Brown-Sequard Syndrome

Nathaniel Yomogida Chloë Kerstein

Brown-Sequard syndrome is a clinical syndrome of SCI involving a hemisection

Types

Brown-Sequard Syndrome

- Complete hemisection
- True hemisections are rare

Brown-Sequard Plus Syndrome

- Partial hemisection
- More common[1]

Etiology

- Typically caused by penetration wounds—that is, gunshot or stab[1,2]
- Herniated cervical disc[2]
- Post-traumatic arachnoiditis[2]
- Chiropractic manipulation[2]
- Tumor (primary or metastatic)[2]
- Multiple sclerosis[2]
- Other inflammatory/infectious causes[2]
- Spinal cord ischemia / spinal epidural hematoma[2]
- Spinal subdural hematoma[2]
- Hematomyelia[2]
- Spinal cord herniation[2]

Pathophysiology

- Lateral corticospinal tract (decussates in brain) and run ipsilaterally, so motor function is affected ipsilaterally

  - Damage to the lateral corticospinal tract causes ipsilateral upper motor neuron (UMN) symptoms below the level of the lesion[3]

DCML

- DCML decussates above the SC, thus there will be loss or impairments in Proprioception, vibration sense, and deep touch *ipsilateral* to the lesion.
- Damage to the DCML results in ipsilateral loss of vibration and proprioception (joint position sense) below the level of the lesion[2,3]
- "Ipsilateral loss of proprioceptive function below the level of the lesion due to interruption of the ascending fibers in the posterior columns (dorsal funiculi). Tactile sensation may be normal or minimally decreased [115]."[2].

Spinothalamic Tracts

- Due to the anatomy of Lissauer's Tract, Lateral and ventral spinothalamic tracts decussate 1-2 levels above their synapse at the SC so there usually is ipsilateral loss of pain and temp sensation 1-2 segments below the lesion and then *contralateral* loss of pain and temp 2+ levels below the lesion[4]
- Light touch is affected contralaterally

Clinical Presentation

Motor Symptoms

- UMN lesion symptoms below lesion
  - Weakness[3]
  - I/L spasticity[2]
  - Hyperreflexia (including clonus)[2]
- I/L LMN lesion issues at level
- Voluntary motor control issues ipsilaterally, preserved contralaterally. (LCST decussates in the brain)

"Segmental LMN (segmental weakness and atrophy) and sensory signs (segmental anesthesia) at the level of the lesion due to damage of the anterior horn cells and dorsal rootlets at this level"[2]

Sensory Symptoms

Ipsilateral

- Sensory Loss
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- Proprioception (DCML)[2,3]
- Light touch
- Vibratory sense below the level of the lesion (DCML)[2,3]

Contralateral

- Impaired Pain sensation more than 2 levels below the lesion (Spinothalamic Tract)
- Impaired Temperature sensation more than 2 levels below the lesion (Spinothalamic Tract)

> **Note**
>
> These symptoms will begin several dermatome segments below the level of injury[5]

Other Functions

"Ipsilateral loss of sweating caudal to the level of the lesion due to interruption of descending autonomic fibers in the ventral funiculus, and ipsilateral Horner syndrome, if the lesion is cervical, and ipsilateral hemidiaphragmatic paralysis due to damage of the upper motor neuron (UMN) pathways for breathing, if the lesion is high cervical"[2].

Prognosis

- Good functional gains are typically achieved during inpatient rehab[1].

References

1. O'Sullivan SB, Schmitz TJ, Fulk GD, eds. *Physical Rehabilitation*. 7th ed. F.A. Davis Company; 2019.
2. Brazis PW, Masdeu JC, Biller J. *Localization in Clinical Neurology*. 8th ed. Wolters Kluwer Health; 2022.

3. Blumenfeld H. *Neuroanatomy Through Clinical Cases*. 3rd ed. Oxford university press; 2022.
4. Shams S, Davidson CL, Arain A. Brown-Séquard Syndrome. In: *StatPearls*. StatPearls Publishing; 2024. Accessed May 16, 2024. http://www.ncbi.nlm.nih.gov/books/NBK538135/
5. O'Sullivan SB, Schmitz TJ, eds. *Improving Functional Outcomes in Physical Rehabilitation*. 2nd ed. F.A. Davis Company; 2016.