Rehabilitation of Orthopaedic Spinal Cord Injury Patients

Sue Paddison
Lead Clinical Specialist Physiotherapist
London Spinal Cord Injury Centre
Royal National Orthopaedic Hospital Trust
Main Objectives

• Identify key areas to identify on assessment of an acute spinal cord injured individual.

• Understanding stability in relation to moving and handling

• Explain terminology and prognostic implications of incomplete and complete spinal cord injury.

• To identify key treatment objectives for management of the spinal cord injured person

• The importance of ongoing reassessment and implications for treatment planning.
ATLS guidelines

- Aim is to maintain spinal alignment, ensure “spinal protection”

- Avoid further damage or insult to the cord eg surgery may be required to relieve cord compression, evacuate bony fragments etc

- Maximise perfusion to SC (MAP monitor)

- Liaise with Orthopaedic/Neurosurgeon in charge

- ATLS guidelines ‘MASCIP/Huntleigh moving and handling guidelines’ available online
Initial Management

- Unstable spinal injuries
- Respiratory assessment
- Neurological Assessment
- CVS
- Skin
- Bladder and Bowel
- Joint Care
- Functional expectations
- Psychological wellbeing
- Pain
Spinal Shock

- Definitions can be varied

- Spinal shock is a body reaction by the central nervous system to a sudden major change. This is usually a Spinal Cord Injury.

- “depressed spinal reflexes caudal to the SCI”

- Severity of spinal shock can be related to severity of the cord injury itself

- It is a temporary state and will resolve with time. From hours to weeks. However there are always exceptions to the rule
Neurogenic Shock

• This a sudden disruption of signals that maintain autonomic nervous system control over vasoconstriction leading to hypotension, this occurs after an acute spinal cord injury that blocks sympathetic activity.

• Neurogenic shock should be suspected if there is a cervical or high thoracic injury with no signs of fluid loss.
Causes of Respiratory Compromise

1. Ascending neurology
   - Loss of inspiratory muscle activity
   - Loss of expiratory muscle activity
   - Loss of effective cough
   - Secretion retention
   - Increased risk of infection

2. Reduced lung volume
   - Decreased chest wall mobility
   - Loss of lung compliance
   - Increased risk of atelectasis/consolidation

3. Fatigue

4. Type 2 Resp Failure

Chest trauma → PE → Reduced lung volume → Decreased chest wall mobility → Loss of lung compliance → Increased risk of atelectasis/consolidation → Fatigue

Loss of effective cough → Secretion retention → Increased risk of infection
Why SCI is different.....

• Neuromuscular injury - level and completeness of injury is different for every patient.
• WOB less in supine, T6 and above. Check FVC supine and sitting and compare.
• Record FVC – TV 10mls/kg. If FVC < 1litre vent support likely to be required.
• Hypersecretion increases if injury above T6
• Ineffective or absent cough T6 and above
Neurological Assessment

- ISNCSCI (ASIA Examination)
- AIS
- Dermatomes From C2 incl S 4,5
- DAP
- Myotomes 10+10 (C5 – T1 and L2-S1)
- VAC
- Specific points
- Method
- Variables/NT
**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 identical inhibiting factors (i.e., pain, clonus) were not present
NT = not testable (e.g., due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of > 50% of the normal range of motion)

**Sensory Grading**

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

**Non Key Muscle Functions (optional)**

May be used to assign a motor level to differentiate AIS B vs. C.

**Movement**

**Root level**

Shoulder: Flexion, extension, abduction, adduction, internal and external rotation
Elbow: Supination
Wrist: Flexion
Finger: Flexion at proximal joint, extension
Thumb: Extension and adduction in plane of thumb
Finger: Flexion at MCP joint
Thumb: Opposition, adduction and abduction perpendicular to palm
Finger: Abduction of the index finger
Hip: Adduction
Hip: External rotation
Hip: Extension, abduction, internal rotation
Knee: Flexion
Ankle: Inversion and eversion
Toe: MP and P extension
Hallux and Toe: DP and PP flexion and abduction
Hallux: Abduction

**ASIA Impairment Scale (AIS)**

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

B = Sensory Incomplete
Sensory but no 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 below the neurological level**, and more than half of key muscle functions below the neurological level of injury (NLI) have a muscle grade less than 3 (Grades 0-2)

D = Motor Incomplete
Motor function is preserved below the neurological level**, and at least half (but or more) of key muscle functions below the NLI have a muscle grade less than 3

E = Normal
If sensation and motor function as tested with the IASCSO are graded as normal in all segments, and the patient had no deficit, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

** For an individual to receive a grade of C, D, or E, motor incomplete status, they must have either (1) voluntary anal sphincter contraction or (2) sacral sensory sparing with sparing of motor function more than three levels below the motor level for that side of the body. The International Standards for Neurological Classification of Spinal Cord Injury at this stage above even non-key muscle function more than 3 levels below the motor level to be used in determining motor incomplete status (AIS B vs. C).**

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

**Steps in Classification**

1. Determine sensory levels for right and left sides.
   - This 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 active 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 key muscle 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) above respectively.
   - The NLI is the most caudal of the sensory and motor levels determined in steps 1 and 2.

4. Determine whether the injury is Complete or Incomplete.
   - Is 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...
AIS= ASIA Impairment Scale

• A= Complete (consider ZPP)
• B= Sensory incomplete
• C= Motor incomplete (a bit)
• D= Motor Incomplete (more)
• E= Normal but had deficits previously
Neurological

- Level of SCI
- Complete or incomplete
- Syndrome
- Functional level to predict functional outcome
Rehabilitation Aims

TEAM:
- Management of abnormal tone.
- Manage Pain
- Maintain joint range
- Manage posture & seating
- Neuro-facilitation/strengthen.
- CV Fitness
- Use of assistive technologies.
- FES
- Robotic assisted movement
- Dynamic splinting
New Technologies
Exoskeletons/ BWSTT
Resources

- ISCOS www.iscos.org.uk (Elearnsci.org)
- ASIA www.asia-spinalinjury.org
- FES www.restorative-therapies.com/healthprofessionals
- International Network of SCI Physiotherapists www.scipt.org

S Paddison 2015