candidates to ask questions, answer these and then summarise the key points.


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## Props to print and laminate

### Trauma 6 - Global overview (to be placed on SIM manikin)

**The child looks scared.**

**She is lying very still.**

## Faculty helper information – Trauma 6

When candidate requests information regarding observations please give the following in “real-time” (e.g., wait for blood pressure to cycle, saturation trace to be achieved). If key treatment points are not undertaken consider a “prompt” that would be visible in a child.

| Assess | Observation | Example prompt |
|---|---|---|
| <c> | No signs of external bleeding | Assess |
| A | Talking and complaining of severe neck pain | “She says her neck is hurting really badly” |
| B | **RR 20, $SpO_2$ 99%** | “Does she need anything to help her breathing?” |
| C | **HR 100, CRT 2, BP 110/60** | “Do you want any monitoring?”<br>“Is it just her neck you are worried about?”<br>“Does she need any medication?” |
| D | GCS 15, PEARL, **BM 6.7** | “Are there any tests you want?” |
| E | **Tender C5**, neurological exam would reveal numbness and loss of power below C5 | If candidate wants to assess the c spine - “okay how should we do this”<br>When you do this you find “numbness and loss of power below C5"<br>“She says she can’t move her fingers” |

## Reassessment – Trauma 6

If candidate wants to assess the c spine - “okay how should we do this”
When you do this you find “numbness and loss of power below C5"

| Assess | Observation | Example prompt |
|---|---|---|
| A | Talks in short sentences, complaining feels hard to breathe | “She looks like she’s struggling with her breathing” |
| B | **RR 24,**<br>**SpO2 99% (15L), 92% (air)**<br>Symmetrical air entry, diaphragmatic breathing | “Why isn’t she able to breathe very well?” |
| C | **HR 80, CRT 2, BP 82/60** | “Why is her heart rate dropping?” |
| D | **GCS 14** (E4V4M6), child is agitated, **BM 8.1** | “She’s a bit confused compared to how she was” |
| E | **Temp 36.9**<br>Consideration of multilevel spinal injury | |


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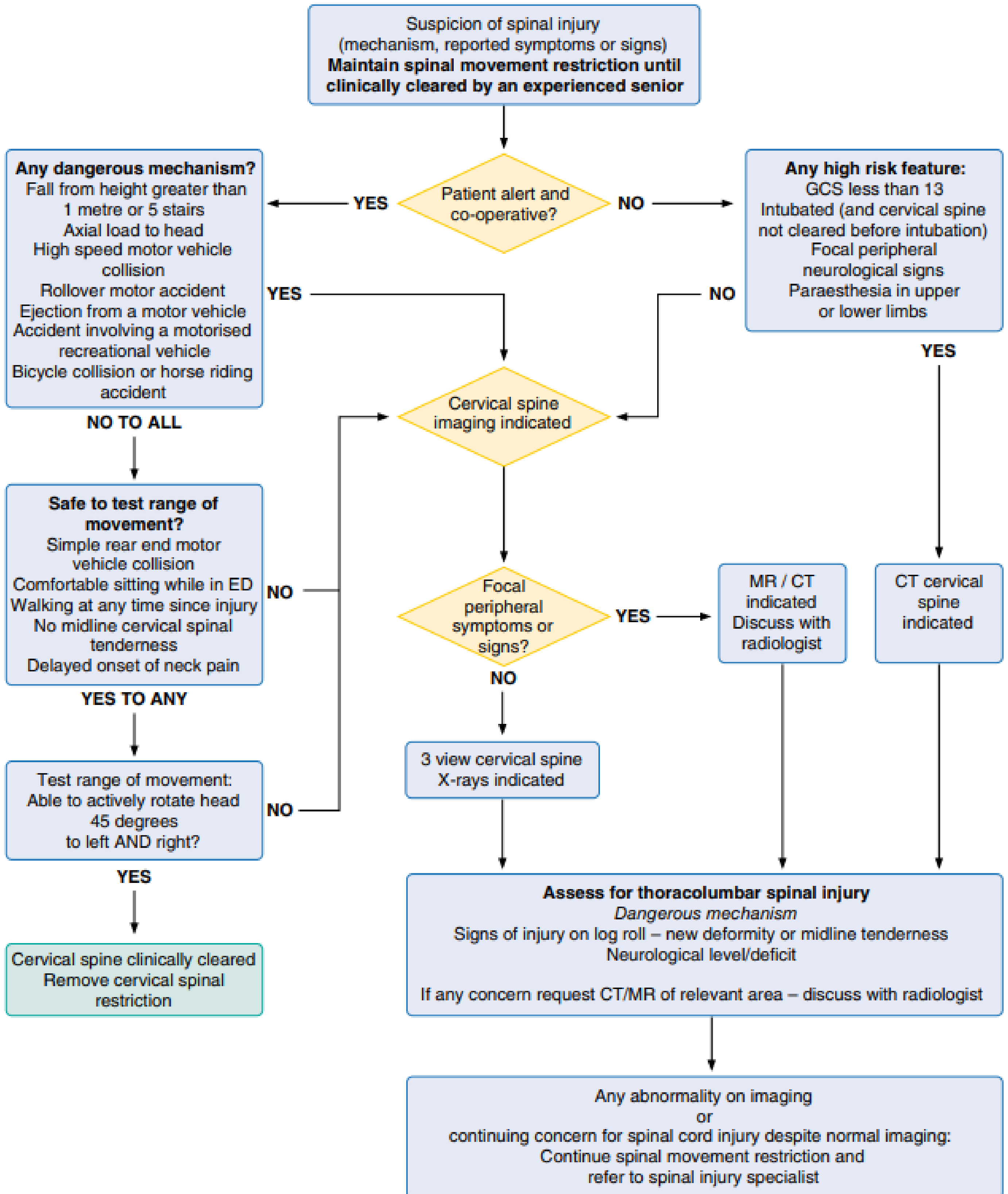
# APLS: Spinal





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# APLS: spinal dermatomes

**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)

**LEFT** — SENSORY KEY SENSORY POINTS: Light Touch (LTL), Pin Prick (PPL); MOTOR KEY MUSCLES

Sensory levels: C2, C3, C4, C5, C6, C7, C8, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, L1, L2, L3, L4, L5, S1, S2, S3, S4-5

**UER** (Upper Extremity Right) / **UEL** (Upper Extremity Left)

- C5 Elbow flexors
- C6 Wrist extensors
- C7 Elbow extensors
- C8 Finger flexors
- T1 Finger abductors (little finger)

**LER** (Lower Extremity Right) / **LEL** (Lower Extremity Left)

- L2 Hip flexors
- L3 Knee extensors
- L4 Ankle dorsiflexors
- L5 Long toe extensors
- S1 Ankle plantar flexors

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

Dermatome diagram labels: C2, C3, C4, C5, C6, C8, T1, T2–T12, L1, L2, L3, L4, L5, S1, S2, S3, S4-5, Dorsum, Palm, • 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)

RIGHT TOTALS (MAXIMUM) (50) (56) (56) | LEFT TOTALS (MAXIMUM) (56) (56) (50)

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

## Sensory Grading

**0** = Absent **1** = Altered, either decreased/impaired sensation or hypersensitivity
**2** = Normal **NT** = Not testable
**0*, 1*, NT*** = Non-SCI condition present *

*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<br>**Elbow**: Supination | C5 |
| **Elbow**: Pronation<br>**Wrist**: Flexion | C6 |
| **Finger**: Flexion at proximal joint, extension<br>**Thumb**: Flexion, extension and abduction in plane of thumb | C7 |
| **Finger**: Flexion at MCP joint<br>**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<br>**Knee**: Flexion<br>**Ankle**: Inversion and eversion<br>**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.

INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

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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".*



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