



Special Considerations in Central Cord Syndrome

Current Concepts in Spinal Cord Injury Rehabilitation

September 15, 2018

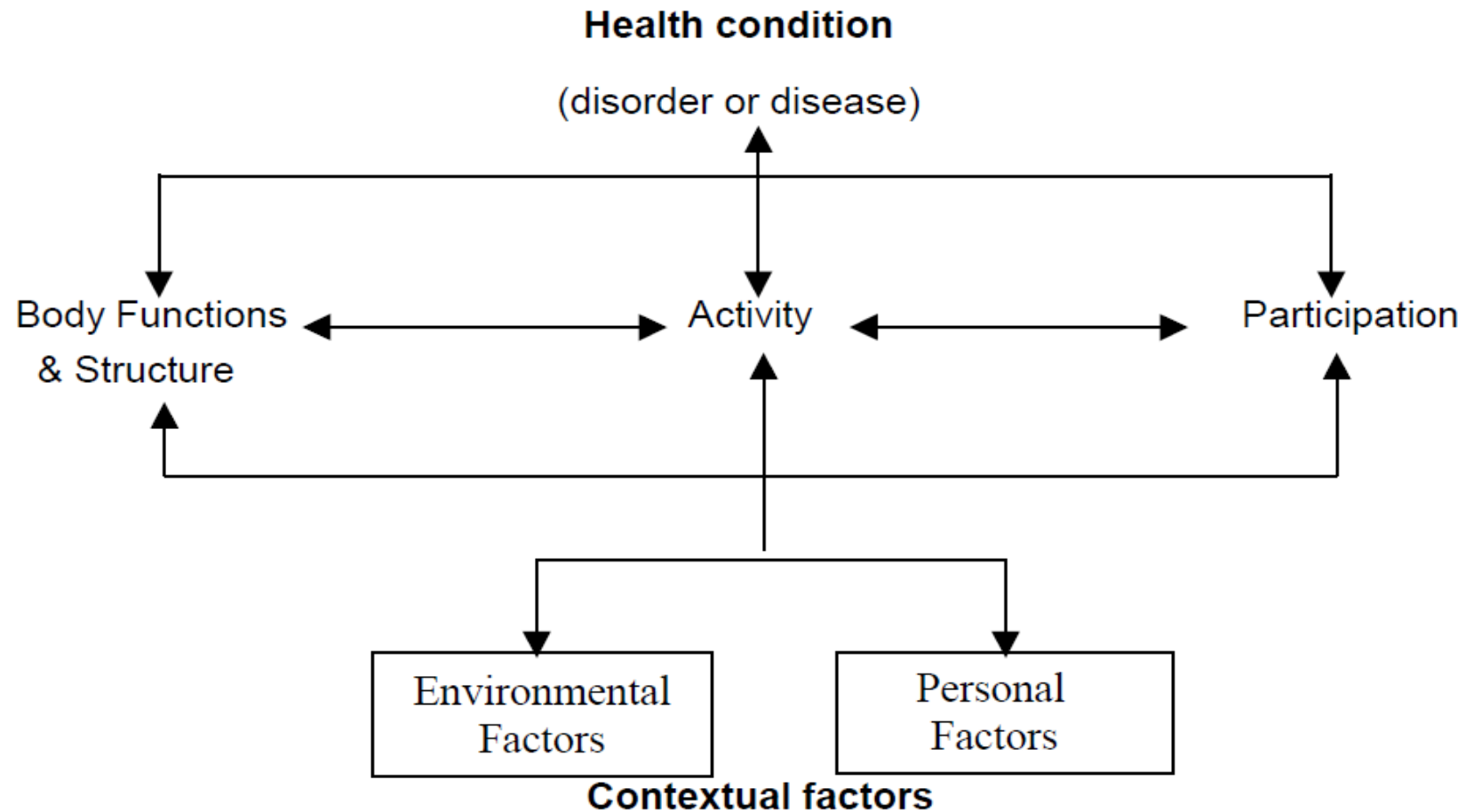
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Learning Objectives

- I. Understand pathophysiology and mechanisms of injury associated with central cord syndrome
- II. Review anatomy and somatotopic organization of spinal cord contributing to specific presentation of central cord syndrome
- III. Recognize the clinical presentation of a client with central cord syndrome
- IV. Identify the skills, considerations, and treatment strategies for functional impairments resulting from central cord injury
- V. Select appropriate objective measures for a client with central cord syndrome

Framework for Health & Disability, WHO ICF



American Spinal Injury Association Impairment Scale

- **AIS A- COMPLETE**

No motor or sensory function is preserved S4-S5

- **AIS B-INCOMPLETE**

Sensory function is preserved below level of injury (including S4-5)

- **AIS C-INCOMPLETE**

At least ½ key muscles below level of injury <3/5

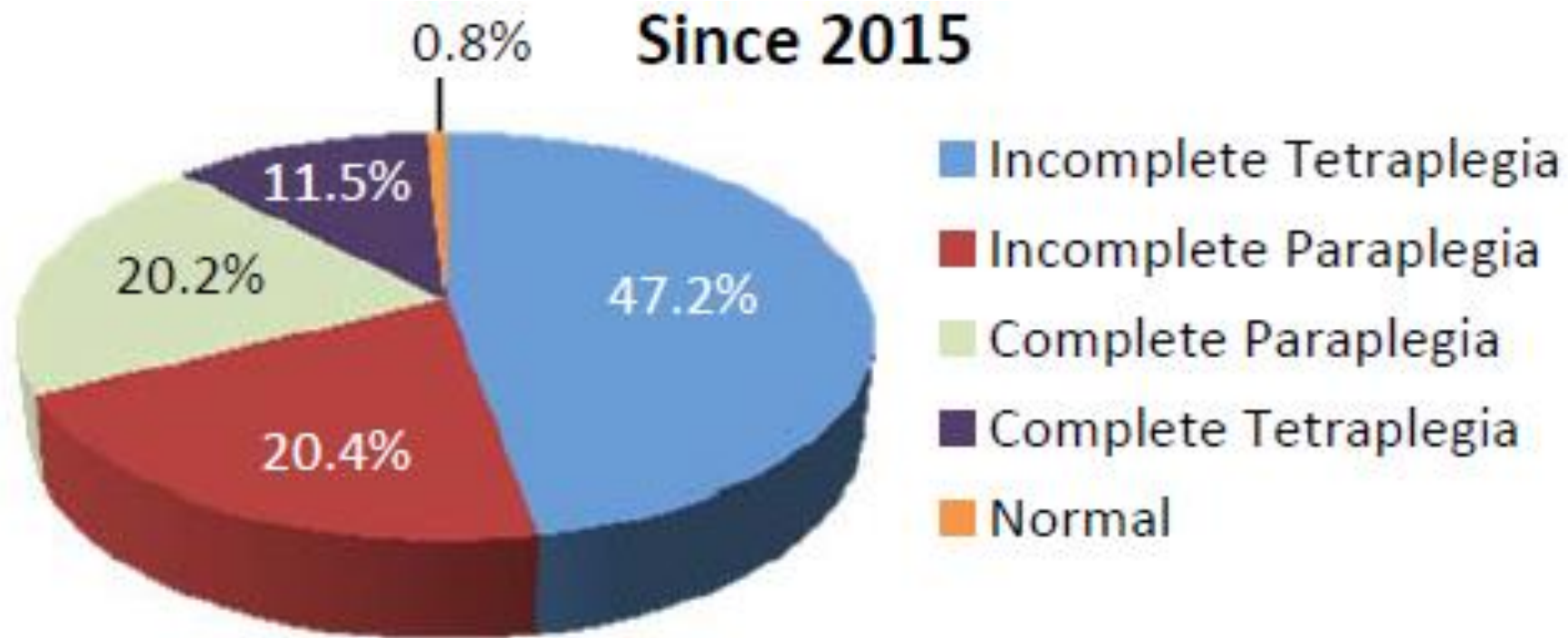
- **AIS D-INCOMPLETE**

At least ½ key muscles below level of injury >3/5

- **AIS E-NORMAL**

Motor and sensory function is normal

Incidence of Neurological Levels



<https://www.nscisc.uab.edu>

Clinical Classifications of Incomplete SCI

- Anterior Cord Syndrome
- Brown-Sequard Syndrome
- Posterior Cord Syndrome
- Central Cord Syndrome
 - 40-70% of cases of incomplete injury₁₃

Demographics of Central Cord Syndrome

- Male
- 50 years or older
 - On average, 15 years older than patients with other traumatic cord injuries
- Most frequent level of injury: C5-C6
- Mechanisms_{2,13,15}
 - Young patients may develop injuries from high velocity trauma that leads to fracture or subluxation
 - Injury is not always associated with fracture or spinal instability, particularly in older patients
 - Hyperextension complicated by congenital or degenerative narrowing of the spinal canal
 - Most common traumatic mechanisms: falls, car accidents

Pathophysiology of Injury

- Pathophysiology
 - Anterior and posterior compression of the spinal cord results from hyperextension
 - Posterior: ligamentum flavum
 - Anterior: underlying spondylosis or osteolytic lesions₃
 - Compressive forces lead to hemorrhage, edema, or ischemia which damages the most central aspects of the cord due to increased pressure_{3,7}

Ascending Tracts

- Somatosensory Pathways
 - Dorsal/posterior columns
 - Spinothalamic tracts
 - Spinocerebellar tracts
- Somatotopic Organization
- Cervical tracts are central

Descending Tracts

- Motor tracts
 - **Corticospinal tracts**
(voluntary movement)
 - Subconscious tracts
- Cervical tracts are central

Clinical Presentation of Central Cord Syndrome

- Most severe motor weakness in upper extremities
- Less motor impairment in lower extremities
- Sensory impairment more variable
 - “Cape-like” distribution of impairment
- Upper motor neuron signs (including increased tone)
- Bowel and bladder involvement

Prognosis

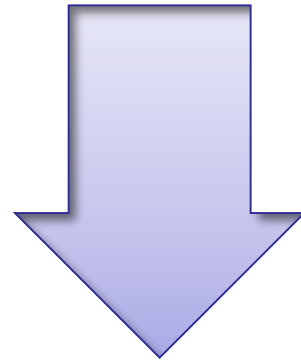
- Most recover some neurological function; ability to walk is recovered in most cases
 - Spontaneous recovery
 - Better outcomes: early medical intervention, younger patients, higher initial AIS score
 - Traumatic mechanisms have better prognosis¹⁴
- Recovery of balance and ambulation precedes UE recovery
- Return of bowel and bladder function is variable
- Timelines are variable based on extent of injury, but mostly a favorable prognosis

Medical Management

- Evaluation
 - Imaging (CT, XRAY, MRI)
- Treatment_{2,15}
 - Corticosteroids to suppress edema
 - Immobilization
 - Surgical
 - Conservative
 - Interdisciplinary rehabilitation

Considerations with Central Cord Syndrome

- Impaired circulatory system
- Neurogenic bladder & bowel
- Pulmonary deficits
- Sensory deficits, pain
- Muscle weakness
- Balance deficits



Limits function in daily tasks, activities, and participation in life roles

Impaired Circulatory System

- Orthostatic hypotension
 - Impaired autonomic regulation
 - Treatment: slow change of position, abdominal binder, compression stockings
- Edema
 - Hand edema due to dependent position
 - Treatment: activity, ROM, positioning, compression gloves, modalities

Neurogenic Bladder & Bowel

- Recovery is variable
- RN and physician collaboration to manage long term deficits

Bladder management

- Indwelling foley catheter
- Intermittent cath
- Suprapubic cath

Bowel management

- Diet
- Medication
- Bowel training program
- Ostomy

Pulmonary Deficits

Lesions C4-T12

- Weakness of intercostals, lats & abdominal muscles

Postural changes due to trunk weakness

- Impaired breathing

Treatment

- Consult Respiratory Therapy
- Trunk strengthening



Sensory Deficits & Pain

- Pain, temperature, light touch, deep pressure *may* be impaired
- LE Proprioception deficits → mobility impairments
- Neuropathic pain
 - Paresthesia of hands
 - Education to prevent injury
 - Involve physician for medical management
 - Modalities

Upper Extremity Muscle Weakness

- Shoulder and hand most affected
- Unable to reach, position arm in space, grasp, and manipulate objects.
- Significant deficits in self-care
- Prioritize goals with patient, such as eating, grooming, toileting
- **Use compensatory techniques & adaptive equipment *while* continuing to remediate the weak muscle groups**

Intervention for Musculoskeletal Impairments

- Remediation of UE weakness
 - Focus: shoulder abduction, shoulder flexion, biceps, triceps, wrist extension, grasp
 - Gravity eliminated position
 - Unweighting technology (Armeo)
 - Electrical stimulation
- Cervical management after immobilization
 - Regain cervical and postural stability
 - Maximize available cervical motion
- Shoulder subluxation positioning
 - cuff, sling, w/c tray, taping



UE Outcome Measures

- Grip strength
- CAHAI (Cherokee Arm & Hand Activity Inventory)
- 9-Hole Peg Test
- Box and Block Test
- Action Research Arm Test
- Fugl-Meyer Test
- Jebsen Taylor Hand Test
- Wolf Motor Function Test

Self–Care: Eating and Feeding

- Skills
 - Proximal support while reaching (to food, to mouth)
 - Manipulation of utensil
- Considerations
 - Dysphagia
 - Head positioning
- Treatment Strategies
 - Consult SLP, OT
 - Compensate for proximal weakness: position UE on table, use of mobile arm support
 - Compensate for distal weakness: universal cuff, built up handles

Self-Care: Grooming and Hygiene

- Skills
 - Proximal stability during prolonged reaching
 - Bilateral hand manipulation of objects
- Considerations
 - Prioritize oral hygiene to prevent pneumonia
 - Head positioning
 - Skin breakdown, moisture around cervical collar
- Treatment Interventions
 - Consult OT
 - Adaptive equipment
 - Positioning for sustained activity



Self-Care: Toileting

- Skills
 - Clothing management, hygiene (hand function)
 - Balance
- Considerations
 - Neurogenic bowel & bladder equipment?
 - Contextual Factors: personal, environment
- Treatment Strategies
 - Disposable wipes
 - Compensate with easy clothing, loops, Velcro
 - Schedule bathing after bowel program

Mobility Skills

- Skills
 - Bed mobility
 - Sit <> supine
 - Sit <> stand
 - Floor <> stand
- Considerations
 - Limited UE support
- Treatment Strategies
 - Core strengthening to compensate for UE deficits
 - Functional strengthening
- Outcome measures
 - 5-times Sit to Stand (5xSTS)₄

Balance

- Skills
 - Static standing and sensory organization
 - Anticipatory postural control
 - Reactive postural control
- Considerations
 - Limited arm support during balance training
 - Sensory impairments will affect static and dynamic balance
 - Limitations with functional reach
 - Reactive strategies may change without the ability to rely on UE₁
 - Anterior trunk displacement and postural changes may alter standing and dynamic balance

Balance

- Treatment Strategies
 - Altered surfaces
 - Eyes-closed activities
 - Education for safety in dark environments if applicable
 - Compensatory strategies for functional reaching
 - Multidirectional reactive stepping
 - Emphasis on posterior reactive balance strategies in the context of postural changes
- Outcome Measures
 - Berg Balance Scale (BBS)₄
 - Functional Gait Assessment (FGA)

Ambulation

- Skills
 - Ambulation
 - Stair negotiation
 - Dynamic gait
- Considerations
 - Limited arm swing and the impact on gait₁
 - Assistive devices may be difficult to use with impaired hand function

Ambulation

- Treatment strategies
 - Consider glenohumeral position during stance and walking
 - Prevent shoulder subluxation
 - Assistive device prescription
 - Platform walker in acute stages, may progress directly to unsupported walking
 - Home and community-based obstacles
 - Dynamic gait: head turns, backward walking, turning
- Outcome measures₄
 - 10 Meter Walk Test (10MWT)
 - 6 Minute Walk Test (6MWT)

Summary: Learning Objectives

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Clinical Practice Guideline: Core Outcomes

- Core Outcome Measures Clinical Practice Guideline- July, 2018
 - Goal: streamline assessments utilized across patients with neurologic conditions
 - Should be collected for all patients with neurologic diagnoses who **have goals and the capacity to improve in these areas**
 - Should be utilized **across all settings and time points** (e.g. acute, inpatient, outpatient, home-health, skilled nursing)
 - Outcomes Included: 10 Meter Walk Test, 5 Times Sit to Stand, 6 Minute Walk Test, Activities-Specific Balance Confidence Scale (ABC), Berg Balance Scale, Functional Gait Assessment
 - **Access here:** <http://www.neuropt.org/professional-resources/anpt-clinical-practice-guidelines/core-outcome-measures-cpg>

Clinical Practice Guideline: Locomotor Training

- Locomotor Training Clinical Practice Guideline- In Process
 - “The scope of the CPG is to evaluate available evidence of the efficacy of various physical interventions to improve walking function of patients with a history of a stroke, motor incomplete SCI, or TBI of > 6 months duration.”
 - Access here when available: <http://www.neuropt.org/professional-resources/anpt-clinical-practice-guidelines/locomotor-training-cpg>

Objective Measurement: SCI EDGE Outcome Measures for Motor Incomplete SCI

Highly Recommended Measures

- 10 meter walk
- 6 minute walk
- ASIA Impairment Scale
- Handheld Myometry
- Timed Up and Go
- Walking Index for Spinal Cord Injury II
- World Health Organization Quality of Life- BREF

Access here:

<http://www.neuropt.org/docs/sci-edge-/sci-edge-motor-incomplete.pdf?sfvrsn=2>

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