



Government of **Western Australia**
Department of **Health**

Functional Outcomes following Spinal Cord Injury

A Resource for Health Service Providers

WA State Spinal Injury Unit

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This document has been developed to provide health service providers with a sound understanding of the functional expectations following Spinal Cord Injury (SCI) relating to neurological level of injury.

Key Points

- The functional outcome of a SCI depends upon the neurological level and severity of the damage to the spinal cord.
- The American Spinal Injury Association (ASIA) assessment is the International Standard for the Neurological Classification of Spinal Cord Injury.
- An international data sets has been developed based on ASIA scores to allow international comparisons of levels and types of SCI.
- The functional expectations outlined in this document should only be used as a guide only as the factors listed must be considered when predicting possible functional outcome following a SCI including
 - Completeness of injury
 - Patient age
 - Pre-injury level of function and health
 - Past medical history and co-morbidities
 - Motivation and psychosocial well-being
 - Concurrent injuries and illness

Refer to the [Anatomy and Physiology of Spinal Cord Injury section](#) for further information to supplement this document, including information related to the Neurological Classification of Spinal Cord Injury.

Introduction

Functional expectations and prognosis following a SCI is dependent upon many individualised factors:

- Neurological level of SCI
- Severity of SCI (complete/incomplete, ASIA Impairment Scale)
- Patient-specific factors
 - o Age, health and pre-morbid fitness/function
 - o Past medical history / co-morbidities
 - o Associated injuries
 - o Secondary complications
 - o Motivation and psychosocial well-being

A full neurological examination will be conducted by an experienced clinician as soon as possible following an acute SCI to determine the neurological level and severity of the SCI. This examination is also vital to determine a baseline of neurological function, from which change over time can be evaluated in terms of neurological recovery compared to deterioration. The change in neurological function over time following a SCI is a key determinant of both management and prognosis.

Neurological function is observed daily in the acute setting to monitor for any deterioration. This should continue until the neurological level is deemed stable and not worsening. Thereafter, neurological examination should be conducted as clinically indicated e.g if the patient reports alteration in function, the patient has a fall, post surgical intervention etc. Any alteration in neurological function requires urgent review by the patient's primary spinal physician.

Expected functional outcomes following a complete SCI

The table below outlines the estimated functional outcomes – including the ability to completed activities of daily living (ADLs), following a complete SCI, specific to the neurological level of injury.

Level of SCI Key Muscle Groups	Expected Functional Outcomes for Complete Spinal Cord Injury
<i>Note: Personal Care and ADL's encompass bladder and bowel management, showering, grooming and dressing, feeding</i>	
C1-3 <u>Neck Muscles</u> Sternocleidomastoid Paraspinal Muscles Accessory muscles	<ul style="list-style-type: none"> • Physical dependence for personal care and ADLs • Physical dependence for mobility (hoist transfers) and pressure care • Often require ventilator to breathe due to diaphragm paralysis • Able to operate an electric wheelchair with head/chin control • Able to control aspects of environment through assistive technology
C4 <u>Neck/Shoulder Muscle</u> Upper Trapezius <u>Respiratory Muscle</u> Diaphragm (C3-5)	<ul style="list-style-type: none"> • Physical dependence for personal care and ADLs • Physical dependence for mobility (hoist transfers) and pressure care • Able to breathe without a ventilator • Able to operate an electric wheelchair with head/chin control • Able to control aspects of environment through assistive technology
C5 <u>Shoulder Muscles</u> Deltoid <u>Elbow Muscles</u> Biceps Brachialis Brachioradialis	<ul style="list-style-type: none"> • Can assist with personal care and ADLs • Independently able to complete some physical tasks such as feeding using assistive devices e.g. splints • Can assist with bed mobility and hoist transfers • Able to operate an electric wheelchair with hand control; may be able to propel a MWC on flat surfaces indoors for short distances
C6 <u>Shoulder Muscles</u> Pectoralis Major (partial) Latissimus Dorsi Serratus Anterior <u>Wrist Muscles</u> Radial Wrist Extensors	<ul style="list-style-type: none"> • Potential for physical independence with some personal care and ADLs tasks (e.g. self-catheterisation for bladder management) with assistive devices & splints, potential for independence with bowel care • Presence of wrist extension provides potential for functional grasp through tenodesis • Potential to be independent with bed mobility and slide-board transfers • Capacity to use a manual wheelchair - may require electric wheelchair for uneven ground, slopes and longer distances • Potential to drive with vehicle modifications • Potential to live independently with support/care

C7 <u>Elbow Muscles</u> Triceps <u>Wrist/Hand Muscles</u> Wrist Flexors Long Finger Extensors	<ul style="list-style-type: none"> • Ability to be physically independent with personal care and ADLs • Independent with bed mobility • Can transfer independently with potential to use lift transfer • Greater function use of hands including stronger grasp and increased dexterity therefore less reliant on splints • Able to use a manual wheelchair • Able to drive with vehicle modifications • Potential to live independently with support • Require assistive equipment
C8/T1 <u>Hand Muscles</u> Finger Flexors	<ul style="list-style-type: none"> • As for C7 with greater dexterity of hand function • Do not require splints to support hand function
T1-6 <u>Trunk Muscles</u> Upper Intercostals Thoracic Extensors	<ul style="list-style-type: none"> • Full function of upper limbs and hands means physical independence for personal care and ADLs • Able to lift transfer independently • May require assistive equipment due to lack of trunk stability • Independent with manual wheelchair • Able to drive with hand controls • Able to live independently
T7-12 <u>Trunk Muscles</u> Abdominals Lumbar Extensors Lower Intercostals	<ul style="list-style-type: none"> • As for T1-T6 with greater preservation of trunk function, improving balance and therefore able to complete more challenging tasks e.g. 180 degree transfers with greater ease
L1-S5 <u>Lower Limb Muscles</u> L1/2 Hip Flexors L3 Knee Extensors L4 Ankle Dorsiflexors L5 Long Toe Extensors S1/2 Ankle Plantarflexors	<ul style="list-style-type: none"> • Independent for personal care and ADLs • Able to lift transfer independently with potential to stand transfer • Independent with manual wheelchair with potential to be able to ambulate with the aid of lower limb orthoses (such as callipers or AFOs) and a walking aid • Able to drive with hand controls • Able to live independently

Expected functional outcomes following an incomplete SCI

An incomplete SCI is an injury involving some preservation of motor and/or sensory function in the lowest sacral segment of the spinal cord, indicating that there is some preservation of motor and/or sensory function below the level of the lesion.

The functional expectations following an incomplete SCI are highly dependent upon the degree of preserved function and a multitude of individualised factors. Overall, it is far more complex to determine the expected functional outcome of an individual with an acute incomplete SCI.

Useful resources

The Consortium for Spinal Cord Medicine have several clinical practice guidelines for health care professionals and companion consumer guides funded and administered by Paralyzed Veterans of America. These guidelines are focussed on evidence-based clinical practice and include recommendations to health care providers based on current research findings that have been graded for their scientific strength and validity.

- Outcomes following traumatic spinal cord injury: Clinical Practice Guidelines for Health Care Professionals.
<http://www.pva.org/site/apps/ka/ec/basket.asp?c=ajlRK9NJLcJ2E&b=6423003&en=9iLHKUMzH8JQL4OCL7JNL1PNJmLSJ0NELgLTKbPUIwH>
- Consortium for Spinal Cord Medicine – Expected Outcomes: What you should know. A Guide for People with SCI.
 - C1-3 http://www.scicpg.org/cpg_cons_pdf/OC1_3.pdf
 - C4 http://www.scicpg.org/cpg_cons_pdf/OC4.pdf
 - C5 http://www.scicpg.org/cpg_cons_pdf/OC5.pdf
 - C6 http://www.scicpg.org/cpg_cons_pdf/OC6.pdf
 - C7-8 http://www.scicpg.org/cpg_cons_pdf/OC78.pdf
 - T1-9 http://www.scicpg.org/cpg_cons_pdf/OT1_9.pdf
 - T10-L1 http://www.scicpg.org/cpg_cons_pdf/OTL1.pdf
 - L2-S5 http://www.scicpg.org/cpg_cons_pdf/OL2_S5.pdf

American Spinal Injury Association (ASIA) - International Standard for the Neurological Classification of Spinal Cord Injury (refer to website for links to examination guidelines, assessment forms, ASIA online learning centre) www.asia-spinalinjury.org/

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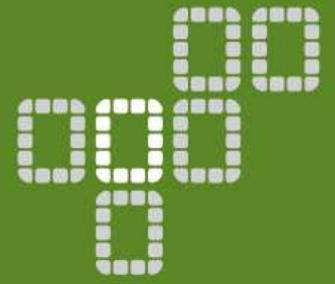
Christine Rimmer, Senior Physiotherapist, State Spinal Unit, Royal Perth Hospital

Contributors

- Nicky Hunter, Acting Senior Occupational Therapist, State Spinal Unit, Royal Perth Hospital
- Carly Hartshorn, Clinical Nurse Consultant Spinal Urology, State Spinal Unit, Royal Perth Hospital
- Claire Cooling, Physiotherapist, Rehabilitation in the Home, SMHS

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